MITSUBISHI ELECTRIC

Changes for the Better

MITSUBISHI CNC

PLC Interface Manual

M700V/M70V Series

IB-1500920(ENG)-E

Introduction

This manual describes the various signal interfaces and functions required when creating MITSUBISHI CNC M700V/M70V Series sequence programs (built-in PLC).
Read this manual thoroughly before programming. Thoroughly study the "Safety Precautions" on the following page to ensure safe use of this NC unit.

Details described in this manual

⚠ CAUTION

⚠ **For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder takes precedence over this manual.**

⚠ **Items that are not described in this manual must be interpreted as "not possible".**

⚠ **This manual is written on the assumption that all optional functions are added. Confirm the specifications issued by the machine tool builder before use.**

⚠ **Some screens and functions may differ or may not be usable depending on the NC version.**

Precautions for Safety

Always read the specifications issued by the machine maker, this manual, related manuals and attached documents before installation, operation, programming, maintenance or inspection to ensure correct use. Understand this numerical controller, safety items and cautions before using the unit.This manual ranks the safety precautions into "DANGER", "WARNING" and "CAUTION".

⚠**DANGER**	**When the user could be subject to imminent fatalities or major injuries if handling is mistaken.**
⚠**WARNING**	**When the user could be subject to fatalities or major injuries if handling is mistaken.**
⚠**CAUTION**	**When the user could be subject to minor or moderate injuries or the property could be damaged if handling is mistaken.**

Note that even items ranked as " ⚠ CAUTION", may lead to major results depending on the situation. In any case, important information that must always be observed is described.

The following sings indicate prohibition and compulsory.

	**This sign indicates prohibited behavior (must not do).** **For example,  indicates "Keep fire away".**
	**This sign indicated a thing that is pompously (must do).** **For example,  indicates "it must be grounded".**

The meaning of each pictorial sing is as follows.

 CAUTION	 CAUTION rotated object	 CAUTION HOT	 Danger Electric shock risk	 Danger explosive
 Prohibited	 Disassembly is prohibited	 KEEP FIRE AWAY	 General instruction	 Earth ground

⚠DANGER

There are no "Danger" items in this manual.

⚠WARNING

1. Items related to prevention of electric shocks

⚠ Do not operate the switches with wet hands, as this may lead to electric shocks.

⚠ Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.

⚠CAUTION

1. Items related to product and manual

⚠ For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder takes precedence over this manual.

⚠ Items not described in this manual must be interpreted as "not possible".

⚠ This manual is written on the assumption that all optional functions are added. Confirm the specifications issued by the machine tool builder before use.

⚠ Some screens and functions may differ or may not be usable depending on the NC system version.

2. Items related to connection

❗ When using an inductive load such as relays, always contact a diode in parallel to the load as a noise measure.

❗ When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.

⚠ Since the analog output R registers are allocated in ascending order of channels and station numbers, the analog output destination may change depending on added option.

3. Items related to design

⚠ Always turn the spindle phase synchronization completion signal ON before chucking both ends of the workpiece to the basic spindle and synchronous spindle. If the spindle phase synchronization signal is turned ON when both ends of the workpiece are chucked to the basic spindle and synchronous spindle, the chuck or workpiece could be damaged by the torsion that occurs during phase alignment.

❗ If the temperature rise detection function is invalidated with the parameters, the control could be disabled when the temperature is excessive. This could result in machine damage or personal injuries due to runaway axis, and could damage the device. Enable the detection function for normal use.

Disposal

(Note)This symbol mark is for EU countries only.

This symbol mark is according to the directive 2006/66/EC Article 20 Information for endusers and Annex II.

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration.
This will be indicated as follows:
Hg: mercury (0,0005%), Cd: cadmium (0,002%), Pb: lead (0,004%)
In the European Union there are separate collection systems for used batteries and accumulators.
Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

Please, help us to conserve the environment we live in!

本製品の取扱いについて

(日本語 /Japanese)
本製品は工業用 (クラス A) 電磁環境適合機器です。販売者あるいは使用者はこの点に注意し、住商業環境以外での使用をお願いいたします。

Handling of our product

(English)
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

본 제품의 취급에 대해서

(한국어 /Korean)
이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정외의 지역에서 사용하는 것을 목적으로 합니다 .

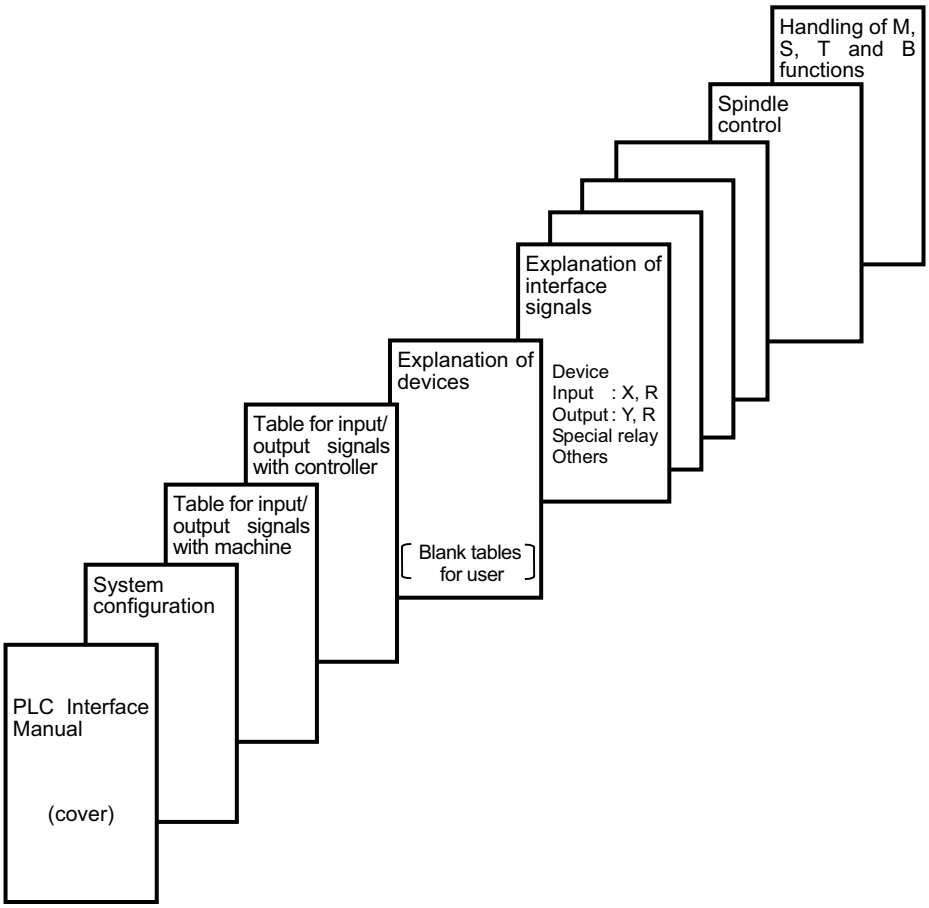
CONTENTS

1

Outline

1 Outline

This manual is prepared to assist you to understand the various control signals necessary for creating the sequence program.
The manual is composed as shown below. Refer to related sections as necessary to gain the maximum benefit from the manual.



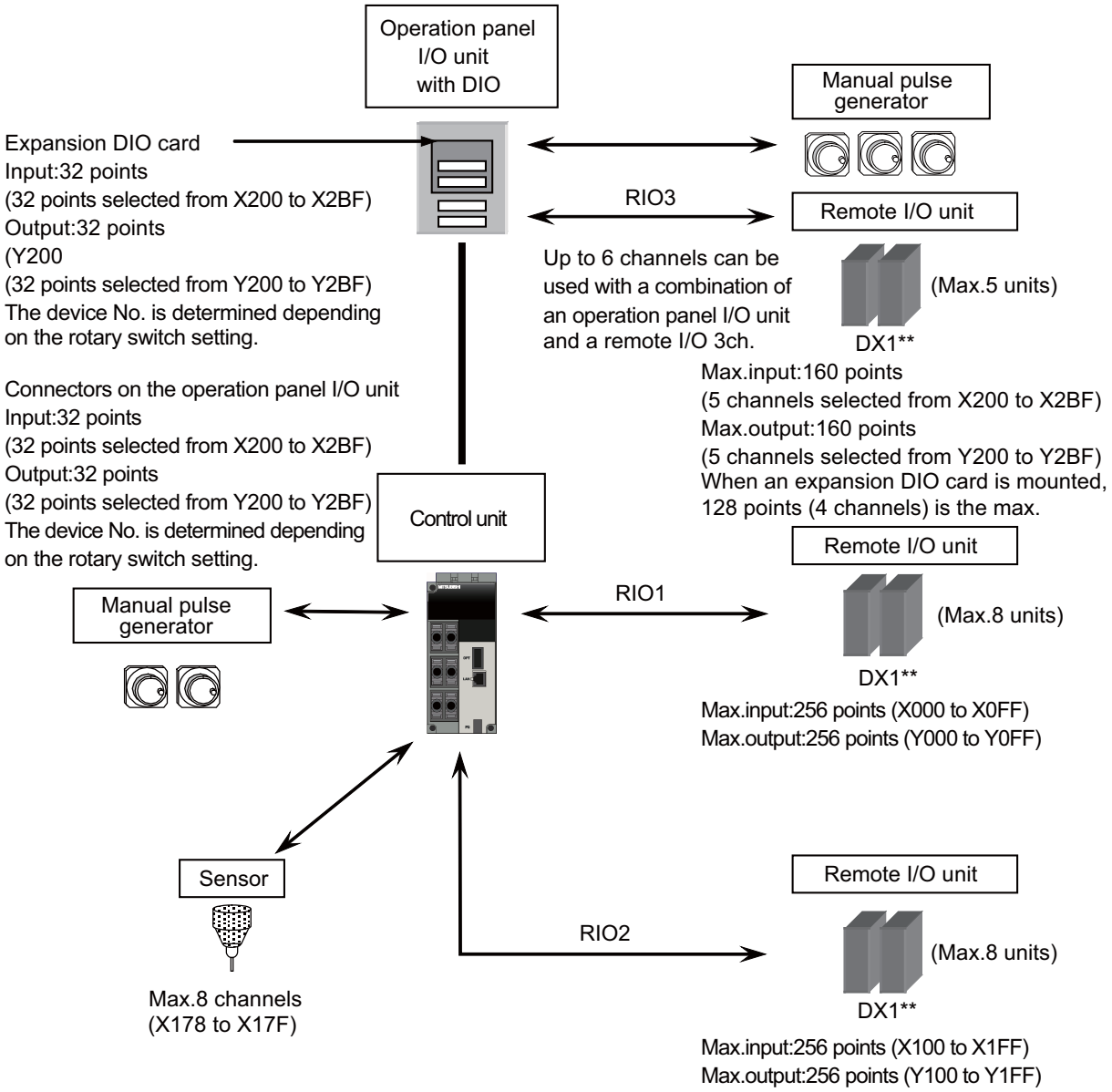
<Caution>

Please note that the specifications referred to in the text represents the maximum specifications which include also those under development.

2

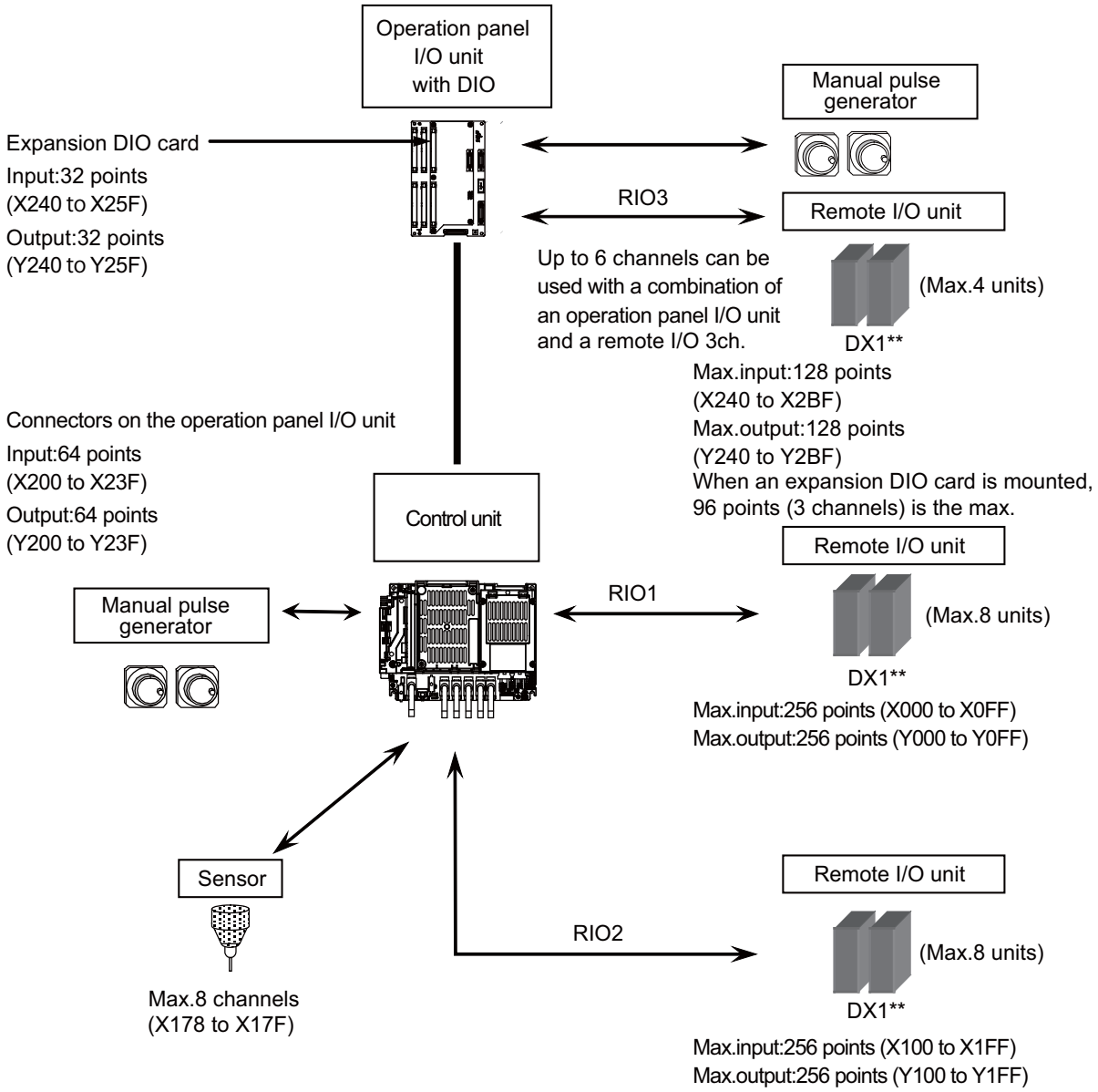
System Configuration

[M700VW]



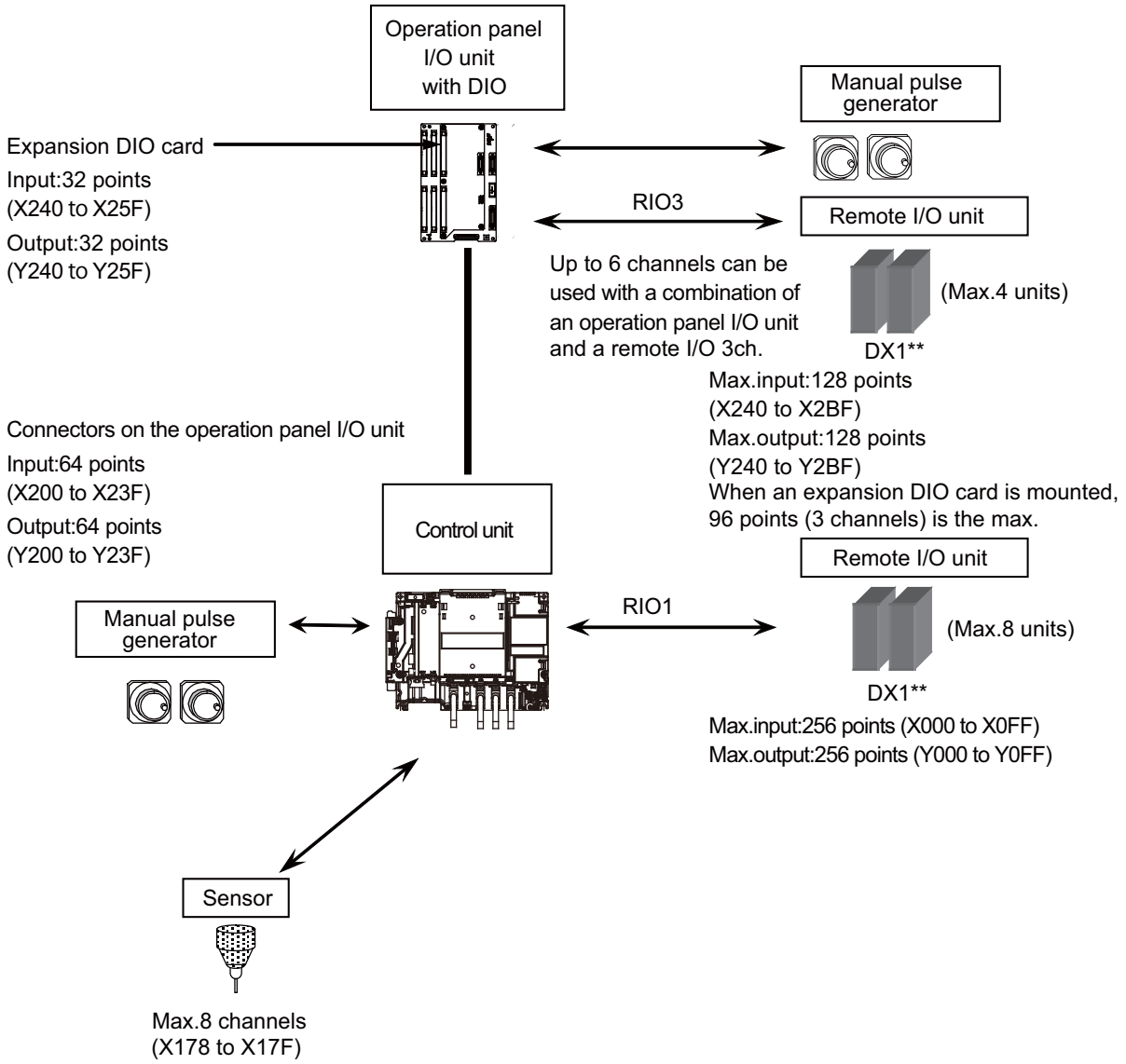
It is possible to connect up to three manual pulse generators.
Refer to "1ST HANDLE AXIS SELECTION CODE m (HS11 to 116)" in "6.3 PLC Output Signals (Bit Type: Y***)" for the connection point of the manual pulse generator and the handle No.

[M700VS]



It is possible to connect up to three manual pulse generators.
Refer to "1ST HANDLE AXIS SELECTION CODE m (HS11 to 116)" in "6.3 PLC Output Signals (Bit Type: Y***)" for the connection point of the manual pulse generator and the handle No.

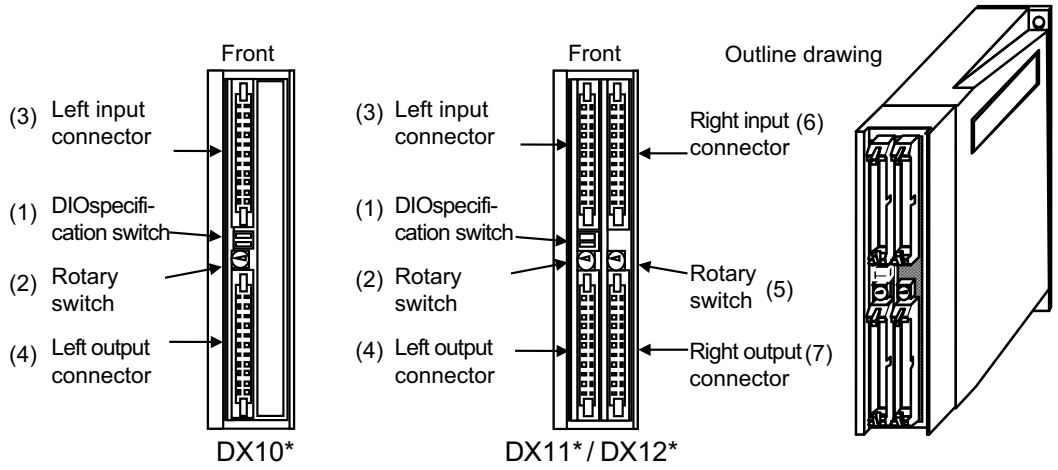
[M70V]

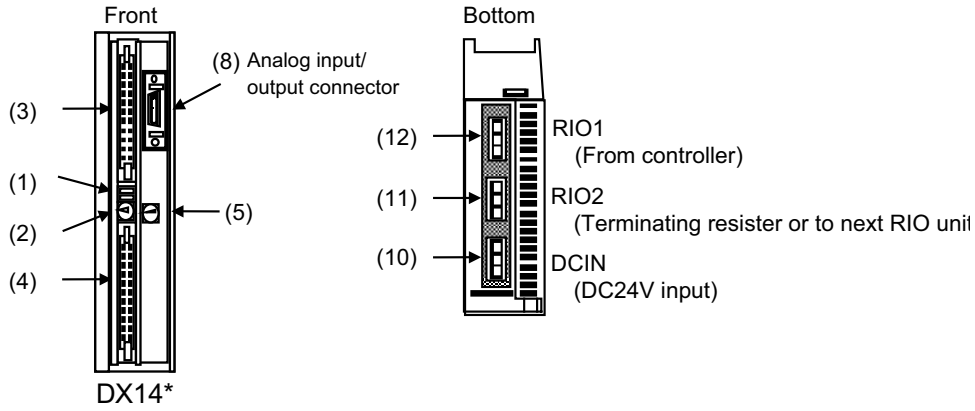


It is possible to connect up to three manual pulse generators.Refer to "1ST HANDLE AXIS SELECTION CODE m (HS11 to 116)" in "6.3 PLC Output Signals (Bit Type: Y***)" for the connection point of the manual pulse generator and the handle No.

2.1 Relation of RIO Unit and Devices

Eight types of remote I/O units (hereafter RIO unit) are available as shown below. The specifications of DX10*, DX11*, DX12* and DX14* (* is "0" or "1") differ. Each unit has a rotary switch for setting the unit No., and for establishing a relation with the device No. (X, Y).





No. of remote I/O unit input/output points

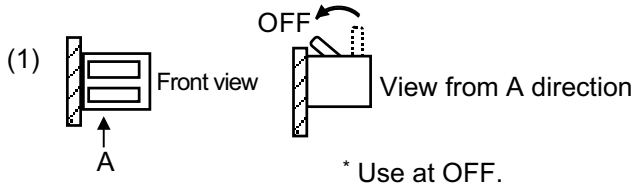
Unit model	Compatible machine control signal		Left	Right	Total
DX10* (FCUA-DX10*)	Digital input signal Digital output signal	(DI) (Photocoupler insulation) (DO) (Non-insulated)	32 points 32 points	- -	32 points 32 points
DX11* (FCUA-DX11*)	Digital input signal Digital output signal	(DI) (Photocoupler insulation) (DO) (Non-insulated)	32 points 32 points	32 points 16 points	64 points 48 points
DX12* (FCUA-DX12*)	Digital input signal Digital output signal Analog output (AO)	(DI) (Photocoupler insulation) (DO) (Non-insulated)	32 points 32 points -	32 points 16 points 1 point	64 points 48 points 1 point
DX14* (FCUA-DX14*)	Digital input signal Digital output signal Analog input (AI) Analog output (AO)	(DI) (Photocoupler insulation) (DO) (Non-insulated)	32 points 32 points - -	- - 4 points 1 point	32 points 32 points 4 points 1 point

(Note) The * mark in the table is 0 when the output is a sink type, and is 1 when the output is a source type. The input is changeable.
Items (1) to (7) are described in the following pages.

2.1.1 DIO Specification Setting Switch

This switch is not used currently, and must always be set to OFF.

DIO specification setting switch



2.1.2 Rotary Switch for Channel No. Setting

Rotary switch for channel No. setting (2) (5)


Set between 0 and 7.

The device used by the PLC is determined by the setting of the rotary switch for channel No. setting.

Rotary switch No.	Device No. read in	Output device No.	Analog output (AO)
	RIO channel 1	RIO channel 1	RIO channel 1
0	X00 to X1F	Y00 to Y1F(Y0F)	The rotary switches correspond to the file registers R200 to R207 in ascending order.
1	X20 to X3F	Y20 to Y3F(Y2F)	
2	X40 to X5F	Y40 to Y5F(Y4F)	
3	X60 to X7F	Y60 to Y7F(Y6F)	
4	X80 to X9F	Y80 to Y9F(Y8F)	
5	XA0 to XBF	YA0 to YBF(YAF)	
6	XC0 to XDF	YC0 to YDF(YCF)	
7	XE0 to XFF	YE0 to YFF(YEF)	

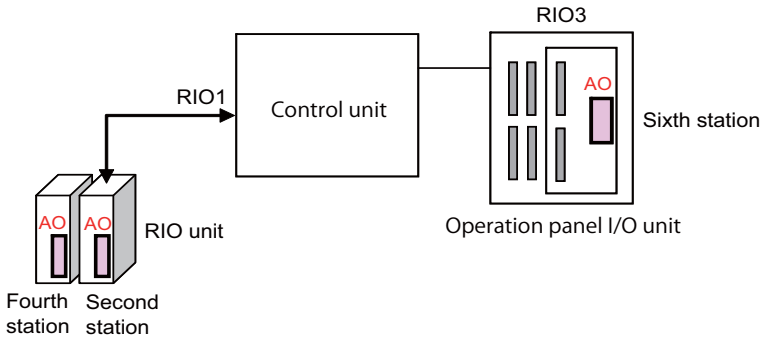
Rotary switch No.	Device No. read in	Output device No.	Analog output (AO)
	RIO channel 2	RIO channel 2	RIO channel 2
0	X100 to X11F	Y100 to Y11F(Y10F)	The rotary switches correspond to the file registers R200 to R207 in ascending order.
1	X120 to X13F	Y120 to Y13F(Y12F)	
2	X140 to X15F	Y140 to Y15F(Y14F)	
3	X160 to X17F	Y160 to Y17F(Y16F)	
4	X180 to X19F	Y180 to Y19F(Y18F)	
5	X1A0 to X1BF	Y1A0 to Y1BF(Y1AF)	
6	X1C0 to X1DF	Y1C0 to Y1DF(Y1CF)	
7	X1E0 to X1FF	Y1E0 to Y1FF(Y1EF)	

Rotary switch No.	Device No. read in	Output device No.	Analog output (AO)
	RIO channel 3	RIO channel 3	RIO channel 3
0	X200 to X21F	Y200 to Y21F(Y20F)	The rotary switches correspond to the file registers R200 to R205 in ascending order.
1	X220 to X23F	Y220 to Y23F(Y22F)	
2	X240 to X25F	Y240 to Y25F(Y24F)	
3	X260 to X27F	Y260 to Y27F(Y26F)	
4	X280 to X29F	Y280 to Y29F(Y28F)	
5	X2A0 to X2BF	Y2A0 to Y2BF(Y2AF)	
6	-	-	
7	-	-	

The values shown in parentheses are the device range of the card mounted to the right side of the unit.
Only channels available for RIO channel 3 are 0 to 5.

(Note) When the analog output is equipped to several RIO channels, up to four RIO channels will be valid in the following order of priority.
(1) RIO channel 1, (2) RIO channel 2, (3) RIO channel 3

(Ex.) When the analog output is equipped to RIO channel 1 and RIO channel 3.



#3024 sout	R register	Allocation of AO
2	R200 (AO1)	2nd station of RIO 1
3	R201 (AO2)	4th station of RIO 1
4	R202 (AO3)	6th station of RIO 1
5	R203 (AO4)	-

⚠CAUTION **Since the analog output R registers are allocated in ascending order of channels and station numbers, the analog output destination may change depending on added option.**

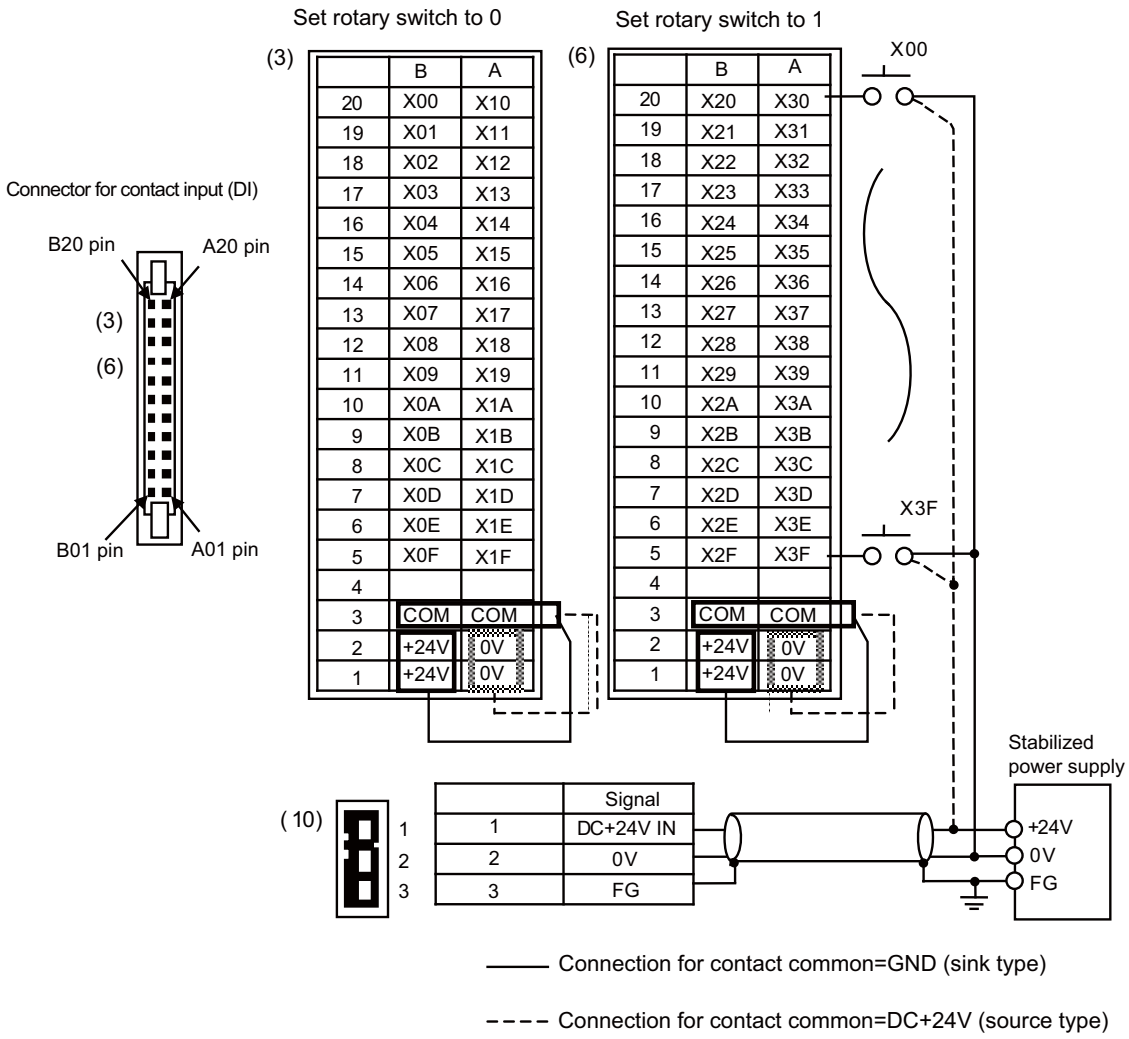
No. of points occupied by each unit

No. of occupied points	Unit name
1	DX100/DX101, Operation panel I/O unit DX670/DX671
2	DX110/DX111, DX120/DX121, DX140/DX141, Operation panel I/O unit DX770/DX771

A max. of 8 units can be connected. DX67* operation panel I/O unit is counted as 1 and DX77* operation panel I/O unit is counted as 2 occupied points. DX11*/DX12*/DX14* remote I/O units are counted as 2, and DX100/DX101 remote I/O units are counted as 1 occupied point.
(Example 1) An operation panel I/O unit (DX771 x1) and remote I/O units (DX120 x3).
(Example 2) An operation panel I/O unit (DX771 x1) and remote I/O units (DX110 x1, DX100 x4).

2.1.3 Relation of Connector Pins and Device

(1) Input (DI) signal



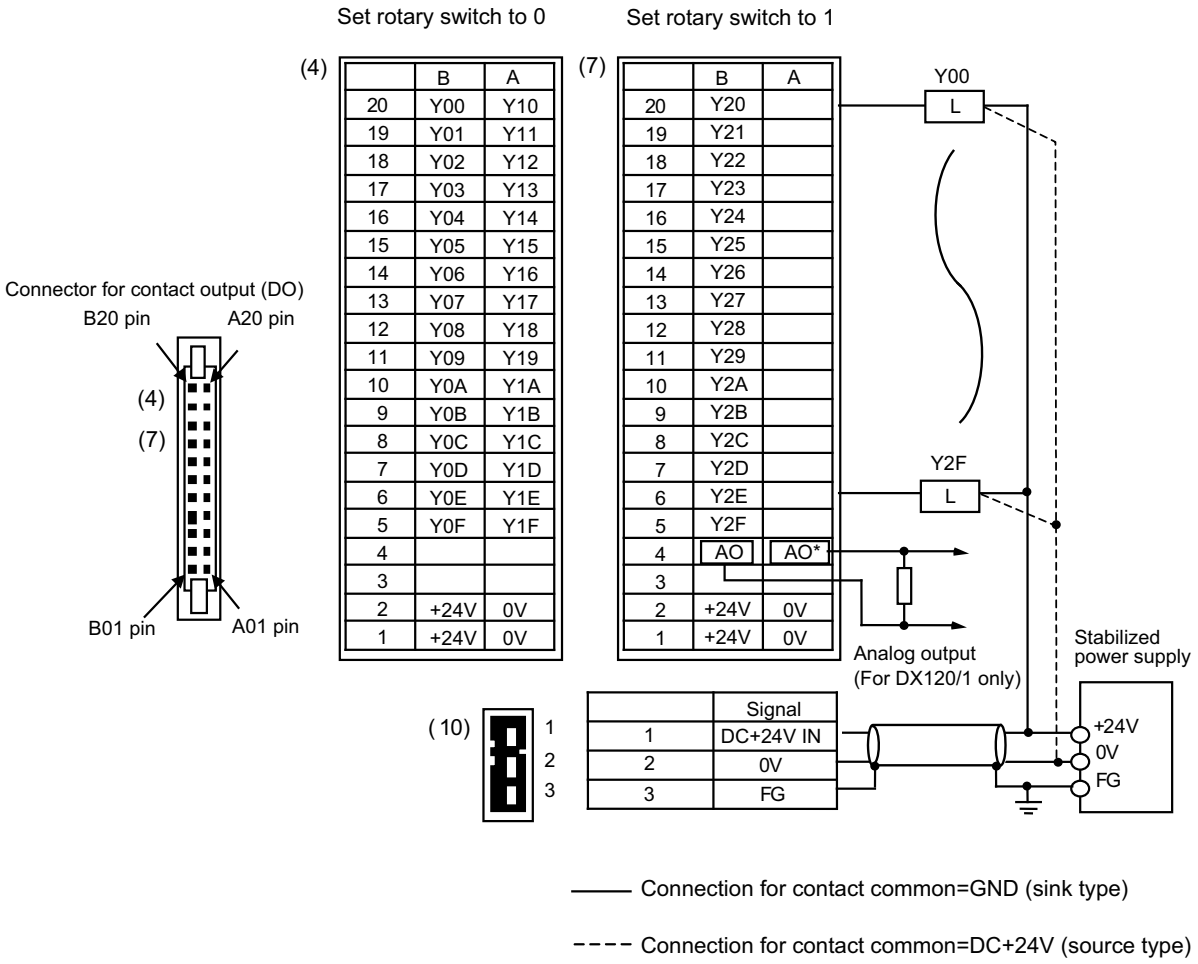
	B	A
20	X00	X10
19	X01	X11
18	X02	X12
17	X03	X13
16	X04	X14
15	X05	X15
14	X06	X16
13	X07	X17
12	X08	X18
11	X09	X19
10	X0A	X1A
9	X0B	X1B
8	X0C	X1C
7	X0D	X1D
6	X0E	X1E
5	X0F	X1F
4		
3	COM	COM
2	+24V	0V
1	+24V	0V

	B	A
20	X20	X30
19	X21	X31
18	X22	X32
17	X23	X33
16	X24	X34
15	X25	X35
14	X26	X36
13	X27	X37
12	X28	X38
11	X29	X39
10	X2A	X3A
9	X2B	X3B
8	X2C	X3C
7	X2D	X3D
6	X2E	X3E
5	X2F	X3F
4		
3	COM	COM
2	+24V	0V
1	+24V	0V

(Note 1) The No. of points (devices) will differ according to the RIO unit type.

(Note 2) The devices shown here show an example for when the rotary switch for channel No. setting on the RIO unit is set to "0" and set to "1".
Refer to the section "Rotary Switch for Channel No. Setting" for details on the relation of the rotary switch and device No.

(2) Output (DO) signal



	B	A
20	Y00	Y10
19	Y01	Y11
18	Y02	Y12
17	Y03	Y13
16	Y04	Y14
15	Y05	Y15
14	Y06	Y16
13	Y07	Y17
12	Y08	Y18
11	Y09	Y19
10	Y0A	Y1A
9	Y0B	Y1B
8	Y0C	Y1C
7	Y0D	Y1D
6	Y0E	Y1E
5	Y0F	Y1F
4		
3		
2	+24V	0V
1	+24V	0V

	B	A
20	Y20	
19	Y21	
18	Y22	
17	Y23	
16	Y24	
15	Y25	
14	Y26	
13	Y27	
12	Y28	
11	Y29	
10	Y2A	
9	Y2B	
8	Y2C	
7	Y2D	
6	Y2E	
5	Y2F	
4	AO	AO*
3		
2	+24V	0V
1	+24V	0V

(Note 1) The No. of points (devices) will differ according to the RIO unit type.

(Note 2) The devices shown here show an example for when the rotary switch for channel No. setting on the RIO unit is set to "0" and set to "1".
Refer to the section "Rotary Switch for Channel No. Setting" for details on the relation of the rotary switch and device No.

(Note 3) The A4 and B4 pin analog output (AO, AO*) in the output connector (7) is found only on the RIO unit DX120/ DX121.
Refer to the section "Outline of Analog Signal Input Circuit " for details on DX140/DX141 connector.

2.1.4 Relationship between MITSUBISHI CNC Operation Panel and the Device

MITSUBISHI CNC Machine operation panel occupies RIO station No. 4 to 6. The device numbers for switch and LED on operation panel are fixed as listed below.
The following lists the devices for using the RIO 1st channel.

Station	Device No.			Detail
	RIO1	RIO2	RIO3	
1	X00 ～ X1F/Y00 ～ Y1F	X100 ～ X11F/Y100 ～ Y11F	X200 ～ X21F/Y200 ～ Y21F	
2	X20 ～ X3F/Y20 ～ Y3F	X120 ～ X13F/Y120 ～ Y13F	X220 ～ X23F/Y220 ～ Y23F	
3	X40 ～ X5F/Y40 ～ Y5F	X140 ～ X15F/Y140 ～ Y15F	X240 ～ X25F/Y240 ～ Y25F	
4	X60 ～ X7F/Y60 ～ Y7F	X160 ～ X17F/Y160 ～ Y17F	X260 ～ X27F/Y260 ～ Y27F	MITSUBISHI CNC Machine operation panel B (Switch)...16 points vacant
5	X80 ～ X9F/Y80 ～ Y9F	X180 ～ X19F/Y180 ～ Y19F	X280 ～ X29F/Y280 ～ Y29F	MITSUBISHI CNC Machine operation panel A (Key switch/LED)
6	XA0 ～ XBF/YA0 ～ YBF	X1A0 ～ X1BF/Y1A0 ～ Y1BF	X2A0 ～ X2BF/Y2A0 ～ Y2BF	MITSUBISHI CNC Machine operation panel A (Key switch/LED)
7	XC0 ～ XDF/YC0 ～ YDF	X1C0 ～ X1DF/Y1C0 ～ Y1DF	-	
8	XE0 ～ XFF/YE0 ～ YFF	X1E0 ～ X1FF/Y1E0 ～ Y1FF	-	

Table: Device No. for MITSUBISHI CHC Machine operation panel

(1) MITSUBISHI CNC Machine operation panel B (Switch)

MITSUBISHI CNC Machine operation panel B is equipped with rotary switches (cutting override, spindle override) and a selector switch (memory protection key), and an emergency stop button. Direct wiring connection will be applied to the emergency stop button, and device numbers for other switches are defined as listed below.

(a) Cutting override (6bit)

21 position code list

	Device No.					
Setting value	X60	X61	X62	X63	X64	X65
0	0	0	0	0	0	0
1	1	0	0	0	0	1
2	1	1	0	0	0	0
3	0	1	0	0	0	1
4	0	1	1	0	0	0
5	1	1	1	0	0	1
6	1	0	1	0	0	0
7	0	0	1	0	0	1
8	0	0	1	1	0	0
9	1	0	1	1	0	1
10	1	1	1	1	0	0
11	0	1	1	1	0	1
12	0	1	0	1	0	0
13	1	1	0	1	0	1
14	1	0	0	1	0	0
15	0	0	0	1	0	1
16	0	0	0	1	1	0
17	1	0	0	1	1	1
18	1	1	0	1	1	0
19	0	1	0	1	1	1
20	0	1	1	1	1	0

(b) Spindle override (6bit)

8 position code list

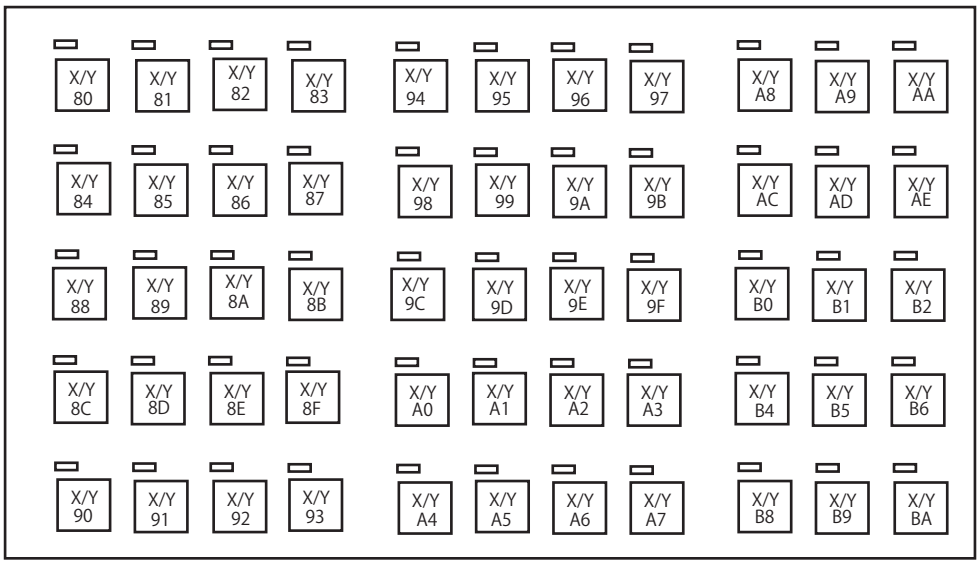
	Device No.					
Setting value	**X66**	**X67**	**X68**	**X69**	**X6A**	**X6B**
0	0	0	0	0	0	Not used
1	0	0	0	0	1	
2	1	1	0	0	0	
3	0	1	0	0	1	
4	0	1	1	0	0	
5	1	1	1	0	1	
6	1	0	1	0	0	
7	0	0	1	0	1	

(c) Memory protection switch (1bit)

Memory protection switch X6C
Spare X6D - X6F

(2) MITSUBISHI CNC Machine operation panel A (Key switch/LED)

MITSUBISHI CNC Machine operation panel A is equipped with 55 switches and 55 LEDs.
They are allocated X device and Y device as in the figure below.



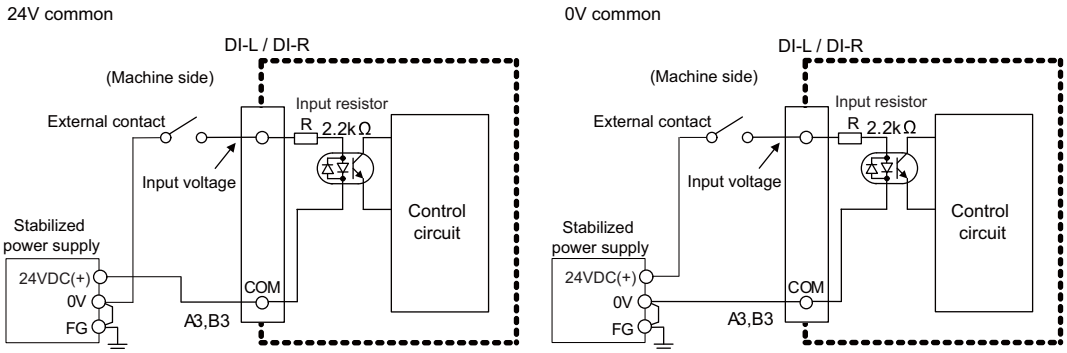
(Note1) If the stations of MITSUBISHI CNC Machine operation panel and other RIO unit overlap, all the connections of the overlapping RIOs will be invalidated and cannot be used. Stations which do not overlap can be used.

(Note2) Refer to the last page "Table: Device No. for MITSUBISHI CNC Machine operation panel" for the device No. when connecting to RIO2 and RIO3.

2.2 Outline of Digital Signal Input Circuit

Both 24V common and 0V common connections are allowed in the digital signal input circuit.
Follow the wiring diagram below for each type.

Input circuit

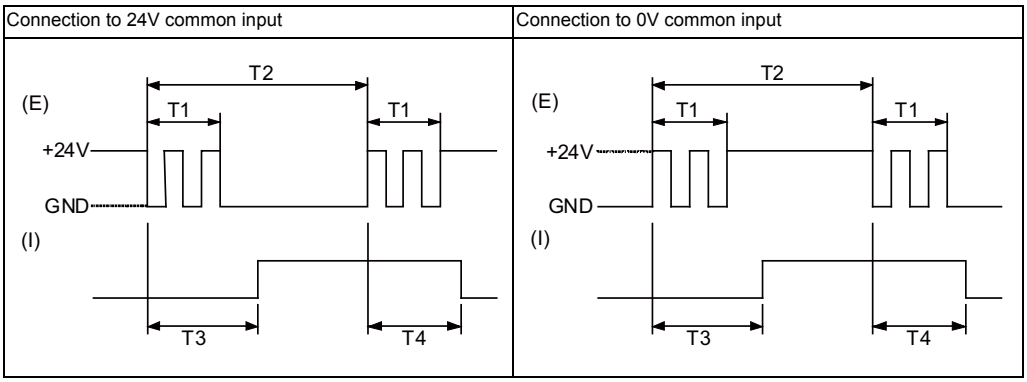


Input conditions

The input signals must be used within the following condition ranges.

		24V common	0V common
1	**Input voltage at external contact ON**	6V or less	18V or more, 25.2V or less
2	**Input current at external contact ON**	9mA or more	
3	**Input voltage at external contact OFF**	20V or more, 25.2V or less	4V or less
4	**Input current at external contact OFF**	2mA or less	
5	**Input resistance**	Approx. 2.2kΩ	
6	**Tolerable chattering time (T1)**	3ms	
7	**Input signal holding time (T2)**	40ms or more (Note)	
8	**input circuit operation delay time (T3 and T4)**	3ms ≦ T3 ≒ T4 ≦ 16ms	
9	**Machine side contact capacity**	30V or more, 16mA or more	

(Note) Input signal holding time: The guide is 40ms or more. The input signal will not be recognized unless it is held for the ladder processing cycle time or longer.

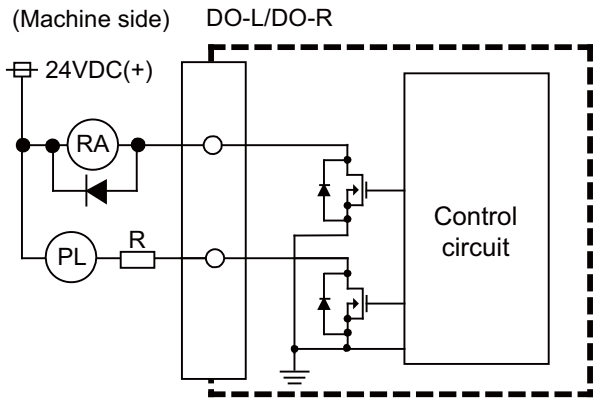


(E) : External signal, (I):Internal signal

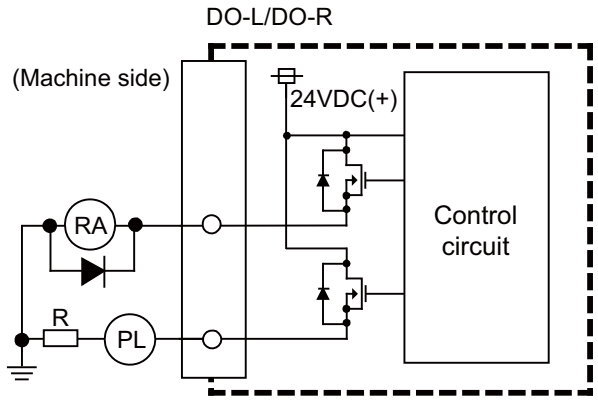
2.3 Outline of Digital Signal Output Circuit

The digital signal output circuit uses a sink type (DX1*0) or source type (DX1*1).
Use within the specification ranges shown below.

Output circuit



Sink type (DX1□0)



Source type (DX1□1)

Output conditions

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	60mA/point
Output delay time	40 μs

(Note 1) When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, 100mA or more) in parallel to the load.

(Note 2) When using a capacitive load such as a lamp, always connect a protective resistor (R=150 Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)

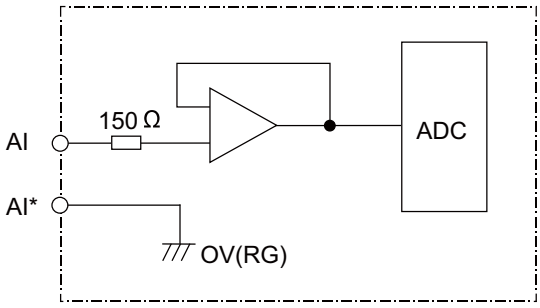
⚠ CAUTION

1. When using an inductive load such as a relay, always connect a diode in parallel to the load.
2. When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.

2.4 Outline of Analog Signal Input Circuit

The analog signal input circuit can be used only for FCUA-DX140/DX141.

Input circuit



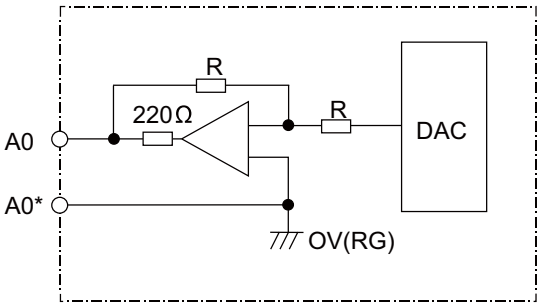
Input conditions

Max. input rating	± 15V
Resolution	10V/2000 (5mV)
Precision	Within ± 25mV
AD input sampling time	14.2ms(AI0)/ 42.6ms(AI1 to 3)

2.5 Outline of Analog Signal Output Circuit

The analog signal output circuit can be used only for FCUA-DX120/DX121/DX140/DX141.

Output circuit



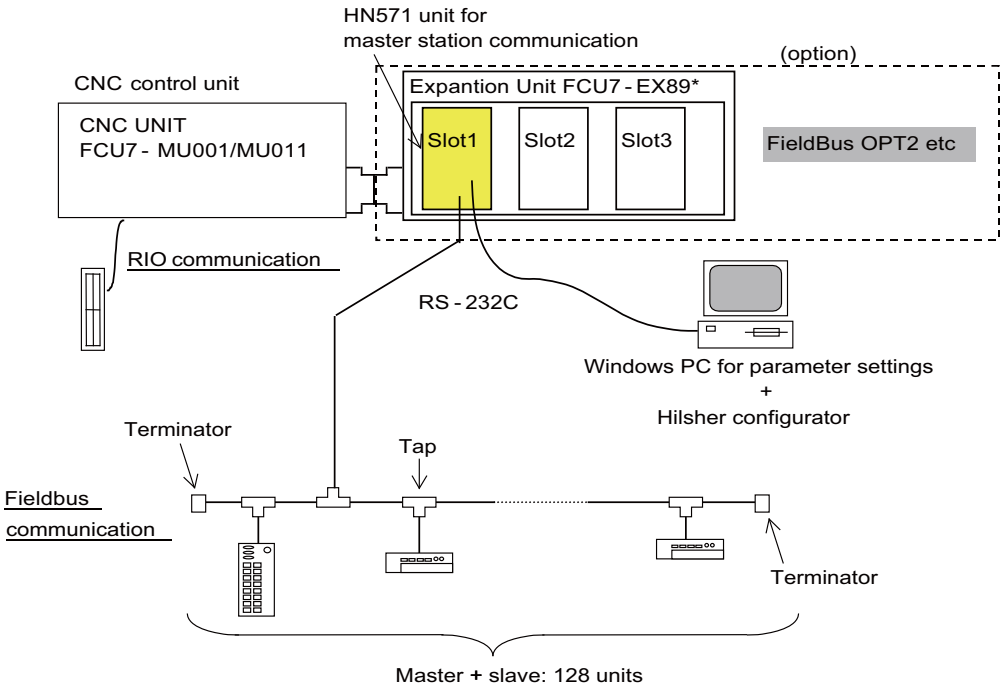
Output conditions

Output voltage	0V to ± 10V (± 5%)
Resolution	12bit (± 10V × n/4096) (Note)
Load conditions	10kΩ load resistance
Output impedance	220Ω

(Note) n=(2^0 to 2^{11})

2.6 Outline of I/O Assignment with PROFIBUS-DP

By installing PROFIBUS-DP unit (FCU7-HN571) on an arbitrary section of CNC expansion slot, slave stations compatible with PROFIBUS-DP communication can be connected to input/output device. No option parameter setting is needed.
Hilsher's Fieldbus communication control unit (COM module) is mounted on HN571, and NC operates as the master station. Up to 128 units can be connected with master station and slave stations combined.
Inputs/outputs of the devices from NC's PLC are all handled as bit device data. Up to 512 points can be input/output.
Maximum number of inputs/outputs for NC remote I/O unit is 768, whether or not HN571 is installed.



Fieldbus connection outline

Machine input/output signal allocation

Input/output device allocation when HN571 is mounted is as shown below.

	RIO communication only			With PROFIBUS-DP communication			
	RIO1	**RIO2**	**RIO3**	**RIO1**	**RIO2**	**RIO3**	**PROFIBUS-DP communication**
Input	X00 to XFF	X100 to X1FF	X200 to X2FF	X00 to XFF	X100 to X1FF	X200 to X2FF	X400 to X5FF
Output	Y00 to YFF	Y100 to Y1FF	Y200 to Y2FF	Y00 to YFF	Y100 to Y1FF	Y200 to Y2FF	Y400 to Y5FF

(Note) OT/DOG arbitrary allocation cannot be made for the device compatible with PROFIBUS-DP communication.

2.7 Fixed Signals

The connector pin Nos. in the input signals that are fixed are shown below.
Note that using the methods below can ignore fixed signals and change the allocations.

Signal name	Device	Signal name	Device
Emergency stop	EMG of main unit	Stroke end -1	X20
Stroke end +1	X28	Stroke end -2	X21
Stroke end +2	X29	Stroke end -3	X22
Stroke end +3	X2A	Stroke end -4	X23
Stroke end +4	X2B	Stroke end -5	X64
Stroke end +5	X6C	Stroke end -6	X65
Stroke end +6	X6D	Stroke end -7	X66
Stroke end +7	X6E	Stroke end -8	X67
Stroke end +8	X6F		
Reference position return near-point detection 1	X18		
Reference position return near-point detection 2	X19		
Reference position return near-point detection 3	X1A		
Reference position return near-point detection 4	X1B		
Reference position return near-point detection 5	X5C		
Reference position return near-point detection 6	X5D		
Reference position return near-point detection 7	X5E		
Reference position return near-point detection 8	X5F		

(Note) When using the multi-part system and the 1st part system has 2 axes and the 2nd part system has 1 axis, the 1st axis in the 2nd part system will correspond to the 3rd axis above.

2.7.1 Ignoring Fixed Signals

The fixed signals can be used as other signals by ignoring them with file registers R248 and R272.

2.7.2 Changing the Addresses of Fixed Signals

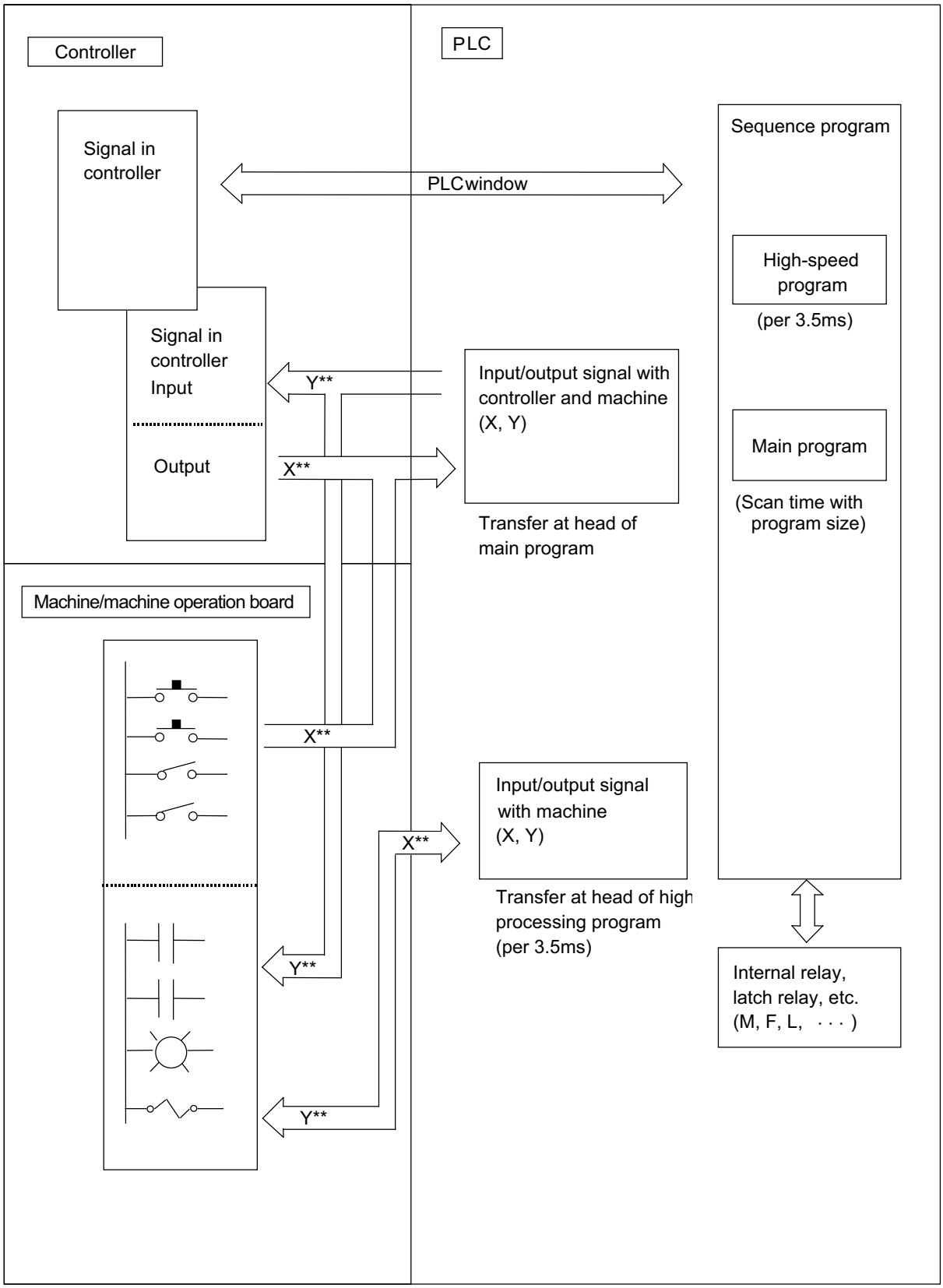
The fixed devices can be allocated arbitrarily with the following parameters.

The parameters #2073 to #2075 are valid when 1 is set in #1226 aux10 bit 5.
When the parameters #2073 to #2075 are valid, do not set the same device number. If the same device number exists, an emergency stop occurs. However, no device number check is performed for an axis to which a signal (R248, R272) that ignores the fixed signal is input.

When the arbitrary allocation is valid, the fixed signals can be used as other signals.

#	Items		Details	Setting range (unit)
1226	aux10 (bit5)	Arbitrary allocation of dog signal	Specify whether to enable the arbitrary allocation parameter for the origin dog and H/W OT. 0: Disable arbitrary allocation. (Fixed device) 1: Enable arbitrary allocation. (Device specified by the parameter)	0/1
2073	zrn_dog	Origin dog	Under the standard specifications, the origin dog signal is assigned to a fixed device. When it is desired to assign the origin dog signal to a position other than the fixed device, specify the input device in this parameter. This parameter is enabled in the following conditions. NC axis: When "#1226 aux10/bit5" is set to "1". PLC axis: When "#1246 set18/bit7" is set to "1". - When this parameter is valid, do not set the same device number. If the same device number exists, an emergency stop occurs. However, no device number check is performed for an axis to which a signal that ignores the near-point dog signal (R272) is input.	0000 to 02FF (HEX)
2074	H/W_OT+	H/W OT+	Under the standard specifications, the OT (+) signal is assigned to a fixed device. When it is desired to assign the OT (+) signal to a position other than the fixed device, specify the input device in this parameter. This parameter is enabled in the following conditions. NC axis: When "#1226 aux10/bit5" is set to "1". PLC axis: When "#1246 set18/bit7" is set to "1". - When this parameter is valid, do not set the same device number. If the same device number exists, an emergency stop occurs. However, no device number check is performed for an axis to which a signal that ignores the OT signal (R248) is input.	0000 to 02FF (HEX)
2075	H/W_OT-	H/W OT-	Under the standard specifications, the OT (-) signal is assigned to a fixed device. When it is desired to assign the OT (-) signal to a position other than the fixed device, specify the input device in this parameter. This parameter is enabled in the following conditions. NC axis: When "#1226 aux10/bit5" is set to "1". PLC axis: When "#1246 set18/bit7" is set to "1". - When this parameter is valid, do not set the same device number. If the same device number exists, an emergency stop occurs. However, no device number check is performed for an axis to which a signal that ignores the OT signal (R248) is input.	0000 to 02FF (HEX)

2.8 Flow of Signals



2.9 List of Devices Used

The devices used by the PLC are shown below.

Device	Device No.	Unit	Details	Format
X*	X0 to X1FFF (8192 points)	1 bit	Input signal to PLC: Machine input, etc.	
Y*	Y0 to Y1FFF (8192 points)	1 bit	Output signal from PLC: Machine output, etc.	
M	M0 to M10239 (10240 points)	1 bit	Temporary memory	1
F	F0 to F1023 (1024 points)	1 bit	Temporary memory. Alarm message interface	2
L	L0 to L511 (512 points)	1 bit	Latch relay (back up memory)	3
SM	SM0 to SM127 (128 points)	1 bit	Special relay	
SB	SB0000 to SB01FF	1 bit	Special relay	
SW	SW0000 to SW01FF	1 bit	Special register	
T	T0 to T703 (704 points)	1 bit/16 bit	Timer (The variable/fixed boundary is set with a parameter.) (Note 3)	4,5
ST	ST0 to ST63 (64 points)	1 bit/16 bit	Integrated timer (100ms unit)	6,7
C	C0 to C255 (256 points)	1 bit/16 bit	Counter (The variable/fixed boundary is set with a parameter.) (Note 3)	8,9
D	D0 to D2047 (2048 points)	16 bit/32 bit	Data register. Register for calculation	10
R*	R0 to R32767 (32768 points)	16 bit/32 bit	File register. CNC word interface	11
Z	Z0 to Z1 (2 points)	16 bit	Address index	
N	N0 to N7 (8 points)	-	Master controller nesting level	
P*	P0 to P249 P4000 to P4005 (256 points)	-	Label for conditional jump, subroutine call command	
K	K-32768 to K32767	-	Decimal constant for 16-bit command	
	K-2147483648 to K2147483647	-	Decimal constant for 32-bit command	
H	H0 to HFFFF	-	Hexadecimal constant for 16-bit command	
	H0 to HFFFFFFFF	-	Hexadecimal constant for 32-bit command	

(Note 1) Devices marked with * in the device column have designated applications. Do not use devices other than those corresponding to the input/output signals with the machine side (input/output signals of the remote I/O unit), even if it is an undefined vacant device.

(Note 2) The format displayed in the table is attached. Copy and use as required.

(Note 3) Distinction of 10ms timer and 100ms timer is performed by command.
(10ms timer is performed by OUTH command, 100ms timer is performed by OUT command.)

2.10 File Register General Map

Device	Details
R00000 to R00199	System common data (NC -> PLC)
R00200 to R00499	System common data (PLC -> NC)
R00500 to R00699	1st part system data (NC -> PLC)
R00700 to R00899	2nd part system data (NC -> PLC)
R00900 to R01099	3rd part system data (NC -> PLC)
R01100 to R01299	4th part system data (NC -> PLC)
R01300 to R02099	System reserve
R02100 to R02349	Pallet program data (Drive unit -> PLC)
R02500 to R02699	1st part system data (PLC -> NC)
R02700 to R02899	2nd part system data (PLC -> NC)
R02900 to R03099	3rd part system data (PLC -> NC)
R03100 to R03299	4th part system data (PLC -> NC)
R03300 to R04099	System reserve
R04100 to R04103	Pallet program data (PLC -> Drive unit)
R04104 to R04499	System reserve
R04500 to R05683	Axis data (NC -> PLC)
R05684 to R05699	System reserve
R05700 to R06371	Axis data (PLC -> NC)
R06372 to R06499	User macro (NC -> PLC: 64 point, PLC -> NC: 64 point)
R06500 to R06549	1st spindle data (NC -> PLC)
R06550 to R06599	2nd spindle data (NC -> PLC)
R06600 to R06649	3rd spindle data (NC -> PLC)
R06650 to R06699	4th spindle data (NC -> PLC)
R06700 to R06749	5th spindle data (NC -> PLC)
R06750 to R06799	6th spindle data (NC -> PLC)
R06800 to R06999	System reserve
R07000 to R07049	1st spindle data (PLC -> NC)
R07050 to R07099	2nd spindle data (PLC -> NC)
R07100 to R07149	3rd spindle data (PLC -> NC)
R07150 to R07199	4th spindle data (PLC -> NC)
R07200 to R07249	5th spindle data (PLC -> NC)
R07250 to R07299	6th spindle data (PLC -> NC)
R07300 to R07499	System reserve
R07500 to R07949	PLC constants
R07950 to R07999	System reserve
R08000 to R08099	PLC axis indexing
R08100 to R08299	System reserve
R08300 to R09799	User backed up area
R09800 to R09899	User work area
R09900 to R09999	J2CT
R10000 to R10099	Remote I/O communication error information
R10100 to R10139	I/O link input
R10140 to R10179	I/O link output
R10180 to R10180	I/O link communication status
R10181 to R10187	System reserve
R10188 to R10189	Base PLC mounting check
R10190 to R10199	MELSEC link II diagnosis I/F
R10200 to R10399	Data buffer for MELSEC link II (machine input)
R10400 to R10599	Data buffer for MELSEC link II (machine output)
R10600 to R12759	ATC data, tool life management for M system / Tool life management I, II for L system
R12760 to R18299	System reserve

Device	Details
R18300 to R19799	User backup area
R19800 to R19899	User work area
R19900 to R28299	System reserve
R28300 to R29799	User backup area
R29800 to R29899	User work area
R29900 to R32767	System reserve

(Note) The system reserve is used for function expansion by Mitsubishi, and must not be used by the user.

3

Input/Output Signals with Machine

How to Read Input/Output Signal Table

The method of reading the input/output signal table is shown below.
Each card mounted on the RIO unit uses 32 points. Thus, even the 16 point output card has 32 points, and the head of the next card number will be a serial No. on the assumption that there are 32 points.

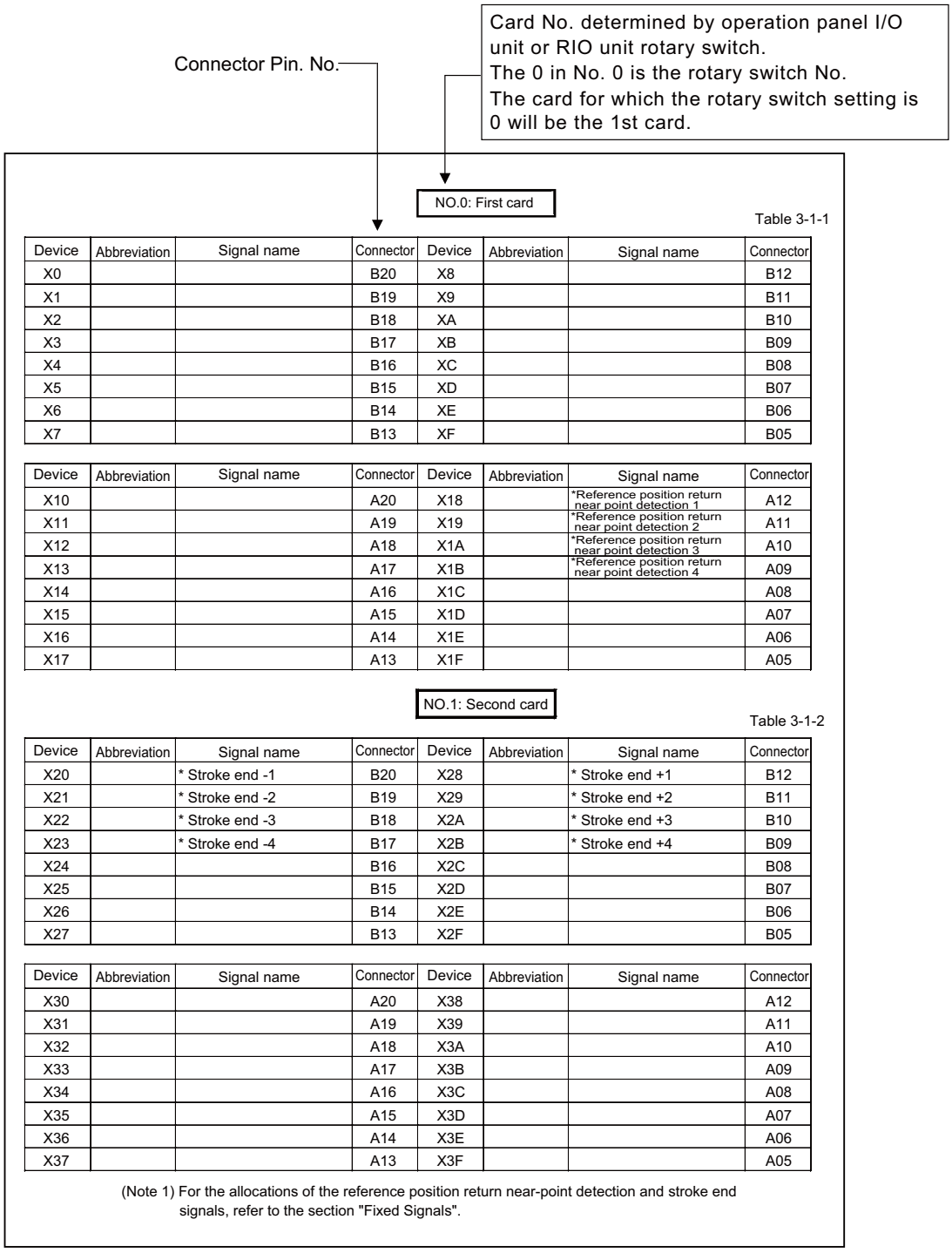


Table 3-1-1

Device	Abbreviation	Signal name	Connector	Device	Abbreviation	Signal name	Connector
X0			B20	X8			B12
X1			B19	X9			B11
X2			B18	XA			B10
X3			B17	XB			B09
X4			B16	XC			B08
X5			B15	XD			B07
X6			B14	XE			B06
X7			B13	XF			B05

Device	Abbreviation	Signal name	Connector	Device	Abbreviation	Signal name	Connector
X10			A20	X18		*Reference position return near point detection 1	A12
X11			A19	X19		*Reference position return near point detection 2	A11
X12			A18	X1A		*Reference position return near point detection 3	A10
X13			A17	X1B		*Reference position return near point detection 4	A09
X14			A16	X1C			A08
X15			A15	X1D			A07
X16			A14	X1E			A06
X17			A13	X1F			A05

NO.1: Second card

Table 3-1-2

Device	Abbreviation	Signal name	Connector	Device	Abbreviation	Signal name	Connector
X20		* Stroke end -1	B20	X28		* Stroke end +1	B12
X21		* Stroke end -2	B19	X29		* Stroke end +2	B11
X22		* Stroke end -3	B18	X2A		* Stroke end +3	B10
X23		* Stroke end -4	B17	X2B		* Stroke end +4	B09
X24			B16	X2C			B08
X25			B15	X2D			B07
X26			B14	X2E			B06
X27			B13	X2F			B05

Device	Abbreviation	Signal name	Connector	Device	Abbreviation	Signal name	Connector
X30			A20	X38			A12
X31			A19	X39			A11
X32			A18	X3A			A10
X33			A17	X3B			A09
X34			A16	X3C			A08
X35			A15	X3D			A07
X36			A14	X3E			A06
X37			A13	X3F			A05

(Note 1) For the allocations of the reference position return near-point detection and stroke end signals, refer to the section "Fixed Signals".

(Note 1) ☐ are 1 word (16-bit) data.
(Note 2) Signals marked with * in the "Single name" column are handled as B contacts.

Classification of Machine Input/Output Signals

The signals handled by the PLC are classified as shown below.
When designing, refer to the section indicated below and make allocations according to the table in the respective section.

	Signal type		Explanation	Reference
Input	DI	Machine	(1) Allocated to device X. (2) Some connector pin allocations are determined. (a) Stroke end signal (+, -) (b) Reference point return near-point detection signal (3) The high-speed processing input is set with the parameters. (Read in at the head of the high-speed processing scan.)	"Input Signals from Machine" "Input Signals from Machine: Using HR378 for Base I/O Unit (For specific manufacturer)"
	PLC switch input (Note)		(1) The switches can be substituted by the setting and display unit. (2) Allocated to device X. (3) The switch names displayed on the setting and display unit are user release switches, and can be created with the ladder message creation.	"PLC Switch/Sensor"
	Sensor input		(1) Differs from other DI signals, and is connected to the controller. This is only used for monitoring on the ladder side.	"PLC Switch/Sensor"
	AI (Analog Input)		(1) The connector pin allocation is determined. (2) Allocated to the file register (R).	"PLC Input Signals (Data Type: R***)"
Output	DO	Machine	(1) Allocated to device Y. (2) The high-speed processing output is set with the parameters.(Output at end of the high-speed processing scan.)	"Output Signals to Machine" "Output Signals from Machine: Using HR378 for Base I/O Unit (For specific manufacturer)"
	PLC switch output (Note)		(1) Output used to show that setting and display unit PLC switch input is valid. (2) Allocated to device Y.	"PLC Switch"
	AO (Analog Output)		(1) The connector pin allocation is determined. (2) Data to be D/A converted and output can be output by reading it into the file register (R).	"PLC Out Signals (Data Type: R***)"

(Note) The PLC switches are not signals for directly inputting/outputting with the machine, and are hypothetical switches used by the user on the setting and display unit. When classified by property, they are as shown above.

3.1 Machine Input Signals

3.1.1 Input Signals from Machine

No.0: First card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X0			B20	X8			B12
X1			B19	X9			B11
X2			B18	XA			B10
X3			B17	XB			B09
X4			B16	XC			B08
X5			B15	XD			B07
X6			B14	XE			B06
X7			B13	XF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X10			A20	X18		* Reference position return near point detection 1	A12
X11			A19	X19		* Reference position return near point detection 2	A11
X12			A18	X1A		* Reference position return near point detection 3	A10
X13			A17	X1B		* Reference position return near point detection 4	A09
X14			A16	X1C			A08
X15			A15	X1D			A07
X16			A14	X1E			A06
X17			A13	X1F			A05

No.1: Second card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X20		* Stroke end -1	B20	X28		* Stroke end +1	B12
X21		* Stroke end -2	B19	X29		* Stroke end +2	B11
X22		* Stroke end -3	B18	X2A		* Stroke end +3	B10
X23		* Stroke end -4	B17	X2B		* Stroke end +4	B09
X24			B16	X2C			B08
X25			B15	X2D			B07
X26			B14	X2E			B06
X27			B13	X2F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X30			A20	X38			A12
X31			A19	X39			A11
X32			A18	X3A			A10
X33			A17	X3B			A09
X34			A16	X3C			A08
X35			A15	X3D			A07
X36			A14	X3E			A06
X37			A13	X3F			A05

(Note 1) For the allocations of the reference position return near-point detection and stroke end signals, refer to the section "Fixed Signals".

No.2: Third card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X40			B20	X48			B12
X41			B19	X49			B11
X42			B18	X4A			B10
X43			B17	X4B			B09
X44			B16	X4C			B08
X45			B15	X4D			B07
X46			B14	X4E			B06
X47			B13	X4F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X50			A20	X58			A12
X51			A19	X59			A11
X52			A18	X5A			A10
X53			A17	X5B			A09
X54			A16	X5C		* Reference position return near point detection 5	A08
X55			A15	X5D		* Reference position return near point detection 6	A07
X56			A14	X5E		* Reference position return near point detection 7	A06
X57			A13	X5F		* Reference position return near point detection 8	A05

No.3: Fourth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X60			B20	X68			B12
X61			B19	X69			B11
X62			B18	X6A			B10
X63			B17	X6B			B09
X64		* Stroke end -5	B16	X6C		* Stroke end +5	B08
X65		* Stroke end -6	B15	X6D		* Stroke end +6	B07
X66		* Stroke end -7	B14	X6E		* Stroke end +7	B06
X67		* Stroke end -8	B13	X6F		* Stroke end +8	B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X70			A20	X78			A12
X71			A19	X79			A11
X72			A18	X7A			A10
X73			A17	X7B			A09
X74			A16	X7C			A08
X75			A15	X7D			A07
X76			A14	X7E			A06
X77			A13	X7F			A05

(Note 1) For the allocations of the reference position return near-point detection and stroke end signals, refer to the section "Fixed Signals".

No.4: Fifth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X80			B20	X88			B12
X81			B19	X89			B11
X82			B18	X8A			B10
X83			B17	X8B			B09
X84			B16	X8C			B08
X85			B15	X8D			B07
X86			B14	X8E			B06
X87			B13	X8F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X90			A20	X98			A12
X91			A19	X99			A11
X92			A18	X9A			A10
X93			A17	X9B			A09
X94			A16	X9C			A08
X95			A15	X9D			A07
X96			A14	X9E			A06
X97			A13	X9F			A05

No.5: Sixth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
XA0			B20	XA8			B12
XA1			B19	XA9			B11
XA2			B18	XAA			B10
XA3			B17	XAB			B09
XA4			B16	XAC			B08
XA5			B15	XAD			B07
XA6			B14	XAE			B06
XA7			B13	XAF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
XB0			A20	XB8			A12
XB1			A19	XB9			A11
XB2			A18	XBA			A10
XB3			A17	XBB			A09
XB4			A16	XBC			A08
XB5			A15	XBD			A07
XB6			A14	XBE			A06
XB7			A13	XBF			A05

No.6: Seventh card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
XC0			B20	XC8			B12
XC1			B19	XC9			B11
XC2			B18	XCA			B10
XC3			B17	XCB			B09
XC4			B16	XCC			B08
XC5			B15	XCD			B07
XC6			B14	XCE			B06
XC7			B13	XCF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
XD0			A20	XD8			A12
XD1			A19	XD9			A11
XD2			A18	XDA			A10
XD3			A17	XDB			A09
XD4			A16	XDC			A08
XD5			A15	XDD			A07
XD6			A14	XDE			A06
XD7			A13	XDF			A05

No.7: Eighth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
XE0			B20	XE8			B12
XE1			B19	XE9			B11
XE2			B18	XEA			B10
XE3			B17	XEB			B09
XE4			B16	XEC			B08
XE5			B15	XED			B07
XE6			B14	XEE			B06
XE7			B13	XEF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
XF0			A20	XF8			A12
XF1			A19	XF9			A11
XF2			A18	XFA			A10
XF3			A17	XFB			A09
XF4			A16	XFC			A08
XF5			A15	XFD			A07
XF6			A14	XFE			A06
XF7			A13	XFF			A05

3.1.2 Using HR378 for Base I/O Unit (For specific manufacturer)

Input Signals from Machine (for HR378)

No.0: First card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X00			MJ2-1	X08			MJ2-10
X01			MJ2-2	X09			MJ2-11
X02			MJ2-3	X0A			MJ2-12
X03			MJ2-4	X0B			MJ2-13
X04			MJ2-5	X0C			MJ2-14
X05			MJ2-6	X0D			MJ2-15
X06			MJ2-7	X0E			MJ2-16
X07			MJ2-8	X0F			MJ2-17

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X10			MJ2-19	X18		* Reference position return near point detection 1	MJ2-28
X11			MJ2-20	X19		* Reference position return near point detection 2	MJ2-29
X12			MJ2-21	X1A		* Reference position return near point detection 3	MJ2-30
X13			MJ2-22	X1B		* Reference position return near point detection 4	MJ2-31
X14			MJ2-23	X1C			MJ2-32
X15			MJ2-24	X1D			MJ2-33
X16			MJ2-25	X1E			MJ2-34
X17			MJ2-26	X1F			MJ2-35

No.1: Second card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X20		* Stroke end -1	MJ2-51	X28		* Stroke end +1	MJ2-60
X21		* Stroke end -2	MJ2-52	X29		* Stroke end +2	MJ2-61
X22		* Stroke end -3	MJ2-53	X2A		* Stroke end +3	MJ2-62
X23		* Stroke end -4	MJ2-54	X2B		* Stroke end +4	MJ2-63
X24			MJ2-55	X2C			MJ2-64
X25			MJ2-56	X2D			MJ2-65
X26			MJ2-57	X2E			MJ2-66
X27			MJ2-58	X2F			MJ2-67

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
X30			MJ2-69	X38			MJ2-78
X31			MJ2-70	X39			MJ2-79
X32			MJ2-71	X3A			MJ2-80
X33			MJ2-72	X3B			MJ2-81
X34			MJ2-73	X3C			MJ2-82
X35			MJ2-74	X3D			MJ2-83
X36			MJ2-75	X3E			MJ2-84
X37			MJ2-76	X3F			MJ2-85

(Note 1) For the allocations of the reference position return near-point detection and stroke end signals, refer to the section "Fixed Signals".

(Note 2) With the base I/O unit HR378, each card has 64 points for input and 64 points for output.

3.1.3 PLC Switch/Sensor

PLC Switch Input

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
X680		PLC switch #1	X688		PLC switch #9
X681		PLC switch #2	X689		PLC switch #10
X682		PLC switch #3	X68A		PLC switch #11
X683		PLC switch #4	X68B		PLC switch #12
X684		PLC switch #5	X68C		PLC switch #13
X685		PLC switch #6	X68D		PLC switch #14
X686		PLC switch #7	X68E		PLC switch #15
X687		PLC switch #8	X68F		PLC switch #16

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
X690		PLC switch #17	X698		PLC switch #25
X691		PLC switch #18	X699		PLC switch #26
X692		PLC switch #19	X69A		PLC switch #27
X693		PLC switch #20	X69B		PLC switch #28
X694		PLC switch #21	X69C		PLC switch #29
X695		PLC switch #22	X69D		PLC switch #30
X696		PLC switch #23	X69E		PLC switch #31
X697		PLC switch #24	X69F		PLC switch #32

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
X6A0		PLC switch #33	X6A8		PLC switch #41
X6A1		PLC switch #34	X6A9		PLC switch #42
X6A2		PLC switch #35	X6AA		PLC switch #43
X6A3		PLC switch #36	X6AB		PLC switch #44
X6A4		PLC switch #37	X6AC		PLC switch #45
X6A5		PLC switch #38	X6AD		PLC switch #46
X6A6		PLC switch #39	X6AE		PLC switch #47
X6A7		PLC switch #40	X6AF		PLC switch #48

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
X6B0		PLC switch #49	X6B8		PLC switch #57
X6B1		PLC switch #50	X6B9		PLC switch #58
X6B2		PLC switch #51	X6BA		PLC switch #59
X6B3		PLC switch #52	X6BB		PLC switch #60
X6B4		PLC switch #53	X6BC		PLC switch #61
X6B5		PLC switch #54	X6BD		PLC switch #62
X6B6		PLC switch #55	X6BE		PLC switch #63
X6B7		PLC switch #56	X6BF		PLC switch #64

(Note) Device Nos. X6A0 to X6BF are assigned when 64 points are provided for the switches.

Sensor Input

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
X6F0			X6F8		Skip input 1
X6F1			X6F9		Skip input 2
X6F2			X6FA		Skip input 3
X6F3			X6FB		Skip input 4
X6F4			X6FC		Skip input 5
X6F5			X6FD		Skip input 6
X6F6			X6FE		Skip input 7
X6F7			X6FF		Skip input 8

3.2 Machine Output Signals

3.2.1 Output Signals to Machine

No.0: First card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y0			B20	Y8			B12
Y1			B19	Y9			B11
Y2			B18	YA			B10
Y3			B17	YB			B09
Y4			B16	YC			B08
Y5			B15	YD			B07
Y6			B14	YE			B06
Y7			B13	YF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y10			A20	Y18			A12
Y11			A19	Y19			A11
Y12			A18	Y1A			A10
Y13			A17	Y1B			A09
Y14			A16	Y1C			A08
Y15			A15	Y1D			A07
Y16			A14	Y1E			A06
Y17			A13	Y1F			A05

No.1: Second card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y20			B20	Y28			B12
Y21			B19	Y29			B11
Y22			B18	Y2A			B10
Y23			B17	Y2B			B09
Y24			B16	Y2C			B08
Y25			B15	Y2D			B07
Y26			B14	Y2E			B06
Y27			B13	Y2F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y30			A20	Y38			A12
Y31			A19	Y39			A11
Y32			A18	Y3A			A10
Y33			A17	Y3B			A09
Y34			A16	Y3C			A08
Y35			A15	Y3D			A07
Y36			A14	Y3E			A06
Y37			A13	Y3F			A05

No.2: Third card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y40			B20	Y48			B12
Y41			B19	Y49			B11
Y42			B18	Y4A			B10
Y43			B17	Y4B			B09
Y44			B16	Y4C			B08
Y45			B15	Y4D			B07
Y46			B14	Y4E			B06
Y47			B13	Y4F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y50			A20	Y58			A12
Y51			A19	Y59			A11
Y52			A18	Y5A			A10
Y53			A17	Y5B			A09
Y54			A16	Y5C			A08
Y55			A15	Y5D			A07
Y56			A14	Y5E			A06
Y57			A13	Y5F			A05

No.3: Fourth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y60			B20	Y68			B12
Y61			B19	Y69			B11
Y62			B18	Y6A			B10
Y63			B17	Y6B			B09
Y64			B16	Y6C			B08
Y65			B15	Y6D			B07
Y66			B14	Y6E			B06
Y67			B13	Y6F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y70			A20	Y78			A12
Y71			A19	Y79			A11
Y72			A18	Y7A			A10
Y73			A17	Y7B			A09
Y74			A16	Y7C			A08
Y75			A15	Y7D			A07
Y76			A14	Y7E			A06
Y77			A13	Y7F			A05

No.4: Fifth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y80			B20	Y88			B12
Y81			B19	Y89			B11
Y82			B18	Y8A			B10
Y83			B17	Y8B			B09
Y84			B16	Y8C			B08
Y85			B15	Y8D			B07
Y86			B14	Y8E			B06
Y87			B13	Y8F			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y90			A20	Y98			A12
Y91			A19	Y99			A11
Y92			A18	Y9A			A10
Y93			A17	Y9B			A09
Y94			A16	Y9C			A08
Y95			A15	Y9D			A07
Y96			A14	Y9E			A06
Y97			A13	Y9F			A05

No.5: Sixth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
YA0			B20	YA8			B12
YA1			B19	YA9			B11
YA2			B18	YAA			B10
YA3			B17	YAB			B09
YA4			B16	YAC			B08
YA5			B15	YAD			B07
YA6			B14	YAE			B06
YA7			B13	YAF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
YB0			A20	YB8			A12
YB1			A19	YB9			A11
YB2			A18	YBA			A10
YB3			A17	YBB			A09
YB4			A16	YBC			A08
YB5			A15	YBD			A07
YB6			A14	YBE			A06
YB7			A13	YBF			A05

No.6: Seventh card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
YC0			B20	YC8			B12
YC1			B19	YC9			B11
YC2			B18	YCA			B10
YC3			B17	YCB			B09
YC4			B16	YCC			B08
YC5			B15	YCD			B07
YC6			B14	YCE			B06
YC7			B13	YCF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
YD0			A20	YD8			A12
YD1			A19	YD9			A11
YD2			A18	YDA			A10
YD3			A17	YDB			A09
YD4			A16	YDC			A08
YD5			A15	YDD			A07
YD6			A14	YDE			A06
YD7			A13	YDF			A05

No.7: Eighth card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
YE0			B20	YE8			B12
YE1			B19	YE9			B11
YE2			B18	YEA			B10
YE3			B17	YEB			B09
YE4			B16	YEC			B08
YE5			B15	YED			B07
YE6			B14	YEE			B06
YE7			B13	YEF			B05

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
YF0			A20	YF8			A12
YF1			A19	YF9			A11
YF2			A18	YFA			A10
YF3			A17	YFB			A09
YF4			A16	YFC			A08
YF5			A15	YFD			A07
YF6			A14	YFE			A06
YF7			A13	YFF			A05

3.2.2 Using HR378 for Base I/O Unit (For specific manufacturer)

Output Signals to Machine (for HR378)

No.0: First card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y00			MJ3-2	Y08			MJ3-12
Y01			MJ3-3	Y09			MJ3-13
Y02			MJ3-4	Y0A			MJ3-14
Y03			MJ3-5	Y0B			MJ3-15
Y04			MJ3-7	Y0C			MJ3-17
Y05			MJ3-8	Y0D			MJ3-18
Y06			MJ3-9	Y0E			MJ3-19
Y07			MJ3-10	Y0F			MJ3-20

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y10			MJ3-22	Y18			MJ3-32
Y11			MJ3-23	Y19			MJ3-33
Y12			MJ3-24	Y1A			MJ3-34
Y13			MJ3-25	Y1B			MJ3-35
Y14			MJ3-27	Y1C			MJ3-37
Y15			MJ3-28	Y1D			MJ3-38
Y16			MJ3-29	Y1E			MJ3-39
Y17			MJ3-30	Y1F			MJ3-40

No.1: Second card

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y20			MJ3-52	Y28			MJ3-62
Y21			MJ3-53	Y29			MJ3-63
Y22			MJ3-54	Y2A			MJ3-64
Y23			MJ3-55	Y2B			MJ3-65
Y24			MJ3-57	Y2C			MJ3-67
Y25			MJ3-58	Y2D			MJ3-68
Y26			MJ3-59	Y2E			MJ3-69
Y27			MJ3-60	Y2F			MJ3-70

Device	Abbrev.	Signal name	Connector	Device	Abbrev.	Signal name	Connector
Y30			MJ3-72	Y38			MJ3-88
Y31			MJ3-74	Y39			MJ3-90
Y32			MJ3-76	Y3A			MJ3-92
Y33			MJ3-78	Y3B			MJ3-94
Y34			MJ3-80	Y3C			MJ3-96
Y35			MJ3-82	Y3D			MJ3-97
Y36			MJ3-84	Y3E			MJ3-98
Y37			MJ3-86	Y3F			MJ3-99

(Note 1) With the base I/O unit HR378, each card has 64 points for input and 64 points for output.

3.2.3 PLC Switch

PLC Switch Output

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y680		PLC switch reversed display #1	Y688		PLC switch reversed display #9
Y681		PLC switch reversed display #2	Y689		PLC switch reversed display #10
Y682		PLC switch reversed display #3	Y68A		PLC switch reversed display #11
Y683		PLC switch reversed display #4	Y68B		PLC switch reversed display #12
Y684		PLC switch reversed display #5	Y68C		PLC switch reversed display #13
Y685		PLC switch reversed display #6	Y68D		PLC switch reversed display #14
Y686		PLC switch reversed display #7	Y68E		PLC switch reversed display #15
Y687		PLC switch reversed display #8	Y68F		PLC switch reversed display #16

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y690		PLC switch reversed display #17	Y698		PLC switch reversed display #25
Y691		PLC switch reversed display #18	Y699		PLC switch reversed display #26
Y692		PLC switch reversed display #19	Y69A		PLC switch reversed display #27
Y693		PLC switch reversed display #20	Y69B		PLC switch reversed display #28
Y694		PLC switch reversed display #21	Y69C		PLC switch reversed display #29
Y695		PLC switch reversed display #22	Y69D		PLC switch reversed display #30
Y696		PLC switch reversed display #23	Y69E		PLC switch reversed display #31
Y697		PLC switch reversed display #24	Y69F		PLC switch reversed display #32

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y6A0		PLC switch reversed display #33	Y6A8		PLC switch reversed display #41
Y6A1		PLC switch reversed display #34	Y6A9		PLC switch reversed display #42
Y6A2		PLC switch reversed display #35	Y6AA		PLC switch reversed display #43
Y6A3		PLC switch reversed display #36	Y6AB		PLC switch reversed display #44
Y6A4		PLC switch reversed display #37	Y6AC		PLC switch reversed display #45
Y6A5		PLC switch reversed display #38	Y6AD		PLC switch reversed display #46
Y6A6		PLC switch reversed display #39	Y6AE		PLC switch reversed display #47
Y6A7		PLC switch reversed display #40	Y6AF		PLC switch reversed display #48

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y6B0		PLC switch reversed display #49	Y6B8		PLC switch reversed display #57
Y6B1		PLC switch reversed display #50	Y6B9		PLC switch reversed display #58
Y6B2		PLC switch reversed display #51	Y6BA		PLC switch reversed display #59
Y6B3		PLC switch reversed display #52	Y6BB		PLC switch reversed display #60
Y6B4		PLC switch reversed display #53	Y6BC		PLC switch reversed display #61
Y6B5		PLC switch reversed display #54	Y6BD		PLC switch reversed display #62
Y6B6		PLC switch reversed display #55	Y6BE		PLC switch reversed display #63
Y6B7		PLC switch reversed display #56	Y6BF		PLC switch reversed display #64

(Note) Device Nos. Y6A0 to Y6BF are assigned when 64 points are provided for the switches.

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y6C0		PLC switch for reverse #1	Y6C8		PLC switch for reverse #9
Y6C1		PLC switch for reverse #2	Y6C9		PLC switch for reverse #10
Y6C2		PLC switch for reverse #3	Y6CA		PLC switch for reverse #11
Y6C3		PLC switch for reverse #4	Y6CB		PLC switch for reverse #12
Y6C4		PLC switch for reverse #5	Y6CC		PLC switch for reverse #13
Y6C5		PLC switch for reverse #6	Y6CD		PLC switch for reverse #14
Y6C6		PLC switch for reverse #7	Y6CE		PLC switch for reverse #15
Y6C7		PLC switch for reverse #8	Y6CF		PLC switch for reverse #16

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y6D0		PLC switch for reverse #17	Y6D8		PLC switch for reverse #25
Y6D1		PLC switch for reverse #18	Y6D9		PLC switch for reverse #26
Y6D2		PLC switch for reverse #19	Y6DA		PLC switch for reverse #27
Y6D3		PLC switch for reverse #20	Y6DB		PLC switch for reverse #28
Y6D4		PLC switch for reverse #21	Y6DC		PLC switch for reverse #29
Y6D5		PLC switch for reverse #22	Y6DD		PLC switch for reverse #30
Y6D6		PLC switch for reverse #23	Y6DE		PLC switch for reverse #31
Y6D7		PLC switch for reverse #24	Y6DF		PLC switch for reverse #32

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y6E0		PLC switch for reverse #33	Y6E8		PLC switch for reverse #41
Y6E1		PLC switch for reverse #34	Y6E9		PLC switch for reverse #42
Y6E2		PLC switch for reverse #35	Y6EA		PLC switch for reverse #43
Y6E3		PLC switch for reverse #36	Y6EB		PLC switch for reverse #44
Y6E4		PLC switch for reverse #37	Y6EC		PLC switch for reverse #45
Y6E5		PLC switch for reverse #38	Y6ED		PLC switch for reverse #46
Y6E6		PLC switch for reverse #39	Y6EE		PLC switch for reverse #47
Y6E7		PLC switch for reverse #40	Y6EF		PLC switch for reverse #48

Common for part systems	Abbrev.	Signal name	Common for part systems	Abbrev.	Signal name
Y6F0		PLC switch for reverse #49	Y6F8		PLC switch for reverse #57
Y6F1		PLC switch for reverse #50	Y6F9		PLC switch for reverse #58
Y6F2		PLC switch for reverse #51	Y6FA		PLC switch for reverse #59
Y6F3		PLC switch for reverse #52	Y6FB		PLC switch for reverse #60
Y6F4		PLC switch for reverse #53	Y6FC		PLC switch for reverse #61
Y6F5		PLC switch for reverse #54	Y6FD		PLC switch for reverse #62
Y6F6		PLC switch for reverse #55	Y6FE		PLC switch for reverse #63
Y6F7		PLC switch for reverse #56	Y6FF		PLC switch for reverse #64

(Note) Device Nos. Y6E0 to Y6FF are assigned when 64 points are provided for the switches.

4

Input/Output Signals with Controller

Types of Input/Output Signals Tables

The followings are the types of input/output signals tables to be used.

For common devices used in part systems (Sample)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X720			X728		
X721			X729		
X722		Diagnosis data output completio	X72A		
X723		Collecting diagnosis data	X72B		
X724		In remote program input ▲	X72C		
X725		Remote program input completion▲	X72D		
X726		Remote program input error ▲	X72E		
X727		In tool ID communication ▲	X72F		Power OFF required after parameter change

For devices used in each part system (Sample)

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
Y7A0	Y7A8	Y7B0	Y7B8	*SVF1	Servo OFF 1st axis
Y7A1	Y7A9	Y7B1	Y7B9	*SVF2	2st axis
Y7A2	Y7AA	Y7B2	Y7BA	*SVF3	3st axis
Y7A3	Y7AB	Y7B3	Y7BB	*SVF4	4st axis
Y7A4	Y7AC	Y7B4	Y7BC	*SVF5	5st axis
Y7A5	Y7AD	Y7B5	Y7BD	*SVF6	6st axis
Y7A6	Y7AE	Y7B6	Y7BE	*SVF7	7st axis
Y7A7	Y7AF	Y7B7	Y7BF	*SVF8	8st axis

For devices used in each spindle (Sample)

Device No.							
1stSP	2stSP	3stSP	4stSP	5stSP	6stSP	Abbrev.	Signal name
R6500	R6550	R6600	R6650	R6700	R6750		Spindle command rotation speed input (L)
R6501	R6551	R6601	R6651	R6701	R6751		(H)
R6502	R6552	R6602	R6652	R6702	R6752		Spindle command final data (rotation speed) (L)
R6503	R6553	R6603	R6653	R6703	R6753		(H)
R6504	R6554	R6604	R6654	R6704	R6754		Spindle command final data (12-bit binary) (L)
R6505	R6555	R6605	R6655	R6705	R6755		(H)
R6506	R6556	R6606	R6656	R6706	R6756		Spindle actual speed (L)
R6507	R6557	R6607	R6657	R6707	R6757		(H)

(Note 1) Signals marked with "*" in the "Abbrev." column are handled as B contacts.

(Note 2) Signals marked with " ▲ " are prepared for a specific machine tool builder.

(Note 3) Unit is changed by "#1040 M_inch" for the signals marked with [M].

(Note 4) 32bit signals are shown with (L)/(H), which indicates Low/High order. Data structure and the descriptions are as follows.

Classification of Input/Output Signals with Controller

There are 1-bit unit, and 16-bit or 32-bit unit controller input/output signals, which are classified as shown below. When designing, refer to the section indicated below and make allocations according to the table in the respective section.

"$" and "SP" in "Device No." column stand for "part system" and "spindle" respectively.

	Signal type	Explanation	Reference
Input	DI	(1) Allocated to device X. (2) Data calculated in bit units are allocated as a principle. (3) Signals with only $1 or 1stSP section filled are common for all part systems or all spindles.	"PLC Input Signals (Bit Type: X***)"
	Data	(1) Allocated to device R. (2) Data handled in 16-bit or 32-bit units is allocated as a principle.	"PLC Input Signals (Data Type: R***)"
Output	DO	(1) Allocated to device Y. (2) Data calculated in bit units are allocated as a principle. (3) Signals with only $1 or 1stSP section filled are common for all part systems or all spindles.	"PLC Output Signals (Bit Type: Y***)"
	Data	(1) Allocated to device R. (2) Data handled in 16-bit or 32-bit units is allocated as a principle.	"PLC Output Signals (Data Type: R***)"
Others	Special relay/ register	(1) Allocated to device SM, SB and SW. (2) The sequence instruction calculation state, results and the signals with special operations are allocated.	"Explanation of Special Relays/Register"
	Classified under purpose	Devices are classified under the usage purpose.	"Explanations for Each Application"

4.1 PLC Input Signals (Bit type: X***)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X2F0	BRST	Board reset			

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X700			X708		
X701			X709		
X702			X70A		
X703			X70B		
X704			X70C		
X705			X70D		
X706			X70E	BATWR	Battery warning
X707		Power OFF processing	X70F	BATAL	Battery alarm

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X710			X718		
X711		Optimum acceleration/deceleration switching parameter completion [spindle] ▲	X719		
X712			X71A		
X713			X71B		
X714			X71C		
X715			X71D		
X716			X71E		
X717			X71F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X720			X728	MDBUSIF	Modbus/TCP communicating ▲
X721			X729	MDBUSER1	Modbus time-out 1 ▲
X722		Diagnosis data output completion	X72A	MDBUSER2	Modbus time-out 2 ▲
X723		Collecting diagnosis data	X72B		
X724		In remote program input ▲	X72C		
X725		Remote program input completion ▲	X72D		
X726		Remote program input error ▲	X72E		
X727		In tool ID communication ▲	X72F		Power OFF required after parameter change

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X730			X738		
X731			X739		
X732			X73A		
X733			X73B		
X734			X73C		
X735			X73D		
X736			X73E		
X737			X73F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X740			X748		
X741			X749		
X742			X74A		
X743			X74B		
X744			X74C		
X745			X74D		
X746			X74E		
X747			X74F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X750			X758		Pallet program registration Ext. workpiece coordinate transfer completion
X751			X759		
X752	CNOP	24 hours continuous operation	X75A		
X753	MSOE	In multi-step speed monitor ▲	X75B		
X754			X75C		
X755			X75D		
X756			X75E		
X757			X75F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X760		$1 Display	X768		
X761		$2 Display	X769		
X762		$3 Display	X76A		
X763		$4 Display	X76B		
X764			X76C		
X765			X76D		
X766			X76E		
X767			X76F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X770			X778		
X771			X779		
X772			X77A		
X773			X77B		
X774			X77C		
X775			X77D		
X776			X77E		
X777			X77F		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X780	X788	X790	X798	RDY1	Servo ready 1st axis
X781	X789	X791	X799	RDY2	Servo ready 2nd axis
X782	X78A	X792	X79A	RDY3	Servo ready 3rd axis
X783	X78B	X793	X79B	RDY4	Servo ready 4th axis
X784	X78C	X794	X79C	RDY5	Servo ready 5th axis
X785	X78D	X795	X79D	RDY6	Servo ready 6th axis
X786	X78E	X796	X79E	RDY7	Servo ready 7th axis
X787	X78F	X797	X79F	RDY8	Servo ready 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X7A0	X7A8	X7B0	X7B8	AX1	Axis selection 1st axis
X7A1	X7A9	X7B1	X7B9	AX2	Axis selection 2nd axis
X7A2	X7AA	X7B2	X7BA	AX3	Axis selection 3rd axis
X7A3	X7AB	X7B3	X7BB	AX4	Axis selection 4th axis
X7A4	X7AC	X7B4	X7BC	AX5	Axis selection 5th axis
X7A5	X7AD	X7B5	X7BD	AX6	Axis selection 6th axis
X7A6	X7AE	X7B6	X7BE	AX7	Axis selection 7th axis
X7A7	X7AF	X7B7	X7BF	AX8	Axis selection 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X7C0	X7C8	X7D0	X7D8	MVP1	In axis plus motion 1st axis
X7C1	X7C9	X7D1	X7D9	MVP2	In axis plus motion 2nd axis
X7C2	X7CA	X7D2	X7DA	MVP3	In axis plus motion 3rd axis
X7C3	X7CB	X7D3	X7DB	MVP4	In axis plus motion 4th axis
X7C4	X7CC	X7D4	X7DC	MVP5	In axis plus motion 5th axis
X7C5	X7CD	X7D5	X7DD	MVP6	In axis plus motion 6th axis
X7C6	X7CE	X7D6	X7DE	MVP7	In axis plus motion 7th axis
X7C7	X7CF	X7D7	X7DF	MVP8	In axis plus motion 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X7E0	X7E8	X7F0	X7F8	MVM1	In axis minus motion 1st axis
X7E1	X7E9	X7F1	X7F9	MVM2	In axis minus motion 2nd axis
X7E2	X7EA	X7F2	X7FA	MVM3	In axis minus motion 3rd axis
X7E3	X7EB	X7F3	X7FB	MVM4	In axis minus motion 4th axis
X7E4	X7EC	X7F4	X7FC	MVM5	In axis minus motion 5th axis
X7E5	X7ED	X7F5	X7FD	MVM6	In axis minus motion 6th axis
X7E6	X7EE	X7F6	X7FE	MVM7	In axis minus motion 7th axis
X7E7	X7EF	X7F7	X7FF	MVM8	In axis minus motion 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X800	X808	X810	X818	ZP11	1st reference position reached 1st axis
X801	X809	X811	X819	ZP12	1st reference position reached 2nd axis
X802	X80A	X812	X81A	ZP13	1st reference position reached 3rd axis
X803	X80B	X813	X81B	ZP14	1st reference position reached 4th axis
X804	X80C	X814	X81C	ZP15	1st reference position reached 5th axis
X805	X80D	X815	X81D	ZP16	1st reference position reached 6th axis
X806	X80E	X816	X81E	ZP17	1st reference position reached 7th axis
X807	X80F	X817	X81F	ZP18	1st reference position reached 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X820	X828	X830	X838	ZP21	2nd reference position reached 1st axis
X821	X829	X831	X839	ZP22	2nd reference position reached 2nd axis
X822	X82A	X832	X83A	ZP23	2nd reference position reached 3rd axis
X823	X82B	X833	X83B	ZP24	2nd reference position reached 4th axis
X824	X82C	X834	X83C	ZP25	2nd reference position reached 5th axis
X825	X82D	X835	X83D	ZP26	2nd reference position reached 6th axis
X826	X82E	X836	X83E	ZP27	2nd reference position reached 7th axis
X827	X82F	X837	X83F	ZP28	2nd reference position reached 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X840	X848	X850	X858	ZP31	3rd reference position reached 1st axis
X841	X849	X851	X859	ZP32	3rd reference position reached 2nd axis
X842	X84A	X852	X85A	ZP33	3rd reference position reached 3rd axis
X843	X84B	X853	X85B	ZP34	3rd reference position reached 4th axis
X844	X84C	X854	X85C	ZP35	3rd reference position reached 5th axis
X845	X84D	X855	X85D	ZP36	3rd reference position reached 6th axis
X846	X84E	X856	X85E	ZP37	3rd reference position reached 7th axis
X847	X84F	X857	X85F	ZP38	3rd reference position reached 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X860	X868	X870	X878	ZP41	4th reference position reached 1st axis
X861	X869	X871	X879	ZP42	4th reference position reached 2nd axis
X862	X86A	X872	X87A	ZP43	4th reference position reached 3rd axis
X863	X86B	X873	X87B	ZP44	4th reference position reached 4th axis
X864	X86C	X874	X87C	ZP45	4th reference position reached 5th axis
X865	X86D	X875	X87D	ZP46	4th reference position reached 6th axis
X866	X86E	X876	X87E	ZP47	4th reference position reached 7th axis
X867	X86F	X877	X87F	ZP48	4th reference position reached 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X880	X888	X890	X898	NRF1	Near reference position 1st axis
X881	X889	X891	X899	NRF2	Near reference position 2nd axis
X882	X88A	X892	X89A	NRF3	Near reference position 3rd axis
X883	X88B	X893	X89B	NRF4	Near reference position 4th axis
X884	X88C	X894	X89C	NRF5	Near reference position 5th axis
X885	X88D	X895	X89D	NRF6	Near reference position 6th axis
X886	X88E	X896	X89E	NRF7	Near reference position 7th axis
X887	X88F	X897	X89F	NRF8	Near reference position 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X8A0	X8A8	X8B0	X8B8		
X8A1	X8A9	X8B1	X8B9		
X8A2	X8AA	X8B2	X8BA		
X8A3	X8AB	X8B3	X8BB		
X8A4	X8AC	X8B4	X8BC		
X8A5	X8AD	X8B5	X8BD		
X8A6	X8AE	X8B6	X8BE		
X8A7	X8AF	X8B7	X8BF		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X8C0	X8C8	X8D0	X8D8	ZSF1	Zero point initialization set completed 1st axis
X8C1	X8C9	X8D1	X8D9	ZSF2	Zero point initialization set completed 2nd axis
X8C2	X8CA	X8D2	X8DA	ZSF3	Zero point initialization set completed 3rd axis
X8C3	X8CB	X8D3	X8DB	ZSF4	Zero point initialization set completed 4th axis
X8C4	X8CC	X8D4	X8DC	ZSF5	Zero point initialization set completed 5th axis
X8C5	X8CD	X8D5	X8DD	ZSF6	Zero point initialization set completed 6th axis
X8C6	X8CE	X8D6	X8DE	ZSF7	Zero point initialization set completed 7th axis
X8C7	X8CF	X8D7	X8DF	ZSF8	Zero point initialization set completed 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X8E0	X8E8	X8F0	X8F8	ZSE1	Zero point initialization set error completed 1st axis
X8E1	X8E9	X8F1	X8F9	ZSE2	Zero point initialization set error completed 2nd axis
X8E2	X8EA	X8F2	X8FA	ZSE3	Zero point initialization set error completed 3rd axis
X8E3	X8EB	X8F3	X8FB	ZSE4	Zero point initialization set error completed 4th axis
X8E4	X8EC	X8F4	X8FC	ZSE5	Zero point initialization set error completed 5th axis
X8E5	X8ED	X8F5	X8FD	ZSE6	Zero point initialization set error completed 6th axis
X8E6	X8EE	X8F6	X8FE	ZSE7	Zero point initialization set error completed 7th axis
X8E7	X8EF	X8F7	X8FF	ZSE8	Zero point initialization set error completed 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X900	X908	X910	X918	ILI1	In current limit 1st axis
X901	X909	X911	X919	ILI2	In current limit 2nd axis
X902	X90A	X912	X91A	ILI3	In current limit 3rd axis
X903	X90B	X913	X91B	ILI4	In current limit 4th axis
X904	X90C	X914	X91C	ILI5	In current limit 5th axis
X905	X90D	X915	X91D	ILI6	In current limit 6th axis
X906	X90E	X916	X91E	ILI7	In current limit 7th axis
X907	X90F	X917	X91F	ILI8	In current limit 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X920	X928	X930	X938	ILA1	Current limit reached 1st axis
X921	X929	X931	X939	ILA2	Current limit reached 2nd axis
X922	X92A	X932	X93A	ILA3	Current limit reached 3rd axis
X923	X92B	X933	X93B	ILA4	Current limit reached 4th axis
X924	X92C	X934	X93C	ILA5	Current limit reached 5th axis
X925	X92D	X935	X93D	ILA6	Current limit reached 6th axis
X926	X92E	X936	X93E	ILA7	Current limit reached 7th axis
X927	X92F	X937	X93F	ILA8	Current limit reached 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X940	X948	X950	X958	ARRF1	NC axis up-to-speed 1st axis
X941	X949	X951	X959	ARRF2	NC axis up-to-speed 2nd axis
X942	X94A	X952	X95A	ARRF3	NC axis up-to-speed 3rd axis
X943	X94B	X953	X95B	ARRF4	NC axis up-to-speed 4th axis
X944	X94C	X954	X95C	ARRF5	NC axis up-to-speed 5th axis
X945	X94D	X955	X95D	ARRF6	NC axis up-to-speed 6th axis
X946	X94E	X956	X95E	ARRF7	NC axis up-to-speed 7th axis
X947	X94F	X957	X95F	ARRF8	NC axis up-to-speed 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X960	X968	X970	X978	UCLP1	Unclamp command 1st axis
X961	X969	X971	X979	UCLP2	Unclamp command 2nd axis
X962	X96A	X972	X97A	UCLP3	Unclamp command 3rd axis
X963	X96B	X973	X97B	UCLP4	Unclamp command 4th axis
X964	X96C	X974	X97C	UCLP5	Unclamp command 5th axis
X965	X96D	X975	X97D	UCLP6	Unclamp command 6th axis
X966	X96E	X976	X97E	UCLP7	Unclamp command 7th axis
X967	X96F	X977	X97F	UCLP8	Unclamp command 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X980	X988	X990	X998		In mixed control (cross axis control) 1st axis
X981	X989	X991	X999		In mixed control (cross axis control) 2nd axis
X982	X98A	X992	X99A		In mixed control (cross axis control) 3rd axis
X983	X98B	X993	X99B		In mixed control (cross axis control) 4th axis
X984	X98C	X994	X99C		In mixed control (cross axis control) 5th axis
X985	X98D	X995	X99D		In mixed control (cross axis control) 6th axis
X986	X98E	X996	X99E		In mixed control (cross axis control) 7th axis
X987	X98F	X997	X99F		In mixed control (cross axis control) 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X9A0	X9A8	X9B0	X9B8		In synchronous/superimposition control 1st axis
X9A1	X9A9	X9B1	X9B9		In synchronous/superimposition control 2nd axis
X9A2	X9AA	X9B2	X9BA		In synchronous/superimposition control 3rd axis
X9A3	X9AB	X9B3	X9BB		In synchronous/superimposition control 4th axis
X9A4	X9AC	X9B4	X9BC		In synchronous/superimposition control 5th axis
X9A5	X9AD	X9B5	X9BD		In synchronous/superimposition control 6th axis
X9A6	X9AE	X9B6	X9BE		In synchronous/superimposition control 7th axis
X9A7	X9AF	X9B7	X9BF		In synchronous/superimposition control 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X9C0	X9C8	X9D0	X9D8	MIR1	In mirror image 1st axis
X9C1	X9C9	X9D1	X9D9	MIR2	In mirror image 2nd axis
X9C2	X9CA	X9D2	X9DA	MIR3	In mirror image 3rd axis
X9C3	X9CB	X9D3	X9DB	MIR4	In mirror image 4th axis
X9C4	X9CC	X9D4	X9DC	MIR5	In mirror image 5th axis
X9C5	X9CD	X9D5	X9DD	MIR6	In mirror image 6th axis
X9C6	X9CE	X9D6	X9DE	MIR7	In mirror image 7th axis
X9C7	X9CF	X9D7	X9DF	MIR8	In mirror image 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
X9E0	X9E8	X9F0	X9F8		Reference position establishment 1st axis
X9E1	X9E9	X9F1	X9F9		Reference position establishment 2nd axis
X9E2	X9EA	X9F2	X9FA		Reference position establishment 3rd axis
X9E3	X9EB	X9F3	X9FB		Reference position establishment 4th axis
X9E4	X9EC	X9F4	X9FC		Reference position establishment 5th axis
X9E5	X9ED	X9F5	X9FD		Reference position establishment 6th axis
X9E6	X9EE	X9F6	X9FE		Reference position establishment 7th axis
X9E7	X9EF	X9F7	X9FF		Reference position establishment 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XA00	XA08	XA10	XA18		Reference position return direction 1st axis
XA01	XA09	XA11	XA19		Reference position return direction 2nd axis
XA02	XA0A	XA12	XA1A		Reference position return direction 3rd axis
XA03	XA0B	XA13	XA1B		Reference position return direction 4th axis
XA04	XA0C	XA14	XA1C		Reference position return direction 5th axis
XA05	XA0D	XA15	XA1D		Reference position return direction 6th axis
XA06	XA0E	XA16	XA1E		Reference position return direction 7th axis
XA07	XA0F	XA17	XA1F		Reference position return direction 8th axis
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XA20	XA28	XA30	XA38		In NC axis control 1st axis
XA21	XA29	XA31	XA39		In NC axis control 2nd axis
XA22	XA2A	XA32	XA3A		In NC axis control 3rd axis
XA23	XA2B	XA33	XA3B		In NC axis control 4th axis
XA24	XA2C	XA34	XA3C		In NC axis control 5th axis
XA25	XA2D	XA35	XA3D		In NC axis control 6th axis
XA26	XA2E	XA36	XA3E		In NC axis control 7th axis
XA27	XA2F	XA37	XA3F		In NC axis control 8th axis
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XA40	XA48	XA50	XA58	ECIL1	Ext. machine coordinate system offset data illegal 1st axis
XA41	XA49	XA51	XA59	ECIL2	Ext. machine coordinate system offset data illegal 2nd axis
XA42	XA4A	XA52	XA5A	ECIL3	Ext. machine coordinate system offset data illegal 3rd axis
XA43	XA4B	XA53	XA5B	ECIL4	Ext. machine coordinate system offset data illegal 4th axis
XA44	XA4C	XA54	XA5C	ECIL5	Ext. machine coordinate system offset data illegal 5th axis
XA45	XA4D	XA55	XA5D	ECIL6	Ext. machine coordinate system offset data illegal 6th axis
XA46	XA4E	XA56	XA5E	ECIL7	Ext. machine coordinate system offset data illegal 7th axis
XA47	XA4F	XA57	XA5F	ECIL8	Ext. machine coordinate system offset data illegal 8th axis
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XA60	XA68	XA70	XA78		Vertical axis pull-up prevented 1st axis
XA61	XA69	XA71	XA79		Vertical axis pull-up prevented 2nd axis
XA62	XA6A	XA72	XA7A		Vertical axis pull-up prevented 3rd axis
XA63	XA6B	XA73	XA7B		Vertical axis pull-up prevented 4th axis
XA64	XA6C	XA74	XA7C		Vertical axis pull-up prevented 5th axis
XA65	XA6D	XA75	XA7D		Vertical axis pull-up prevented 6th axis
XA66	XA6E	XA76	XA7E		Vertical axis pull-up prevented 7th axis
XA67	XA6F	XA77	XA7F		Vertical axis pull-up prevented 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XB00	XB08	XB10	XB18		Clamp command 1st axis ▲
XB01	XB09	XB11	XB19		Clamp command 2nd axis ▲
XB02	XB0A	XB12	XB1A		Clamp command 3rd axis ▲
XB03	XB0B	XB13	XB1B		Clamp command 4th axis ▲
XB04	XB0C	XB14	XB1C		Clamp command 5th axis ▲
XB05	XB0D	XB15	XB1D		Clamp command 6th axis ▲
XB06	XB0E	XB16	XB1E		Clamp command 7th axis ▲
XB07	XB0F	XB17	XB1F		Clamp command 8th axis ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC00	XD40	XE80	XFC0	JO	In jog mode
XC01	XD41	XE81	XFC1	HO	In handle mode
XC02	XD42	XE82	XFC2	SO	In incremental mode
XC03	XD43	XE83	XFC3	PTPO	In manual arbitrary feed mode
XC04	XD44	XE84	XFC4	ZRNO	In reference position return mode
XC05	XD45	XE85	XFC5	ASTO	In automatic initial set mode
XC06	XD46	XE86	XFC6		In JOG-handle simultaneous mode
XC07	XD47	XE87	XFC7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC08	XD48	XE88	XFC8	MEMO	In memory mode
XC09	XD49	XE89	XFC9	TO	In tape mode
XC0A	XD4A	XE8A	XFCA		In online operation mode
XC0B	XD4B	XE8B	XFCB	DO	In MDI mode
XC0C	XD4C	XE8C	XFCC		
XC0D	XD4D	XE8D	XFCD		
XC0E	XD4E	XE8E	XFCE		
XC0F	XD4F	XE8F	XFCF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC10	XD50	XE90	XFD0	MA	Controller ready completion
XC11	XD51	XE91	XFD1	SA	Servo ready completion
XC12	XD52	XE92	XFD2	OP	In automatic operation "run"
XC13	XD53	XE93	XFD3	STL	In automatic operation "start"
XC14	XD54	XE94	XFD4	SPL	In automatic operation "pause"
XC15	XD55	XE95	XFD5	RST	In "reset"
XC16	XD56	XE96	XFD6	CXN	In manual arbitrary feed
XC17	XD57	XE97	XFD7	RWD	In rewind

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC18	XD58	XE98	XFD8	DEN	Motion command completion
XC19	XD59	XE99	XFD9	TIMP	All axes in-position
XC1A	XD5A	XE9A	XFDA	TSMZ	All axes smoothing zero
XC1B	XD5B	XE9B	XFDB		
XC1C	XD5C	XE9C	XFDC	CXFIN	Manual arbitrary feed completion
XC1D	XD5D	XE9D	XFDD		External search finished
XC1E	XD5E	XE9E	XFDE		
XC1F	XD5F	XE9F	XFDF		In high-speed machining mode (G05)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC20	XD60	XEA0	XFE0	RPN	In rapid traverse
XC21	XD61	XEA1	XFE1	CUT	In cutting feed
XC22	XD62	XEA2	XFE2	TAP	In tapping
XC23	XD63	XEA3	XFE3	THRD	In thread cutting
XC24	XD64	XEA4	XFE4	SYN	In synchronous feed
XC25	XD65	XEA5	XFE5	CSS	In constant surface speed
XC26	XD66	XEA6	XFE6	SKIP	In skip
XC27	XD67	XEA7	XFE7	ZRNN	In reference position return
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC28	XD68	XEA8	XFE8	INCH	In inch unit selection
XC29	XD69	XEA9	XFE9	DLKN	In display lock
XC2A	XD6A	XEAA	XFEA	F1DN	F 1-digit commanded
XC2B	XD6B	XEAB	XFEB	TLFO	In tool life management
XC2C	XD6C	XEAC	XFEC		
XC2D	XD6D	XEAD	XFED		
XC2E	XD6E	XEAE	XFEE	TLOV	Tool life over
XC2F	XD6F	XEAF	XFEF		Tool group life over
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC30	XD70	XEB0	XFF0	F11	F1-digit No. code 1
XC31	XD71	XEB1	XFF1	F12	F1-digit No. code 2
XC32	XD72	XEB2	XFF2	F14	F1-digit No. code 4
XC33	XD73	XEB3	XFF3	F18	F1-digit No. code 8
XC34	XD74	XEB4	XFF4		Waiting between part systems
XC35	XD75	XEB5	XFF5	PCINO	In PLC interrupt
XC36	XD76	XEB6	XFF6		
XC37	XD77	XEB7	XFF7	ASLE	Illegal axis selected

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC38	XD78	XEB8	XFF8		
XC39	XD79	XEB9	XFF9		
XC3A	XD7A	XEBA	XFFA		
XC3B	XD7B	XEBB	XFFB		
XC3C	XD7C	XEBC	XFFC		
XC3D	XD7D	XEBD	XFFD		
XC3E	XD7E	XEBE	XFFE		
XC3F	XD7F	XEBF	XFFF		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC40	XD80	XEC0	X1000	DM00	M code independent output M00
XC41	XD81	XEC1	X1001	DM01	M code independent output M01
XC42	XD82	XEC2	X1002	DM02	M code independent output M02
XC43	XD83	XEC3	X1003	DM30	M code independent output M30
XC44	XD84	XEC4	X1004		
XC45	XD85	XEC5	X1005		
XC46	XD86	XEC6	X1006		
XC47	XD87	XEC7	X1007		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC48	XD88	XEC8	X1008		In manual speed command valid
XC49	XD89	XEC9	X1009	MMS	Manual numerical command
XC4A	XD8A	XECA	X100A		In tool escape and return mode
XC4B	XD8B	XECB	X100B		
XC4C	XD8C	XECC	X100C		
XC4D	XD8D	XECD	X100D		
XC4E	XD8E	XECE	X100E		
XC4F	XD8F	XECF	X100F		In circular feed in manual mode
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC50	XD90	XED0	X1010		
XC51	XD91	XED1	X1011		
XC52	XD92	XED2	X1012		
XC53	XD93	XED3	X1013		
XC54	XD94	XED4	X1014		
XC55	XD95	XED5	X1015		
XC56	XD96	XED6	X1016		
XC57	XD97	XED7	X1017		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC58	XD98	XED8	X1018		
XC59	XD99	XED9	X1019		
XC5A	XD9A	XEDA	X101A		
XC5B	XD9B	XEDB	X101B		
XC5C	XD9C	XEDC	X101C		
XC5D	XD9D	XEDD	X101D		
XC5E	XD9E	XEDE	X101E		
XC5F	XD9F	XEDF	X101F		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC60	XDA0	XEE0	X1020	MF1	M function strobe 1
XC61	XDA1	XEE1	X1021	MF2	M function strobe 2
XC62	XDA2	XEE2	X1022	MF3	M function strobe 3
XC63	XDA3	XEE3	X1023	MF4	M function strobe 4
XC64	XDA4	XEE4	X1024	SF1	S function strobe 1
XC65	XDA5	XEE5	X1025	SF2	S function strobe 2
XC66	XDA6	XEE6	X1026	SF3	S function strobe 3
XC67	XDA7	XEE7	X1027	SF4	S function strobe 4
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC68	XDA8	XEE8	X1028	TF1	T function strobe 1
XC69	XDA9	XEE9	X1029	TF2	T function strobe 2
XC6A	XDAA	XEEA	X102A	TF3	T function strobe 3
XC6B	XDAB	XEEB	X102B	TF4	T function strobe 4
XC6C	XDAC	XEEC	X102C	BF1	2nd M function strobe 1
XC6D	XDAD	XEED	X102D	BF2	2nd M function strobe 2
XC6E	XDAE	XEEE	X102E	BF3	2nd M function strobe 3
XC6F	XDAF	XEEF	X102F	BF4	2nd M function strobe 4
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC70	XDB0	XEF0	X1030		
XC71	XDB1	XEF1	X1031		
XC72	XDB2	XEF2	X1032		
XC73	XDB3	XEF3	X1033		
XC74	XDB4	XEF4	X1034		
XC75	XDB5	XEF5	X1035		
XC76	XDB6	XEF6	X1036		
XC77	XDB7	XEF7	X1037		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC78	XDB8	XEF8	X1038		
XC79	XDB9	XEF9	X1039		
XC7A	XDBA	XEFA	X103A		
XC7B	XDBB	XEFB	X103B		
XC7C	XDBC	XEFC	X103C		
XC7D	XDBD	XEFD	X103D		
XC7E	XDBE	XEFE	X103E		
XC7F	XDBF	XEFF	X103F	CHPRCC	Chopping compensation update prevented

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC80	XDC0	XF00	X1040	CHOP	In chopping start
XC81	XDC1	XF01	X1041	CHP1	Basic position -> upper dead point path flag
XC82	XDC2	XF02	X1042	CHP2	Upper dead point -> bottom dead point path flag
XC83	XDC3	XF03	X1043	CHP3	Bottom dead point -> upper dead point path flag
XC84	XDC4	XF04	X1044	CHP4	Upper dead point -> basic position path flag
XC85	XDC5	XF05	X1045	CHPMD	In chopping mode
XC86	XDC6	XF06	X1046		Stroke compensation completion
XC87	XDC7	XF07	X1047		Tool escape and return transit point recognition completed

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC88	XDC8	XF08	X1048		
XC89	XDC9	XF09	X1049		
XC8A	XDCA	XF0A	X104A	SSE	Search & start Error
XC8B	XDCB	XF0B	X104B	SSG	Search & start Search
XC8C	XDCC	XF0C	X104C		
XC8D	XDCD	XF0D	X104D		
XC8E	XDCE	XF0E	X104E		
XC8F	XDCF	XF0F	X104F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC90	XDD0	XF10	X1050		
XC91	XDD1	XF11	X1051		
XC92	XDD2	XF12	X1052		
XC93	XDD3	XF13	X1053	TCP	Tool change position return completion
XC94	XDD4	XF14	X1054	TCRQ	New tool change
XC95	XDD5	XF15	X1055		All spindles simultaneous control (G47.1)
XC96	XDD6	XF16	X1056		Life prediction
XC97	XDD7	XF17	X1057		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XC98	XDD8	XF18	X1058	AL1	NC alarm 1
XC99	XDD9	XF19	X1059	AL2	NC alarm 2 (Servo alarm)
XC9A	XDDA	XF1A	X105A	AL3	NC alarm 3 (Program error)
XC9B	XDDB	XF1B	X105B	AL4	NC alarm 4 (Operation error)
XC9C	XDDC	XF1C	X105C	WR1	NC warning (Servo warning)
XC9D	XDDD	XF1D	X105D		
XC9E	XDDE	XF1E	X105E		
XC9F	XDDF	XF1F	X105F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCA0	XDE0	XF20	X1060		Load monitor In execution ▲
XCA1	XDE1	XF21	X1061		Load monitor Teaching mode valid ▲
XCA2	XDE2	XF22	X1062		Load monitor Monitor mode valid ▲
XCA3	XDE3	XF23	X1063		Adaptive control in execution ▲
XCA4	XDE4	XF24	X1064		
XCA5	XDE5	XF25	X1065	TRVE	Tap retract possible
XCA6	XDE6	XF26	X1066	PCNT	No. of work machining over
XCA7	XDE7	XF27	X1067	ABSW	Absolute position warning

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCA8	XDE8	XF28	X1068		
XCA9	XDE9	XF29	X1069		In axis name switch
XCAA	XDEA	XF2A	X106A		Optimum acceleration/deceleration parameter switch completion [axis] ▲
XCAB	XDEB	XF2B	X106B		
XCAC	XDEC	XF2C	X106C		
XCAD	XDED	XF2D	X106D		
XCAE	XDEE	XF2E	X106E		
XCAF	XDEF	XF2F	X106F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCB0	XDF0	XF30	X1070		In spindle-NC axis polygon mode
XCB1	XDF1	XF31	X1071	AL5	NC alarm 5
XCB2	XDF2	XF32	X1072		In spindle-spindle polygon mode
XCB3	XDF3	XF33	X1073		Spindle-spindle polygon synchronization completion
XCB4	XDF4	XF34	X1074		
XCB5	XDF5	XF35	X1075		
XCB6	XDF6	XF36	X1076		
XCB7	XDF7	XF37	X1077		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCB8	XDF8	XF38	X1078		
XCB9	XDF9	XF39	X1079		In 3-dimensional coordinate conversion
XCBA	XDFA	XF3A	X107A		
XCBB	XDFB	XF3B	X107B		
XCBC	XDFC	XF3C	X107C		
XCBD	XDFD	XF3D	X107D		
XCBE	XDFE	XF3E	X107E		
XCBF	XDFF	XF3F	X107F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCC0	XE00	XF40	X1080	RTAP	In synchronized tapping selection (M command)
XCC1	XE01	XF41	X1081		In small diameter deep hole cycle
XCC2	XE02	XF42	X1082		High-speed retract function valid state ▲
XCC3	XE03	XF43	X1083		In high-speed retract function operation ▲
XCC4	XE04	XF44	X1084		
XCC5	XE05	XF45	X1085		
XCC6	XE06	XF46	X1086		
XCC7	XE07	XF47	X1087		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCC8	XE08	XF48	X1088		In barrier valid (left)
XCC9	XE09	XF49	X1089		In barrier valid (right)
XCCA	XE0A	XF4A	X108A	TLMSFIN	Tool length measurement completion ▲
XCCB	XE0B	XF4B	X108B	TLMSERR	Tool length measurement error ▲
XCCC	XE0C	XF4C	X108C		
XCCD	XE0D	XF4D	X108D		
XCCE	XE0E	XF4E	X108E	TLMSSELO	Tool length measurement sub-side selected ▲
XCCF	XE0F	XF4F	X108F		Tool retract position reached ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCD0	XE10	XF50	X1090	TRME	With tool retract amount command ▲
XCD1	XE11	XF51	X1091	TRRP	In tool repositioning ▲
XCD2	XE12	XF52	X1092		
XCD3	XE13	XF53	X1093		
XCD4	XE14	XF54	X1094		
XCD5	XE15	XF55	X1095		
XCD6	XE16	XF56	X1096		
XCD7	XE17	XF57	X1097		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCD8	XE18	XF58	X1098		Door open enable
XCD9	XE19	XF59	X1099		
XCDA	XE1A	XF5A	X109A		
XCDB	XE1B	XF5B	X109B		
XCDC	XE1C	XF5C	X109C		
XCDD	XE1D	XF5D	X109D		
XCDE	XE1E	XF5E	X109E		
XCDF	XE1F	XF5F	X109F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCE0	XE20	XF60	X10A0		
XCE1	XE21	XF61	X10A1		
XCE2	XE22	XF62	X10A2		
XCE3	XE23	XF63	X10A3		
XCE4	XE24	XF64	X10A4		
XCE5	XE25	XF65	X10A5		
XCE6	XE26	XF66	X10A6		
XCE7	XE27	XF67	X10A7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCE8	XE28	XF68	X10A8		Door open enable (2 channels per 1 part system)
XCE9	XE29	XF69	X10A9		
XCEA	XE2A	XF6A	X10AA		
XCEB	XE2B	XF6B	X10AB		
XCEC	XE2C	XF6C	X10AC		
XCED	XE2D	XF6D	X10AD		Optimum machining diagnosis in progress ▲
XCEE	XE2E	XF6E	X10AE		Cutting torque estimation in progress ▲
XCEF	XE2F	XF6F	X10AF		Cutting torque estimation completed ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCF0	XE30	XF70	X10B0		
XCF1	XE31	XF71	X10B1		
XCF2	XE32	XF72	X10B2		
XCF3	XE33	XF73	X10B3		
XCF4	XE34	XF74	X10B4		
XCF5	XE35	XF75	X10B5		
XCF6	XE36	XF76	X10B6		
XCF7	XE37	XF77	X10B7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XCF8	XE38	XF78	X10B8		
XCF9	XE39	XF79	X10B9		
XCFA	XE3A	XF7A	X10BA		
XCFB	XE3B	XF7B	X10BB		
XCFC	XE3C	XF7C	X10BC		
XCFD	XE3D	XF7D	X10BD		
XCFE	XE3E	XF7E	X10BE		
XCFF	XE3F	XF7F	X10BF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XD00	XE40	XF80	X10C0		
XD01	XE41	XF81	X10C1		
XD02	XE42	XF82	X10C2		
XD03	XE43	XF83	X10C3		
XD04	XE44	XF84	X10C4		
XD05	XE45	XF85	X10C5		
XD06	XE46	XF86	X10C6		
XD07	XE47	XF87	X10C7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
XD08	XE48	XF88	X10C8		
XD09	XE49	XF89	X10C9		
XD0A	XE4A	XF8A	X10CA		
XD0B	XE4B	XF8B	X10CB		
XD0C	XE4C	XF8C	X10CC		
XD0D	XE4D	XF8D	X10CD		
XD0E	XE4E	XF8E	X10CE		
XD0F	XE4F	XF8F	X10CF		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
XD18	XE58	XF98	X10D8	MJST	Tool axis coordinate system in manual feed for 5-axis machining (JOG, INC)
XD19	XE59	XF99	X10D9	MJSB	Table coordinate system in manual feed for 5-axis machining (JOG, INC)
XD1A	XE5A	XF9A	X10DA	MJSF	Feature coordinate system in manual feed for 5-axis machining (JOG, INC)
XD1B	XE5B	XF9B	X10DB	MH1ST	Tool axis coordinate system in manual feed for 5-axis machining (1st handle)
XD1C	XE5C	XF9C	X10DC	MH1SB	Table coordinate system in manual feed for 5-axis machining (1st handle)
XD1D	XE5D	XF9D	X10DD	MH1SF	Feature coordinate system in manual feed for 5-axis machining (1st handle)
XD1E	XE5E	XF9E	X10DE	MH2ST	Tool axis coordinate system in manual feed for 5-axis machining (2nd handle)
XD1F	XE5F	XF9F	X10DF	MH2SB	Table coordinate system in manual feed for 5-axis machining (2nd handle)
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
XD20	XE60	XFA0	X10E0	MH2SF	Feature coordinate system in manual feed for 5-axis machining (2nd handle)
XD21	XE61	XFA1	X10E1	MH3ST	Tool axis coordinate system in manual feed for 5-axis machining (3rd handle)
XD22	XE62	XFA2	X10E2	MH3SB	Table coordinate system in manual feed for 5-axis machining (3rd handle)
XD23	XE63	XFA3	X10E3	MH3SF	Feature coordinate system in manual feed for 5-axis machining (3rd handle)
XD24	XE64	XFA4	X10E4		
XD25	XE65	XFA5	X10E5		
XD26	XE66	XFA6	X10E6		
XD27	XE67	XFA7	X10E7	TCPRS	In tool center point rotation

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X1870			X1878		Edit/search window displayed
X1871			X1879		
X1872			X187A		
X1873			X187B		
X1874			X187C		
X1875			X187D		
X1876			X187E		
X1877			X187F		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X1880	X18E0	X1940	X19A0	X1A00	X1A60		
X1881	X18E1	X1941	X19A1	X1A01	X1A61		
X1882	X18E2	X1942	X19A2	X1A02	X1A62	SIGE	S command gear No. illegal
X1883	X18E3	X1943	X19A3	X1A03	X1A63	SOVE	S command max./min. command value over
X1884	X18E4	X1944	X19A4	X1A04	X1A64	SNGE	S command no gear selected
X1885	X18E5	X1945	X19A5	X1A05	X1A65	GR1	Spindle gear shift command 1
X1886	X18E6	X1946	X19A6	X1A06	X1A66	GR2	Spindle gear shift command 2
X1887	X18E7	X1947	X19A7	X1A07	X1A67		(Always "0")
Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X1888	X18E8	X1948	X19A8	X1A08	X1A68		Spindle 2nd in-position
X1889	X18E9	X1949	X19A9	X1A09	X1A69	CDO	Current detection
X188A	X18EA	X194A	X19AA	X1A0A	X1A6A	VRO	Speed detection
X188B	X18EB	X194B	X19AB	X1A0B	X1A6B	FLO	In spindle alarm
X188C	X18EC	X194C	X19AC	X1A0C	X1A6C	ZSO	Zero speed
X188D	X18ED	X194D	X19AD	X1A0D	X1A6D	USO	Spindle up-to-speed
X188E	X18EE	X194E	X19AE	X1A0E	X1A6E	ORAO	Spindle in-position
X188F	X18EF	X194F	X19AF	X1A0F	X1A6F	LCSA	In L coil selection
Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X1890	X18F0	X1950	X19B0	X1A10	X1A70	SMA	Spindle ready-ON
X1891	X18F1	X1951	X19B1	X1A11	X1A71	SSA	Spindle servo-ON
X1892	X18F2	X1952	X19B2	X1A12	X1A72	SEMG	In spindle emergency stop
X1893	X18F3	X1953	X19B3	X1A13	X1A73	SSRN	In spindle forward run
X1894	X18F4	X1954	X19B4	X1A14	X1A74	SSRI	In spindle reverse run
X1895	X18F5	X1955	X19B5	X1A15	X1A75		Z phase passed
X1896	X18F6	X1956	X19B6	X1A16	X1A76	SIMP	Position loop in-position
X1897	X18F7	X1957	X19B7	X1A17	X1A77	STLQ	In spindle torque limit
Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X1898	X18F8	X1958	X19B8	X1A18	X1A78		In motor 1 selection
X1899	X18F9	X1959	X19B9	X1A19	X1A79		In motor 2 selection
X189A	X18FA	X195A	X19BA	X1A1A	X1A7A		
X189B	X18FB	X195B	X19BB	X1A1B	X1A7B		
X189C	X18FC	X195C	X19BC	X1A1C	X1A7C		
X189D	X18FD	X195D	X19BD	X1A1D	X1A7D	SD2	Speed detection 2
X189E	X18FE	X195E	X19BE	X1A1E	X1A7E	MCSA	In M coil selection
X189F	X18FF	X195F	X19BF	X1A1F	X1A7F		Index positioning completion

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18A0	X1900	X1960	X19C0	X1A20	X1A80	ENB	Spindle enable
X18A1	X1901	X1961	X19C1	X1A21	X1A81		
X18A2	X1902	X1962	X19C2	X1A22	X1A82		
X18A3	X1903	X1963	X19C3	X1A23	X1A83		
X18A4	X1904	X1964	X19C4	X1A24	X1A84		
X18A5	X1905	X1965	X19C5	X1A25	X1A85		
X18A6	X1906	X1966	X19C6	X1A26	X1A86		
X18A7	X1907	X1967	X19C7	X1A27	X1A87		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18A8	X1908	X1968	X19C8	X1A28	X1A88	SPSYN1	In spindle synchronization
X18A9	X1909	X1969	X19C9	X1A29	X1A89	FSPRV	Spindle rotation speed synchronization completion
X18AA	X190A	X196A	X19CA	X1A2A	X1A8A	FSPPH	Spindle phase synchronization completion
X18AB	X190B	X196B	X19CB	X1A2B	X1A8B	SPSYN2	In spindle synchronization 2
X18AC	X190C	X196C	X19CC	X1A2C	X1A8C	SPCMP	Chuck close confirmation
X18AD	X190D	X196D	X19CD	X1A2D	X1A8D		
X18AE	X190E	X196E	X19CE	X1A2E	X1A8E	SPSYN3	In tool spindle synchronization II
X18AF	X190F	X196F	X19CF	X1A2F	X1A8F		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18B0	X1910	X1970	X19D0	X1A30	X1A90		
X18B1	X1911	X1971	X19D1	X1A31	X1A91		
X18B2	X1912	X1972	X19D2	X1A32	X1A92		
X18B3	X1913	X1973	X19D3	X1A33	X1A93	PHOVR	Hob axis delay excess
X18B4	X1914	X1974	X19D4	X1A34	X1A94		
X18B5	X1915	X1975	X19D5	X1A35	X1A95	EXOFN	In spindle holding force up
X18B6	X1916	X1976	X19D6	X1A36	X1A96		
X18B7	X1917	X1977	X19D7	X1A37	X1A97		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18B8	X1918	X1978	X19D8	X1A38	X1A98		
X18B9	X1919	X1979	X19D9	X1A39	X1A99		
X18BA	X191A	X197A	X19DA	X1A3A	X1A9A		
X18BB	X191B	X197B	X19DB	X1A3B	X1A9B		
X18BC	X191C	X197C	X19EC	X1A3C	X1A9C		
X18BD	X191D	X197D	X19DD	X1A3D	X1A9D		
X18BE	X191E	X197E	X19DE	X1A3E	X1A9E		
X18BF	X191F	X197F	X19DF	X1A3F	X1A9F		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18C0	X1920	X1980	X19E0	X1A40	X1AA0		
X18C1	X1921	X1981	X19E1	X1A41	X1AA1		
X18C2	X1922	X1982	X19E2	X1A42	X1AA2		
X18C3	X1923	X1983	X19E3	X1A43	X1AA3		
X18C4	X1924	X1984	X19E4	X1A44	X1AA4		
X18C5	X1925	X1985	X19E5	X1A45	X1AA5		
X18C6	X1926	X1986	X19E6	X1A46	X1AA6		
X18C7	X1927	X1987	X19E7	X1A47	X1AA7		
Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18C8	X1928	X1988	X19E8	X1A48	X1AA8		
X18C9	X1929	X1989	X19E9	X1A49	X1AA9		
X18CA	X192A	X198A	X19EA	X1A4A	X1AAA		
X18CB	X192B	X198B	X19EB	X1A4B	X1AAB		
X18CC	X192C	X198C	X19EC	X1A4C	X1AAC		
X18CD	X192D	X198D	X19EE	X1A4D	X1AAD		
X18CE	X192E	X198E	X19E6	X1A4E	X1AAE		
X18CF	X192F	X198F	X19E7	X1A4F	X1AAF		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
X1CD0		Handy terminal key 1	X1CD8		Handy terminal key 9
X1CD1		Handy terminal key 2	X1CD9		Handy terminal key 10
X1CD2		Handy terminal key 3	X1CDA		Handy terminal key 11
X1CD3		Handy terminal key 4	X1CDB		Handy terminal key 12
X1CD4		Handy terminal key 5	X1CDC		Handy terminal key 13
X1CD5		Handy terminal key 6	X1CDD		Handy terminal key 14
X1CD6		Handy terminal key 7	X1CDE		Handy terminal key 15
X1CD7		Handy terminal key 8	X1CDF		Handy terminal key 16
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
X1CE0		Handy terminal key 17	X1CE8		Handy terminal key 25
X1CE1		Handy terminal key 18	X1CE9		Handy terminal key 26
X1CE2		Handy terminal key 19	X1CEA		Handy terminal key 27
X1CE3		Handy terminal key 20	X1CEB		Handy terminal key 28
X1CE4		Handy terminal key 21	X1CEC		Handy terminal key 29
X1CE5		Handy terminal key 22	X1CED		Handy terminal key 30
X1CE6		Handy terminal key 23	X1CEE		Handy terminal key 31
X1CE7		Handy terminal key 24	X1CEF		Handy terminal key 32
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
X1CF0		Handy terminal key 33	X1CF8		Handy terminal key 41
X1CF1		Handy terminal key 34	X1CF9		Handy terminal key 42
X1CF2		Handy terminal key 35	X1CFA		Handy terminal key 43
X1CF3		Handy terminal key 36	X1CFB		Handy terminal key 44
X1CF4		Handy terminal key 37	X1CFC		Handy terminal key 45
X1CF5		Handy terminal key 38	X1CFD		
X1CF6		Handy terminal key 39	X1CFE		
X1CF7		Handy terminal key 40	X1CFF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X1D00	X1D20	X1D40	X1D60	PSW1	Position switch 1
X1D01	X1D21	X1D41	X1D61	PSW2	Position switch 2
X1D02	X1D22	X1D42	X1D62	PSW3	Position switch 3
X1D03	X1D23	X1D43	X1D63	PSW4	Position switch 4
X1D04	X1D24	X1D44	X1D64	PSW5	Position switch 5
X1D05	X1D25	X1D45	X1D65	PSW6	Position switch 6
X1D06	X1D26	X1D46	X1D66	PSW7	Position switch 7
X1D07	X1D27	X1D47	X1D67	PSW8	Position switch 8

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X1D08	X1D28	X1D48	X1D68	PSW9	Position switch 9
X1D09	X1D29	X1D49	X1D69	PSW10	Position switch 10
X1D0A	X1D2A	X1D4A	X1D6A	PSW11	Position switch 11
X1D0B	X1D2B	X1D4B	X1D6B	PSW12	Position switch 12
X1D0C	X1D2C	X1D4C	X1D6C	PSW13	Position switch 13
X1D0D	X1D2D	X1D4D	X1D6D	PSW14	Position switch 14
X1D0E	X1D2E	X1D4E	X1D6E	PSW15	Position switch 15
X1D0F	X1D2F	X1D4F	X1D6F	PSW16	Position switch 16

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
X1D10	X1D30	X1D50	X1D70	PSW17	Position switch 17
X1D11	X1D31	X1D51	X1D71	PSW18	Position switch 18
X1D12	X1D32	X1D52	X1D72	PSW19	Position switch 19
X1D13	X1D33	X1D53	X1D73	PSW20	Position switch 20
X1D14	X1D34	X1D54	X1D74	PSW21	Position switch 21
X1D15	X1D35	X1D55	X1D75	PSW22	Position switch 22
X1D16	X1D36	X1D56	X1D76	PSW23	Position switch 23
X1D17	X1D37	X1D57	X1D77	PSW24	Position switch 24

4.2 PLC Input Signals (Data type: R***)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R0	AI1	Analog input 1	R8		KEY IN 1
R1	AI2	Analog input 2	R9		
R2	AI3	Analog input 3	R10		
R3	AI4	Analog input 4	R11		Clock data Year/Month
R4	AI5	Analog input 5	R12		Clock data Date/Hour
R5	AI6	Analog input 6	R13		Clock data Minute/Second
R6	AI7	Analog input 7	R14		
R7	AI8	Analog input 8	R15		
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
R16		CNC software version code A	R24		
R17		CNC software version code B	R25		PC high-speed process time
R18		CNC software version code C1	R26		Turret interference check status
R19		CNC software version code C2	R27		Interference object alarm information
R20			R28		
R21			R29		
R22			R30		Remote program input error information ▲
R23			R31		Diagnosis data output
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
R32			R40		
R33			R41		
R34			R42		
R35			R43		
R36			R44		
R37		PLC window parameter status	R45		
R38			R46		
R39			R47		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R48			R56		Battery drop cause
R49			R57		Temperature warning cause
R50			R58		5V/24V error cause
R51			R59		Control unit temperature 2
R52			R60		Control unit temperature
R53			R61		
R54			R62		Tool ID communication error information ▲
R55			R63		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R64			R72		Ball screw thermal displacement compensation Compensation amount 1st [M] axis
R65			R73		Ball screw thermal displacement compensation Compensation amount 2nd [M] axis
R66			R74		Ball screw thermal displacement compensation Compensation amount 3rd [M] axis
R67			R75		Ball screw thermal displacement compensation Compensation amount 4th [M] axis
R68		PLC main scan time	R76		
R69		Emergency stop cause	R77		
R70		DIO card information	R78		
R71			R79		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R80			R88		
R81			R89		
R82			R90		Modbus/TCP connection request monitor ▲
R83		Modbus/RTU received packet monitor ▲	R91		Modbus/TCP number of connections monitor ▲
R84		Modbus/RTU communication error monitor ▲	R92		Modbus/TCP received packet monitor ▲
R85		Modal task data update cycle	R93		Modbus/TCP communication error monitor ▲
R86			R94		Modbus/TCP protocol error packet monitor ▲
R87			R95		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R96	SMDOEN	Speed monitor door open possible	R104		
R97	SODIO	Safety observation I/O signal status	R105		
R98	SOPFN	Multi-step speed monitor selected speed output ▲	R106		
R99			R107		
R100			R108		
R101			R109		
R102			R110		
R103			R111		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R160			R168		PLC axis alarm/warning No. 1st axis
R161			R169		PLC axis alarm/warning No. 2nd axis
R162			R170		PLC axis alarm/warning No. 3rd axis
R163			R171		PLC axis alarm/warning No. 4th axis
R164			R172		PLC axis alarm/warning No. 5th axis
R165			R173		PLC axis alarm/warning No. 6th axis
R166			R174		
R167			R175		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R500	R700	R900	R1100		External search status
R501	R701	R901	R1101		
R502	R702	R902	R1102		
R503	R703	R903	R1103		
R504	R704	R904	R1104		M code data 1 (L)
R505	R705	R905	R1105		M code data 1 (H)
R506	R706	R906	R1106		M code data 2 (L)
R507	R707	R907	R1107		M code data 2 (H)
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R508	R708	R908	R1108		M code data 3 (L)
R509	R709	R909	R1109		M code data 3 (H)
R510	R710	R910	R1110		M code data 4 (L)
R511	R711	R911	R1111		M code data 4 (H)
R512	R712	R912	R1112		S code data 1 (L)
R513	R713	R913	R1113		S code data 1 (H)
R514	R714	R914	R1114		S code data 2 (L)
R515	R715	R915	R1115		S code data 2 (H)
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R516	R716	R916	R1116		S code data 3 (L)
R517	R717	R917	R1117		S code data 3 (H)
R518	R718	R918	R1118		S code data 4 (L)
R519	R719	R919	R1119		S code data 4 (H)
R520	R720	R920	R1120		
R521	R721	R921	R1121		
R522	R722	R922	R1122		
R523	R723	R923	R1123		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R524	R724	R924	R1124		
R525	R725	R925	R1125		
R526	R726	R926	R1126		
R527	R727	R927	R1127		
R528	R728	R928	R1128		
R529	R729	R929	R1129		
R530	R730	R930	R1130		
R531	R731	R931	R1131		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R532	R732	R932	R1132		
R533	R733	R933	R1133		
R534	R734	R934	R1134		
R535	R735	R935	R1135		
R536	R736	R936	R1136		T code data 1 (L)
R537	R737	R937	R1137		T code data 1 (H)
R538	R738	R938	R1138		T code data 2 (L)
R539	R739	R939	R1139		T code data 2 (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R540	R740	R940	R1140		T code data 3 (L)
R541	R741	R941	R1141		T code data 3 (H)
R542	R742	R942	R1142		T code data 4 (L)
R543	R743	R943	R1143		T code data 4 (H)
R544	R744	R944	R1144		2nd M function data 1 (L)
R545	R745	R945	R1145		2nd M function data 1 (H)
R546	R746	R946	R1146		2nd M function data 2 (L)
R547	R747	R947	R1147		2nd M function data 2 (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R548	R748	R948	R1148		2nd M function data 3 (L)
R549	R749	R949	R1149		2nd M function data 3 (H)
R550	R750	R950	R1150		2nd M function data 4 (L)
R551	R751	R951	R1151		2nd M function data 4 (H)
R552	R752	R952	R1152		
R553	R753	R953	R1153		
R554	R754	R954	R1154		Chopping error No.
R555	R755	R955	R1155		Manual measurement status
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R556	R756	R956	R1156		
R557	R757	R957	R1157		
R558	R758	R958	R1158		
R559	R759	R959	R1159		
R560	R760	R960	R1160		
R561	R761	R961	R1161		
R562	R762	R962	R1162		
R563	R763	R963	R1163		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R564	R764	R964	R1164		Load monitor warning axis ▲
R565	R765	R965	R1165		Load monitor alarm axis ▲
R566	R766	R966	R1166		Load monitor data alarm information ▲
R567	R767	R967	R1167		Group in tool life management
R568	R768	R968	R1168		
R569	R769	R969	R1169		
R570	R770	R970	R1170		
R571	R771	R971	R1171		Adaptive control override ▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R572	R772	R972	R1172		CNC completion standby status
R573	R773	R973	R1173		
R574	R774	R974	R1174		In initialization
R575	R775	R975	R1175		Initialization incompletion
R576	R776	R976	R1176		Reference position adjustment value parameter setting completed
R577	R777	R977	R1177		
R578	R778	R978	R1178		Measurement tool tip point No. ▲
R579	R779	R979	R1179		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R580	R780	R980	R1180		Near reference position (per reference position) 1st to 4th axis
R581	R781	R981	R1181		Near reference position (per reference position) 5th to 8th axis
R582	R782	R982	R1182		Presetter contact
R583	R783	R983	R1183		Presetter interlock
R584	R784	R984	R1184		Area signal X axis ON/OFF ▲
R585	R785	R985	R1185		Area signal Z axis ON/OFF ▲
R586	R786	R986	R1186		Area signal X axis (-) ON/OFF ▲
R587	R787	R987	R1187		Area signal Z axis (-) ON/OFF ▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R588	R788	R988	R1188		Takt time (ms) (L)
R589	R789	R989	R1189		Takt time (ms) (H)
R590	R790	R990	R1190		Takt time (min) (L)
R591	R791	R991	R1191		Takt time (min) (H)
R592	R792	R992	R1192		
R593	R793	R993	R1193		
R594	R794	R994	R1194		
R595	R795	R995	R1195		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R596	R796	R996	R1196		Load monitor status (1) ▲
R597	R797	R997	R1197		Load monitor status (2) ▲
R598	R798	R998	R1198		Load monitor status (3) ▲
R599	R799	R999	R1199		Load monitor status (4) ▲
R600	R800	R1000	R1200		Load monitor status (5) ▲
R601	R801	R1001	R1201		Load monitor status (6) ▲
R602	R802	R1002	R1202		Load monitor status (7) ▲
R603	R803	R1003	R1203		Load monitor status (8) ▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R604	R804	R1004	R1204		Load monitor status (9) ▲
R605	R805	R1005	R1205		Load monitor status (10) ▲
R606	R806	R1006	R1206		No. of work machining (current value) (L)
R607	R807	R1007	R1207		No. of work machining (current value) (H)
R608	R808	R1008	R1208		No. of work machining (maximum value) (L)
R609	R809	R1009	R1209		No. of work machining (maximum value) (H)
R610	R810	R1010	R1210		
R611	R811	R1011	R1211		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R612	R812	R1012	R1212		
R613	R813	R1013	R1213		
R614	R814	R1014	R1214		
R615	R815	R1015	R1215		
R616	R816	R1016	R1216		
R617	R817	R1017	R1217		
R618	R818	R1018	R1218		
R619	R819	R1019	R1219		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R620	R820	R1020	R1220		
R621	R821	R1021	R1221		
R622	R822	R1022	R1222		
R623	R823	R1023	R1223		
R624	R824	R1024	R1224		
R625	R825	R1025	R1225		
R626	R826	R1026	R1226		
R627	R827	R1027	R1227		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R628	R828	R1028	R1228		Tool life usage data (L)
R629	R829	R1029	R1229		Tool life usage data (H)
R630	R830	R1030	R1230		Number of registered tool life control tools
R631	R831	R1031	R1231		
R632	R832	R1032	R1232		
R633	R833	R1033	R1233		
R634	R834	R1034	R1234		
R635	R835	R1035	R1235		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R636	R836	R1036	R1236		Circular feed in manual mode Current position X (L) [M]
R637	R837	R1037	R1237		Circular feed in manual mode Current position X (H) [M]
R638	R838	R1038	R1238		
R639	R839	R1039	R1239		
R640	R840	R1040	R1240		Circular feed in manual mode Current position Y (L) [M]
R641	R841	R1041	R1241		Circular feed in manual mode Current position Y (H) [M]
R642	R842	R1042	R1242		
R643	R843	R1043	R1243		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R644	R844	R1044	R1244		
R645	R845	R1045	R1245		
R646	R846	R1046	R1246		Machining mode state ▲
R647	R847	R1047	R1247		
R648	R848	R1048	R1248		
R649	R849	R1049	R1249		
R650	R850	R1050	R1250		
R651	R851	R1051	R1251		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R652	R852	R1052	R1252	TLMSLNO1	Censor ON Tool length compensation No. (BCD output) ▲
R653	R853	R1053	R1253	TLMSWNO1	Censor ON Tool wear compensation No. (BCD output) ▲
R654	R854	R1054	R1254	TLMSLNO2	Compensation data update Tool length compensation No. (BCD output) ▲
R655	R855	R1055	R1255	TLMSWNO2	Compensation data update Tool wear compensation No. (BCD output) ▲
R656	R856	R1056	R1256		
R657	R857	R1057	R1257		
R658	R858	R1058	R1258		
R659	R859	R1059	R1259		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R684	R884	R1084	R1284		Specific user NC status 1 ▲
R685	R885	R1085	R1285		
R686	R886	R1086	R1286		
R687	R887	R1087	R1287		
R688	R888	R1088	R1288		Specific user Manual skip Axis in skip motion ▲
R689	R889	R1089	R1289		Specific user Manual skip Skip motion direction ▲
R690	R890	R1090	R1290		Specific user Error/Warning detail ▲
R691	R891	R1091	R1291		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4500	R4532	R4564	R4596		Machine position 1st axis (L) [M]
R4501	R4533	R4565	R4597		Machine position 1st axis (H) [M]
R4502	R4534	R4566	R4598		
R4503	R4535	R4567	R4599		
R4504	R4536	R4568	R4600		Machine position 2nd axis (L) [M]
R4505	R4537	R4569	R4601		Machine position 2nd axis (H) [M]
R4506	R4538	R4570	R4602		
R4507	R4539	R4571	R4603		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4508	R4540	R4572	R4604		Machine position 3rd axis (L) [M]
R4509	R4541	R4573	R4605		Machine position 3rd axis (H) [M]
R4510	R4542	R4574	R4606		
R4511	R4543	R4575	R4607		
R4512	R4544	R4576	R4608		Machine position 4th axis (L) [M]
R4513	R4545	R4577	R4609		Machine position 4th axis (H) [M]
R4514	R4546	R4578	R4610		
R4515	R4547	R4579	R4611		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4516	R4548	R4580	R4612		Machine position 5th axis (L) [M]
R4517	R4549	R4581	R4613		Machine position 5th axis (H) [M]
R4518	R4550	R4582	R4614		
R4519	R4551	R4583	R4615		
R4520	R4552	R4584	R4616		Machine position 6th axis (L) [M]
R4521	R4553	R4585	R4617		Machine position 6th axis (H) [M]
R4522	R4554	R4586	R4618		
R4523	R4555	R4587	R4619		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4524	R4556	R4588	R4620		Machine position 7th axis (L) [M]
R4525	R4557	R4589	R4621		Machine position 7th axis (H) [M]
R4526	R4558	R4590	R4622		
R4527	R4559	R4591	R4623		
R4528	R4560	R4592	R4624		Machine position 8th axis (L) [M]
R4529	R4561	R4593	R4625		Machine position 8th axis (H) [M]
R4530	R4562	R4594	R4626		
R4531	R4563	R4595	R4627		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4628	R4660	R4692	R4724		Feedback machine position 1st axis (L) [M]
R4629	R4661	R4693	R4725		Feedback machine position 1st axis (H) [M]
R4630	R4662	R4694	R4726		
R4631	R4663	R4695	R4727		
R4632	R4664	R4696	R4728		Feedback machine position 2nd axis (L) [M]
R4633	R4665	R4697	R4729		Feedback machine position 2nd axis (H) [M]
R4634	R4666	R4698	R4730		
R4635	R4667	R4699	R4731		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4636	R4668	R4700	R4732		Feedback machine position 3rd axis (L) [M]
R4637	R4669	R4701	R4733		Feedback machine position 3rd axis (H) [M]
R4638	R4670	R4702	R4734		
R4639	R4671	R4703	R4735		
R4640	R4672	R4704	R4736		Feedback machine position 4th axis (L) [M]
R4641	R4673	R4705	R4737		Feedback machine position 4th axis (H) [M]
R4642	R4674	R4706	R4738		
R4643	R4675	R4707	R4739		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4644	R4676	R4708	R4740		Feedback machine position 5th axis (L) [M]
R4645	R4677	R4709	R4741		Feedback machine position 5th axis (H) [M]
R4646	R4678	R4710	R4742		
R4647	R4679	R4711	R4743		
R4648	R4680	R4712	R4744		Feedback machine position 6th axis (L) [M]
R4649	R4681	R4713	R4745		Feedback machine position 6th axis (H) [M]
R4650	R4682	R4714	R4746		
R4651	R4683	R4715	R4747		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4652	R4684	R4716	R4748		Feedback machine position 7th axis (L) [M]
R4653	R4685	R4717	R4749		Feedback machine position 7th axis (H) [M]
R4654	R4686	R4718	R4750		
R4655	R4687	R4719	R4751		
R4656	R4688	R4720	R4752		Feedback machine position 8th axis (L) [M]
R4657	R4689	R4721	R4753		Feedback machine position 8th axis (H) [M]
R4658	R4690	R4722	R4754		
R4659	R4691	R4723	R4755		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R4756	R4772	R4788	R4804		Servo deflection amount 1st axis (L) [M]
R4757	R4773	R4789	R4805		Servo deflection amount 1st axis (H) [M]
R4758	R4774	R4790	R4806		Servo deflection amount 2nd axis (L) [M]
R4759	R4775	R4791	R4807		Servo deflection amount 2nd axis (H) [M]
R4760	R4776	R4792	R4808		Servo deflection amount 3rd axis (L) [M]
R4761	R4777	R4793	R4809		Servo deflection amount 3rd axis (H) [M]
R4762	R4778	R4794	R4810		Servo deflection amount 4th axis (L) [M]
R4763	R4779	R4795	R4811		Servo deflection amount 4th axis (H) [M]

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R4764	R4780	R4796	R4812		Servo deflection amount 5th axis (L) [M]
R4765	R4781	R4797	R4813		Servo deflection amount 5th axis (H) [M]
R4766	R4782	R4798	R4814		Servo deflection amount 6th axis (L) [M]
R4767	R4783	R4799	R4815		Servo deflection amount 6th axis (H) [M]
R4768	R4784	R4800	R4816		Servo deflection amount 7th axis (L) [M]
R4769	R4785	R4801	R4817		Servo deflection amount 7th axis (H) [M]
R4770	R4786	R4802	R4818		Servo deflection amount 8th axis (L) [M]
R4771	R4787	R4803	R4819		Servo deflection amount 8th axis (H) [M]

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R4820	R4836	R4852	R4868		Motor rotation speed 1st axis (L)
R4821	R4837	R4853	R4869		Motor rotation speed 1st axis (H)
R4822	R4838	R4854	R4870		Motor rotation speed 2nd axis (L)
R4823	R4839	R4855	R4871		Motor rotation speed 2nd axis (H)
R4824	R4840	R4856	R4872		Motor rotation speed 3rd axis (L)
R4825	R4841	R4857	R4873		Motor rotation speed 3rd axis (H)
R4826	R4842	R4858	R4874		Motor rotation speed 4th axis (L)
R4827	R4843	R4859	R4875		Motor rotation speed 4th axis (H)

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4828	R4844	R4860	R4876		Motor rotation speed 5th axis (L)
R4829	R4845	R4861	R4877		Motor rotation speed 5th axis (H)
R4830	R4846	R4862	R4878		Motor rotation speed 6th axis (L)
R4831	R4847	R4863	R4879		Motor rotation speed 6th axis (H)
R4832	R4848	R4864	R4880		Motor rotation speed 7th axis (L)
R4833	R4849	R4865	R4881		Motor rotation speed 7th axis (H)
R4834	R4850	R4866	R4882		Motor rotation speed 8th axis (L)
R4835	R4851	R4867	R4883		Motor rotation speed 8th axis (H)

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4884	R4900	R4916	R4932		Motor load current 1st axis (L)
R4885	R4901	R4917	R4933		Motor load current 1st axis (H)
R4886	R4902	R4918	R4934		Motor load current 2nd axis (L)
R4887	R4903	R4919	R4935		Motor load current 2nd axis (H)
R4888	R4904	R4920	R4936		Motor load current 3rd axis (L)
R4889	R4905	R4921	R4937		Motor load current 3rd axis (H)
R4890	R4906	R4922	R4938		Motor load current 4th axis (L)
R4891	R4907	R4923	R4939		Motor load current 4th axis (H)

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4892	R4908	R4924	R4940		Motor load current 5th axis (L)
R4893	R4909	R4925	R4941		Motor load current 5th axis (H)
R4894	R4910	R4926	R4942		Motor load current 6th axis (L)
R4895	R4911	R4927	R4943		Motor load current 6th axis (H)
R4896	R4912	R4928	R4944		Motor load current 7th axis (L)
R4897	R4913	R4929	R4945		Motor load current 7th axis (H)
R4898	R4914	R4930	R4946		Motor load current 8th axis (L)
R4899	R4915	R4931	R4947		Motor load current 8th axis (H)

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R4948	R4980	R5012	R5044		Skip coordinate position 1st axis (L) [M]
R4949	R4981	R5013	R5045		Skip coordinate position 1st axis (H) [M]
R4950	R4982	R5014	R5046		
R4951	R4983	R5015	R5047		
R4952	R4984	R5016	R5048		Skip coordinate position 2nd axis (L) [M]
R4953	R4985	R5017	R5049		Skip coordinate position 2nd axis (H) [M]
R4954	R4986	R5018	R5050		
R4955	R4987	R5019	R5051		

Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R4956	R4988	R5020	R5052		Skip coordinate position 3rd axis (L)	[M]
R4957	R4989	R5021	R5053		Skip coordinate position 3rd axis (H)	[M]
R4958	R4990	R5022	R5054			
R4959	R4991	R5023	R5055			
R4960	R4992	R5024	R5056		Skip coordinate position 4th axis (L)	[M]
R4961	R4993	R5025	R5057		Skip coordinate position 4th axis (H)	[M]
R4962	R4994	R5026	R5058			
R4963	R4995	R5027	R5059			

Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R4964	R4996	R5028	R5060		Skip coordinate position 5th axis (L)	[M]
R4965	R4997	R5029	R5061		Skip coordinate position 5th axis (H)	[M]
R4966	R4998	R5030	R5062			
R4967	R4999	R5031	R5063			
R4968	R5000	R5032	R5064		Skip coordinate position 6th axis (L)	[M]
R4969	R5001	R5033	R5065		Skip coordinate position 6th axis (H)	[M]
R4970	R5002	R5034	R5066			
R4971	R5003	R5035	R5067			

Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R4972	R5004	R5036	R5068		Skip coordinate position 7th axis (L)	[M]
R4973	R5005	R5037	R5069		Skip coordinate position 7th axis (H)	[M]
R4974	R5006	R5038	R5070			
R4975	R5007	R5039	R5071			
R4976	R5008	R5040	R5072		Skip coordinate position 8th axis (L)	[M]
R4977	R5009	R5041	R5073		Skip coordinate position 8th axis (H)	[M]
R4978	R5010	R5042	R5074			
R4979	R5011	R5043	R5075			

Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R5076	R5092	R5108	R5124		Synchronous error amount 1st, 9th, 17th, 25th axis (L)	[M]
R5077	R5093	R5109	R5125		Synchronous error amount 1st, 9th, 17th, 25th axis (H)	[M]
R5078	R5094	R5110	R5126		Synchronous error amount 2nd, 10th, 18th, 26th axis (L)	[M]
R5079	R5095	R5111	R5127		Synchronous error amount 2nd, 10th, 18th, 26th axis (H)	[M]
R5080	R5096	R5112	R5128		Synchronous error amount 3rd, 11th, 19th, 27th axis (L)	[M]
R5081	R5097	R5113	R5129		Synchronous error amount 3rd, 11th, 19th, 27th axis (H)	[M]
R5082	R5098	R5114	R5130		Synchronous error amount 4th, 12th, 20th, 28th axis (L)	[M]
R5083	R5099	R5115	R5131		Synchronous error amount 4th, 12th, 20th, 28th axis (H)	[M]

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5084	R5100	R5116	R5132		Synchronous error amount 5th, 13th, 21st, 29th axis (L) [M]
R5085	R5101	R5117	R5133		Synchronous error amount 5th, 13th, 21st, 29th axis (H) [M]
R5086	R5102	R5118	R5134		Synchronous error amount 6th, 14th, 22nd, 30th axis (L) [M]
R5087	R5103	R5119	R5135		Synchronous error amount 6th, 14th, 22nd, 30th axis (H) [M]
R5088	R5104	R5120	R5136		Synchronous error amount 7th, 15th, 23rd, 31st axis (L) [M]
R5089	R5105	R5121	R5137		Synchronous error amount 7th, 15th, 23rd, 31st axis (H) [M]
R5090	R5106	R5122	R5138		Synchronous error amount 8th, 16th, 24th, 32nd axis (L) [M]
R5091	R5107	R5123	R5139		Synchronous error amount 8th, 16th, 24th, 32nd axis (H) [M]

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5140	R5148	R5156	R5164		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 1st axis
R5141	R5149	R5157	R5165		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 2nd axis
R5142	R5150	R5158	R5166		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 3rd axis
R5143	R5151	R5159	R5167		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 4th axis
R5144	R5152	R5160	R5168		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 5th axis
R5145	R5153	R5161	R5169		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 6th axis
R5146	R5154	R5162	R5170		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 7th axis
R5147	R5155	R5163	R5171		Optimum acceleration/deceleration parameter group currently selected [axis] ▲ 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5172	R5204	R5236	R5268		Cutting feed movement amount 1st axis (L) [M]
R5173	R5205	R5237	R5269		Cutting feed movement amount 1st axis (H) [M]
R5174	R5206	R5238	R5270		
R5175	R5207	R5239	R5271		
R5176	R5208	R5240	R5272		Cutting feed movement amount 2nd axis (L) [M]
R5177	R5209	R5241	R5273		Cutting feed movement amount 2nd axis (H) [M]
R5178	R5210	R5242	R5274		
R5179	R5211	R5243	R5275		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5180	R5212	R5244	R5276		Cutting feed movement amount 3rd axis (L) [M]
R5181	R5213	R5245	R5277		Cutting feed movement amount 3rd axis (H) [M]
R5182	R5214	R5246	R5278		
R5183	R5215	R5247	R5279		
R5184	R5216	R5248	R5280		Cutting feed movement amount 4th axis (L) [M]
R5185	R5217	R5249	R5281		Cutting feed movement amount 4th axis (H) [M]
R5186	R5218	R5250	R5282		
R5187	R5219	R5251	R5283		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5188	R5220	R5252	R5284		Cutting feed movement amount 5th axis (L) [M]
R5189	R5221	R5253	R5285		Cutting feed movement amount 5th axis (H) [M]
R5190	R5222	R5254	R5286		
R5191	R5223	R5255	R5287		
R5192	R5224	R5256	R5288		Cutting feed movement amount 6th axis (L) [M]
R5193	R5225	R5257	R5289		Cutting feed movement amount 6th axis (H) [M]
R5194	R5226	R5258	R5290		
R5195	R5227	R5259	R5291		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5196	R5228	R5260	R5292		Cutting feed movement amount 7th axis (L) [M]
R5197	R5229	R5261	R5293		Cutting feed movement amount 7th axis (H) [M]
R5198	R5230	R5262	R5294		
R5199	R5231	R5263	R5295		
R5200	R5232	R5264	R5296		Cutting feed movement amount 8th axis (L) [M]
R5201	R5233	R5265	R5297		Cutting feed movement amount 8th axis (H) [M]
R5202	R5234	R5266	R5298		
R5203	R5235	R5267	R5299		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5300	R5308	R5316	R5324		
R5301	R5309	R5317	R5325		
R5302	R5310	R5318	R5326		
R5303	R5311	R5319	R5327		
R5304	R5312	R5320	R5328		
R5305	R5313	R5321	R5329		
R5306	R5314	R5322	R5330		
R5307	R5315	R5323	R5331		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5332	R5340	R5348	R5356		Servo alarm/warning No. 1st axis
R5333	R5341	R5349	R5357		Servo alarm/warning No. 2nd axis
R5334	R5342	R5350	R5358		Servo alarm/warning No. 3rd axis
R5335	R5343	R5351	R5359		Servo alarm/warning No. 4th axis
R5336	R5344	R5352	R5360		Servo alarm/warning No. 5th axis
R5337	R5345	R5353	R5361		Servo alarm/warning No. 6th axis
R5338	R5346	R5354	R5362		Servo alarm/warning No. 7th axis
R5339	R5347	R5355	R5363		Servo alarm/warning No. 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5364	R5396	R5428	R5460		Skip coordinate position 1st axis feature coordinate (L) [M]
R5365	R5397	R5429	R5461		Skip coordinate position 1st axis feature coordinate(H) [M]
R5366	R5398	R5430	R5462		
R5367	R5399	R5431	R5463		
R5368	R5400	R5432	R5464		Skip coordinate position 2nd axis feature coordinate (L) [M]
R5369	R5401	R5433	R5465		Skip coordinate position 2nd axis feature coordinate (H) [M]
R5370	R5402	R5434	R5466		
R5371	R5403	R5435	R5467		
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5372	R5404	R5436	R5468		Skip coordinate position 3rd axis feature coordinate (L) [M]
R5373	R5405	R5437	R5469		Skip coordinate position 3rd axis feature coordinate (H) [M]
R5374	R5406	R5438	R5470		
R5375	R5407	R5439	R5471		
R5376	R5408	R5440	R5472		Skip coordinate position 4th axis feature coordinate (L) [M]
R5377	R5409	R5441	R5473		Skip coordinate position 4th axis feature coordinate (H) [M]
R5378	R5410	R5442	R5474		
R5379	R5411	R5443	R5475		

Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R5380	R5412	R5444	R5476		Skip coordinate position 5th axis feature coordinate (L)	[M]
R5381	R5413	R5445	R5477		Skip coordinate position 5th axis feature coordinate (H	[M]
R5382	R5414	R5446	R5478			
R5383	R5415	R5447	R5479			
R5384	R5416	R5448	R5480		Skip coordinate position 6th axis feature coordinate (L)	[M]
R5385	R5417	R5449	R5481		Skip coordinate position 6th axis feature coordinate (H)	[M]
R5386	R5418	R5450	R5482			
R5387	R5419	R5451	R5483			
Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R5388	R5420	R5452	R5484		Skip coordinate position 7th axis feature coordinate (L)	[M]
R5389	R5421	R5453	R5485		Skip coordinate position 7th axis feature coordinate (H)	[M]
R5390	R5422	R5454	R5486			
R5391	R5423	R5455	R5487			
R5392	R5424	R5456	R5488		Skip coordinate position 8th axis feature coordinate (L)	[M]
R5393	R5425	R5457	R5489		Skip coordinate position 8th axis feature coordinate (L)	[M]
R5394	R5426	R5458	R5490			
R5395	R5427	R5459	R5491			

Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R5492	R5500	R5508	R5516		Cutting torque output value 1st axis	▲
R5493	R5501	R5509	R5517		Cutting torque output value 2nd axis	▲
R5494	R5502	R5510	R5518		Cutting torque output value 3rd axis	▲
R5495	R5503	R5511	R5519		Cutting torque output value 4th axis	▲
R5496	R5504	R5512	R5520		Cutting torque output value 5th axis	▲
R5497	R5505	R5513	R5521		Cutting torque output value 6th axis	▲
R5498	R5506	R5514	R5522		Cutting torque output value 7th axis	▲
R5499	R5507	R5515	R5523		Cutting torque output value 8th axis	▲
Device No.						
$1	$2	$3	$4	Abbrev.	Signal name	
R5524	R5532	R5540	R5548		Actual machining time 1st axis	▲
R5525	R5533	R5541	R5549		Actual machining time 2nd axis	▲
R5526	R5534	R5542	R5550		Actual machining time 3rd axis	▲
R5527	R5535	R5543	R5551		Actual machining time 4th axis	▲
R5528	R5536	R5544	R5552		Actual machining time 5th axis	▲
R5529	R5537	R5545	R5553		Actual machining time 6th axis	▲
R5530	R5538	R5546	R5554		Actual machining time 7th axis	▲
R5531	R5539	R5547	R5555		Actual machining time 8h axis	▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5620	R5628	R5636	R5644		
R5621	R5629	R5637	R5645		
R5622	R5630	R5638	R5646		
R5623	R5631	R5639	R5647		
R5624	R5632	R5640	R5648		
R5625	R5633	R5641	R5649		
R5626	R5634	R5642	R5650		
R5627	R5635	R5643	R5651		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5652	R5660	R5668	R5676		
R5653	R5661	R5669	R5677		
R5654	R5662	R5670	R5678		
R5655	R5663	R5671	R5679		
R5656	R5664	R5672	R5680		
R5657	R5665	R5673	R5681		
R5658	R5666	R5674	R5682		
R5659	R5667	R5675	R5683		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R6372	R6380	R6388	R6396		User macro output #1132 (NC -> PLC) (L)
R6373	R6381	R6389	R6397		User macro output #1132 (NC -> PLC) (H)
R6374	R6382	R6390	R6398		User macro output #1133 (NC -> PLC) (L)
R6375	R6383	R6391	R6399		User macro output #1133 (NC -> PLC) (H)
R6376	R6384	R6392	R6400		User macro output #1134 (NC -> PLC) (L)
R6377	R6385	R6393	R6401		User macro output #1134 (NC -> PLC) (H)
R6378	R6386	R6394	R6402		User macro output #1135 (NC -> PLC) (L)
R6379	R6387	R6395	R6403		User macro output #1135 (NC -> PLC) (H)

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6500	R6550	R6600	R6650	R6700	R6750		Spindle command rotation speed input (L)
R6501	R6551	R6601	R6651	R6701	R6751		Spindle command rotation speed input (H)
R6502	R6552	R6602	R6652	R6702	R6752		Spindle command final data (rotation speed) (L)
R6503	R6553	R6603	R6653	R6703	R6753		Spindle command final data (rotation speed) (H)
R6504	R6554	R6604	R6654	R6704	R6754		Spindle command final data (12-bit binary) (L)
R6505	R6555	R6605	R6655	R6705	R6755		Spindle command final data (12-bit binary) (H)
R6506	R6556	R6606	R6656	R6706	R6756		Spindle actual speed (L)
R6507	R6557	R6607	R6657	R6707	R6757		Spindle actual speed (H)
Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6508	R6558	R6608	R6658	R6708	R6758		
R6509	R6559	R6609	R6659	R6709	R6759		
R6510	R6560	R6610	R6660	R6710	R6760		
R6511	R6561	R6611	R6661	R6711	R6761		
R6512	R6562	R6612	R6662	R6712	R6762		
R6513	R6563	R6613	R6663	R6713	R6763		
R6514	R6564	R6614	R6664	R6714	R6764		Optimum acceleration/deceleration estimated inertia ratio [spindle] ▲
R6515	R6565	R6615	R6665	R6715	R6765		Optimum acceleration/deceleration parameter group currently selected [spindle] ▲
Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6516	R6566	R6616	R6666	R6716	R6766		Spindle synchronization phase error /Hob axis delay angle
R6517	R6567	R6617	R6667	R6717	R6767		Spindle synchronization Maximum phase error/ Maximum hob axis delay angle
R6518	R6568	R6618	R6668	R6718	R6768		Spindle synchronization Phase offset data
R6519	R6569	R6619	R6669	R6719	R6769		Spindle synchronization Phase error monitor
R6520	R6570	R6620	R6670	R6720	R6770		Spindle synchronization Phase error monitor (lower limit)
R6521	R6571	R6621	R6671	R6721	R6771		Spindle synchronization Phase error monitor (upper limit)
R6522	R6572	R6622	R6672	R6722	R6772		Spindle synchronization Phase error 1
R6523	R6573	R6623	R6673	R6723	R6773		Spindle synchronization Phase error 2

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6524	R6574	R6624	R6674	R6724	R6774		
R6525	R6575	R6625	R6675	R6725	R6775		
R6526	R6576	R6626	R6676	R6726	R6776		
R6527	R6577	R6627	R6677	R6727	R6777		Spindle actual machining time ▲
R6528	R6578	R6628	R6678	R6728	R6778		Spindle cutting torque output value ▲
R6529	R6579	R6629	R6679	R6729	R6779		Spindle alarm/warning No.
R6530	R6580	R6630	R6680	R6730	R6780		
R6531	R6581	R6631	R6681	R6731	R6781		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6532	R6582	R6632	R6682	R6732	R6782		Synchronous tapping Current error width (L)
R6533	R6583	R6633	R6683	R6733	R6783		Synchronous tapping Current error width (H)
R6534	R6584	R6634	R6684	R6734	R6784		Synchronous tapping Maximum error width (L)
R6535	R6585	R6635	R6685	R6735	R6785		Synchronous tapping Maximum error width (H)
R6536	R6586	R6636	R6686	R6736	R6786		Synchronous tapping Current error angle (L)
R6537	R6587	R6637	R6687	R6737	R6787		Synchronous tapping Current error angle (H)
R6538	R6588	R6638	R6688	R6738	R6788		Synchronous tapping Maximum error angle (L)
R6539	R6589	R6639	R6689	R6739	R6789		Synchronous tapping Maximum error angle (H)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R10000		RIO1 No. of error occurrences 1st ch	R10008		RIO2 No. of error occurrences 1st ch
R10001		RIO1 No. of error occurrences 2nd ch	R10009		RIO2 No. of error occurrences 2nd ch
R10002		RIO1 No. of error occurrences 3rd ch	R10010		RIO2 No. of error occurrences 3rd ch
R10003		RIO1 No. of error occurrences 4th ch	R10011		RIO2 No. of error occurrences 4th ch
R10004		RIO1 No. of error occurrences 5th ch	R10012		RIO2 No. of error occurrences 5th ch
R10005		RIO1 No. of error occurrences 6th ch	R10013		RIO2 No. of error occurrences 6th ch
R10006		RIO1 No. of error occurrences 7th ch	R10014		RIO2 No. of error occurrences 7th ch
R10007		RIO1 No. of error occurrences 8th ch	R10015		RIO2 No. of error occurrences 8th ch

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R10016		RIO3 No. of error occurrences 1st ch	R10024		
R10017		RIO3 No. of error occurrences 2nd ch	R10025		
R10018		RIO3 No. of error occurrences 3rd ch	R10026		
R10019		RIO3 No. of error occurrences 4th ch	R10027		
R10020		RIO3 No. of error occurrences 5th ch	R10028		
R10021		RIO3 No. of error occurrences 6th ch	R10029		
R10022		RIO3 No. of error occurrences 7th ch	R10030		
R10023		RIO3 No. of error occurrences 8th ch	R10031		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R10064		Connection status of each channel RIO1,2	R10073		
R10065		Connection status of each channel RIO3	R10074		
R10066			R10075		
R10067			R10076		
R10068		CRC warning channel RIO1,2	R10077		
R10069		CRC warning channel RIO3	R10078		
R10070			R10079		
R10071			R10079		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
					T life mgmt (M system)
R11800	R11850	R11900	R11950		Spare tool: Group No. (L)
R11801	R11851	R11901	R11951		Spare tool: Group No. (H)
R11802	R11852	R11902	R11952		Spare tool: Tool No. (L)
R11803	R11853	R11903	R11953		Spare tool: Tool No. (H)
R11804	R11854	R11904	R11954		Spare tool: Tool data flag/Status
R11805	R11855	R11905	R11955		Spare tool: Auxiliary data
R11806	R11856	R11906	R11956		Spare tool: Cumulative usage time (L)
R11807	R11857	R11907	R11957		Spare tool: Cumulative usage time (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R11808	R11858	R11908	R11958		Spare tool: Service lifetime (L)
R11809	R11859	R11909	R11959		Spare tool: Service lifetime (H)
R11810	R11860	R11910	R11960		Spare tool: Cumulative usage count
R11811	R11861	R11911	R11961		Spare tool: Service life count
R11812	R11862	R11912	R11962		Spare tool: Cumulative usage wear amount (L)
R11813	R11863	R11913	R11963		Spare tool: Cumulative usage wear amount (H)
R11814	R11864	R11914	R11964		Spare tool: Service life wear amount (L)
R11815	R11865	R11915	R11965		Spare tool: Service life wear amount (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R11816	R11866	R11916	R11966		Spare tool: Length compensation amount (L)
R11817	R11867	R11917	R11967		Spare tool: Length compensation amount (H)
R11818	R11868	R11918	R11968		Spare tool: Radius compensation amount (L)
R11819	R11869	R11919	R11969		Spare tool: Radius compensation amount (H)
R11820	R11870	R11920	R11970		Spare tool: Length wear amount (L)
R11821	R11871	R11921	R11971		Spare tool: Length wear amount (H)
R11822	R11872	R11922	R11972		Spare tool: Radius wear amount (L)
R11823	R11873	R11923	R11973		Spare tool: Radius wear amount (H)

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R11824	R11874	R11924	R11974		T life mgmt (M system) Active tool: Group No. (L)
R11825	R11875	R11925	R11975		Active tool: Group No. (H)
R11826	R11876	R11926	R11976		Active tool: Tool No. (L)
R11827	R11877	R11927	R11977		Active tool: Tool No. (H)
R11828	R11878	R11928	R11978		Active tool: Tool data flag/Status
R11829	R11879	R11929	R11979		Active tool: Auxiliary data
R11830	R11880	R11930	R11980		Active tool: Cumulative usage time (L)
R11831	R11881	R11931	R11981		Active tool: Cumulative usage time (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R11832	R11882	R11932	R11982		Active tool: Service lifetime (L)
R11833	R11883	R11933	R11983		Active tool: Service lifetime (H)
R11834	R11884	R11934	R11984		Active tool: Cumulative usage count
R11835	R11885	R11935	R11985		Active tool: Service life count
R11836	R11886	R11936	R11986		Active tool: Cumulative usage wear amount (L)
R11837	R11887	R11937	R11987		Active tool: Cumulative usage wear amount (H)
R11838	R11888	R11938	R11988		Active tool: Service life wear amount (L)
R11839	R11889	R11939	R11989		Active tool: Service life wear amount (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R11840	R11890	R11940	R11990		Active tool: Length compensation amount (L)
R11841	R11891	R11941	R11991		Active tool: Length compensation amount (H)
R11842	R11892	R11942	R11992		Active tool: Radius compensation amount (L)
R11843	R11893	R11943	R11993		Active tool: Radius compensation amount (H)
R11844	R11894	R11944	R11994		Active tool: Length wear amount (L)
R11845	R11895	R11945	R11995		Active tool: Length wear amount (H)
R11846	R11896	R11946	R11996		Active tool: Radius wear amount (L)
R11847	R11897	R11947	R11997		Active tool: Radius wear amount (H)
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R20516	R20716	R20916	R21116		Appropriate machining diagnosis error axis ▲
R20517	R20717	R20917	R21117		
R20518	R20718	R20918	R21118		
R20519	R20719	R20919	R21119		
R20520	R20720	R20920	R21120		
R20521	R20721	R20921	R21121		
R20522	R20722	R20922	R21122		
R20523	R20723	R20923	R21123		

4.3 PLC Output Signals (Bit type: Y***)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y700			Y708	*KEY1	Data protect key 1
Y701			Y709	*KEY2	Data protect key 2
Y702			Y70A	*KEY3	Data protect key 3
Y703			Y70B		
Y704	RHD1	Integration time input 1	Y70C	PDISP	Program display during operation
Y705	RHD2	Integration time input 2	Y70D		Handle pulse encoder communication connector priority
Y706	MDBUSRST1	Modbus Time-out 1 cancel ▲	Y70E		
Y707	MDBUSRST2	Modbus Time-out 2 cancel ▲	Y70F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y710			Y718	*PCD1	PLC axis near point detection 1st axis
Y711		Optimum acceleration/deceleration parameter switch request [spindle] ▲	Y719	*PCD2	PLC axis near point detection 2nd axis
Y712			Y71A	*PCD3	PLC axis near point detection 3rd axis
Y713			Y71B	*PCD4	PLC axis near point detection 4th axis
Y714			Y71C	*PCD5	PLC axis near point detection 5th axis
Y715			Y71D	*PCD6	PLC axis near point detection 6th axis
Y716			Y71E		
Y717			Y71F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y720	HS1P	PLC axis 1st handle valid	Y728	CRTFN	CRT changeover completion
Y721	HS2P	PLC axis 2nd handle valid	Y729	SCRON	Screen display request
Y722	HS3P	PLC axis 3rd handle valid	Y72A		
Y723		PLC axis control buffering mode valid	Y72B		Collecting diagnosis data stop
Y724			Y72C	SMPTRG	NC data sampling trigger
Y725			Y72D		
Y726			Y72E		Pallet program registration In APC execution
Y727			Y72F		Pallet program registration Ext. workpiece coordinate transfer ready

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y730	DISP1	Display changeover $1	Y738		
Y731	DISP2	Display changeover $2	Y739		
Y732	DISP3	Display changeover $3	Y73A		
Y733	DISP4	Display changeover $4	Y73B		
Y734			Y73C		
Y735			Y73D		
Y736			Y73E		
Y737			Y73F	CCHK	Interference check valid

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y740		Tool IC new read ▲	Y748		PLC skip 1
Y741		Tool IC exchange read ▲	Y749		PLC skip 2
Y742	MCT	Contactor shutoff test	Y74A		PLC skip 3
Y743			Y74B		PLC skip 4
Y744			Y74C		PLC skip 5
Y745			Y74D		PLC skip 6
Y746			Y74E		PLC skip 7
Y747		Turret interference check valid	Y74F		PLC skip 8

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y750			Y758		
Y751			Y759		
Y752			Y75A		
Y753			Y75B		
Y754			Y75C		
Y755			Y75D		Automatic power OFF request
Y756			Y75E		
Y757			Y75F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y760			Y768		Door open I
Y761			Y769		
Y762			Y76A		
Y763			Y76B		
Y764		Encoder 1 arbitrary pulse selection	Y76C		Remote program input start ▲
Y765		Encoder 2 arbitrary pulse selection	Y76D		Tool ID data read ▲
Y766		Encoder 1 arbitrary pulse valid	Y76E		Tool ID data write ▲
Y767		Encoder 2 arbitrary pulse valid	Y76F		Tool ID data erase ▲

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y770		PLC axis control valid 1st axis	Y778		
Y771		PLC axis control valid 2nd axis	Y779		
Y772		PLC axis control valid 3rd axis	Y77A		
Y773		PLC axis control valid 4th axis	Y77B		
Y774		PLC axis control valid 5th axis	Y77C		
Y775		PLC axis control valid 6th axis	Y77D		
Y776			Y77E		
Y777			Y77F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y780	Y788	Y790	Y798	DTCH1	Control axis detach 1st axis
Y781	Y789	Y791	Y799	DTCH2	Control axis detach 2nd axis
Y782	Y78A	Y792	Y79A	DTCH3	Control axis detach 3rd axis
Y783	Y78B	Y793	Y79B	DTCH4	Control axis detach 4th axis
Y784	Y78C	Y794	Y79C	DTCH5	Control axis detach 5th axis
Y785	Y78D	Y795	Y79D	DTCH6	Control axis detach 6th axis
Y786	Y78E	Y796	Y79E	DTCH7	Control axis detach 7th axis
Y787	Y78F	Y797	Y79F	DTCH8	Control axis detach 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y7A0	Y7A8	Y7B0	Y7B8	*SVF1	Servo OFF 1st axis
Y7A1	Y7A9	Y7B1	Y7B9	*SVF2	Servo OFF 2nd axis
Y7A2	Y7AA	Y7B2	Y7BA	*SVF3	Servo OFF 3rd axis
Y7A3	Y7AB	Y7B3	Y7BB	*SVF4	Servo OFF 4th axis
Y7A4	Y7AC	Y7B4	Y7BC	*SVF5	Servo OFF 5th axis
Y7A5	Y7AD	Y7B5	Y7BD	*SVF6	Servo OFF 6th axis
Y7A6	Y7AE	Y7B6	Y7BE	*SVF7	Servo OFF 7th axis
Y7A7	Y7AF	Y7B7	Y7BF	*SVF8	Servo OFF 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y7C0	Y7C8	Y7D0	Y7D8	MI1	Mirror image 1st axis
Y7C1	Y7C9	Y7D1	Y7D9	MI2	Mirror image 2nd axis
Y7C2	Y7CA	Y7D2	Y7DA	MI3	Mirror image 3rd axis
Y7C3	Y7CB	Y7D3	Y7DB	MI4	Mirror image 4th axis
Y7C4	Y7CC	Y7D4	Y7DC	MI5	Mirror image 5th axis
Y7C5	Y7CD	Y7D5	Y7DD	MI6	Mirror image 6th axis
Y7C6	Y7CE	Y7D6	Y7DE	MI7	Mirror image 7th axis
Y7C7	Y7CF	Y7D7	Y7DF	MI8	Mirror image 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y7E0	Y7E8	Y7F0	Y7F8	*+EDT1	External deceleration+ 1st axis
Y7E1	Y7E9	Y7F1	Y7F9	*+EDT2	External deceleration+ 2nd axis
Y7E2	Y7EA	Y7F2	Y7FA	*+EDT3	External deceleration+ 3rd axis
Y7E3	Y7EB	Y7F3	Y7FB	*+EDT4	External deceleration+ 4th axis
Y7E4	Y7EC	Y7F4	Y7FC	*+EDT5	External deceleration+ 5th axis
Y7E5	Y7ED	Y7F5	Y7FD	*+EDT6	External deceleration+ 6th axis
Y7E6	Y7EE	Y7F6	Y7FE	*+EDT7	External deceleration+ 7th axis
Y7E7	Y7EF	Y7F7	Y7FF	*+EDT8	External deceleration+ 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y800	Y808	Y810	Y818	*-EDT1	External deceleration- 1st axis
Y801	Y809	Y811	Y819	*-EDT2	External deceleration- 2nd axis
Y802	Y80A	Y812	Y81A	*-EDT3	External deceleration- 3rd axis
Y803	Y80B	Y813	Y81B	*-EDT4	External deceleration- 4th axis
Y804	Y80C	Y814	Y81C	*-EDT5	External deceleration- 5th axis
Y805	Y80D	Y815	Y81D	*-EDT6	External deceleration- 6th axis
Y806	Y80E	Y816	Y81E	*-EDT7	External deceleration- 7th axis
Y807	Y80F	Y817	Y81F	*-EDT8	External deceleration- 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y820	Y828	Y830	Y838	*+AIT1	Automatic interlock+ 1st axis
Y821	Y829	Y831	Y839	*+AIT2	Automatic interlock+ 2nd axis
Y822	Y82A	Y832	Y83A	*+AIT3	Automatic interlock+ 3rd axis
Y823	Y82B	Y833	Y83B	*+AIT4	Automatic interlock+ 4th axis
Y824	Y82C	Y834	Y83C	*+AIT5	Automatic interlock+ 5th axis
Y825	Y82D	Y835	Y83D	*+AIT6	Automatic interlock+ 6th axis
Y826	Y82E	Y836	Y83E	*+AIT7	Automatic interlock+ 7th axis
Y827	Y82F	Y837	Y83F	*+AIT8	Automatic interlock+ 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y840	Y848	Y850	Y858	*-AIT1	Automatic interlock- 1st axis
Y841	Y849	Y851	Y859	*-AIT2	Automatic interlock- 2nd axis
Y842	Y84A	Y852	Y85A	*-AIT3	Automatic interlock- 3rd axis
Y843	Y84B	Y853	Y85B	*-AIT4	Automatic interlock- 4th axis
Y844	Y84C	Y854	Y85C	*-AIT5	Automatic interlock- 5th axis
Y845	Y84D	Y855	Y85D	*-AIT6	Automatic interlock- 6th axis
Y846	Y84E	Y856	Y85E	*-AIT7	Automatic interlock- 7th axis
Y847	Y84F	Y857	Y85F	*-AIT8	Automatic interlock- 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y860	Y868	Y870	Y878	*+MIT1	Manual interlock+ 1st axis
Y861	Y869	Y871	Y879	*+MIT2	Manual interlock+ 2nd axis
Y862	Y86A	Y872	Y87A	*+MIT3	Manual interlock+ 3rd axis
Y863	Y86B	Y873	Y87B	*+MIT4	Manual interlock+ 4th axis
Y864	Y86C	Y874	Y87C	*+MIT5	Manual interlock+ 5th axis
Y865	Y86D	Y875	Y87D	*+MIT6	Manual interlock+ 6th axis
Y866	Y86E	Y876	Y87E	*+MIT7	Manual interlock+ 7th axis
Y867	Y86F	Y877	Y87F	*+MIT8	Manual interlock+ 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y880	Y888	Y890	Y898	*-MIT1	Manual interlock- 1st axis
Y881	Y889	Y891	Y899	*-MIT2	Manual interlock- 2nd axis
Y882	Y88A	Y892	Y89A	*-MIT3	Manual interlock- 3rd axis
Y883	Y88B	Y893	Y89B	*-MIT4	Manual interlock- 4th axis
Y884	Y88C	Y894	Y89C	*-MIT5	Manual interlock- 5th axis
Y885	Y88D	Y895	Y89D	*-MIT6	Manual interlock- 6th axis
Y886	Y88E	Y896	Y89E	*-MIT7	Manual interlock- 7th axis
Y887	Y88F	Y897	Y89F	*-MIT8	Manual interlock- 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y8A0	Y8A8	Y8B0	Y8B8	AMLK1	Automatic machine lock 1st axis
Y8A1	Y8A9	Y8B1	Y8B9	AMLK2	Automatic machine lock 2nd axis
Y8A2	Y8AA	Y8B2	Y8BA	AMLK3	Automatic machine lock 3rd axis
Y8A3	Y8AB	Y8B3	Y8BB	AMLK4	Automatic machine lock 4th axis
Y8A4	Y8AC	Y8B4	Y8BC	AMLK5	Automatic machine lock 5th axis
Y8A5	Y8AD	Y8B5	Y8BD	AMLK6	Automatic machine lock 6th axis
Y8A6	Y8AE	Y8B6	Y8BE	AMLK7	Automatic machine lock 7th axis
Y8A7	Y8AF	Y8B7	Y8BF	AMLK8	Automatic machine lock 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y8C0	Y8C8	Y8D0	Y8D8	MMLK1	Manual machine lock 1st axis
Y8C1	Y8C9	Y8D1	Y8D9	MMLK2	Manual machine lock 2nd axis
Y8C2	Y8CA	Y8D2	Y8DA	MMLK3	Manual machine lock 3rd axis
Y8C3	Y8CB	Y8D3	Y8DB	MMLK4	Manual machine lock 4th axis
Y8C4	Y8CC	Y8D4	Y8DC	MMLK5	Manual machine lock 5th axis
Y8C5	Y8CD	Y8D5	Y8DD	MMLK6	Manual machine lock 6th axis
Y8C6	Y8CE	Y8D6	Y8DE	MMLK7	Manual machine lock 7th axis
Y8C7	Y8CF	Y8D7	Y8DF	MMLK8	Manual machine lock 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y8E0	Y8E8	Y8F0	Y8F8	+J1	Feed axis selection+ 1st axis
Y8E1	Y8E9	Y8F1	Y8F9	+J2	Feed axis selection+ 2nd axis
Y8E2	Y8EA	Y8F2	Y8FA	+J3	Feed axis selection+ 3rd axis
Y8E3	Y8EB	Y8F3	Y8FB	+J4	Feed axis selection+ 4th axis
Y8E4	Y8EC	Y8F4	Y8FC	+J5	Feed axis selection+ 5th axis
Y8E5	Y8ED	Y8F5	Y8FD	+J6	Feed axis selection+ 6th axis
Y8E6	Y8EE	Y8F6	Y8FE	+J7	Feed axis selection+ 7th axis
Y8E7	Y8EF	Y8F7	Y8FF	+J8	Feed axis selection+ 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y900	Y908	Y910	Y918	-J1	Feed axis selection- 1st axis
Y901	Y909	Y911	Y919	-J2	Feed axis selection- 2nd axis
Y902	Y90A	Y912	Y91A	-J3	Feed axis selection- 3rd axis
Y903	Y90B	Y913	Y91B	-J4	Feed axis selection- 4th axis
Y904	Y90C	Y914	Y91C	-J5	Feed axis selection- 5th axis
Y905	Y90D	Y915	Y91D	-J6	Feed axis selection- 6th axis
Y906	Y90E	Y916	Y91E	-J7	Feed axis selection- 7th axis
Y907	Y90F	Y917	Y91F	-J8	Feed axis selection- 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y920	Y928	Y930	Y938	MAE1	Manual/Automatic simultaneous valid 1st axis
Y921	Y929	Y931	Y939	MAE2	Manual/Automatic simultaneous valid 2nd axis
Y922	Y92A	Y932	Y93A	MAE3	Manual/Automatic simultaneous valid 3rd axis
Y923	Y92B	Y933	Y93B	MAE4	Manual/Automatic simultaneous valid 4th axis
Y924	Y92C	Y934	Y93C	MAE5	Manual/Automatic simultaneous valid 5th axis
Y925	Y92D	Y935	Y93D	MAE6	Manual/Automatic simultaneous valid 6th axis
Y926	Y92E	Y936	Y93E	MAE7	Manual/Automatic simultaneous valid 7th axis
Y927	Y92F	Y937	Y93F	MAE8	Manual/Automatic simultaneous valid 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y940	Y948	Y950	Y958	FBE1	Manual feedrate B valid 1st axis
Y941	Y949	Y951	Y959	FBE2	Manual feedrate B valid 2nd axis
Y942	Y94A	Y952	Y95A	FBE3	Manual feedrate B valid 3rd axis
Y943	Y94B	Y953	Y95B	FBE4	Manual feedrate B valid 4th axis
Y944	Y94C	Y954	Y95C	FBE5	Manual feedrate B valid 5th axis
Y945	Y94D	Y955	Y95D	FBE6	Manual feedrate B valid 6th axis
Y946	Y94E	Y956	Y95E	FBE7	Manual feedrate B valid 7th axis
Y947	Y94F	Y957	Y95F	FBE8	Manual feedrate B valid 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y960	Y968	Y970	Y978	AZS1	Zero point initialization set mode 1st axis
Y961	Y969	Y971	Y979	AZS2	Zero point initialization set mode 2nd axis
Y962	Y96A	Y972	Y97A	AZS3	Zero point initialization set mode 3rd axis
Y963	Y96B	Y973	Y97B	AZS4	Zero point initialization set mode 4th axis
Y964	Y96C	Y974	Y97C	AZS5	Zero point initialization set mode 5th axis
Y965	Y96D	Y975	Y97D	AZS6	Zero point initialization set mode 6th axis
Y966	Y96E	Y976	Y97E	AZS7	Zero point initialization set mode 7th axis
Y967	Y96F	Y977	Y97F	AZS8	Zero point initialization set mode 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
Y980	Y988	Y990	Y998	ZST1	Zero point initialization set start 1st axis
Y981	Y989	Y991	Y999	ZST2	Zero point initialization set start 2nd axis
Y982	Y98A	Y992	Y99A	ZST3	Zero point initialization set start 3rd axis
Y983	Y98B	Y993	Y99B	ZST4	Zero point initialization set start 4th axis
Y984	Y98C	Y994	Y99C	ZST5	Zero point initialization set start 5th axis
Y985	Y98D	Y995	Y99D	ZST6	Zero point initialization set start 6th axis
Y986	Y98E	Y996	Y99E	ZST7	Zero point initialization set start 7th axis
Y987	Y98F	Y997	Y99F	ZST8	Zero point initialization set start 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
Y9A0	Y9A8	Y9B0	Y9B8	ILC1	Current limit changeover 1st axis
Y9A1	Y9A9	Y9B1	Y9B9	ILC2	Current limit changeover 2nd axis
Y9A2	Y9AA	Y9B2	Y9BA	ILC3	Current limit changeover 3rd axis
Y9A3	Y9AB	Y9B3	Y9BB	ILC4	Current limit changeover 4th axis
Y9A4	Y9AC	Y9B4	Y9BC	ILC5	Current limit changeover 5th axis
Y9A5	Y9AD	Y9B5	Y9BD	ILC6	Current limit changeover 6th axis
Y9A6	Y9AE	Y9B6	Y9BE	ILC7	Current limit changeover 7th axis
Y9A7	Y9AF	Y9B7	Y9BF	ILC8	Current limit changeover 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
Y9C0	Y9C8	Y9D0	Y9D8	DOR1	Droop release request 1st axis
Y9C1	Y9C9	Y9D1	Y9D9	DOR2	Droop release request 2nd axis
Y9C2	Y9CA	Y9D2	Y9DA	DOR3	Droop release request 3rd axis
Y9C3	Y9CB	Y9D3	Y9DB	DOR4	Droop release request 4th axis
Y9C4	Y9CC	Y9D4	Y9DC	DOR5	Droop release request 5th axis
Y9C5	Y9CD	Y9D5	Y9DD	DOR6	Droop release request 6th axis
Y9C6	Y9CE	Y9D6	Y9DE	DOR7	Droop release request 7th axis
Y9C7	Y9CF	Y9D7	Y9DF	DOR8	Droop release request 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
Y9E0	Y9E8	Y9F0	Y9F8		Workpiece coordinate Measurement 1st axis (Spare)
Y9E1	Y9E9	Y9F1	Y9F9		Workpiece coordinate Measurement 2nd axis
Y9E2	Y9EA	Y9F2	Y9FA		Workpiece coordinate Measurement 3rd axis (Spare)
Y9E3	Y9EB	Y9F3	Y9FB		Workpiece coordinate Measurement 4th axis (Spare)
Y9E4	Y9EC	Y9F4	Y9FC		Workpiece coordinate Measurement 5th axis (Spare)
Y9E5	Y9ED	Y9F5	Y9FD		Workpiece coordinate Measurement 6th axis (Spare)
Y9E6	Y9EE	Y9F6	Y9FE		Workpiece coordinate Measurement 7th axis (Spare)
Y9E7	Y9EF	Y9F7	Y9FF		Workpiece coordinate Measurement 8th axis (Spare)

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YA00	YA08	YA10	YA18	DTCH21	Control axis detach 2 1st axis
YA01	YA09	YA11	YA19	DTCH22	Control axis detach 2 2nd axis
YA02	YA0A	YA12	YA1A	DTCH23	Control axis detach 2 3rd axis
YA03	YA0B	YA13	YA1B	DTCH24	Control axis detach 2 4th axis
YA04	YA0C	YA14	YA1C	DTCH25	Control axis detach 2 5th axis
YA05	YA0D	YA15	YA1D	DTCH26	Control axis detach 2 6th axis
YA06	YA0E	YA16	YA1E	DTCH27	Control axis detach 2 7th axis
YA07	YA0F	YA17	YA1F	DTCH28	Control axis detach 2 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YA20	YA28	YA30	YA38		Unclamp completion 1st axis
YA21	YA29	YA31	YA39		Unclamp completion 2nd axis
YA22	YA2A	YA32	YA3A		Unclamp completion 3rd axis
YA23	YA2B	YA33	YA3B		Unclamp completion 4th axis
YA24	YA2C	YA34	YA3C		Unclamp completion 5th axis
YA25	YA2D	YA35	YA3D		Unclamp completion 6th axis
YA26	YA2E	YA36	YA3E		Unclamp completion 7th axis
YA27	YA2F	YA37	YA3F		Unclamp completion 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YA40	YA48	YA50	YA58		Each axis reference position return 1st axis
YA41	YA49	YA51	YA59		Each axis reference position return 2nd axis
YA42	YA4A	YA52	YA5A		Each axis reference position return 3rd axis
YA43	YA4B	YA53	YA5B		Each axis reference position return 4th axis
YA44	YA4C	YA54	YA5C		Each axis reference position return 5th axis
YA45	YA4D	YA55	YA5D		Each axis reference position return 6th axis
YA46	YA4E	YA56	YA5E		Each axis reference position return 7th axis
YA47	YA4F	YA57	YA5F		Each axis reference position return 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YA60	YA68	YA70	YA78		Mixed control (cross axis control) request 1st axis
YA61	YA69	YA71	YA79		Mixed control (cross axis control) request 2nd axis
YA62	YA6A	YA72	YA7A		Mixed control (cross axis control) request 3rd axis
YA63	YA6B	YA73	YA7B		Mixed control (cross axis control) request 4th axis
YA64	YA6C	YA74	YA7C		Mixed control (cross axis control) request 5th axis
YA65	YA6D	YA75	YA7D		Mixed control (cross axis control) request 6th axis
YA66	YA6E	YA76	YA7E		Mixed control (cross axis control) request 7th axis
YA67	YA6F	YA77	YA7F		Mixed control (cross axis control) request 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YA80	YA88	YA90	YA98	SYNC1	Synchronous control request 1st axis
YA81	YA89	YA91	YA99	SYNC2	Synchronous control request 2nd axis
YA82	YA8A	YA92	YA9A	SYNC3	Synchronous control request 3rd axis
YA83	YA8B	YA93	YA9B	SYNC4	Synchronous control request 4th axis
YA84	YA8C	YA94	YA9C	SYNC5	Synchronous control request 5th axis
YA85	YA8D	YA95	YA9D	SYNC6	Synchronous control request 6th axis
YA86	YA8E	YA96	YA9E	SYNC7	Synchronous control request 7th axis
YA87	YA8F	YA97	YA9F	SYNC8	Synchronous control request 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YAA0	YAA8	YAB0	YAB8	PILE1	Superimposition control request 1st axis
YAA1	YAA9	YAB1	YAB9	PILE2	Superimposition control request 2nd axis
YAA2	YAAA	YAB2	YABA	PILE3	Superimposition control request 3rd axis
YAA3	YAAB	YAB3	YABB	PILE4	Superimposition control request 4th axis
YAA4	YAAC	YAB4	YABC	PILE5	Superimposition control request 5th axis
YAA5	YAAD	YAB5	YABD	PILE6	Superimposition control request 6th axis
YAA6	YAAE	YAB6	YABE	PILE7	Superimposition control request 7th axis
YAA7	YAAF	YAB7	YABF	PILE8	Superimposition control request 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YAC0	YAC8	YAD0	YAD8		NC axis control selection 1st axis
YAC1	YAC9	YAD1	YAD9		NC axis control selection 2nd axis
YAC2	YACA	YAD2	YADA		NC axis control selection 3rd axis
YAC3	YACB	YAD3	YADB		NC axis control selection 4th axis
YAC4	YACC	YAD4	YADC		NC axis control selection 5th axis
YAC5	YACD	YAD5	YADD		NC axis control selection 6th axis
YAC6	YACE	YAD6	YADE		NC axis control selection 7th axis
YAC7	YACF	YAD7	YADF		NC axis control selection 8th axis

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YAE0	YAE8	YAF0	YAF8		Vertical axis pull-up prevention request 1st axis
YAE1	YAE9	YAF1	YAF9		Vertical axis pull-up prevention request 2nd axis
YAE2	YAEA	YAF2	YAFA		Vertical axis pull-up prevention request 3rd axis
YAE3	YAEB	YAF3	YAFB		Vertical axis pull-up prevention request 4th axis
YAE4	YAEC	YAF4	YAFC		Vertical axis pull-up prevention request 5th axis
YAE5	YAED	YAF5	YAFD		Vertical axis pull-up prevention request 6th axis
YAE6	YAEE	YAF6	YAFE		Vertical axis pull-up prevention request 7th axis
YAE7	YAEF	YAF7	YAFF		Vertical axis pull-up prevention request 8th axis

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YB00	YB08	YB10	YB18		Clamp completion 1st axis ▲
YB01	YB09	YB11	YB19		Clamp completion 2nd axis ▲
YB02	YB0A	YB12	YB1A		Clamp completion 3rd axis ▲
YB03	YB0B	YB13	YB1B		Clamp completion 4th axis ▲
YB04	YB0C	YB14	YB1C		Clamp completion 5th axis ▲
YB05	YB0D	YB15	YB1D		Clamp completion 6th axis ▲
YB06	YB0E	YB16	YB1E		Clamp completion 7th axis ▲
YB07	YB0F	YB17	YB1F		Clamp completion 8th axis ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC00	YD40	YE80	YFC0	J	Jog mode
YC01	YD41	YE81	YFC1	H	Handle mode
YC02	YD42	YE82	YFC2	S	Incremental mode
YC03	YD43	YE83	YFC3	PTP	Manual arbitrary feed mode
YC04	YD44	YE84	YFC4	ZRN	Reference position return mode
YC05	YD45	YE85	YFC5	AST	Automatic initialization mode
YC06	YD46	YE86	YFC6		
YC07	YD47	YE87	YFC7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC08	YD48	YE88	YFC8	MEM	Memory mode
YC09	YD49	YE89	YFC9	T	Tape mode
YC0A	YD4A	YE8A	YFCA		Online operation mode (Computer link B)
YC0B	YD4B	YE8B	YFCB	D	MDI mode
YC0C	YD4C	YE8C	YFCC		
YC0D	YD4D	YE8D	YFCD		
YC0E	YD4E	YE8E	YFCE		
YC0F	YD4F	YE8F	YFCF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC10	YD50	YE90	YFD0	ST	Automatic operation "start" command (Cycle start)
YC11	YD51	YE91	YFD1	*SP	Automatic operation "pause" command (Feed hold)
YC12	YD52	YE92	YFD2	SBK	Single block
YC13	YD53	YE93	YFD3	*BSL	Block start interlock
YC14	YD54	YE94	YFD4	*CSL	Cutting block start interlock
YC15	YD55	YE95	YFD5	DRN	Dry run
YC16	YD56	YE96	YFD6		
YC17	YD57	YE97	YFD7	ERD	Error detection

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC18	YD58	YE98	YFD8	NRST1	NC reset 1
YC19	YD59	YE99	YFD9	NRST2	NC reset 2
YC1A	YD5A	YE9A	YFDA	RRW	Reset & rewind
YC1B	YD5B	YE9B	YFDB	*CDZ	Chamfering
YC1C	YD5C	YE9C	YFDC	ARST	Automatic restart
YC1D	YD5D	YE9D	YFDD		External search strobe
YC1E	YD5E	YE9E	YFDE	FIN1	M function finish 1
YC1F	YD5F	YE9F	YFDF	FIN2	M function finish 2

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC20	YD60	YEA0	YFE0	TLM	Tool length measurement 1
YC21	YD61	YEA1	YFE1	TLMS	Tool length measurement 2
YC22	YD62	YEA2	YFE2		Synchronization correction mode
YC23	YD63	YEA3	YFE3	PRST	Program restart
YC24	YD64	YEA4	YFE4	PB	Playback
YC25	YD65	YEA5	YFE5	UIT	Macro interrupt
YC26	YD66	YEA6	YFE6	RT	Rapid traverse
YC27	YD67	YEA7	YFE7	VRV	Reverse run

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC28	YD68	YEA8	YFE8	ABS	Manual absolute
YC29	YD69	YEA9	YFE9	DLK	Display lock
YC2A	YD6A	YEAA	YFEA	F1D	F1-digit speed change valid
YC2B	YD6B	YEAB	YFEB	CRQ	Recalculation request
YC2C	YD6C	YEAC	YFEC	QEMG	PLC emergency stop
YC2D	YD6D	YEAD	YFED	RTN	Reference position retract
YC2E	YD6E	YEAE	YFEE	PIT	PLC interrupt
YC2F	YD6F	YEAF	YFEF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC30	YD70	YEB0	YFF0	CHPS	Chopping
YC31	YD71	YEB1	YFF1	RSST	Search & start
YC32	YD72	YEB2	YFF2		
YC33	YD73	YEB3	YFF3		
YC34	YD74	YEB4	YFF4		Chopping parameter valid
YC35	YD75	YEB5	YFF5		Inclined axis control valid
YC36	YD76	YEB6	YFF6		Inclined axis control: No Z axis compensation
YC37	YD77	YEB7	YFF7	BDT1	Optional block skip 1

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC38	YD78	YEB8	YFF8	BDT2	Optional block skip 2
YC39	YD79	YEB9	YFF9	BDT3	Optional block skip 3
YC3A	YD7A	YEBA	YFFA	BDT4	Optional block skip 4
YC3B	YD7B	YEBB	YFFB	BDT5	Optional block skip 5
YC3C	YD7C	YEBC	YFFC	BDT6	Optional block skip 6
YC3D	YD7D	YEBD	YFFD	BDT7	Optional block skip 7
YC3E	YD7E	YEBE	YFFE	BDT8	Optional block skip 8
YC3F	YD7F	YEBF	YFFF	BDT9	Optional block skip 9
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC40	YD80	YEC0	Y1000	HS11	1st handle axis selection code 1
YC41	YD81	YEC1	Y1001	HS12	1st handle axis selection code 2
YC42	YD82	YEC2	Y1002	HS14	1st handle axis selection code 4
YC43	YD83	YEC3	Y1003	HS18	1st handle axis selection code 8
YC44	YD84	YEC4	Y1004	HS116	1st handle axis selection code 16
YC45	YD85	YEC5	Y1005		
YC46	YD86	YEC6	Y1006		
YC47	YD87	YEC7	Y1007	HS1S	1st handle valid
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC48	YD88	YEC8	Y1008	HS21	2nd handle axis selection code 1
YC49	YD89	YEC9	Y1009	HS22	2nd handle axis selection code 2
YC4A	YD8A	YECA	Y100A	HS24	2nd handle axis selection code 4
YC4B	YD8B	YECB	Y100B	HS28	2nd handle axis selection code 8
YC4C	YD8C	YECC	Y100C	HS216	2nd handle axis selection code 16
YC4D	YD8D	YECD	Y100D		
YC4E	YD8E	YECE	Y100E		
YC4F	YD8F	YECF	Y100F	HS2S	2nd handle valid
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC50	YD90	YED0	Y1010	HS31	3rd handle axis selection code 1
YC51	YD91	YED1	Y1011	HS32	3rd handle axis selection code 2
YC52	YD92	YED2	Y1012	HS34	3rd handle axis selection code 4
YC53	YD93	YED3	Y1013	HS38	3rd handle axis selection code 8
YC54	YD94	YED4	Y1014	HS316	3rd handle axis selection code 16
YC55	YD95	YED5	Y1015		
YC56	YD96	YED6	Y1016		
YC57	YD97	YED7	Y1017	HS3S	3rd handle valid

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC58	YD98	YED8	Y1018	OVC	Override cancel
YC59	YD99	YED9	Y1019	OVSL	Manual override method selection
YC5A	YD9A	YEDA	Y101A	AFL	Miscellaneous function lock
YC5B	YD9B	YEDB	Y101B		
YC5C	YD9C	YEDC	Y101C	TRV	Tap retract
YC5D	YD9D	YEDD	Y101D		
YC5E	YD9E	YEDE	Y101E		Tool handle feed mode
YC5F	YD9F	YEDF	Y101F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC60	YDA0	YEE0	Y1020	*FV1	Cutting feedrate override code 1
YC61	YDA1	YEE1	Y1021	*FV2	Cutting feedrate override code 2
YC62	YDA2	YEE2	Y1022	*FV4	Cutting feedrate override code 4
YC63	YDA3	YEE3	Y1023	*FV8	Cutting feedrate override code 8
YC64	YDA4	YEE4	Y1024	*FV16	Cutting feedrate override code 16
YC65	YDA5	YEE5	Y1025		
YC66	YDA6	YEE6	Y1026	FV2E	2nd cutting feedrate override valid
YC67	YDA7	YEE7	Y1027	FVS	Cutting feedrate override method selection

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC68	YDA8	YEE8	Y1028	ROV1	Rapid traverse override code 1
YC69	YDA9	YEE9	Y1029	ROV2	Rapid traverse override code 2
YC6A	YDAA	YEEA	Y102A		
YC6B	YDAB	YEEB	Y102B		
YC6C	YDAC	YEEC	Y102C		
YC6D	YDAD	YEED	Y102D		
YC6E	YDAE	YEEE	Y102E		
YC6F	YDAF	YEEF	Y102F	ROVS	Rapid traverse override method selection

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC70	YDB0	YEF0	Y1030	*JV1	Manual feedrate code 1
YC71	YDB1	YEF1	Y1031	*JV2	Manual feedrate code 2
YC72	YDB2	YEF2	Y1032	*JV4	Manual feedrate code 4
YC73	YDB3	YEF3	Y1033	*JV8	Manual feedrate code 8
YC74	YDB4	YEF4	Y1034	*JV16	Manual feedrate code 16
YC75	YDB5	YEF5	Y1035		
YC76	YDB6	YEF6	Y1036		
YC77	YDB7	YEF7	Y1037	JVS	Manual feedrate method selection

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC78	YDB8	YEF8	Y1038	PCF1	Feedrate least increment code 1
YC79	YDB9	YEF9	Y1039	PCF2	Feedrate least increment code 2
YC7A	YDBA	YEFA	Y103A		
YC7B	YDBB	YEFB	Y103B	JHAN	Jog handle synchronous
YC7C	YDBC	YEFC	Y103C		Each axis manual feedrate B valid
YC7D	YDBD	YEFD	Y103D		Manual feedrate B surface speed control valid
YC7E	YDBE	YEFE	Y103E		Circular feed in manual mode valid
YC7F	YDBF	YEFF	Y103F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC80	YDC0	YF00	Y1040	MP1	Handle/incremental feed magnification code 1
YC81	YDC1	YF01	Y1041	MP2	Handle/incremental feed magnification code 2
YC82	YDC2	YF02	Y1042	MP4	Handle/incremental feed magnification code 4
YC83	YDC3	YF03	Y1043		
YC84	YDC4	YF04	Y1044		
YC85	YDC5	YF05	Y1045		
YC86	YDC6	YF06	Y1046		Magnification valid for each handle
YC87	YDC7	YF07	Y1047	MPS	Handle/incremental feed magnification method selection

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC88	YDC8	YF08	Y1048	TAL1	Tool alarm 1/Tool-skip
YC89	YDC9	YF09	Y1049	TAL2	Tool alarm 2
YC8A	YDCA	YF0A	Y104A	TCEF	Usage data count valid
YC8B	YDCB	YF0B	Y104B	TLF1	Tool life management input
YC8C	YDCC	YF0C	Y104C	TRST	Tool change reset
YC8D	YDCD	YF0D	Y104D		Tool escape and return Transit point designation
YC8E	YDCE	YF0E	Y104E		Manual tool length measurement interlock temporarily canceled ▲
YC8F	YDCF	YF0F	Y104F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YC90	YDD0	YF10	Y1050	ZSL1	Reference position selection code 1
YC91	YDD1	YF11	Y1051	ZSL2	Reference position selection code 2
YC92	YDD2	YF12	Y1052		Tool length compensation along the tool axis Compensation amount change mode
YC93	YDD3	YF13	Y1053		
YC94	YDD4	YF14	Y1054		
YC95	YDD5	YF15	Y1055		
YC96	YDD6	YF16	Y1056		
YC97	YDD7	YF17	Y1057		Reference position selection method

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YC98	YDD8	YF18	Y1058		
YC99	YDD9	YF19	Y1059		
YC9A	YDDA	YF1A	Y105A		
YC9B	YDDB	YF1B	Y105B		
YC9C	YDDC	YF1C	Y105C		
YC9D	YDDD	YF1D	Y105D		Manual speed command valid
YC9E	YDDE	YF1E	Y105E		Manual speed command sign reversed
YC9F	YDDF	YF1F	Y105F		Manual speed command reverse run valid

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YCA0	YDE0	YF20	Y1060	CX11	Manual arbitrary feed 1st axis selection code 1
YCA1	YDE1	YF21	Y1061	CX12	Manual arbitrary feed 1st axis selection code 2
YCA2	YDE2	YF22	Y1062	CX14	Manual arbitrary feed 1st axis selection code 4
YCA3	YDE3	YF23	Y1063	CX18	Manual arbitrary feed 1st axis selection code 8
YCA4	YDE4	YF24	Y1064	CX116	Manual arbitrary feed 1st axis selection code 16
YCA5	YDE5	YF25	Y1065		
YCA6	YDE6	YF26	Y1066		
YCA7	YDE7	YF27	Y1067	CX1S	Manual arbitrary feed 1st axis valid

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YCA8	YDE8	YF28	Y1068	CX21	Manual arbitrary feed 2nd axis selection code 1
YCA9	YDE9	YF29	Y1069	CX22	Manual arbitrary feed 2nd axis selection code 2
YCAA	YDEA	YF2A	Y106A	CX24	Manual arbitrary feed 2nd axis selection code 4
YCAB	YDEB	YF2B	Y106B	CX28	Manual arbitrary feed 2nd axis selection code 8
YCAC	YDEC	YF2C	Y106C	CX216	Manual arbitrary feed 2nd axis selection code 16
YCAD	YDED	YF2D	Y106D		
YCAE	YDEE	YF2E	Y106E		
YCAF	YDEF	YF2F	Y106F	CX2S	Manual arbitrary feed 2nd axis valid

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCB0	YDF0	YF30	Y1070	CX31	Manual arbitrary feed 3rd axis selection code 1
YCB1	YDF1	YF31	Y1071	CX32	Manual arbitrary feed 3rd axis selection code 2
YCB2	YDF2	YF32	Y1072	CX34	Manual arbitrary feed 3rd axis selection code 4
YCB3	YDF3	YF33	Y1073	CX38	Manual arbitrary feed 3rd axis selection code 8
YCB4	YDF4	YF34	Y1074	CX316	Manual arbitrary feed 3rd axis selection code 16
YCB5	YDF5	YF35	Y1075		
YCB6	YDF6	YF36	Y1076		
YCB7	YDF7	YF37	Y1077	CX3S	Manual arbitrary feed 3rd axis valid

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCB8	YDF8	YF38	Y1078	CXS1	Manual arbitrary feed Smoothing off
YCB9	YDF9	YF39	Y1079	CXS2	Manual arbitrary feed Axis independent
YCBA	YDFA	YF3A	Y107A	CXS3	Manual arbitrary feed EX.F/MODAL.F
YCBB	YDFB	YF3B	Y107B	CXS4	Manual arbitrary feed G0/G1
YCBC	YDFC	YF3C	Y107C	CXS5	Manual arbitrary feed MC/WK
YCBD	YDFD	YF3D	Y107D	CXS6	Manual arbitrary feed ABS/INC
YCBE	YDFE	YF3E	Y107E	*CXS7	Manual arbitrary feed Stop
YCBF	YDFF	YF3F	Y107F	CXS8	Manual arbitrary feed Strobe

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCC0	YE00	YF40	Y1080	ILM1	Current limit mode 1
YCC1	YE01	YF41	Y1081	ILM2	Current limit mode 2
YCC2	YE02	YF42	Y1082		
YCC3	YE03	YF43	Y1083	LDWT	Load monitor Execution ▲
YCC4	YE04	YF44	Y1084		Load monitor Teaching mode ▲
YCC5	YE05	YF45	Y1085		Load monitor Monitor mode ▲
YCC6	YE06	YF46	Y1086		Load monitor Alarm reset ▲
YCC7	YE07	YF47	Y1087		Load monitor Warning reset ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCC8	YE08	YF48	Y1088	*ZRIT	2nd reference position return interlock
YCC9	YE09	YF49	Y1089		Adaptive control execution ▲
YCCA	YE0A	YF4A	Y108A		Small diameter deep hole drilling cycle
YCCB	YE0B	YF4B	Y108B		Chuck barrier ON
YCCC	YE0C	YF4C	Y108C		High-speed retract function valid ▲
YCCD	YE0D	YF4D	Y108D		
YCCE	YE0E	YF4E	Y108E		
YCCF	YE0F	YF4F	Y108F		Tool retract start ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCD0	YE10	YF50	Y1090		Waiting ignore
YCD1	YE11	YF51	Y1091		Spindle-spindle polygon cancel
YCD2	YE12	YF52	Y1092		Synchronous tapping command polarity reversal
YCD3	YE13	YF53	Y1093		Spindle OFF mode
YCD4	YE14	YF54	Y1094		Longitudinal hole drilling axis selection
YCD5	YE15	YF55	Y1095		Optimum acceleration/deceleration parameter switching request [axis] ▲
YCD6	YE16	YF56	Y1096	TRVEC	Tap retract possible state cancel
YCD7	YE17	YF57	Y1097	CHPRCR	Chopping compensation update prevention request

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCD8	YE18	YF58	Y1098		Barrier valid (left)
YCD9	YE19	YF59	Y1099		Barrier valid (right)
YCDA	YE1A	YF5A	Y109A		Tool presetter sub-side valid ▲
YCDB	YE1B	YF5B	Y109B		
YCDC	YE1C	YF5C	Y109C		
YCDD	YE1D	YF5D	Y109D		
YCDE	YE1E	YF5E	Y109E		
YCDF	YE1F	YF5F	Y109F		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCE0	YE20	YF60	Y10A0		
YCE1	YE21	YF61	Y10A1		Door open II
YCE2	YE22	YF62	Y10A2		Door open signal input (spindle speed monitor)
YCE3	YE23	YF63	Y10A3		Door interlock spindle speed clamp ▲
YCE4	YE24	YF64	Y10A4		
YCE5	YE25	YF65	Y10A5		
YCE6	YE26	YF66	Y10A6		
YCE7	YE27	YF67	Y10A7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCE8	YE28	YF68	Y10A8		Door open II (2 channels per 1 part system)
YCE9	YE29	YF69	Y10A9		
YCEA	YE2A	YF6A	Y10AA		
YCEB	YE2B	YF6B	Y10AB		
YCEC	YE2C	YF6C	Y10AC		
YCED	YE2D	YF6D	Y10AD		
YCEE	YE2E	YF6E	Y10AE		
YCEF	YE2F	YF6F	Y10AF		Cutting torque estimation in progress ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCF0	YE30	YF70	Y10B0		
YCF1	YE31	YF71	Y10B1		
YCF2	YE32	YF72	Y10B2		
YCF3	YE33	YF73	Y10B3		
YCF4	YE34	YF74	Y10B4	BCHK	Barrier check invalid
YCF5	YE35	YF75	Y10B5		
YCF6	YE36	YF76	Y10B6		
YCF7	YE37	YF77	Y10B7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YCF8	YE38	YF78	Y10B8		
YCF9	YE39	YF79	Y10B9		
YCFA	YE3A	YF7A	Y10BA	DRNC	Dry run invalid
YCFB	YE3B	YF7B	Y10BB		
YCFC	YE3C	YF7C	Y10BC		
YCFD	YE3D	YF7D	Y10BD		
YCFE	YE3E	YF7E	Y10BE		Appropriate machining diagnosis in progress ▲
YCFF	YE3F	YF7F	Y10BF		Appropriate machining diagnosis error reset ▲

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YD00	YE40	YF80	Y10C0		
YD01	YE41	YF81	Y10C1		
YD02	YE42	YF82	Y10C2		
YD03	YE43	YF83	Y10C3		
YD04	YE44	YF84	Y10C4		
YD05	YE45	YF85	Y10C5		
YD06	YE46	YF86	Y10C6		
YD07	YE47	YF87	Y10C7		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YD08	YE48	YF88	Y10C8	RVSP	Reverse run from block start
YD09	YE49	YF89	Y10C9	RVIT	Macro interrupt priority
YD0A	YE4A	YF8A	Y10CA	RVMD	Reverse run control mode
YD0B	YE4B	YF8B	Y10CB		
YD0C	YE4C	YF8C	Y10CC		
YD0D	YE4D	YF8D	Y10CD		
YD0E	YE4E	YF8E	Y10CE		
YD0F	YE4F	YF8F	Y10CF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YD18	YE58	YF98	Y10D8	MJCT	Manual feed for 5-axis machining (JOG, INC) in tool axis coordinate system
YD19	YE59	YF99	Y10D9	MJCB	Manual feed for 5-axis machining (JOG, INC) in table coordinate system
YD1A	YE5A	YF9A	Y10DA	MJCF	Manual feed for 5-axis machining (JOG, INC) in feature coordinate system
YD1B	YE5B	YF9B	Y10DB	MH1CT	Manual feed for 5-axis machining (1st handle) in tool axis coordinate system
YD1C	YE5C	YF9C	Y10DC	MH1CB	Manual feed for 5-axis machining (1st handle) in table coordinate system
YD1D	YE5D	YF9D	Y10DD	MH1CF	Manual feed for 5-axis machining (1st handle) in feature coordinate system
YD1E	YE5E	YF9E	Y10DE	MH2CT	Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system
YD1F	YE5F	YF9F	Y10DF	MH2CB	Manual feed for 5-axis machining (2nd handle) in table coordinate system

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
YD20	YE60	YFA0	Y10E0	MH2CF	Manual feed for 5-axis machining (2nd handle) in feature coordinate system
YD21	YE61	YFA1	Y10E1	MH3CT	Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system
YD22	YE62	YFA2	Y10E2	MH3CB	Manual feed for 5-axis machining (3rd handle) in table coordinate system
YD23	YE63	YFA3	Y10E3	MH3CF	Manual feed for 5-axis machining (3rd handle) in feature coordinate system
YD24	YE64	YFA4	Y10E4		
YD25	YE65	YFA5	Y10E5		
YD26	YE66	YFA6	Y10E6		
YD27	YE67	YFA7	Y10E7	TCPRC	Tool center point rotation

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
Y1870			Y1878		Edit/search
Y1871			Y1879		
Y1872			Y187A		
Y1873			Y187B		
Y1874			Y187C		
Y1875			Y187D		
Y1876			Y187E		
Y1877			Y187F		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y1880	Y18E0	Y1940	Y19A0	Y1A00	Y1A60		
Y1881	Y18E1	Y1941	Y19A1	Y1A01	Y1A61		
Y1882	Y18E2	Y1942	Y19A2	Y1A02	Y1A62		
Y1883	Y18E3	Y1943	Y19A3	Y1A03	Y1A63		
Y1884	Y18E4	Y1944	Y19A4	Y1A04	Y1A64		
Y1885	Y18E5	Y1945	Y19A5	Y1A05	Y1A65	GFIN	Gear shift completion
Y1886	Y18E6	Y1946	Y19A6	Y1A06	Y1A66		
Y1887	Y18E7	Y1947	Y19A7	Y1A07	Y1A67		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y1888	Y18E8	Y1948	Y19A8	Y1A08	Y1A68	SP1	Spindle speed override code 1
Y1889	Y18E9	Y1949	Y19A9	Y1A09	Y1A69	SP2	Spindle speed override code 2
Y188A	Y18EA	Y194A	Y19AA	Y1A0A	Y1A6A	SP4	Spindle speed override code 4
Y188B	Y18EB	Y194B	Y19AB	Y1A0B	Y1A6B		
Y188C	Y18EC	Y194C	Y19AC	Y1A0C	Y1A6C		
Y188D	Y18ED	Y194D	Y19AD	Y1A0D	Y1A6D		
Y188E	Y18EE	Y194E	Y19AE	Y1A0E	Y1A6E		
Y188F	Y18EF	Y194F	Y19AF	Y1A0F	Y1A6F	SPS	Spindle override method selection

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y1890	Y18F0	Y1950	Y19B0	Y1A10	Y1A70	GI1	Spindle gear selection code 1
Y1891	Y18F1	Y1951	Y19B1	Y1A11	Y1A71	GI2	Spindle gear selection code 2
Y1892	Y18F2	Y1952	Y19B2	Y1A12	Y1A72		
Y1893	Y18F3	Y1953	Y19B3	Y1A13	Y1A73	EXOBS	Spindle holding force up
Y1894	Y18F4	Y1954	Y19B4	Y1A14	Y1A74	SSTP	Spindle stop
Y1895	Y18F5	Y1955	Y19B5	Y1A15	Y1A75	SSFT	Spindle gear shift
Y1896	Y18F6	Y1956	Y19B6	Y1A16	Y1A76	SORC	Spindle orientation
Y1897	Y18F7	Y1957	Y19B7	Y1A17	Y1A77		Spindle command invalid

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y1898	Y18F8	Y1958	Y19B8	Y1A18	Y1A78	SRN	Spindle forward run start
Y1899	Y18F9	Y1959	Y19B9	Y1A19	Y1A79	SRI	Spindle reverse run start
Y189A	Y18FA	Y195A	Y19BA	Y1A1A	Y1A7A	TL1	Spindle torque limit 1
Y189B	Y18FB	Y195B	Y19BB	Y1A1B	Y1A7B	TL2	Spindle torque limit 2
Y189C	Y18FC	Y195C	Y19BC	Y1A1C	Y1A7C	WRN	Spindle forward run index
Y189D	Y18FD	Y195D	Y19BD	Y1A1D	Y1A7D	WRI	Spindle reverse run index
Y189E	Y18FE	Y195E	Y19BE	Y1A1E	Y1A7E	ORC	Spindle orientation command
Y189F	Y18FF	Y195F	Y19BF	Y1A1F	Y1A7F	LRSL	L coil selection

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18A0	Y1900	Y1960	Y19C0	Y1A20	Y1A80		
Y18A1	Y1901	Y1961	Y19C1	Y1A21	Y1A81		
Y18A2	Y1902	Y1962	Y19C2	Y1A22	Y1A82		Spindle position control (C axis) Cutting gain L
Y18A3	Y1903	Y1963	Y19C3	Y1A23	Y1A83		Spindle position control (C axis) Cutting gain H
Y18A4	Y1904	Y1964	Y19C4	Y1A24	Y1A84		
Y18A5	Y1905	Y1965	Y19C5	Y1A25	Y1A85		
Y18A6	Y1906	Y1966	Y19C6	Y1A26	Y1A86	LRSM	M coil selection
Y18A7	Y1907	Y1967	Y19C7	Y1A27	Y1A87		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18A8	Y1908	Y1968	Y19C8	Y1A28	Y1A88	SWS	Spindle selection
Y18A9	Y1909	Y1969	Y19C9	Y1A29	Y1A89		
Y18AA	Y190A	Y196A	Y19CA	Y1A2A	Y1A8A		
Y18AB	Y190B	Y196B	Y19CB	Y1A2B	Y1A8B		
Y18AC	Y190C	Y196C	Y19CC	Y1A2C	Y1A8C		
Y18AD	Y190D	Y196D	Y19CD	Y1A2D	Y1A8D		
Y18AE	Y190E	Y196E	Y19CE	Y1A2E	Y1A8E		
Y18AF	Y190F	Y196F	Y19CF	Y1A2F	Y1A8F	MPCSL	PLC coil changeover

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18B0	Y1910	Y1970	Y19D0	Y1A30	Y1A90	SPSY	Spindle synchronization
Y18B1	Y1911	Y1971	Y19D1	Y1A31	Y1A91	SPPHS	Spindle phase synchronization
Y18B2	Y1912	Y1972	Y19D2	Y1A32	Y1A92	SPSDR	Spindle synchronous rotation direction
Y18B3	Y1913	Y1973	Y19D3	Y1A33	Y1A93	SSPHM	Phase shift calculation request
Y18B4	Y1914	Y1974	Y19D4	Y1A34	Y1A94	SSPHF	Phase offset request
Y18B5	Y1915	Y1975	Y19D5	Y1A35	Y1A95	SPDRPO	Error temporary cancel
Y18B6	Y1916	Y1976	Y19D6	Y1A36	Y1A96		
Y18B7	Y1917	Y1977	Y19D7	Y1A37	Y1A97		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18B8	Y1918	Y1978	Y19D8	Y1A38	Y1A98	SPSYC	Spindle synchronization/ superimposition cancel
Y18B9	Y1919	Y1979	Y19D9	Y1A39	Y1A99	SPCMPC	Chuck close
Y18BA	Y191A	Y197A	Y19DA	Y1A3A	Y1A9A		
Y18BB	Y191B	Y197B	Y19DB	Y1A3B	Y1A9B		
Y18BC	Y19!C	Y197C	Y19DC	Y1A3C	Y1A9C		
Y18BD	Y191D	Y197D	Y19DD	Y1A3D	Y1A9D		
Y18BE	Y191E	Y197E	Y19DE	Y1A3E	Y1A9E		
Y18BF	Y191F	Y197F	Y19DF	Y1A3F	Y1A9F		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18C0	Y1920	Y1980	Y19E0	Y1A40	Y1AA0		
Y18C1	Y1921	Y1981	Y19E1	Y1A41	Y1AA1		
Y18C2	Y1922	Y1982	Y19E2	Y1A42	Y1AA2		
Y18C3	Y1923	Y1983	Y19E3	Y1A43	Y1AA3		
Y18C4	Y1924	Y1984	Y19E4	Y1A44	Y1AA4		
Y18C5	Y1925	Y1985	Y19E5	Y1A45	Y1AA5		
Y18C6	Y1926	Y1986	Y19E6	Y1A46	Y1AA6		
Y18C7	Y1927	Y1987	Y19E7	Y1A47	Y1AA7		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18C8	Y1928	Y1988	Y19E8	Y1A48	Y1AA8		
Y18C9	Y1929	Y1989	Y19E9	Y1A49	Y1AA9		
Y18CA	Y192A	Y198A	Y19EA	Y1A4A	Y1AAA		
Y18CB	Y192B	Y198B	Y19EB	Y1A4B	Y1AAB		
Y18CC	Y192C	Y198C	Y19EC	Y1A4C	Y1AAC		
Y18CD	Y192D	Y198D	Y19ED	Y1A4D	Y1AAD		
Y18CE	Y192E	Y198E	Y19EE	Y1A4E	Y1AAE		
Y18CF	Y192F	Y198F	Y19EF	Y1A4F	Y1AAF		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18D0	Y1930	Y1990	Y19F0	Y1A50	Y1AB0		
Y18D1	Y1931	Y1991	Y19F1	Y1A51	Y1AB1		
Y18D2	Y1932	Y1992	Y19F2	Y1A52	Y1AB2		
Y18D3	Y1933	Y1993	Y19F3	Y1A53	Y1AB3		
Y18D4	Y1934	Y1994	Y19F4	Y1A54	Y1AB4		
Y18D5	Y1935	Y1995	Y19F5	Y1A55	Y1AB5		
Y18D6	Y1936	Y1996	Y19F6	Y1A56	Y1AB6		
Y18D7	Y1937	Y1997	Y19F7	Y1A57	Y1AB7		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y18D8	Y1938	Y1998	Y19F8	Y1A58	Y1AB8		
Y18D9	Y1939	Y1999	Y19F9	Y1A59	Y1AB9		
Y18DA	Y193A	Y199A	Y19FA	Y1A5A	Y1ABA		
Y18DB	Y193B	Y199B	Y19FB	Y1A5B	Y1ABB		
Y18DC	Y193C	Y199C	Y19FC	Y1A5C	Y1ABC		
Y18DD	Y193D	Y199D	Y19FD	Y1A5D	Y1ABD		
Y18DE	Y193E	Y199E	Y19FE	Y1A5E	Y1ABE		
Y18DF	Y193F	Y199F	Y19FF	Y1A5F	Y1ABF		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y1D00	Y1D20	Y1D40	Y1D60		Position switch 1 interlock
Y1D01	Y1D21	Y1D41	Y1D61		Position switch 2 interlock
Y1D02	Y1D22	Y1D42	Y1D62		Position switch 3 interlock
Y1D03	Y1D23	Y1D43	Y1D63		Position switch 4 interlock
Y1D04	Y1D24	Y1D44	Y1D64		Position switch 5 interlock
Y1D05	Y1D25	Y1D45	Y1D65		Position switch 6 interlock
Y1D06	Y1D26	Y1D46	Y1D66		Position switch 7 interlock
Y1D07	Y1D27	Y1D47	Y1D67		Position switch 8 interlock
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y1D08	Y1D28	Y1D48	Y1D68		Position switch 9 interlock
Y1D09	Y1D29	Y1D49	Y1D69		Position switch 10 interlock
Y1D0A	Y1D2A	Y1D4A	Y1D6A		Position switch 11 interlock
Y1D0B	Y1D2B	Y1D4B	Y1D6B		Position switch 12 interlock
Y1D0C	Y1D2C	Y1D4C	Y1D6C		Position switch 13 interlock
Y1D0D	Y1D2D	Y1D4D	Y1D6D		Position switch 14 interlock
Y1D0E	Y1D2E	Y1D4E	Y1D6E		Position switch 15 interlock
Y1D0F	Y1D2F	Y1D4F	Y1D6F		Position switch 16 interlock
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y1D10	Y1D30	Y1D50	Y1D70		Position switch 17 interlock
Y1D11	Y1D31	Y1D51	Y1D71		Position switch 18 interlock
Y1D12	Y1D32	Y1D52	Y1D72		Position switch 19 interlock
Y1D13	Y1D33	Y1D53	Y1D73		Position switch 20 interlock
Y1D14	Y1D34	Y1D54	Y1D74		Position switch 21 interlock
Y1D15	Y1D35	Y1D55	Y1D75		Position switch 22 interlock
Y1D16	Y1D36	Y1D56	Y1D76		Position switch 23 interlock
Y1D17	Y1D37	Y1D57	Y1D77		Position switch 24 interlock
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
Y1D18	Y1D38	Y1D58	Y1D78		
Y1D19	Y1D39	Y1D59	Y1D79		
Y1D1A	Y1D3A	Y1D5A	Y1D7A		
Y1D1B	Y1D3B	Y1D5B	Y1D7B		
Y1D1C	Y1D3C	Y1D5C	Y1D7C		
Y1D1D	Y1D3D	Y1D5D	Y1D7D		
Y1D1E	Y1D3E	Y1D5E	Y1D7E		
Y1D1F	Y1D3F	Y1D5F	Y1D7F		

4.4 PLC Output Signals (Data type: R***)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R200	AO1	Analog output 1	R208		
R201	AO2	Analog output 2	R209		
R202	AO3	Analog output 3	R210		Displayed screen No.
R203	AO4	Analog output 4	R211		
R204	AO5	Analog output 5	R212		KEY OUT 1
R205	AO6	Analog output 6	R213		
R206	AO7	Analog output 7	R214		
R207	AO8	Analog output 8	R215		Power OFF indication Y device No.
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
R216			R224		User sequence program version code A
R217			R225		User sequence program version code B
R218			R226		User sequence program version code C
R219			R227		User sequence program version code D
R220			R228		
R221			R229		
R222			R230		
R223			R231		
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
R232		User sequence program version code 2 A	R240		APLC version A
R233		User sequence program version code 2 B	R241		APLC version B
R234		User sequence program version code 2 C	R242		APLC version C
R235		User sequence program version code 2 D	R243		APLC version D
R236		User sequence program version code 2 E	R244		
R237		User sequence program version code 2 F	R245		
R238		User sequence program version code 2 G	R246		
R239		User sequence program version code 2 H	R247		
Device	**Abbrev.**	**Signal name**	**Device**	**Abbrev.**	**Signal name**
R248		OT ignored (Axis 1 to 8 for part system 1,2)	R256		
R249		OT ignored (Axis 1 to 8 for part system 3,4)	R257		
R250			R258		
R251			R259		
R252			R260		
R253			R261		
R254			R262		
R255		PLC axis OT ignored	R263		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R264			R272		Near-point dog ignored (Axis 1 to 8 for part system 1,2)
R265			R273		Near-point dog ignored (Axis 1 to 8 for part system 3,4)
R266			R274		
R267			R275		
R268			R276		
R269			R277		
R270			R278		
R271			R279		PLC axis near-point dog ignored

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R280			R288		
R281			R289		
R282			R290		
R283			R291		
R284			R292		
R285			R293		
R286			R294		
R287			R295		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R296	SOMD	Speed monitor mode	R304		
R297		Handy terminal Data area top address	R305		
R298		Handy terminal Data valid number of registers	R306		
R299		Handy terminal Cause of communication error	R307		
R300			R308		
R301			R309		
R302			R310		
R303			R311		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R312			R320		
R313			R321		
R314			R322		
R315			R323		
R316			R324		
R317			R325		
R318			R326		
R319			R327		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R328			R336		Tool I/D R/W pot No. designation ▲
R329			R337		Large diameter tool information ▲
R330			R338		Tool weight (spindle tool) ▲
R331			R339		Tool weight (standby tool) ▲
R332			R340		Unset tool information ▲
R333			R341		
R334			R342		Specified shape interference Shape No. designation
R335			R343		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R344			R352		Remote program input No. (L) ▲
R345			R353		Remote program input No. (H) ▲
R346			R354		Machine manufacturer macro password No. (L)
R347		Skip retract valid	R355		Machine manufacturer macro password No. (H)
R348		Skip retract amount (L) [M]	R356		Direct screen selection A
R349		Skip retract amount (H) [M]	R357		Direct screen selection B
R350		Skip retract speed (L) [M]	R358		Direct screen selection C
R351		Skip retract speed (H) [M]	R359		Direct screen selection D

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R360			R368		
R361			R369		
R362			R370		
R363			R371		
R364		Machine parameter lock I/F	R372		
R365		Measures against tool setter chattering Movement amount	R373		
R366			R374		
R367			R375		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R376			R384		
R377		Load meter comment designation	R385		
R378			R386		
R379			R387		
R380			R388		
R381			R389		
R382			R390		
R383			R391		Optimum acceleration/deceleration parameter switching axis (spindle and bit selection) ▲

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R392			R400		Ball screw thermal displacement compensation Offset amount 1st axis [M]
R393			R401		Ball screw thermal displacement compensation Max. compensation amount 1st axis [M]
R394			R402		Ball screw thermal displacement compensation Part-system, axis No. 1st axis
R395			R403		Ball screw thermal displacement compensation Offset amount 2nd axis [M]
R396		User PLC info program format info	R404		Ball screw thermal displacement compensation Max. compensation amount 2nd axis [M]
R397			R405		Ball screw thermal displacement compensation Part-system, axis No. 2nd axis
R398			R406		Ball screw thermal displacement compensation Offset amount 3rd axis [M]
R399			R407		Ball screw thermal displacement compensation Max. compensation amount 3rd axis

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R408		Ball screw thermal displacement compensation Part-system, axis No. 3rd [M] axis	R416		
R409		Ball screw thermal displacement compensation Offset amount 4th axis [M]	R417		
R410		Ball screw thermal displacement compensation Max. compensation amount 3rd axis [M]	R418		
R411		Ball screw thermal displacement compensation Part-system, axis No. 4th axis	R419		
R412			R420		
R413			R421		
R414			R422		
R415			R423		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R424		PLC window Reading start R register 1	R432		PLC window Reading start R register 3
R425		PLC window Number of read windows 1	R433		PLC window Number of read windows 3
R426		PLC window Writing start R register 1	R434		PLC window Writing start R register 3
R427		PLC window Number of write windows 1	R435		PLC window Number of write windows 3
R428		PLC window Reading start R register 2	R436		
R429		PLC window Number of read windows 2	R437		
R430		PLC window Writing start R register 2	R438		
R431		PLC window Number of write windows 2	R439		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R440		PLC axis control information address 1st axis	R448		PLC axis control buffering mode information address
R441		PLC axis control information address 2nd axis	R449		
R442		PLC axis control information address 3rd axis	R450		
R443		PLC axis control information address 4th axis	R451		
R444		PLC axis control information address 5th axis	R452		
R445		PLC axis control information address 6th axis	R453		
R446		PLC axis control information address 7th axis	R454		
R447		PLC axis control information address 8th axis	R455		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R456		Encoder 1 arbitrary pulse 1	R464		
R457		Encoder 1 arbitrary pulse 2	R465		
R458		Encoder 2 arbitrary pulse 1	R466		
R459		Encoder 2 arbitrary pulse 2	R467		
R460			R468		
R461			R469		
R462			R470		Modbus block 1 transfer position ▲
R463			R471		Modbus block 1 number of transfer ▲

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R472		Modbus block 2 transfer position ▲	R480		
R473		Modbus block 2 number of transfers ▲	R481		
R474		Modbus block 3 transfer position ▲	R482		
R475		Modbus block 3 number of transfers ▲	R483		
R476		Modbus block 4 transfer position ▲	R484		
R477		Modbus block 4 number of transfers ▲	R485		
R478		Modbus transfer cycle ▲	R486		
R479		Modbus time-out period ▲	R487		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R488			R496		
R489			R497		
R490			R498		
R491			R499		
R492					
R493					
R494					
R495					

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2500	R2700	R2900	R3100		1st cutting feedrate override
R2501	R2701	R2901	R3101		2nd cutting feedrate override
R2502	R2702	R2902	R3102		Rapid traverse override
R2503	R2703	R2903	R3103	CHPOV	Chopping override
R2504	R2704	R2904	R3104		Manual feedrate (L) [M]
R2505	R2705	R2905	R3105		Manual feedrate (H) [M]
R2506	R2706	R2906	R3106		Manual feedrate B (L) [M]
R2507	R2707	R2907	R3107		Manual feedrate B (H) [M]

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2508	R2708	R2908	R3108		1st handle/incremental feed magnification (L)
R2509	R2709	R2909	R3109		1st handle/incremental feed magnification (H)
R2510	R2710	R2910	R3110		2nd handle feed magnification (L)
R2511	R2711	R2911	R3111		2nd handle feed magnification (H)
R2512	R2712	R2912	R3112		3rd handle feed magnification (L)
R2513	R2713	R2913	R3113		3rd handle feed magnification (H)
R2514	R2714	R2914	R3114		
R2515	R2715	R2915	R3115		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2516	R2716	R2916	R3116		
R2517	R2717	R2917	R3117		Machine status animated warning display type
R2518	R2718	R2918	R3118		PLC interrupt program number (L)
R2519	R2719	R2919	R3119		PLC interrupt program number (H)
R2520	R2720	R2920	R3120		Load meter display interface 1 (L)
R2521	R2721	R2921	R3121		Load meter display interface 1 (H)
R2522	R2722	R2922	R3122		Load meter display interface 2 (L)
R2523	R2723	R2923	R3123		Load meter display interface 2 (H)

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2524	R2724	R2924	R3124		Manual feedrate B override
R2525	R2725	R2925	R3125		External search device No.
R2526	R2726	R2926	R3126		External search program No. (L)
R2527	R2727	R2927	R3127		External search program No. (H)
R2528	R2728	R2928	R3128		External search sequence No. (L)
R2529	R2729	R2929	R3129		External search sequence No. (H)
R2530	R2730	R2930	R3130		External search block No. (L)
R2531	R2731	R2931	R3131		External search block No. (H)

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2532	R2732	R2932	R3132		
R2533	R2733	R2933	R3133		
R2534	R2734	R2934	R3134		
R2535	R2735	R2935	R3135		
R2536	R2736	R2936	R3136		
R2537	R2737	R2937	R3137		
R2538	R2738	R2938	R3138		
R2539	R2739	R2939	R3139		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2540	R2740	R2940	R3140		
R2541	R2741	R2941	R3141		
R2542	R2742	R2942	R3142		
R2543	R2743	R2943	R3143		
R2544	R2744	R2944	R3144		Manual arbitrary feed 1st axis travel amount (L) [M]
R2545	R2745	R2945	R3145		Manual arbitrary feed 1st axis travel amount (H) [M]
R2546	R2746	R2946	R3146		
R2547	R2747	R2947	R3147		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2548	R2748	R2948	R3148		Manual arbitrary feed 2nd axis travel amount (L) [M]
R2549	R2749	R2949	R3149		Manual arbitrary feed 2nd axis travel amount (H) [M]
R2550	R2750	R2950	R3150		
R2551	R2751	R2951	R3151		
R2552	R2752	R2952	R3152		Manual arbitrary feed 3rd axis travel amount (L) [M]
R2553	R2753	R2953	R3153		Manual arbitrary feed 3rd axis travel amount (H) [M]
R2554	R2754	R2954	R3154		
R2555	R2755	R2955	R3155		
Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2556	R2756	R2956	R3156		Alarm message I/F 1
R2557	R2757	R2957	R3157		Alarm message I/F 2
R2558	R2758	R2958	R3158		Alarm message I/F 3
R2559	R2759	R2959	R3159		Alarm message I/F 4
R2560	R2760	R2960	R3160		Operator message I/F
R2561	R2761	R2961	R3161		
R2562	R2762	R2962	R3162		Search & start program No. (L)
R2563	R2763	R2963	R3163		Search & start program No. (H)

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2564	R2764	R2964	R3164		Manual skip I/F 1 (Manual skip control) ▲
R2565	R2765	R2965	R3165		Manual skip I/F 2 (Manual skip axis stop/ read request) ▲
R2566	R2766	R2966	R3166		Manual skip I/F 3 (Manual skip axis stop mode) ▲
R2567	R2767	R2967	R3167		Encoder selection
R2568	R2768	R2968	R3168		C axis selection
R2569	R2769	R2969	R3169		
R2570	R2770	R2970	R3170		
R2571	R2771	R2971	R3171		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2572	R2772	R2972	R3172		
R2573	R2773	R2973	R3173		
R2574	R2774	R2974	R3174		
R2575	R2775	R2975	R3175		
R2576	R2776	R2976	R3176		
R2577	R2777	R2977	R3177		
R2578	R2778	R2978	R3178		
R2579	R2779	R2979	R3179		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2580	R2780	R2980	R3180		Load monitor Teaching axis selection ▲
R2581	R2781	R2981	R3181		Load monitor Load change rate detection axis ▲
R2582	R2782	R2982	R3182		Load monitor Teaching data sub-No. ▲
R2583	R2783	R2983	R3183		Adaptive control Basic axis selection ▲
R2584	R2784	R2984	R3184		Each axis reference position selection
R2585	R2785	R2985	R3185		
R2586	R2786	R2986	R3186		
R2587	R2787	R2987	R3187		Chopping control data address

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2588	R2788	R2988	R3188		Tool life management data sort
R2589	R2789	R2989	R3189		Synchronous control operation method
R2590	R2790	R2990	R3190		Tool group No. designation (L)
R2591	R2791	R2991	R3191		Tool group No. designation (H)
R2592	R2792	R2992	R3192		Reference position adjustment completion
R2593	R2793	R2993	R3193		Current limit changeover
R2594	R2794	R2994	R3194		Wear compensation No. (tool presetter)
R2595	R2795	R2995	R3195		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2596	R2796	R2996	R3196		Turret interference object tool No. designation
R2597	R2797	R2997	R3197		
R2598	R2798	R2998	R3198		
R2599	R2799	R2999	R3199		Workpiece coordinate selection ▲
R2600	R2800	R3000	R3200		Workpiece coordinate offset Measurement tool compensation No./Selected compensation tool No.(main) (L) (Note 1)
R2601	R2801	R3001	R3201		WWorkpiece coordinate offset Measurement tool compen. No./Selected compen. tool No.(main) (H)
R2602	R2802	R3002	R3202		Workpiece coordinate offset Measurement tool No./Selected tool No.(main) (L) (Note 1)
R2603	R2803	R3003	R3203		Workpiece coordinate offset Measurement tool No./Selected tool No.(main) (H)
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2604	R2804	R3004	R3204		Selected tool compensation No.(sub) (L)
R2605	R2805	R3005	R3205		Selected tool compensation No.(sub) (H)
R2606	R2806	R3006	R3206		Selected tool wear No. (sub) (L)
R2607	R2807	R3007	R3207		Selected tool wear No. (sub) (H)
R2608	R2808	R3008	R3208		Tool mounting information 1-16
R2609	R2809	R3009	R3209		Tool mounting information 17-32
R2610	R2810	R3010	R3210		Tool mounting information 33-48
R2611	R2811	R3011	R3211		Tool mounting information 49-64
Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2612	R2812	R3012	R3212		Tool mounting information (65 - 80)
R2613	R2813	R3013	R3213		
R2614	R2814	R3014	R3214		
R2615	R2815	R3015	R3215		
R2616	R2816	R3016	R3216		
R2617	R2817	R3017	R3217		Optimum acceleration/deceleration parameter switching axis (axis and bit selection) ▲
R2618	R2818	R3018	R3218		Tool length measurement 2 Tool No. (L)
R2619	R2819	R3019	R3219		Tool length measurement 2 Tool No. (H)

(Note 1) When the chuck barrier is checked, "Selected tool compensation No.(main):R2600, R2601" and "Selected tool No.(main):R2602, R2603" are applied.

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2620	R2820	R3020	R3220		
R2621	R2821	R3021	R3221		
R2622	R2822	R3022	R3222		
R2623	R2823	R3023	R3223		
R2624	R2824	R3024	R3224		
R2625	R2825	R3025	R3225		Servo ready completion output designation
R2626	R2826	R3026	R3226		
R2627	R2827	R3027	R3227		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2628	R2828	R3028	R3228		Mechanical axis specifications 1st rotary axis angle (L)
R2629	R2829	R3029	R3229		Mechanical axis specifications 1st rotary axis angle (H)
R2630	R2830	R3030	R3230		Mechanical axis specifications 2nd rotary axis angle (L)
R2631	R2831	R3031	R3231		Mechanical axis specifications 2nd rotary axis angle (H)
R2632	R2832	R3032	R3232		
R2633	R2833	R3033	R3233		
R2634	R2834	R3034	R3234		
R2635	R2835	R3035	R3235		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2636	R2836	R3036	R3236		Circular feed in manual mode Operation mode data (L)
R2637	R2837	R3037	R3237		Circular feed in manual mode Operation mode data (H)
R2638	R2838	R3038	R3238		Circular feed in manual mode Part system designation
R2639	R2839	R3039	R3239		
R2640	R2840	R3040	R3240		Circular feed in manual mode Horizontal axis designation
R2641	R2841	R3041	R3241		Circular feed in manual mode Vertical axis designation
R2642	R2842	R3042	R3242		
R2643	R2843	R3043	R3243		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2644	R2844	R3044	R3244		Circular feed in manual mode Basic point X data (L)
R2645	R2845	R3045	R3245		Circular feed in manual mode Basic point X data (H)
R2646	R2846	R3046	R3246		
R2647	R2847	R3047	R3247		
R2648	R2848	R3048	R3248		Circular feed in manual mode Basic point Y data (L)
R2649	R2849	R3049	R3249		Circular feed in manual mode Basic point Y data (H)
R2650	R2850	R3050	R3250		
R2651	R2851	R3051	R3251		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R2652	R2852	R3052	R3252		Circular feed in manual mode Travel range X+ data (L)
R2653	R2853	R3053	R3253		Circular feed in manual mode Travel range X+ data (H)
R2654	R2854	R3054	R3254		
R2655	R2855	R3055	R3255		
R2656	R2856	R3056	R3256		Circular feed in manual mode Travel range X- data (L)
R2657	R2857	R3057	R3257		Circular feed in manual mode Travel range X- data (H)
R2658	R2858	R3058	R3258		
R2659	R2859	R3059	R3259		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2660	R2860	R3060	R3260		Circular feed in manual mode Travel range Y+ data (L)
R2661	R2861	R3061	R3261		Circular feed in manual mode Travel range Y+ data (H)
R2662	R2862	R3062	R3262		
R2663	R2863	R3063	R3263		
R2664	R2864	R3064	R3264		Circular feed in manual mode Travel range Y- data (L)
R2665	R2865	R3065	R3265		Circular feed in manual mode Travel range Y- data (H)
R2666	R2866	R3066	R3266		
R2667	R2867	R3067	R3267		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2668	R2868	R3068	R3268		Circular feed in manual mode Gradient/arc center X data (L)
R2669	R2869	R3069	R3269		Circular feed in manual mode Gradient/arc center X data (H)
R2670	R2870	R3070	R3270		
R2671	R2871	R3071	R3271		
R2672	R2872	R3072	R3272		Circular feed in manual mode Gradient/arc center Y data (L)
R2673	R2873	R3073	R3273		Circular feed in manual mode Gradient/arc center Y data (H)
R2674	R2874	R3074	R3274		
R2675	R2875	R3075	R3275		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2684	R2884	R3084	R3284		For specific users NC control signal 1 ▲
R2685	R2885	R3085	R3285		
R2686	R2886	R3086	R3286		
R2687	R2887	R3087	R3287		
R2688	R2888	R3088	R3288		Specific users Manual skip motion direction (-) ▲
R2689	R2889	R3089	R3289		Specific users Manual skip motion direction (+) ▲
R2690	R2890	R3090	R3290		
R2691	R2891	R3091	R3291		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5700	R5716	R5732	R5748		Ext. machine coordinate system offset data 1st axis (L) [M]
R5701	R5717	R5733	R5749		Ext. machine coordinate system offset data 1st axis (H) [M]
R5702	R5718	R5734	R5750		Ext. machine coordinate system offset data 2nd axis (L) [M]
R5703	R5719	R5735	R5751		Ext. machine coordinate system offset data 2nd axis (H) [M]
R5704	R5720	R5736	R5752		Ext. machine coordinate system offset data 3rd axis (L) [M]
R5705	R5721	R5737	R5753		Ext. machine coordinate system offset data 3rd axis (H) [M]
R5706	R5722	R5738	R5754		Ext. machine coordinate system offset data 4th axis (L) [M]
R5707	R5723	R5739	R5755		Ext. machine coordinate system offset data 4th axis (H) [M]

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5708	R5724	R5740	R5756		Ext. machine coordinate system offset data 5th axis (L) [M]
R5709	R5725	R5741	R5757		Ext. machine coordinate system offset data 5th axis (H) [M]
R5710	R5726	R5742	R5758		Ext. machine coordinate system offset data 6th axis (L) [M]
R5711	R5727	R5743	R5759		Ext. machine coordinate system offset data 6th axis (H) [M]
R5712	R5728	R5744	R5760		Ext. machine coordinate system offset data 7th axis (L) [M]
R5713	R5729	R5745	R5761		Ext. machine coordinate system offset data 7th axis (H) [M]
R5714	R5730	R5746	R5762		Ext. machine coordinate system offset data 8th axis (L) [M]
R5715	R5731	R5747	R5763		Ext. machine coordinate system offset data 8th axis (H) [M]

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R5764	R5780	R5796	R5812		Each axis manual feedrate B 1st axis (L) [M]
R5765	R5781	R5797	R5813		Each axis manual feedrate B 1st axis (H) [M]
R5766	R5782	R5798	R5814		Each axis manual feedrate B 2nd axis (L) [M]
R5767	R5783	R5799	R5815		Each axis manual feedrate B 2nd axis (H) [M]
R5768	R5784	R5800	R5816		Each axis manual feedrate B 3rd axis (L) [M]
R5769	R5785	R5801	R5817		Each axis manual feedrate B 3rd axis (H) [M]
R5770	R5786	R5802	R5818		Each axis manual feedrate B 4th axis (L) [M]
R5771	R5787	R5803	R5819		Each axis manual feedrate B 4th axis (H) [M]

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5772	R5788	R5804	R5820		Each axis manual feedrate B 5th axis (L) [M]
R5773	R5789	R5805	R5821		Each axis manual feedrate B 5th axis (H) [M]
R5774	R5790	R5806	R5822		Each axis manual feedrate B 6th axis (L) [M]
R5775	R5791	R5807	R5823		Each axis manual feedrate B 6th axis (H) [M]
R5776	R5792	R5808	R5824		Each axis manual feedrate B 7th axis (L) [M]
R5777	R5793	R5809	R5825		Each axis manual feedrate B 7th axis (H) [M]
R5778	R5794	R5810	R5826		Each axis manual feedrate B 8th axis (L) [M]
R5779	R5795	R5811	R5827		Each axis manual feedrate B 8th axis (H) [M]

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5828	R5836	R5844	R5852		
R5829	R5837	R5845	R5853		
R5830	R5838	R5846	R5854		
R5831	R5839	R5847	R5855		
R5832	R5840	R5848	R5856		
R5833	R5841	R5849	R5857		
R5834	R5842	R5850	R5858		
R5835	R5843	R5851	R5859		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5860	R5868	R5876	R5884		
R5861	R5869	R5877	R5885		
R5862	R5870	R5878	R5886		
R5863	R5871	R5879	R5887		
R5864	R5872	R5880	R5888		
R5865	R5873	R5881	R5889		
R5866	R5874	R5882	R5890		
R5867	R5875	R5883	R5891		

Device No.					
$1	**$2**	**$3**	**$4**	**Abbrev.**	**Signal name**
R5892	R5900	R5908	R5916		
R5893	R5901	R5909	R5917		
R5894	R5902	R5910	R5918		
R5895	R5903	R5911	R5919		
R5896	R5904	R5912	R5920		
R5897	R5905	R5913	R5921		
R5898	R5906	R5914	R5922		
R5899	R5907	R5915	R5923		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R6052	R6060	R6068	R6076		External deceleration speed selection 1st axis ▲
R6053	R6061	R6069	R6077		External deceleration speed selection 2nd axis ▲
R6054	R6062	R6070	R6078		External deceleration speed selection 3rd axis ▲
R6055	R6063	R6071	R6079		External deceleration speed selection 4th axis ▲
R6056	R6064	R6072	R6080		External deceleration speed selection 5th axis ▲
R6057	R6065	R6073	R6081		External deceleration speed selection 6th axis ▲
R6058	R6066	R6074	R6082		External deceleration speed selection 7th axis ▲
R6059	R6067	R6075	R6083		External deceleration speed selection 8th axis ▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R6084	R6092	R6100	R6108		Optimum acceleratin/deceleration parameter group selection 1st axis ▲
R6085	R6093	R6101	R6109		Optimum acceleratin/deceleration parameter group selection 2nd axis ▲
R6086	R6094	R6102	R6110		Optimum acceleratin/deceleration parameter group selection 3rd axis ▲
R6087	R6095	R6103	R6111		Optimum acceleratin/deceleration parameter group selection 4th axis ▲
R6088	R6096	R6104	R6112		Optimum acceleratin/deceleration parameter group selection 5th axis ▲
R6089	R6097	R6105	R6113		Optimum acceleratin/deceleration parameter group selection 6th axis ▲
R6090	R6098	R6106	R6114		Optimum acceleratin/deceleration parameter group selection 7th axis ▲
R6091	R6099	R6107	R6115		Optimum acceleratin/deceleration parameter group selection 8th axis ▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R6116	R6124	R6132	R6140		Target machining time 1st axis ▲
R6117	R6125	R6133	R6141		Target machining time 2nd axis ▲
R6118	R6126	R6134	R6142		Target machining time 3rd axis ▲
R6119	R6127	R6135	R6143		Target machining time 4th axis ▲
R6120	R6128	R6136	R6144		Target machining time 5th axis ▲
R6121	R6129	R6137	R6145		Target machining time 6th axis ▲
R6122	R6130	R6138	R6146		Target machining time 7th axis ▲
R6123	R6131	R6139	R6147		Target machining time 8th axis ▲

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R6436	R6444	R6452	R6460		User macro input #1032 (PLC -> NC) (L)
R6437	R6445	R6453	R6461		User macro input #1032 (PLC -> NC) (H)
R6438	R6446	R6454	R6462		User macro input #1033 (PLC -> NC) (L)
R6439	R6447	R6455	R6463		User macro input #1033 (PLC -> NC) (H)
R6440	R6448	R6456	R6464		User macro input #1034 (PLC -> NC) (L)
R6441	R6449	R6457	R6465		User macro input #1034 (PLC -> NC) (H)
R6442	R6450	R6458	R6466		User macro input #1035 (PLC -> NC) (L)
R6443	R6451	R6459	R6467		User macro input #1035 (PLC -> NC) (H)

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R7000	R7050	R7100	R7150	R7200	R7250		Spindle command rotation speed output (L)
R7001	R7051	R7101	R7151	R7201	R7251		Spindle command rotation speed output (H)
R7002	R7052	R7102	R7152	R7202	R7252	SLSP	Spindle command selection
R7003	R7053	R7103	R7153	R7203	R7253		Optimum acceleration/deceleration parameter group selection [spindle] ▲
R7004	R7054	R7104	R7154	R7204	R7254		Spindle target machining time ▲
R7005	R7055	R7105	R7155	R7205	R7255		
R7006	R7056	R7106	R7156	R7206	R7256		
R7007	R7057	R7107	R7157	R7207	R7257		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R7008	R7058	R7108	R7158	R7208	R7258		S command override
R7009	R7059	R7109	R7159	R7209	R7259		Multi-point orientation position data
R7010	R7060	R7110	R7160	R7210	R7260		
R7011	R7061	R7111	R7161	R7211	R7261		
R7012	R7062	R7112	R7162	R7212	R7262		
R7013	R7063	R7113	R7163	R7213	R7263		
R7014	R7064	R7114	R7164	R7214	R7264		
R7015	R7065	R7115	R7165	R7215	R7265		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R7016	R7066	R7116	R7166	R7216	R7266		Spindle synchronization Basic spindle selection
R7017	R7067	R7117	R7167	R7217	R7267		Spindle synchronization Synchronous spindle selection
R7018	R7068	R7118	R7168	R7218	R7268		Spindle synchronization Phase shift amount
R7019	R7069	R7119	R7169	R7219	R7269		
R7020	R7070	R7120	R7170	R7220	R7270		
R7021	R7071	R7121	R7171	R7221	R7271		
R7022	R7072	R7122	R7172	R7222	R7272		
R7023	R7073	R7123	R7173	R7223	R7273		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R7024	R7074	R7124	R7174	R7224	R7274		
R7025	R7075	R7125	R7175	R7225	R7275		
R7026	R7076	R7126	R7176	R7226	R7276		
R7027	R7077	R7127	R7177	R7227	R7277		
R7028	R7078	R7128	R7178	R7228	R7278		
R7029	R7079	R7129	R7179	R7229	R7279		
R7030	R7080	R7130	R7180	R7230	R7280		
R7031	R7081	R7131	R7181	R7231	R7281		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R12200	R12210	R12220	R12230		Spindle tool No. (L)
R12201	R12211	R12221	R12231		Spindle tool No. (H)
R12202	R12212	R12222	R12232		Standby tool No. (L)
R12203	R12213	R12223	R12233		Standby tool No. (H)

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R10600		ATC control parameter	R10608		
R10601			R10609		
R10602			R10610		
R10603		Display tool selection parameter	R10611		
R10604			R10612		
R10605			R10613		
R10606			R10614		
R10607			R10615		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R20200		Skip coordinate (PLC axis 1st axis) ▲	R20208		Skip coordinate (PLC axis 3rd axis) ▲
R20201			R20209		
R20202			R20210		
R20203			R20211		
R20204		Skip coordinate (PLC axis 2nd axis) ▲	R20212		Skip coordinate (PLC axis 4th axis) ▲
R20205			R20213		
R20206			R20214		
R20207			R20215		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
R20216		Skip coordinate (PLC axis 5th axis) ▲	R20224		Skip coordinate (PLC axis 7th axis) ▲
R20217			R20225		
R20218			R20226		
R20219			R20227		
R20220		Skip coordinate (PLC axis 6th axis) ▲	R20228		Skip coordinate (PLC axis 8th axis) ▲
R20221			R20229		
R20222			R20230		
R20223			R20231		

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R22692	R22892	R23092	R23292		Cutting torque estimation target axis ▲
R22693	R22893	R23093	R23293		
R22694	R22894	R23094	R23294		
R22695	R22895	R23095	R23295		
R22696	R22896	R23096	R23296		
R22697	R22897	R23097	R23297		
R22698	R22898	R23098	R23298		
R22699	R22899	R23099	R23299		

4.5 Special Relay/Register

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM00			SM08		
SM01			SM09		
SM02			SM10		
SM03			SM11		
SM04			SM12		
SM05			SM13		
SM06			SM14		
SM07			SM15		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM16		Temperature rise	SM24		
SM17			SM25		
SM18			SM26		
SM19			SM27		
SM20			SM28		
SM21			SM29		
SM22			SM30		
SM23			SM31		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM32			SM40		
SM33			SM41		
SM34			SM42		
SM35			SM43		
SM36			SM44		
SM37			SM45		
SM38			SM46		
SM39			SM47		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM48			SM56		
SM49			SM57		
SM50			SM58		
SM51			SM59		
SM52			SM60		
SM53			SM61		
SM54			SM62		
SM55			SM63		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM64			SM72		
SM65			SM73		
SM66			SM74		
SM67			SM75		
SM68			SM76		
SM69			SM77		
SM70			SM78		
SM71			SM79		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM80			SM88		
SM81			SM89		
SM82			SM90		
SM83			SM91		
SM84			SM92		
SM85			SM93		
SM86			SM94		
SM87			SM95		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM96			SM104		
SM97			SM105		
SM98			SM106		
SM99			SM107		
SM100			SM108		
SM101			SM109		
SM102			SM110		
SM103			SM111		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SM112			SM120		
SM113			SM121		
SM114			SM122		
SM115			SM123		
SM116			SM124		
SM117			SM125		
SM118			SM126		
SM119			SM127		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0000		Data link restart	SB0008		Line test request
SB0001		Refresh instruction at standby master switching	SB0009		Parameter setting test request
SB0002		Data link stop	SB000A		
SB0003			SB000B		
SB0004		Temporary error cancel request	SB000C		Forced master switching
SB0005		Temporary error cancel canceling request	SB000D		
SB0006			SB000E		
SB0007			SB000F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0040		Data link restart acceptance	SB0048		Temporary error cancel acceptance status
SB0041		Data link restart complete	SB0049		Temporary error cancel complete status
SB0042		Refresh instruction acknowledgment status at standby master switching	SB004A		Temporary error cancel acceptance status
SB0043		Refresh instruction complete status at standby master switching	SB004B		Temporary error cancel acceptance status
SB0044		Data link stop acceptance	SB004C		Line test acceptance status
SB0045		Data link stop complete	SB004D		Line test complete status
SB0046		Forced master switching executable status	SB004E		Parameter setting test acknowledgment status
SB0047			SB004F		Parameter setting test completion status

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0050		Offline test status	SB0058		
SB0051			SB0059		
SB0052			SB005A		Master switching request acknowledgment
SB0053			SB005B		Master switching request complete
SB0054		Shipping test acceptance	SB005C		Forced master switching request acknowledgment
SB0055		Shipping test complete status	SB005D		Forced master switching request complete
SB0056			SB005E		
SB0057			SB005F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0060		Host mode	SB0068		
SB0061		Host type	SB0069		
SB0062		Host standby master station setting status	SB006A		Switch setting status
SB0063			SB006B		Host station operation status
SB0064			SB006C		Link status
SB0065		Host station operation status	SB006D		Parameter setting status
SB0066		Number of host occupied stations	SB006E		Host station operation status
SB0067			SB006F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0070		Master station information	SB0078		Host station switch change detection
SB0071		Standby master station information	SB0079		Master station return specification information
SB0072			SB007A		
SB0073		Operation specification when driver has an error	SB007B		Host master/standby master operation status
SB0074		Reserved station specified status	SB007C		
SB0075		Error cancel station specified status	SB007D		
SB0076		Temporary error cancel station setting information	SB007E		
SB0077		Parameter receive status	SB007F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0080		Other station data link status	SB0088		
SB0081		Other station watchdog timer error status	SB0089		
SB0082		Other station fuse blown status	SB008A		
SB0083		Other station switch change status	SB008B		
SB0084			SB008C		
SB0085			SB008D		
SB0086			SB008E		
SB0087			SB008F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB0090		Host line status	SB0098		
SB0091			SB0099		
SB0092			SB009A		
SB0093			SB009B		
SB0094		Transient transmission status	SB009C		
SB0095		Master station transient transmission status	SB009D		
SB0096			SB009E		
SB0097			SB009F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SB00B0			SB00B8		
SB00B1			SB00B9		
SB00B2			SB00BA		
SB00B3			SB00BB		
SB00B4		Standby master station test result	SB00BC		
SB00B5			SB00BD		
SB00B6			SB00BE		
SB00B7			SB00BF		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0000			SW0008		Line test station setting
SW0001			SW0009		Monitoring time setting
SW0002			SW000A		Driver monitoring time setting
SW0003		Multiple temporary error cancel station specification	SW000B		
SW0004		Temporary error cancel station specification	SW000C		
SW0005			SW000D		
SW0006			SW000E		
SW0007			SW000F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0040			SW0048		
SW0041		Data link restart result	SW0049		Temporary error cancel station result
SW0042			SW004A		
SW0043		Refresh instruction at standby master switching result	SW004B		Temporary error cancel station specification cancel result
SW0044			SW004C		
SW0045		Data link stop result	SW004D		Line test result
SW0046			SW004E		
SW0047			SW004F		Parameter setting test result

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0050			SW0058		Interface board status
SW0051			SW0059		Transmission speed setting
SW0052			SW005A		Add-on board switch setting status
SW0053			SW005B		
SW0054			SW005C		
SW0055			SW005D		Forced master switching instruction result
SW0056			SW005E		
SW0057			SW005F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0060		Mode setting status	SW0068		Host parameter status
SW0061		Host station number	SW0069		Installation status
SW0062		Operation setting status	SW006A		Switch setting status
SW0063			SW006B		Host station operation status
SW0064		No. of retries information	SW006C		Host data link status
SW0065		No. of automatic return stations	SW006D		Max. link scan time
SW0066		Delay timer	SW006E		Current link scan time
SW0067			SW006F		Min. link scan time

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0070		Total number of stations	SW0078		Error cancel station specified status
SW0071		Max. communication station number	SW0079		
SW0072		Number of connected modules	SW007A		
SW0073		Standby master station number	SW007B		
SW0074		Reserved station specified status	SW007C		Temporary error cancel status
SW0075			SW007D		
SW0076			SW007E		
SW0077			SW007F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0080		Other station data link status	SW0088		Other station fuse blown status
SW0081			SW0089		
SW0082			SW008A		
SW0083			SW008B		
SW0084		Other station watchdog timer error occurrence status	SW008C		Other station switch change status
SW0085			SW008D		
SW0086			SW008E		
SW0087			SW008F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0090		Line status	SW0098		Station number overlap status
SW0091			SW0099		
SW0092			SW009A		
SW0093			SW009B		
SW0094		Transient transmission status	SW009C		Installation/Parameter matching status
SW0095			SW009D		
SW0096			SW009E		
SW0097			SW009F		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW00B0			SW00B8		Line test 2 result
SW00B1			SW00B9		
SW00B2			SW00BA		
SW00B3			SW00BB		
SW00B4		Line test 1 result	SW00BC		
SW00B5			SW00BD		
SW00B6			SW00BE		
SW00B7			SW00BF		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW00C0		No. of retries	SW00C8		Overflow
SW00C1		TIME error	SW00C9		
SW00C2		CRC error	SW00CA		
SW00C3		Abort error	SW00CB		
SW00C4		H/W error	SW00CC		
SW00C5		Line error	SW00CD		
SW00C6		S/W error	SW00CE		
SW00C7		Illegal XCD	SW00CF		

Device	Abbrev.	Signal name	Device	Abbrev.	Signal name
SW0140		Station type (3)	SW0148		Parameter mode
SW0141			SW0149		Host parameter mode
SW0142			SW014A		
SW0143			SW014B		
SW0144		Installation/Parameter matching status (2)	SW014C		
SW0145			SW014D		
SW0146			SW014E		
SW0147			SW014F		

4.6 Classified for Each Application

(1) MR-J2-CT link

Device No.		Abbrev.	Signal name
	bit		
R9998	bit0		J2CT operation adjustment mode valid (common for all axes)

J2CT						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R9950	R9956	R9962	R9968	R9974	R9980	CTCM4	J2CT control command 4
R9951	R9957	R9963	R9969	R9975	R9981	CTCM3	J2CT control command 3
R9952	R9958	R9964	R9970	R9976	R9982	CTCM2	J2CT control command 2
R9953	R9959	R9965	R9971	R9977	R9983	CTCM1	J2CT control command 1
R9954	R9960	R9966	R9972	R9978	R9984	CTCML	J2CT control command position (L)
R9955	R9961	R9967	R9973	R9979	R9985	CTCMH	J2CT control command position (H)

Device No.		Abbrev.	Signal name
	bit		
R9948	bit0		J2CT in operation adjustment mode 1st axis
	bit1		J2CT in operation adjustment mode 2nd axis
	bit2		J2CT in operation adjustment mode 3rd axis
	bit3		J2CT in operation adjustment mode 4th axis
	bit4		J2CT in operation adjustment mode 5th axis
	bit5		J2CT in operation adjustment mode 6th axis

J2CT						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R9900	R9906	R9912	R9918	R9924	R9930	CTST4	J2CT control status 4
R9901	R9907	R9913	R9919	R9925	R9931	CTST3	J2CT control status 3
R9902	R9908	R9914	R9920	R9926	R9932	CTST2	J2CT control status 2
R9903	R9909	R9915	R9921	R9927	R9933	CTST1	J2CT control status 1
R9904	R9910	R9916	R9922	R9928	R9934		J2CT control machine position (L)
R9905	R9911	R9917	R9923	R9929	R9935		J2CT control machine position (H)

(2) PLC axis indexing interfaces

Device No.		Abbrev.	Signal name
	bit		
R8098	bit0		PLC indexing axis operation adjustment mode valid (common for all axes)

PLC indexing axis						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R8050	R8056	R8062	R8068	R8074	R8080	AUXCM4	PLC axis indexing control command 4
R8051	R8057	R8063	R8069	R8075	R8081	AUXCM3	PLC axis indexing control command 3
R8052	R8058	R8064	R8070	R8076	R8082	AUXCM2	PLC axis indexing control command 2
R8053	R8059	R8065	R8071	R8077	R8083	AUXCM1	PLC axis indexing control command 1
R8054	R8060	R8066	R8072	R8078	R8084		PLC axis indexing control command position (L)
R8055	R8061	R8067	R8073	R8079	R8085		PLC axis indexing control command position (H)

Device No.		Abbrev.	Signal name
	bit		
R8048	bit0		PLC indexing axis in operation adjustment mode 1st axis
	bit1		PLC indexing axis in operation adjustment mode 2nd axis
	bit2		PLC indexing axis in operation adjustment mode 3rd axis
	bit3		PLC indexing axis in operation adjustment mode 4th axis
	bit4		PLC indexing axis in operation adjustment mode 5th axis
	bit5		PLC indexing axis in operation adjustment mode 6th axis

PLC indexing axis						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R8000	R8006	R8012	R8018	R8024	R8030	AUXST4	PLC axis indexing control status 4
R8001	R8007	R8013	R8019	R8025	R8031	AUXST3	PLC axis indexing control status 3
R8002	R8008	R8014	R8020	R8026	R8032	AUXST2	PLC axis indexing control status 2
R8003	R8009	R8015	R8021	R8027	R8033	AUXST1	PLC axis indexing control status 1
R8004	R8010	R8016	R8022	R8028	R8034		PLC axis indexing control machine position (L)
R8005	R8011	R8017	R8023	R8029	R8035		PLC axis indexing control machine position (H)

(3) Other file registers (R)

Device No.	Signal name
R2100 to R2349	Pallet program data (Drive unit -> PLC)
R4100 to R4103	Pallet program data (PLC -> Drive unit)
R7500 to R7799	PLC constant parameters (corresponds to parameters #18001 to #18150)
R7800 to R7897	PLC bit selection parameters (corresponds to parameters #6401 to #6596)
R8290 to R8293	Optimum acceleration/deceleration estimated inertia level 1st spindle to 4th spindle
R12800 to R13099	Computer link interfaces
R13200 to R13299	Special table interfaces
R17300 to R17499	Modbus input/outpu device ▲
R17800 to R17999	Modbus input/outpu device ▲

M system		L system	
R10600 to R11779	ATC command control information	R10600 and later	Tool life management interfaces I, II
R11800 and later	Tool life management interfaces		

(4) Other inputs/outputs (X, Y)

Device No.	Signal name
X680 to X6BF	PLC switch #1 to 64
X6F8 to X6FF	Skip input 1 to 8 for monitor
Y680 to Y6BF	PLC switch reversed display #1 to 64
Y6C0 to Y6FF	PLC switch for reverse #1 to 64

(5) Fixed (semi-fixed) devices

Device No.	Signal name
X18 to X1B	Reference position return near-point detection 1 to 4
X20 to X23	Stroke end (-) 1 to 4
X28 to X2B	Stroke end (+) 1 to 4
X5C to X5F	Reference position return near-point detection 5 to 8
X64 to X67	Stroke end (-) 5 to 8
X6C to X6F	Stroke end (+) 5 to 8

(6) Maintenance

Device No.	Signal name
R13170	CRC count (servo #1)
R13171	CRC count (servo #2)
R13172	Address illegal (servo #1)
R13173	Address illegal (servo #2)
R13174	CRC count (display unit)
R13175	Address illegal (display unit)
R13176	CRC count (servo #3)
R13177	Address illegal (servo #3)

(7) Spindle related devices

CNC -> PLC

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X1880	X18E0	X1940	X19A0	X1A00	X1A60		
X1881	X18E1	X1941	X19A1	X1A01	X1A61		
X1882	X18E2	X1942	X19A2	X1A02	X1A62	SIGE	S command gear No. illegal
X1883	X18E3	X1943	X19A3	X1A03	X1A63	SOVE	S command max./min. command value over
X1884	X18E4	X1944	X19A4	X1A04	X1A64	SNGE	S command no gear selected
X1885	X18E5	X1945	X19A5	X1A05	X1A65	GR1	Spindle gear shift command 1
X1886	X18E6	X1946	X19A6	X1A06	X1A66	GR2	Spindle gear shift command 2
X1887	X18E7	X1947	X19A7	X1A07	X1A67		(Always "0")
X1888	X18E8	X1948	X19A8	X1A08	X1A68		Spindle 2nd in-position
X1889	X18E9	X1949	X19A9	X1A09	X1A69	CDO	Current detection
X188A	X18EA	X194A	X19AA	X1A0A	X1A6A	VRO	Speed detection
X188B	X18EB	X194B	X19AB	X1A0B	X1A6B	FLO	In spindle alarm
X188C	X18EC	X194C	X19AC	X1A0C	X1A6C	ZSO	Zero speed
X188D	X18ED	X194D	X19AD	X1A0D	X1A6D	USO	Spindle up-to-speed
X188E	X18EE	X194E	X19AE	X1A0E	X1A6E	ORAO	Spindle in-position
X188F	X18EF	X194F	X19AF	X1A0F	X1A6F	LCSA	In L coil selection
X1890	X18F0	X1950	X19B0	X1A10	X1A70	SMA	Spindle ready-ON
X1891	X18F1	X1951	X19B1	X1A11	X1A71	SSA	Spindle servo-ON
X1892	X18F2	X1952	X19B2	X1A12	X1A72	SEMG	In spindle emergency stop
X1893	X18F3	X1953	X19B3	X1A13	X1A73	SSRN	In spindle forward run
X1894	X18F4	X1954	X19B4	X1A14	X1A74	SSRI	In spindle reverse run
X1895	X18F5	X1955	X19B5	X1A15	X1A75		Z phase passed
X1896	X18F6	X1956	X19B6	X1A16	X1A76	SIMP	Position loop in-position
X1897	X18F7	X1957	X19B7	X1A17	X1A77	STLQ	In spindle torque limit
X1898	X18F8	X1958	X19B8	X1A18	X1A78		In motor 1 selection
X1899	X18F9	X1959	X19B9	X1A19	X1A79		In motor 2 selection
X189D	X18FD	X195D	X19BD	X1A1D	X1A7D	SD2	Speed detection 2
X189E	X18FE	X195E	X19BE	X1A1E	X1A7E	MCSA	In M coil selection
X189F	X18FF	X195F	X19BF	X1A1F	X1A7F		Index positioning completion

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
X18A0	X1900	X1960	X19C0	X1A20	X1A80	ENB	Spindle enable
X18A8	X1908	X1968	X19C8	X1A28	X1A88	SPSYN1	In spindle synchronization
X18A9	X1909	X1969	X19C9	X1A29	X1A89	FSPRV	Spindle rotation speed synchronization completion
X18AA	X190A	X196A	X19CA	X1A2A	X1A8A	FSPPH	Spindle phase synchronization completion
X18AB	X190B	X196B	X19CB	X1A2B	X1A8B	SPSYN2	In spindle synchronization 2
X18AC	X190C	X196C	X19CC	X1A2C	X1A8C	SPCMP	Chuck close confirmation
X18B5	X1915	X1975	X19D5	X1A35	X1A95	EXOFN	In spindle holding force up

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
XC64	XDA4	XEE4	X1024	SF1	S function strobe 1
XC65	XDA5	XEE5	X1025	SF2	S function strobe 2
XC66	XDA6	XEE6	X1026	SF3	S function strobe 3
XC67	XDA7	XEE7	X1027	SF4	S function strobe 4
XCB0	XDF0	XF30	X1070		In spindle-NC axis polygon mode
XCB2	XDF2	XF32	X1072		In spindle-spindle polygon mode
XCB3	XDF3	XF33	X1073		Spindle-spindle polygon synchronization completion

CNC -> PLC

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6500	R6550	R6600	R6650	R6700	R6750		Spindle command rotation speed input (L)
R6501	R6551	R6601	R6651	R6701	R6751		Spindle command rotation speed input (H)
R6502	R6552	R6602	R6652	R6702	R6752		Spindle command final data (rotation speed) (L)
R6503	R6553	R6603	R6653	R6703	R6753		Spindle command final data (rotation speed) (H)
R6504	R6554	R6604	R6654	R6704	R6754		Spindle command final data (12-bit binary) (L)
R6505	R6555	R6605	R6655	R6705	R6755		Spindle command final data (12-bit binary) (H)
R6506	R6556	R6606	R6656	R6706	R6756		Spindle actual speed (L)
R6507	R6557	R6607	R6657	R6707	R6757		Spindle actual speed (H)
R6508	R6558	R6608	R6658	R6708	R6758		

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R6516	R6566	R6616	R6666	R6716	R6766		Spindle synchronization phase error /Hob axis delay angle
R6517	R6567	R6617	R6667	R6717	R6767		Spindle synchronization Maximum phase error/Maximum hob axis delay angle
R6518	R6568	R6618	R6668	R6718	R6768		Spindle synchronization Phase offset data
R6519	R6569	R6619	R6669	R6719	R6769		Spindle synchronization Phase error monitor
R6520	R6570	R6620	R6670	R6720	R6770		Spindle synchronization Phase error monitor (lower limit)
R6521	R6571	R6621	R6671	R6721	R6771		Spindle synchronization Phase error monitor (upper limit)
R6522	R6572	R6622	R6672	R6722	R6772		Spindle synchronization Phase error 1
R6523	R6573	R6623	R6673	R6723	R6773		Spindle synchronization Phase error 2

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R512	R712	R912	R1112		S code data 1 (L)
R513	R713	R913	R1113		S code data 1 (H)
R514	R714	R914	R1114		S code data 2 (L)
R515	R715	R915	R1115		S code data 2 (H)
R516	R716	R916	R1116		S code data 3 (L)
R517	R717	R917	R1117		S code data 3 (H)
R518	R718	R918	R1118		S code data 4 (L)
R519	R719	R919	R1119		S code data 4 (H)

PLC -> CNC

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
Y1885	Y18E5	Y1945	Y19A5	Y1A05	Y1A65	GFIN	Gear shift completion
Y1888	Y18E8	Y1948	Y19A8	Y1A08	Y1A68	SP1	Spindle speed override code 1
Y1889	Y18E9	Y1949	Y19A9	Y1A09	Y1A69	SP2	Spindle speed override code 2
Y188A	Y18EA	Y194A	Y19AA	Y1A0A	Y1A6A	SP4	Spindle speed override code 4
Y188F	Y18EF	Y194F	Y19AF	Y1A0F	Y1A6F	SPS	Spindle override method selection
Y1890	Y18F0	Y1950	Y19B0	Y1A10	Y1A70	GI1	Spindle gear selection code 1
Y1891	Y18F1	Y1951	Y19B1	Y1A11	Y1A71	GI2	Spindle gear selection code 2
Y1893	Y18F3	Y1953	Y19B3	Y1A13	Y1A73	EXOBS	Spindle holding force up
Y1894	Y18F4	Y1954	Y19B4	Y1A14	Y1A74	SSTP	Spindle stop
Y1895	Y18F5	Y1955	Y19B5	Y1A15	Y1A75	SSFT	Spindle gear shift
Y1896	Y18F6	Y1956	Y19B6	Y1A16	Y1A76	SORC	Spindle orientation
Y1897	Y18F7	Y1957	Y19B7	Y1A17	Y1A77		Spindle command invalid
Y1898	Y18F8	Y1958	Y19B8	Y1A18	Y1A78	SRN	Spindle forward run start
Y1899	Y18F9	Y1959	Y19B9	Y1A19	Y1A79	SRI	Spindle reverse run start
Y189A	Y18FA	Y195A	Y19BA	Y1A1A	Y1A7A	TL1	Spindle torque limit 1
Y189B	Y18FB	Y195B	Y19BB	Y1A1B	Y1A7B	TL2	Spindle torque limit 2
Y189C	Y18FC	Y195C	Y19BC	Y1A1C	Y1A7C	WRN	Spindle forward run index
Y189D	Y18FD	Y195D	Y19BD	Y1A1D	Y1A7D	WRI	Spindle reverse run index
Y189E	Y18FE	Y195E	Y19BE	Y1A1E	Y1A7E	ORC	Spindle orientation command
Y189F	Y18FF	Y195F	Y19BF	Y1A1F	Y1A7F	LRSL	L coil selection
Y18A2	Y1902	Y1962	Y19C2	Y1A22	Y1A82		Spindle position control (C axis) Cutting gain L
Y18A3	Y1903	Y1963	Y19C3	Y1A23	Y1A83		Spindle position control (C axis) Cutting gain H
Y18A6	Y1906	Y1966	Y19C6	Y1A26	Y1A86	LRSM	M coil selection
Y18A8	Y1908	Y1968	Y19C8	Y1A28	Y1A88	SWS	Spindle selection
Y18AF	Y190F	Y196F	Y19CF	Y1A2F	Y1A8F	MPCSL	PLC coil changeover
Y18B0	Y1910	Y1970	Y19D0	Y1A30	Y1A90	SPSY	Spindle synchronization
Y18B1	Y1911	Y1971	Y19D1	Y1A31	Y1A91	SPPHS	Spindle phase synchronization
Y18B2	Y1912	Y1972	Y19D2	Y1A32	Y1A92	SPSDR	Spindle synchronization rotation direction
Y18B3	Y1913	Y1973	Y19D3	Y1A33	Y1A93	SSPHM	Phase shift calculation request
Y18B4	Y1914	Y1974	Y19D4	Y1A34	Y1A94	SSPHF	Phase offset request
Y18B5	Y1915	Y1975	Y19D5	Y1A35	Y1A95	SPDRPO	Error temporary cancel
Y18B8	Y1918	Y1978	Y19D8	Y1A38	Y1A98	SPSYC	Spindle synchronization/ superimposition cancel
Y18B9	Y1919	Y1979	Y19D9	Y1A39	Y1A99	SPCMPC	Chuck close

PLC -> CNC

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
YCD1	YE11	YF51	Y1091		Spindle-spindle polygon cancel
YCD2	YE12	YF52	Y1092		Synchronized tapping command polarity reversal
YCD3	YE13	YF53	Y1093		Spindle OFF mode
YCE1	YE21	YF61	Y10A1		Door open II
YCE2	YE22	YF62	Y10A2		Door open signal input (spindle speed monitor)
YCE3	YE23	YF63	Y10A3		Door interlock spindle speed clamp ▲

PLC -> CNC

Device No.							
1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP	Abbrev.	Signal name
R7000	R7050	R7100	R7150	R7200	R7250		Spindle command rotation speed output (L)
R7001	R7051	R7101	R7151	R7201	R7251		Spindle command rotation speed output (H)
R7002	R7052	R7102	R7152	R7202	R7252	SLSP	Spindle command selection
R7008	R7058	R7108	R7158	R7208	R7258		S command override
R7009	R7059	R7109	R7159	R7209	R7259		Multi-point orientation position data
R7016	R7066	R7116	R7166	R7216	R7266		Spindle synchronization Basic spindle selection
R7017	R7067	R7117	R7167	R7217	R7267		Spindle synchronization Synchronous spindle selection
R7018	R7068	R7118	R7168	R7218	R7268		Spindle synchronization Phase shift amount

Device No.					
$1	$2	$3	$4	Abbrev.	Signal name
R2567	R2767	R2967	R3167		Encoder selection

5

Other Devices

5 Other Devices

In addition to X, Y and R devices described above, the following devices exist:

Name	Symbol	Description
Internal relay Latch relay	M F L	(1) Internal and latch relays are auxiliary relays in the sequence that cannot directly be output to the external. (2) The latch relay L will be backed up even if the power is turned OFF. (3) The internal relay F may be used as the interface for the alarm message display.
Timer	T ST	(1) Timers T are count-up timers. (2) Timer T and ST can set the timer value from either the sequence program or setting and display unit. (3) The 100ms, 10ms and 100ms integral timer are available.
Counter	C	(1) Counters C are count-up counters. (2) Counter C can set the counter value from either the sequence program or setting and display unit.
Data register	D	(1) The data register stores sequence data. (2) One data register consists of 16 bits and can be read or written in 16-bit units. To handle 32-bit data, two data registers are used. The data register addressed by a 32-bit command is used as the low-order 16 bits; the data register addressed by the specified data register number +1 is used as the high-order 16 bits.
File register	R	(1) The file register release area can be used in the same manner as the data register. (2) To handle 32-bit data, two file registers are used. The file register addressed by a 32-bit command is used as the low-order 16 bits; the file register addressed by the specified file register number +1 is used as the high-order 16 bits.

The assignment tables for the above tables are on the following pages. Copy and use them as necessary.

<Format 1>

<Internal relay>

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		
M			M		

<Format 2>

<Internal relay>

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		
F			F		

<Format 3>

<Latch relay>

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		
L			L		

<Format 4>

<Timer>

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

<Format 5>

<Timer numerical value setting data output>

16-bit unit

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		
T			T		

<Format 6>

<Timer>

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

<Format 7>

<Timer numerical value setting data output>

16-bit unit

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		
ST			ST		

<Format 8>

<Counter>

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
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C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
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C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
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C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
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C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
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C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
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C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
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C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
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C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
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C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
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C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

<Format 9>

<Counter numerical value setting data>

16-bit unit

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		
C			C		

<Format 10>

<Data register>

16-bit unit

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		
D			D		

<Format 11>

<File register>

16-bit unit

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		

Device	Abbreviation	Signal name	Device	Abbreviation	Signal name
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		
R			R		

6

Explanation of Interface Signals

The signals are explained in order of the tables of input/output signals with the controller as shown below.

6.1 PLC Input Signals (Bit Type: X***)

6.2 PLC Input Signals (Data Type: R***)

6.3 PLC Output Signals (Bit Type: Y***)

6.4 PLC Output Signals (Data Type: R***)

6.5 Explanation of Special Relays (SM***)

6.6 Explanations of Each Application

How to read the signals

Contact	Signal name	Signal abbreviation		$1	$2	$3	$4
B	AUTOMATIC INTERLOCK+ n-TH AXIS	*+AIT1 to 8		Y820 to 7	Y828 to F	Y830 to 7	Y838 to F

Indicates a device No. for each part system or spindle.
"-" indicates that there is no corresponding device, or that the device for the 1st part system (1st spindle) is used commonly.

Types of contact
A : Becomes valid when turned ON (A contact)
B : Becomes valid when turned OFF (B contact)

(Note) An asterisk "*" is prefixed to a B-contact signal abbreviation.

6.1 PLC Input Signals (Bit Type: X***)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	BOARD RESET	BRST	X2F0

[Function]

This signal indicates that the NC keyboard or the soft keyboard reset button is pressed.

[Operation]

When the NC keyboard or the soft keyboard reset button is pressed, this signal turns ON; and then it turns OFF after 10ms.

NC will not be reset even if this signal is turned ON. In order to reset the NC, check the status of this signal with ladder, and turn NC reset (NRST1), etc. ON/OFF.

[Related signals]

(1) NC reset 1 (NRST1)
(2) NC reset 2 (NRST2)
(3) Reset & rewind (RRW)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	POWER OFF PROCESSING		X707

[Function][Operation]

This signal notifies that the power OFF processing is in execution.

This signal is remained ON until the control unit's power is turned OFF.

Refer to the "Automatic power OFF request" signal (Y75D) for details.

0: Not executed
1: During execution

[Related signals]

(1) Automatic power OFF request (Y75D)
(2) Power OFF indication Y device No. (R215)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	BATTERY WARNING	BATWR	X70E

[Function]

This signal notifies that the voltage of the data storage battery in the controller has dropped below the battery alarm detection level.

[Operation]

The signal turns ON when:

(1) The voltage of the data storage battery, which is checked constantly, has dropped below the battery alarm detection level.
The alarm display indicates the system alarm (Z52 0001) at this time.
The alarm display can be turned OFF by reset, but the signal will not be turned OFF.

Even if this signal is ON, starting the automatic operation is possible.

The signal turns OFF when:

(1) The voltage of the data storage battery drops below the battery alarm detection level, and the battery alarm (BATAL) signal turns ON.
(The system alarm (Z52 0003) is displayed.)

[Caution]

(1) When this signal (X70E) turns ON, replacement of the battery with new one is recommended.
(2) If invalidating the battery alarm/warning detection (#6449 bit4=1), this signal will not turn ON and the alarm messages will not be displayed either.

[Related signals]

(1) Battery alarm (BATAL:X70F)
(2) Battery drop cause (R56)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	BATTERY ALARM	BATAL	X70F

[Function]

This signal notifies that the voltage of the data storage battery in the controller or the battery supplying to the absolute position detector has dropped below the specified value.

[Operation]

The signal turns ON when:

(1) The voltage of the data storage battery is checked when the power is turned ON and is below the specified voltage (approx. 2.6V). At this time, the system alarm (Z52) will display.

(2) A fault is detected in the power voltage supplied to the absolute position detector.
At this time, the absolute position detection system alarm (Z73 0001) and servo alarm (S52 9F) will display.

(3) A fault is detected in the power voltage for the speed detector in the absolute position detector.
At this time, the absolute position detection system alarm (Z71 0001) will display.

When this signal is ON, automatic starting is not possible.

The signal turns OFF when:

(1) For alarms caused by ON condition (1), the signal can be turned OFF by resetting after the battery is replaced with new one.

(2) For alarms caused by ON conditions (2) and (3), the signal can be turned OFF by removing the power voltage fault and then turning the power ON again.

[Caution]

(1) If simply turning the control unit power OFF upon occurrence of this battery alarm (especially in the "ON" conditions (1)), data storing machining programs, etc. will be destroyed. Replace the battery with new one before turning the power OFF and confirm that this signal is turned OFF. If this battery alarm has occurred when the control unit power is ON (especially in the "ON" conditions (1)), take measures, assuming that the data storing machining programs may have been destroyed.

(2) If invalidating the battery alarm/warning detection (#6449 bit4=1), this signal will not turn ON or the alarm messages will not be displayed.

(3) Make sure to backup the control unit data and keep it in case that this alarm occurs.

[Related signals]

(1) Battery warning (BATWR: X70E)

(2) Battery drop cause (R56)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	COLLECTING DIAGNOSIS DATA		X723

[Function]

This signal informs that collecting history data is being executed by the operation history function.

[Operation]

This signal turns ON while collecting history data is executed.

[Related signals]

(1) Collecting diagnosis data stop (Y72B)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	IN REMOTE PROGRAM INPUT		X724
A	REMOTE PROGRAM INPUT COMPLETION		X725
A	REMOTE PROGRAM INPUT ERROR		X726

[Function][Operation]

Refer to the section on "Remote program input start" signal for the function and operation.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Remote program input error information (R30)
(2) Remote program input start (Y76C)
(3) Remote program input No. (R352,R353)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	IN TOOL ID COMMUNICATION		X727

[Function]

This signal indicates that data transmission and reception with the tool ID controller are executed.

[Operation]

This signal turns ON during commanding to write and read the tool ID data, and turns OFF after the transmission and reception with the tool ID controller is completed.

For whether transmission and reception have normally completed or not, refer to the "Tool ID communication error information".

[Caution]

(1) Even if the "Reset" signal is turned ON during the tool ID communication, the communication is not stopped.
(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Tool ID communication error information (R62)

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus/TCP COMMUNICATING	MDBUSIF	X728

[Function]

This signal notifies that the connection to Modbus/TCP master station is completed.

[Operation]

This signal turns ON when more than one connection to Modbus/TCP master station is established.

This signal turns OFF when the connection is reset and there is no master station to connect.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus TIME-OUT 1	MDBUSER 1	X729

[Function]

This signal notifies that the communication remains idle for a given amount of time after communicating to Modbus/TCP master station is completed.

[Operation]

This signal detects the time-out and turns ON when the connection to Modbus/TCP master station was established and data was received but the next one is not received for longer than the timeout period.

When the time-out is detected, the device in the transfer block that the Modbus/TCP clear is valid is cleared and that block's transfer stops.

Once the signal is turned ON, it will not turn OFF until "Modbus Time-out 1 cancel" signal (MDBUSRST2) is turned ON or the power is turned ON again.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus TIME-OUT 2	MDBUSER 2	X72A

[Function]

This signal notifies that the communication from Modbus/RTU master station remains idle for a given amount of time.

[Operation]

This signal detects the time-out and turns ON if the next data is not received for longer than the timeout period after the data was received from Modbus RTU master station.

When the time-out is detected, the device in the transfer block that the Modbus/RTU clear is valid is cleared and that block's transfer stops.

Once the signal is turned ON, it will not turn OFF until "Modbus Time-out 2 cancel" signal (MDBUSRST2) is turned ON or the power is turned ON again.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	POWER OFF REQUIRED AFTER PARAMETER CHANGE		X72F

[Function]

This signal informs that the set parameter is not valid without rebooting the power.

[Operation]

When the following operation is executed, the "Power OFF required after parameter change" signal is output, and the display symbol "PR" is displayed in the operation status section.

(1) The parameters to be valid after rebooting the power are set. / Such parameter data is input.
(2) The auxiliary axis parameters to be valid after rebooting the power are set. / Such data is input. / Such data backed up before is input.
(3) The maintenance data for the ALL1 is input.
(4) The backup data is input with the SRAM backup function.

If the power is rebooted, the "Power OFF required after parameter change" signal will turn OFF, and the "PR" display will disappear.

(Note 1) Even if the same value is set to the parameter which needs to reboot the power, the "Power OFF required parameter change" signal is output, and the "PR" is displayed.
(Note 2) Even if the value is returned to the original value after setting the parameter which needs to reboot the power, the "Power OFF required after parameter change" signal remains ON, and the "PR" also remains displayed.
(Note 3) The parameters which do not need to reboot the power are targeted for rewriting the parameters with DDB or G10, so the "Power OFF required after parameter change" signal is not output, and the "PR" is not displayed.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	24 HOURS CONTINUOUS OPERATION	CNOP	X752

[Function]

This signal notifies that the connector status of the drive power has been ON for over 24 hours.

[Operation]

This signal turns OFF when the contactor shutoff is confirmed by the contactor shutoff test.

Turn the "contactor shutoff test" signal ON to carry out this test.

[Caution]

There is a possibility that the contactor is welded and so your safety may not be secured when "24 hours continuous operation" signal is output. Thus, under this condition, do not input "speed monitor mode" signal to open the door.

[Related signals]

(1) Contactor shutoff test (MCT:Y742)

(2) Speed monitor mode (SOMD:R296)

Con-tact	Signal name	Signal ab-breviation	Common for part sys-tems
A	PALLET PROGRAM REGISTRATION EXT. WORKPIECE COORDINATE TRANSFER COMPLETION		X758

[Function][Operation]

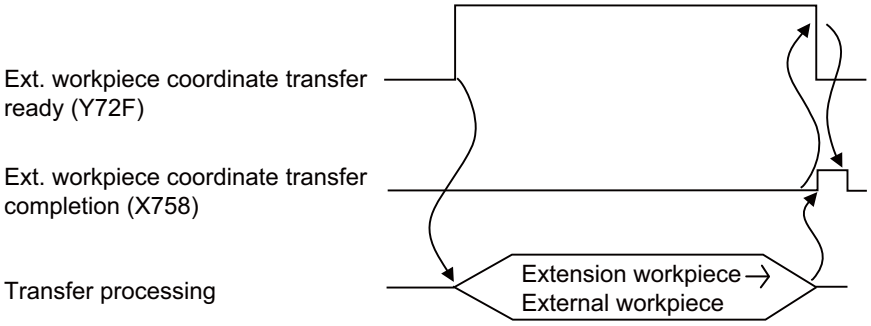
Completion of transfer from extension workpiece coordinate to external workpiece coordinate offset (EXT) during pallet 4 page registration is displayed.

This signal turns ON at the completion of transfer processing.

This signal turns OFF when external workpiece coordinate transfer ready is turned OFF.

The transferred external workpiece coordinate offset (EXT) will be effective as soon as when this signal is turned ON.

[Timing chart]



[Related signals]

(1) Pallet program registration Ext. workpiece coordinate transfer ready (Y72F)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	$1 DISPLAY		X760
A	$2 DISPLAY		X761
A	$3 DISPLAY		X762
A	$4 DISPLAY		X763

[Function]

This signal indicates the part system displayed on the screen.

[Operation]

This signal turns ON when the part-system display has been changed by pressing the $<=>$ key, by turning ON the "Display changeover $1 to $4" signal (DISP1 to 4), or with the touch panel.

[Related signals]

(1) Display changeover $1 to $4 (DISP1 to 4: Y730 to 733)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SERVO READY n-TH AXIS	RDY1 to 8	X780 to 7	X788 to F	X790 to 7	X798 to F

[Function]

This signal indicates that the drive section of the nth axis is ready for operation.

[Operation]

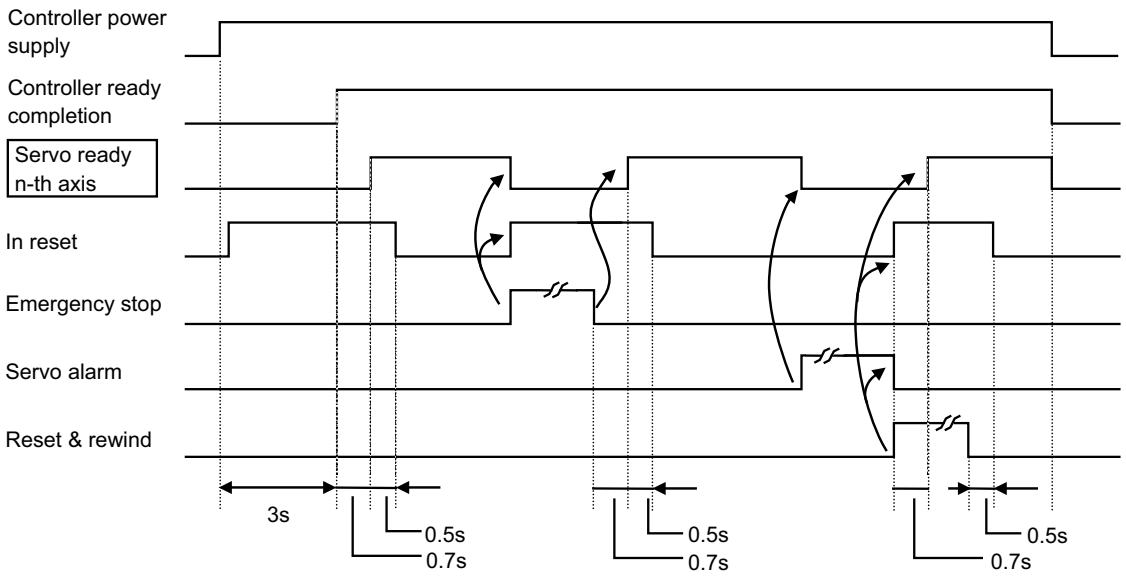
The signal turns ON when:

(1) The power supply of the controller is turned ON and the diagnosis on the servo system has been completed successfully.
(2) Servo alarm has been reset.
(3) Emergency stop has been reset.
(4) "Servo off"(*SVFn) signal is reset.

The signal turns OFF when:

(1) Servo alarm occurs.
(2) Emergency stop is issued.
(3) "Servo off"(*SVFn) signal is input.

[Operation sequence]



[Related signals]

(1) Servo ready completion (SA: XC11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	AXIS SELECTED n-TH AXIS	AX1 to 8	X7A0 to 7	X7A8 to F	X7B0 to 7	X7B8 to F

[Function]

This signal indicates that motion command is issued to the control axis.

[Operation]

This signal turns ON and OFF as follows:

(1) Automatic operation

The signal is ON while the motion command is issued to the end of movement, or to when automatic operation pause turns ON.

(2) Manual operation

(a) For JOG mode

The signal is ON while "Feed axis selection +/-" (+Jn and -Jn) signal is ON.

(b) For HANDLE mode

When "1st to 3rd handle axis selection code m" (HS1mn to HS3mn) and "Handle valid" signal (HS1Sn, HS2Sn, HS3Sn) have been selected, the "Axis selected" signal for the axis specified by the "1st to 3rd handle axis selection code m" (HS1mn to HS3mn) signal is ON.

(c) For INCREMENTAL mode

The signal turns ON when "Feed axis selection +/-" (+Jn, -Jn) signal turns ON, and turns OFF when the specified motion is completed.

(d) For MANUAL ARBITRARY FEED mode

The signal turns ON when "Manual arbitrary feed strobe" (CXS8n) signal turns ON, and turns OFF when the specified motion is completed.

(e) For REFERENCE POSITION RETURN mode

The signal is ON while "Feed axis selection +/-" (+Jn and -Jn) signal is ON. After "Reference position return near point detection" signal is detected, and the motion speed changes to approach (creeping) speed, the "Axis selected" signal remains ON until the motion stops at the reference position, even when "Feed axis selection +/-" (+Jn and -Jn) signal turns OFF.

(3) Other conditions

(a) The signal can turn ON even during machine lock (Z-axis is in cancellation). However, it does not turn ON during machine lock in manual operation mode.

(b) The signal remains on even when motion stops due to feedrate override set at 0%, manual control feedrate set at 0 mm/min, or 0 inch/min.

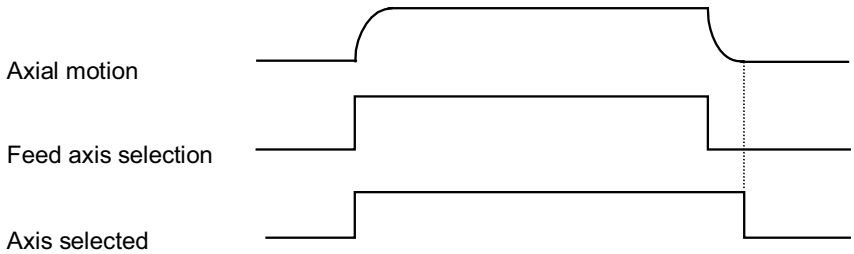
(c) Interlock does not affect status of this signal (the signal remains ON, or turns ON).

(d) "Servo off" signal does not affect status of this signal.

(e) The signal cannot be turned ON by G04 and G92.

(f) The signal turns OFF with "controller Reset & Rewind", or "Emergency stop".

(Example)



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AXIS PLUS MOTION n-TH AXIS	MVP1 to 8	X7C0 to 7	X7C8 to F	X7D0 to 7	X7D8 to F

[Function]

This signal indicates that the specified axial motion is in plus (+) direction.

This signal is available per control axis, and the last number of the signal name indicates the control axis No.

[Operation]

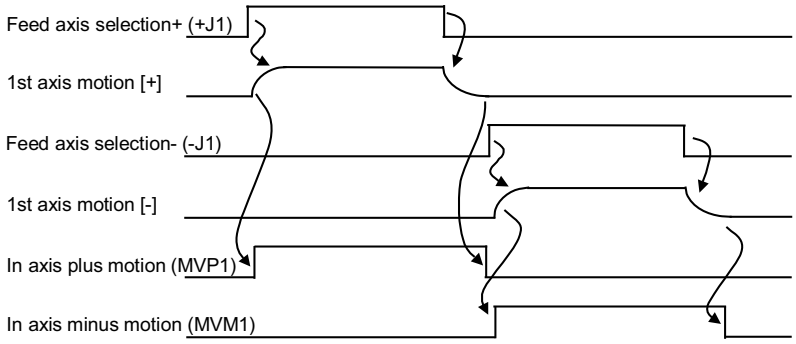
The signal turns ON when:

(1) The specified axial component starts moving in the plus direction or when moving.

The signal turns OFF when:

(2) The specified control axis stops moving or moves in the minus direction.

An example of the timing chart for the jog mode is shown below.



(Note 1) This signal operates regardless of the operation mode.

(Note 2) The real movement direction is indicated.

(Note 3) The signal does not turn ON during machine lock.

[Related signals]

(1) In axis minus motion n-th axis (MVM1 to 8: X7E0 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AXIS MINUS MOTION n-TH AXIS	MVM1 to 8	X7E0 to 7	X7E8 to F	X7F0 to 7	X7F8 to F

[Function]

This signal indicates that the control axis is moving in the minus direction

[Operation]

This motion direction is the reverse of the plus motion, and the operation is the same as IN AXIS PLUS MOTION + (MVPn).

[Related signals]

(1) In axis plus motion n-th axis (MVP1 to 8: X7C0 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	1ST REFERENCE POSITION REACHED n-TH AXIS	ZP11 to 18	X800 to 7	X808 to F	X810 to 7	X818 to F

[Function]

This signal indicates that the axial component of the nth axis is ON the 1st reference position.
Each control axis is provided with this signal. The last number (n = 1, 2, 3...) of the signal abbreviation indicates the control axis No.

[Operation]

(1) The signal turns ON when:

- "1st reference position reached" is attained with reference position return mode in manual operation.
  Refer to the REFERENCE POSITION RETURN (ZRNn) section for details on returning.
- "1st reference position reached" is attained with G28 command in automatic operation.

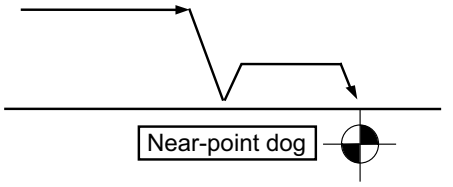
(Note 1) If "1st reference position reached" is achieved in other operation mode, or by other command, the signal does not turn ON.

(2) The signal turns OFF when:

- The axial component in position is relocated from the 1st reference position by motion command.
- "Emergency stop" signal is input or servo alarm occurs, causing stop to the machine.

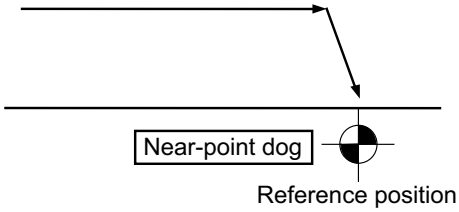
(3) Reference position return operation pattern

○ Dog-type reference position return



- When basic machine coordinate system is not established.
- When dog-type return is selected with setup parameters, basic specification parameter "#1063 mandog" in the manual mode.

○ High-speed reference position return



- When basic machine coordinate system is not established.
- When high-speed return is selected with setup parameters, basic specification parameter "#1063 mandog" in the manual mode.

(Note)
Reference position return will be the high-speed return when the basic machine coordinate system is established (2nd time and following).

[Related signals]

(1) 2nd reference position reached n-th axis (ZP21 to 28: X820 to 7)
(2) 3rd reference position reached n-th axis (ZP31 to 38: X840 to 7)
(3) 4th reference position reached n-th axis (ZP41 to 48: X860 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND REFERENCE POSITION REACHED n-TH AXIS	ZP21 to 28	X820 to 7	X828 to F	X830 to 7	X838 to F

[Function]

This signal indicates that the axial component of the nth axis is on the 2nd reference position.

Each control axis is provided with this signal. The last number (n = 1, 2, 3...) of the signal abbreviation indicates the control axis No.

[Operation]

(1) The signal turns ON when:

- "2nd reference position reached" is attained with G30 command (G30 P2 X_ Y_ ...) in automatic operation.
- "2nd reference position reached" is attained with reference position retern mode of automatic operation (Reference position selection code 1, 2).

(Note) If "2nd reference position reached" is achieved in other operation mode, or by other command, the signal does not turn ON.

(2) The signal turns OFF when:

- The axial component in position is relocated from the 1st reference position by motion command.
- "Emergency stop" signal is input or servo alarm occurs, causing stop to the machine.

[Related signals]

(1) 1st reference position reached n-th axis (ZP11 to 18: X800 to 7)
(2) 3rd reference position reached n-th axis (ZP31 to 38: X840 to 7)
(3) 4th reference position reached n-th axis (ZP41 to 48: X860 to 7)
(4) Reference position selection code m (ZSLmn: YC190,1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	3RD REFERENCE POSITION REACHED n-TH AXIS	ZP31 to 38	X840 to 7	X848 to F	X850 to 7	X858 to F

[Function][Operation]

This signal informs that the control axis is on the 3rd reference position.

Function and operation are the same as the 2nd reference position reached, but the reference position and G command are different.

- Reference position: 3rd reference position
- G comand: G30 P3

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	4TH REFERENCE POSITION REACHED n-TH AXIS	ZP41 to 48	X860 to 7	X868 to F	X870 to 7	X878 to F

[Function][Operation]

This signal informs that the control axis is on the 4th reference position.

Function and operation are the same as the 2nd reference position reached, but the reference position and G command are different.

- Reference position: 4th reference position
- G comand: G30 P4

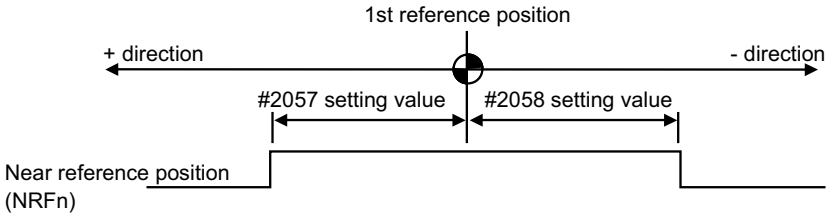
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NEAR REFERENCE POSITION n-TH AXIS	NRF1 to 8	X880 to 7	X888 to F	X890 to 7	X898 to F

[Function]

This signal indicates that the control axis is near the 1st reference position in the absolute position detection system.

[Operation]

This signal turns ON when the control axis is in the range of the parameter set using the 1st reference position as a base point, and turns OFF when the range is exceeded. The parameter is set with #2057 (nrefp) and #2058 (nrefn) in the [ABS. POSI PARAM] screen.



(Note 1) The "Near reference position" signal is output even while the axis is moving, but there may be a slight deviation with the actual machine position.
Rapid traverse: Approx. 19mm at 20m/min.
Cutting feed: Approx. 9.5mm at 10m/min.

(Note 2) This signal is valid only with the absolute position detection system.

(Note 3) When 0 is set for #2057 (nrefp) and #2058 (nrefn) in the [ABS. POSI PARAM] screen, it will be same as when the grid width is set.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ZERO POINT INITIALIZATION SET COMPLETED n-TH AXIS	ZSF1 to 8	X8C0 to 7	X8C8 to F	X8D0 to 7	X8D8 to F

[Function]

This signal notifies that the basic machine coordinate system has been set (established) during zero point initialization set using the marked point alignment method in the absolute position detection system.

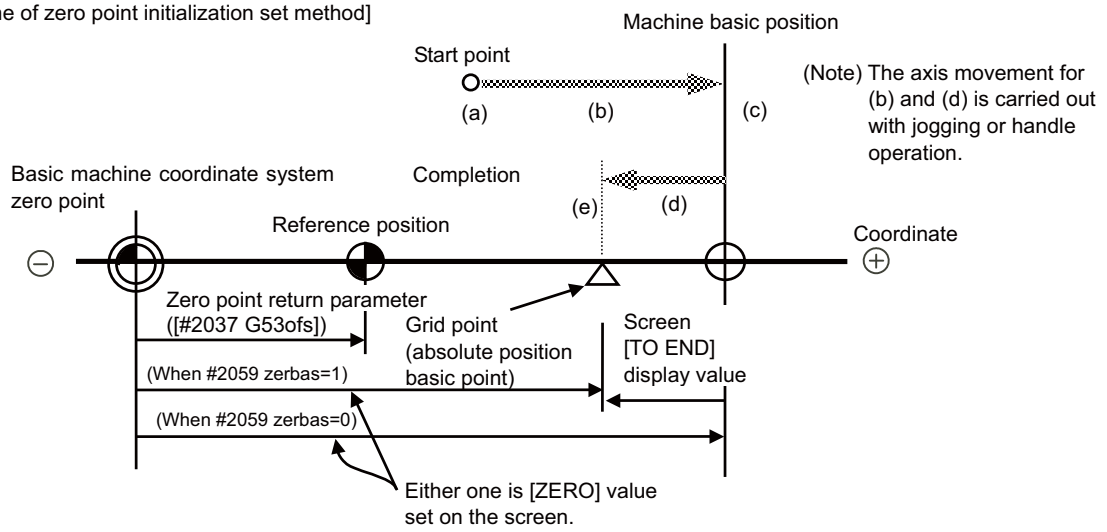
[Operation]

This signal is valid when "#2049 TYPE" on the [ABS. POSI PARAM] screen is set to "2", and turns ON when the basic machine coordinate system is set (established).

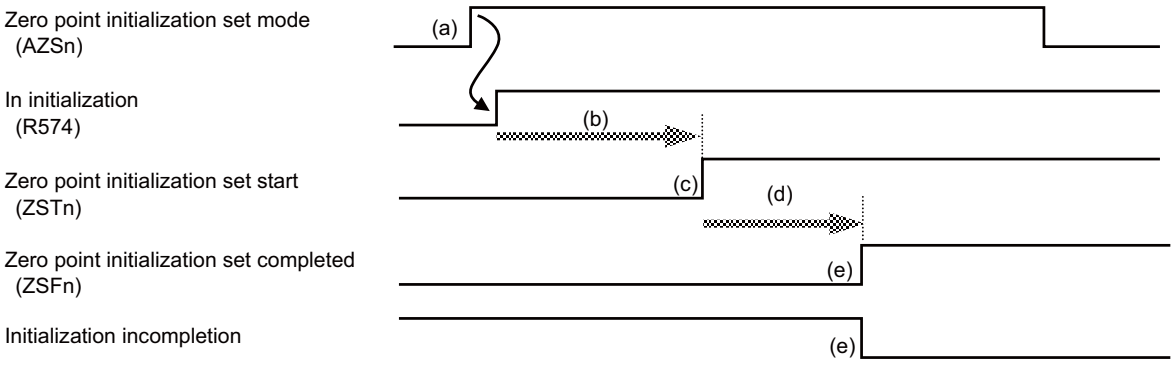
This signal will turn OFF if initializing is carried out again or if the power is turned ON again.

<Zero point initialization set method using marked point alignment method, and timing chart>

[Outline of zero point initialization set method]



[Time chart] ((a) to (e) in the figure correspond to (a) to (e) above)



[Related signals]

(1) Zero point initialization set error completed (ZSE1 to 8: X8E0 to 7)
(2) In initialization (R574)
(3) Initialization incompletion (R575)
(4) Zero point initialization set mode (AZS1 to 8: Y960 to 7)
(5) Zero point initialization set start (ZST1 to 8: Y980 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ZERO POINT INITIALIZATION SET ERROR COMPLETED n-TH AXIS	ZSE1 to 8	X8E0 to 7	X8E8 to F	X8F0 to 7	X8F8 to F

[Function]

This signal is output when initializing is not possible during the marked point alignment method of the absolute position detection system.

[Operation]

This signal turns ON when the initializing is not possible at the rising edge of the "Zero point initialization set start" (ZSTn) signal.

This signal is invalidated in the following cases:

- During emergency stop
- During reset
- When "Zero point initialization set start" (ZSTn) signal is turned ON before the "Zero point initialization set mode" (AZSn) signal
- When grid has not been passed even once after the power has been turned ON. (Depends on the detector type)

[Related signals]

(1) Zero point initialization set completed (ZSF1 to 8: X8C0 to 7)
(2) In initialization (R574)
(3) Initialization incompletion (R575)
(4) Zero point initialization set mode (AZS1 to 8: Y960 to 7)
(5) Zero point initialization set start (ZST1 to 8: Y980 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN CURRENT LIMIT n-TH AXIS	ILI1 to 8	X900 to 7	X908 to F	X910 to 7	X918 to F

[Function][Operation]

This signal turns ON during the current limit.

[Related signals]

(1) Current limit reached n-th axis (ILA1 to 8: X920 to 7)
(2) Current limit changeover n-th axis (ILC1 to 8: Y9A0 to 7)
(3) Droop release request n-th axis (DOR1 to 8: Y9C0 to 7)
(4) Current limit mode 1,2 (ILM1,2: YCC0,1)
(5) Current limit changeover (R2593)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CURRENT LIMIT REACHED n-TH AXIS	ILA1 to 8	X920 to 7	X928 to F	X930 to 7	X938 to F

[Function][Operation]

This signal turns ON when the current reaches its limit during the current limit control.

[Related signals]

(1) In current limit n-th axis (ILI1 to 8:X900 to 7)
(2) Current limit changeover n-th axis (ILC1 to 8: Y9A0 to 7)
(3) Droop release request n-th axis (DOR1 to 8: Y9C0 to 7)
(4) Current limit mode 1,2 (ILM1,2: YCC0,1)
(5) Current limit changeover (R2593)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC AXIS UP-TO-SPEED n-TH AXIS	ARRFn	X940 to 7	X948 to F	X950 to 7	X958 to F

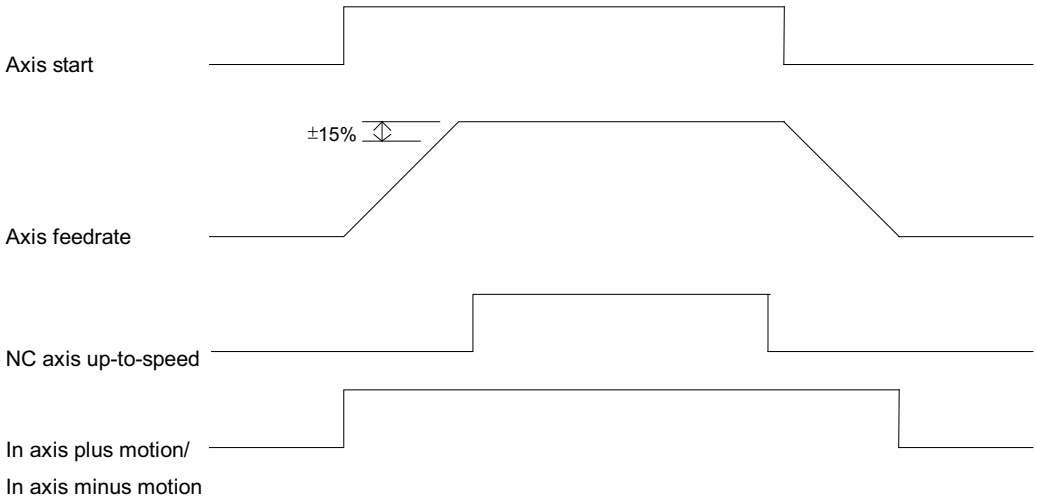
[Function]

This signal indicates that the actual axis feedrate has reached the feedrate commanded for each axis.

[Operation]

This signal turns ON when the difference of the speed commanded for each axis and the motor feedback feedrate is within a set range (approx. ±15%).

This signal turns OFF when the speed difference exceeds the set range.



[Related signals]

(1) In axis plus motion n-th axis (MVP1 to 8: X7C0 to 7)

(2) In axis minus motion n-th axis (MVM1 to 8: X7E0 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	UNCLAMP COMMAND n-TH AXIS	UCLPn	X960 to 7	X968 to F	X970 to 7	X978 to F

[Function]

This signal is output when movement of the axis selected as the index table indexing axis is commanded.

[Operation]

When this signal turns ON, the index table indexing axis clamp is released by the ladder, and the "unclamp completion" (UCLPFn) signal is set.

This signal turns OFF when movement of the index table indexing axis is completed.

The signal turns ON when:

- Movement of the indexing axis is commanded during automatic operation.

This signal turns OFF when:

- Movement of the indexing axis is completed during automatic operation.
- The axis movement is forcibly ended with reset or emergency stop, etc.

(Note 1) The index command will not turn OFF if the axis movement is interrupted with an interlock or automatic operation pause, etc.

(Note 2) This signal is turned ON and OFF when the index table indexing axis acceleration/deceleration has completed. Thus, if the in-position has to be confirmed during the clamp/unclamp operation, confirm with the PLC.

[Related signals]

(1) Unclamp completion (UCLPFn:YA20 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MIXED CONTROL (CROSS AXIS CONTROL) n-TH AXIS		X980 to 7	X988 to F	X990 to 7	X998 to F

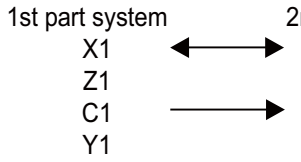
[Function]

This signal is a status signal that indicates a state commanded by the "mixed control(cross axis control) request" signal.

[Operation]

The axis in the in mixed control(cross axis control) is "1".

(Example)



(1) Mixed control (cross axis control) between X1 and X2:
X980 and X988 are "1".
(2) When C1 is controlled in 2nd part system:
X982 and X98A are "1".

[Related signals]

(1) Mixed control (cross axis control) request n-th axis (YA60 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN SYNCHRONOUS/ SUPERIMPOSITION CONTROL n-TH AXIS		X9A0 to 7	X9A8 to F	X9B0 to 7	X9B8 to F

[Function]

This signal informs the axis in the control axis synchronization across part systems/superimposition control.

0: Axis not in control axis synchronization across part systems/superimposition control

1: Axis in control axis synchronization across part systems/superimposition control

[Operation]

The synchronous axis/superimposing axis and synchronization basic axis/superimposition basic axis are indicated.

[Note]

(1) Since the control axis synchronization function across part systems and the control axis superimposition control function cannot be used simultaneously, when this signal is set to "1", it indicates that the axis is either in synchronization control or superimposition control at all times.

[Related signals]

(1) Synchronous control request n-th axis (YA80 to F)
(2) Superimposition control request n-th axis (YAA0 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MIRROR IMAGE n-TH AXIS	MIRn	X9C0 to 7	X9C8 to F	X9D0 to 7	X9D8 to F

[Function]

This signal indicates that a control axis is in mirror image.

There is a signal for each control axis. The last digit in the signal name indicates the control axis No.

[Operation]

The signal turns ON during:

(1) Programmable mirror image
(2) Parameter setting mirror image
(3) External input mirror image
(4) Facing turret mirror image

The signal turns OFF when:

(1) The mirror image above is canceled.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION ESTABLISHMENT n-TH AXIS		X9E0 to 7	X9E8 to F	X9F0 to 7	X9F8 to F

[Function]

This signal indicates that a reference position is established.

There is a signal for each control axis. The last digit in the signal name indicates the control axis No.

[Operation]

The signal turns ON when:

(1) Manual reference position return is completed and a reference position is established.

(2) A reference position is confirmed by the absolute position detector when the power is turned ON.

The signal turns OFF when:

(1) The reference position is lost

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION RETURN DIRECTION n-TH AXIS		XA00 to 7	XA08 to F	XA10 to 7	XA18 to F

[Function]

This signal indicates that whether the reference position selected by "Reference position selection code 1,2" or "Each axis reference position selection" is in the plus direction or minus direction with respect to the current position.

[Operation]

The signal turns ON when:

(1) The reference position selected by "Reference position selection code 1,2" (ZSL1, ZSL2: YC90, YC91) or "Each axis reference position selection" (R2584) is in the minus direction while reference position is established.

The signal turns OFF when:

(1) The reference position is in the plus direction.

(2) The current position is on the reference position

(3) The reference position is lost

(Note 1) If the rotation axis type is other than all coordinate linear type, this signal turns ON when $0° < \theta \leqq 180°$, and turns OFF when $180° < \theta \leqq 360°(0°)$.

(Note 2) "Reference position return direction" signal is not output for the reference position commanded by the machining program in an automatic operation.

(Note 3) "Reference position selection code 1,2" and "Each axis reference position selection" hold the state of the reference position return start in the reference position return mode.

(Note 4) When the zero point is changed during reference position return while "Reference position selection code 1,2" is valid, the "Reference position return direction" is output to the zero point prior to the change.

(Note 5) When the zero point is changed during reference position return while "Each axis reference position selection" is valid, the "Reference position return direction" is output to the zero point after the change.

[Related signals]

(1) Reference position establishment (X9E0 to X9E7)

(2) Reference position selection method (M:YC97)

(3) Reference position selection code 1,2 (ZSL1, 2: YC90, YC91)

(4) Each axis reference position selection (R2584)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	IN NC AXIS CONTROL n-TH AXIS	-	XA20 to 7	XA28 to F	XA30 to 7	XA38 to F

[Function]

This signal indicates the control status (NC control or PLC control) of the NC axis which can be operated under PLC control.

[Operation]

This signal turns ON when the NC axis is under NC control.

This signal turns OFF when the NC axis is under the PLC control.

The following shows the correspondence of axis Nos. and device Nos.

Device No.	Signal name	Device No.	Signal name
XA20	In NC axis control 1st axis	XA24	In NC axis control 5th axis
XA21	In NC axis control 2nd axis	XA25	In NC axis control 6th axis
XA22	In NC axis control 3rd axis	XA26	In NC axis control 7th axis
XA23	In NC axis control 4th axis	XA27	In NC axis control 8th axis

[Caution]

(1) "The NC axis which can be operated under PLC control" has the axis No. for PLC axis indexing, designated by "#12800 chgauxno".

(2) If the axis is moving, turning ON/OFF the "NC axis control selection n-th axis" leads an operation error. The signal is changed to ON/OFF after the axis has decelerated and stopped.

[Related signals]

(1) NC axis control selection n-th axis (YAC0 to YAC7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	EXT. MACHINE COORDINATE SYSTEM OFFSET DATA ILLE-GAL n-TH AXIS	ECIL1 to 8	XA40 to 7	XA48 to F	XA50 to 7	XA58 to F

[Function]

This signal indicates that the external machine coordinate system offset data is illegal, as the changed amount by the data will exceed the rapid traverse feedrate.

[Operation]

This signal turns ON when the external machine coordinate system offset data is illegal.

Then the change of the external machine coordinate system offset data is ignored. The compensation is executed with the set value unchanged.

[Related signals]

(1) Ext. machine coordinate system offset data n-th axis (R5700 to R5715)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	VERTICAL AXIS PULL-UP PREVENTED n-TH AXIS		XA60 to 7	XA68 to F	XA70 to 7	XA78 to F

[Function]

This signal indicates that the vertical axis pull-up function has been prevented.

[Operation]

This signal is ON while the vertical axis pull-up function is prevented.

[Related signals]

(1) Vertical axis pull-up prevention request (YAE0 to YAE7)

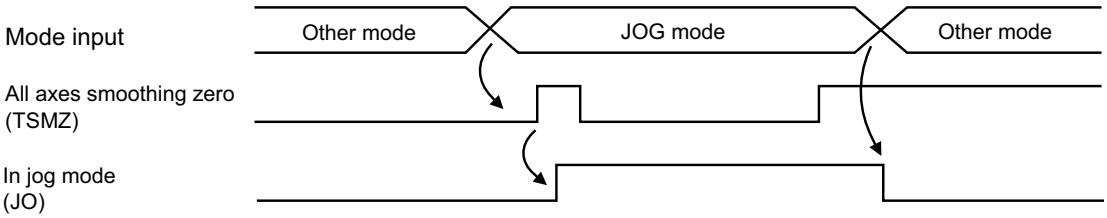
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN JOG MODE	JO	XC00	XD40	XE80	XFC0

[Function]

This signal indicates that JOG mode is selected.

[Operation]

Mode is changed to JOG mode from other mode after "All axes smoothing zero" (TSMZ) (command acceleration/ deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

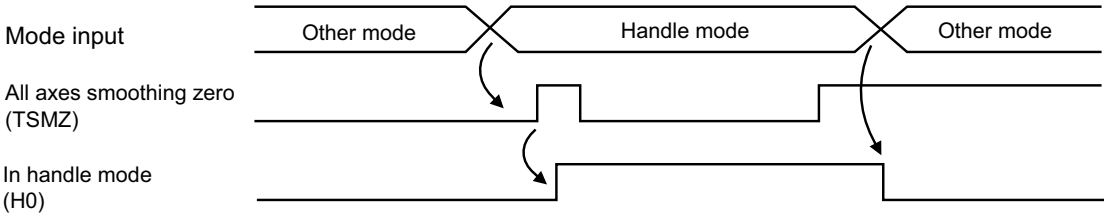
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN HANDLE MODE	HO	XC01	XD41	XE81	XFC1

[Function]

This signal indicates that HANDLE mode is selected.

[Operation]

Mode is changed to HANDLE mode from other mode after "All axes smoothing zero" (TSMZn) (command acceleration/ deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

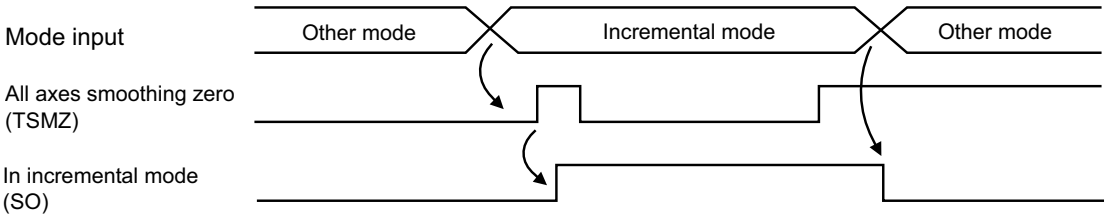
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN INCREMENTAL MODE	SO	XC02	XD42	XE82	XFC2

[Function]

This signal indicates that INCREMENTAL mode is selected.

[Operation]

Mode is changed to INCREMENTAL mode from other mode after "All axes smoothing zero" (command acceleration/ deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

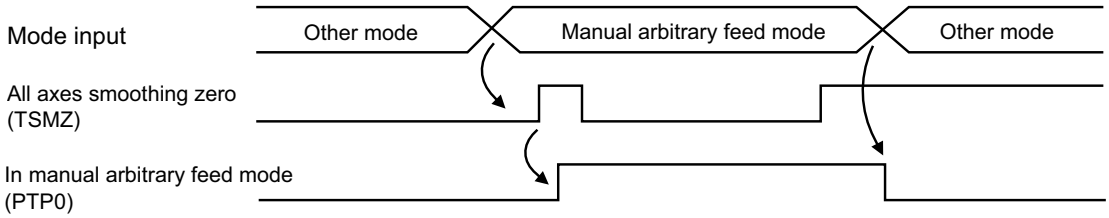
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MANUAL ARBITRARY FEED MODE	PTPO	XC03	XD43	XE83	XFC3

[Function]

This signal indicates that MANUAL ARBITRARY FEED mode is selected.

[Operation]

Mode is changed to MANUAL ARBITRARY FEED mode from other mode after "All axes smoothing zero" (command acceleration/deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

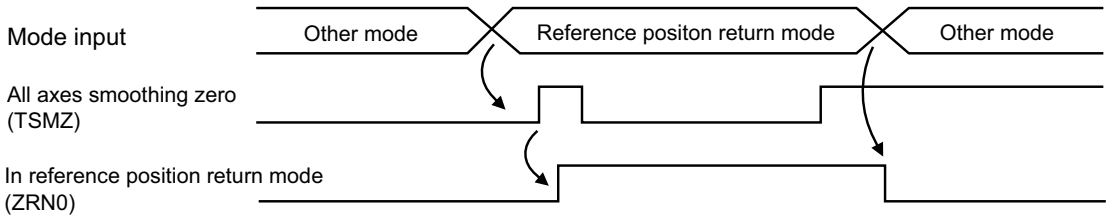
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN REFERENCE POSITION RETURN MODE	ZRNO	XC04	XD44	XE84	XFC4

[Function]

This signal indicates that REFERENCE POSITION RETURN mode is selected.

[Operation]

Mode is changed from other mode to REFERENCE POSITION RETURN mode after "All axes smoothing zero" (command acceleration/deceleration delay is zero) has been verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

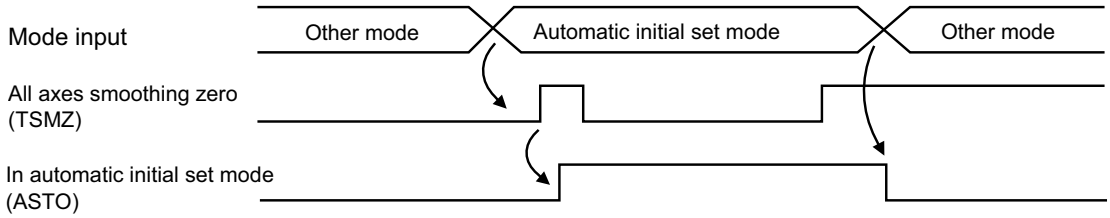
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AUTOMATIC INITIAL SET MODE	ASTO	XC05	XD45	XE85	XFC5

[Function]

This signal indicates that AUTOMATIC INITIAL SET MODE is selected.

[Operation]

Mode is changed over from other mode to IN AUTOMATIC INITIAL SET MODE mode after "All axes smoothing zero" (command acceleration/deceleration delay is zero) has been verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN JOG-HANDLE SIMULTANEOUS MODE	JHANO	XC06	XD46	XE86	XFC6

[Function]

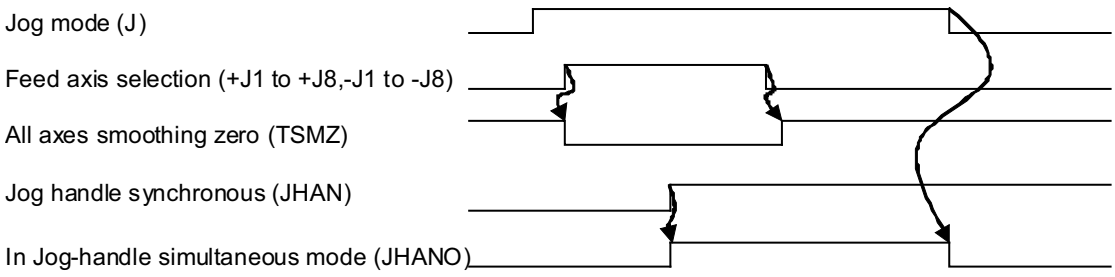
This signal indicates that the simultaneous operation of JOG and handle mode has been entered.

[Operation]

(1) This signal turns ON regardless of "All axes smoothing zero" (TSMZ) signal which informs there is no delay caused by the acceleration/deceleration time constants.

(2) This signal will not turn ON when the "Jog Mode" (J) signal is OFF, even if the "Jog-handle synchronous" (JHAN) signal is ON.

[Timing chart]



[Related signals]

(1) Jog mode (J: YC00)

(2) Jog handle synchronous (JHAN: YC7B)

(3) All axes smoothing zero (TSMZ: XC1A)

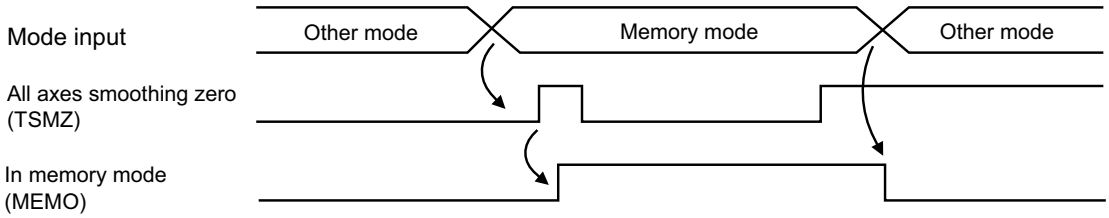
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MEMORY MODE	MEMO	XC08	XD48	XE88	XFC8

[Function]

This signal indicates that MEMORY mode is selected.

[Operation]

Mode is changed from other mode to MEMORY mode after "All axes smoothing zero" (command acceleration/ deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

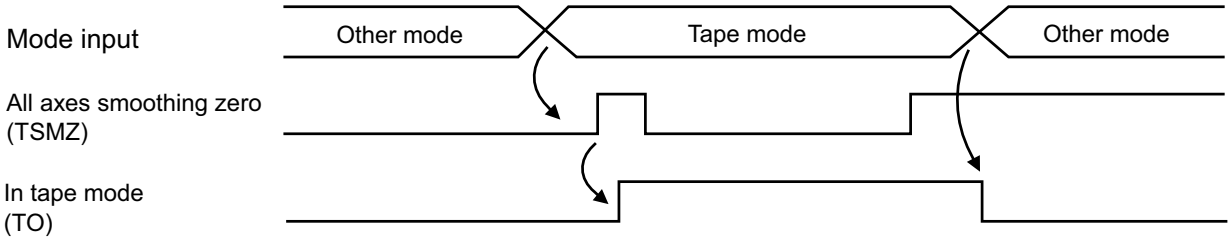
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN TAPE MODE	TO	XC09	XD49	XE89	XFC9

[Function]

This signal indicates TAPE mode is selected.

[Operation]

Mode is changed from other mode to TAPE mode when "All axes smoothing zero" (TSMZ)(command acceleration/ deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

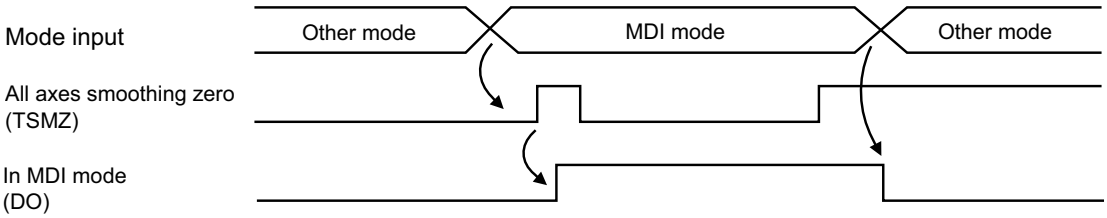
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MDI MODE	DO	XC0B	XD4B	XE8B	XFCB

[Function]

This signal indicates that MDI mode is selected.

[Operation]

Mode is changed from other mode to MDI mode when "All axes smoothing zero" (command acceleration/deceleration delay is zero) is verified.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CONTROLLER READY COMPLETION	MA	XC10	XD50	XE90	XFD0

[Function]

This signal indicates that the controller is ready for normal operation.

[Operation]

The signal turns ON when:

(1) The controller starts working successfully after it is turned ON or when no off-condition exists.

The signal turns OFF when:

(1) The controller is turned OFF.

(2) Trouble occurs with the controller (such as failure in the CPU, memory, etc.).

(3) "Servo alarm" which cannot be reset without turning OFF the power supply of the controller occurs.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SERVO READY COMPLETION	SA	XC11	XD51	XE91	XFD1

[Function]

This signal indicates that the servo system is ready for normal operation.

In other words, the servo system (position control) is not working when the signal is OFF.

[Operation]

The signal turns ON when:

(1) The diagnosis on the servo system is completed successfully after the control unit is turned ON.

(2) "Servo alarm", if occurs, is reset. (Resetting may not be possible depending on the servo alarm contents.)

(3) "Emergency stop" input is removed.

(4) The power is turned OFF and ON again by entering the decryption code upon expiration set in the credit system.

The signal turns OFF when:

(1) "Servo alarm" occurs.

(2) "Emergency stop" is input.

(3) The power supply of controller is turned OFF.

(4) Trouble occurs with the controller (such as failure in the CPU or memory).

(5) The decryption code has not been entered to the controller by the specified expiration date in the credit system.

(Note 1) This signal (SA) cannot be turned OFF only with the "Servo OFF" (*SVFn) signal.

[Related signals]

(1) Servo ready completion output designation (R2625)

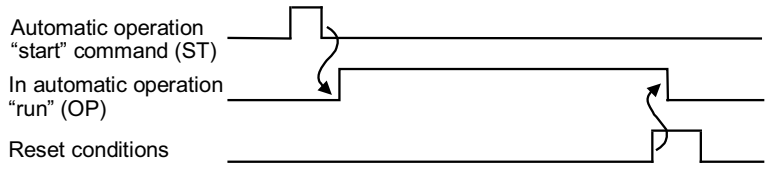
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AUTOMATIC OPERATION "RUN"	OP	XC12	XD52	XE92	XFD2

[Function]

This signal indicates that the controller is in automatic operation caused by "Auto operation "start" command" signal.

[Operation]

This signal stays ON from when automatic operation starts with the "Automatic operation "start" command (ST)" signal in the memory, MDI or tape mode, until the operation is reset.



(1) Reset conditions include the followings:
- "Reset & rewind (RRW)" is input.
- "Emergency stop" signal or "Servo alarm" signal is input.

(2) Signals that indicates status of automatic operation are "In automatic operation "start"(STL)" and "In automatic operation pause (SPL)" besides "In automatic operation "run"(OP)".
The ON/OFF state of these signals in each state are shown below.

	n automatic operation "RUN" (OP)	In automatic operation "START" (STL)	In automatic operation "PAUSE" (SPL)
Reset condition	0	0	0
Automatic operation stop condition	1	0	0
Automatic operation pause condition	1	0	1
Automatic operation start condition	1	1	0

The outline of each condition is as follows:
- Reset condition
  Automatic operation is stopped by one of reset conditions described above.
  (All states not in automatic operation are this state.)
- Automatic operation stop condition
  Automatic operation is stopped after completion of one block.
  (This state is entered during single block stop.)
- Automatic operation pause condition
  Automatic operation suspended in the course of execution of one block.
  (This state is entered when the "Automatic operation "pause" command" signal (*SP) is OFF.)
- Automatic operation start condition
  Automatic operation is being executed.

[Related signals]

(1) In automatic operation "start" (STL: XC13)
(2) In automatic operation "pause" (SPL: XC14)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AUTOMATIC OPERATION "START"	STL	XC13	XD53	XE93	XFD3

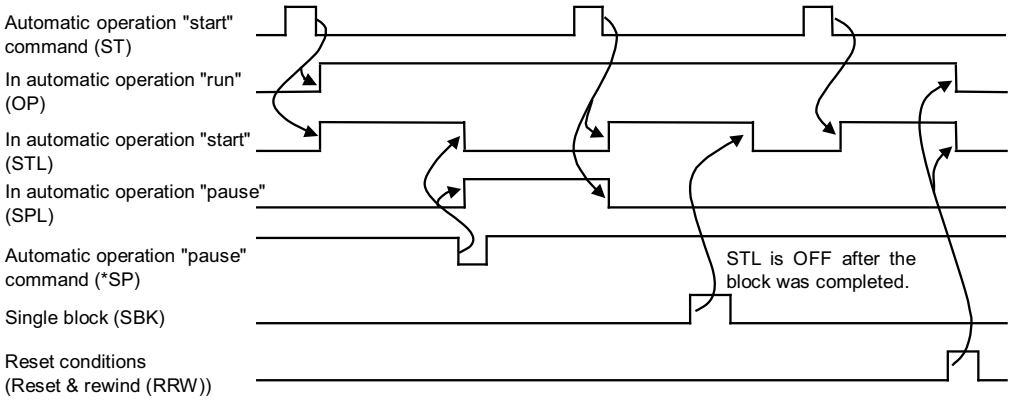
[Function]

This signal informs the PLC that the controller is started by automatic operation and motion command or M,S, T, B processing is in execution.

[Operation]

The signal turns ON by the "Automatic operation "start" command" signal (ST) in memory, MDI or tape mode, and OFF when automatic operation pause, block stop or reset condition occurs.

The "In automatic operation "start"" signal (STL) timing chart, including automatic operation "pause" and block stop, is shown below.



(Note 1) For reset conditions, refer to the section on "In automatic operation "run"" (OP).

[Related signals]

(1) In automatic operation "run" (OP: XC12)
(2) In automatic operation "pause" (SPL: XC14)
(3) Automatic operation "start" command (ST: YC10)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AUTOMATIC OPERATION "PAUSE"	SPL	XC14	XD54	XE94	XFD4

[Function]

This signal informs that the controller operation has been stopped due to the "Auto operation "pause" command" signal, etc., during motion command or miscellaneous function command.

[Operation]

The "In automatic operation "pause"" signal (SPL) turns ON with the following factors during automatic operation using the memory, MDI or tape mode.

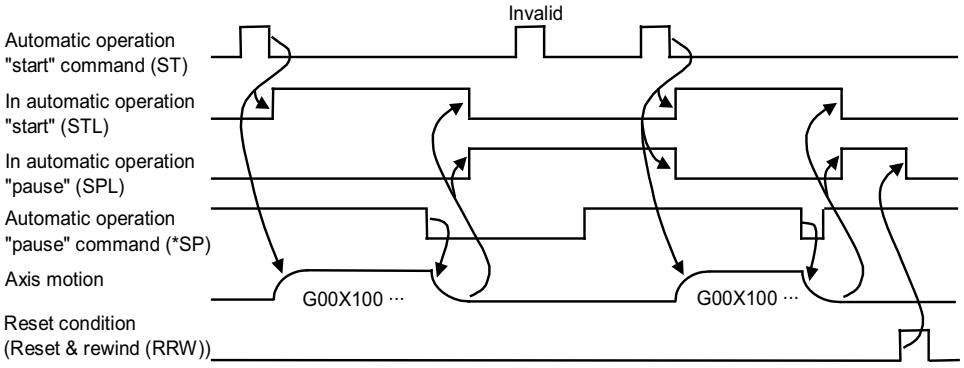
(1) When "Automatic operation "pause" command" signal (*SP) turns OFF.
(2) When mode changes to manual operation mode (jog, handle, incremental, reference position return mode, etc.).

This signal turns ON even during machine lock or a miscellaneous function (M, S, T, B) command.

This signal turns OFF in the following cases.

(1) When "Automatic operation "start" command" signal (ST) turns OFF from ON. However, this will be invalid if the "Automatic operation "pause" command" signal (*SP) is not turned back ON or if the mode is not automatic operation (memory, MDI, tape).
(2) When reset conditions are input.

The timing chart for the "In automatic operation "pause"" signal (SPL) is shown below.



(Note 1) Refer to the section on "In automatic operation "run"" (OP) for the rest conditions.

[Related signals]

(1) In automatic operation (OP: XC12)
(2) In automatic operation "start" (STL: XC13)
(3) Automatic operation "start" command (ST: YC10)
(4) Automatic operation "pause" command (*SP: YC11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN "RESET"	RST	XC15	XD55	XE95	XFD5

[Function]

This signal informs that the controller is in reset condition.

[Operation]

The signal turns ON:

(1) For about 4 to 5 seconds after the power is turned ON.
(2) While "Reset and rewind" (RRWn) signal is ON, and for about 0.5 to 1 seconds after "Reset and rewind" (RRWn) signal turns OFF.
(3) While "Emergency stop" signal is being input, and for 1 to 1.5 seconds after "Emergency stop" signal turns OFF.
(4) During "Servo alarm", and for 1 to 1.5 seconds after "Servo alarm" is removed.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MANUAL ARBITRARY FEED	CXN	XC16	XD56	XE96	XFD6

[Function]

This signal is output during execution of manual arbitrary feed command.

[Operation]

The signal turns ON:

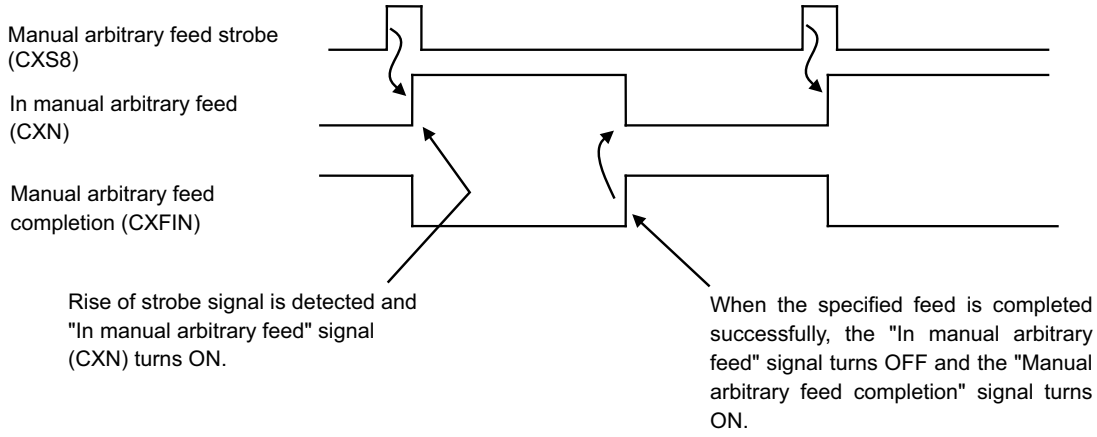
(1) "Manual arbitrary feed strobe" signal (CXS8n) turns ON during MANUAL ARBITRARY FEED mode.

The signal turns OFF:

(1) Commanded feed has been completed.

(2) When "Reset & Rewind" signal is input during execution of manual arbitrary feed command.

[Timing chart]



[Related signals]

(1) Manual arbitrary feed strobe (CXS8: YCBF)

(2) In manual arbitrary feed (CXFIN: XC1C)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN REWIND	RWD	XC17	XD57	XE97	XFD7

[Function]

This signal informs that the controller is indexing the memory mode.

[Operation]

The signal turns ON when "Reset & rewind" (RRWn) signal is turned ON by the PLC in memory mode (with M02 or M30 command), and turns OFF when the controller completes indexing the program in execution.

(Note 1) Since indexing of program in memory mode ends immediately, it may not be verified by user PLC.

[Related signals]

(1) Reset & rewind (RRW: YC1A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MOTION COMMAND COMPLETION	DEN	XC18	XD58	XE98	XFD8

[Function]

This signal notifies that the commanded motion has been completed by the controller.

In the machining program when the motion command and miscellaneous function (M, S, T, B) command are specified in the same block, this signal can be used as a synchronization signal to determine whether miscellaneous function command is executed simultaneously with or after the motion command.

[Operation]

The signal turns ON when:

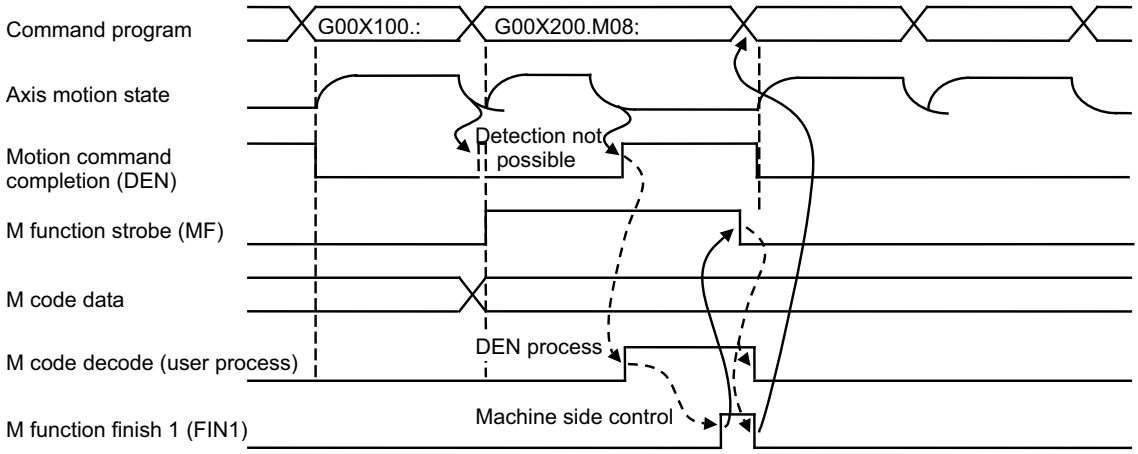
(1) The system is initialized after the power is turned ON.

(2) Execution of motion command is completed in automatic operation.

(3) Reset condition occurs.

(For reset conditions, refer to the section on "In automatic operation "run"" (OPn) signal.)

The timing chart for the "Motion command completion" (DENn) signal is shown below.



(Note 1) The "Motion command completion" signal is output even during machine lock.

(Note 2) Unless commanded motion is completed, this signal does not turn ON even when motion is suspended by interlock function or "Auto operation "pause" command" signal.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ALL AXES IN-POSITION	TIMP	XC19	XD59	XE99	XFD9

[Function]

This signal informs the PLC that the all axis components of the controller are in commanded positions.

[Operation]

The signal turns ON when:

(1) when there is no acceleration/deceleration delay in all control axes and servo errors (remaining pulses) in positioning are within the specified range.

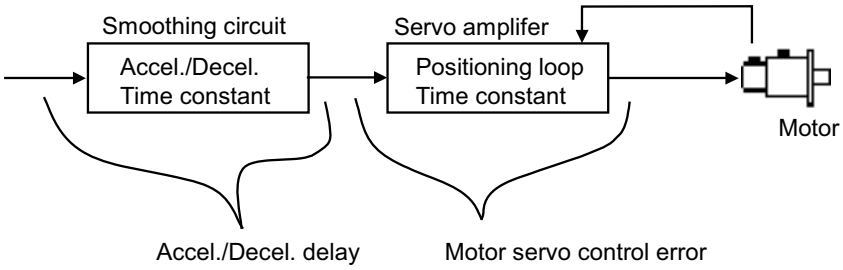
The signal turns OFF when:

(1) Acceleration/deceleration motion is delayed in a control axis.

(2) Servo positioning error (remaining pulses) for a control axis exceeds the specified range.

(Note 1) The signal may turn ON even during motion if the motion is an extremely low speed.

(Note 2) The condition where the servo errors must be in a specific range to turn ON the signal can be invalidated with parameters. In this case, the signal will turn ON/OFF depending on whether there is any delay in the acceleration/deceleration.



[Related signals]

(1) All axes smoothing zero (TSMZ: XC1A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ALL AXES SMOOTHING ZERO	TSMZ	XC1A	XD5A	XE9A	XFDA

[Function]

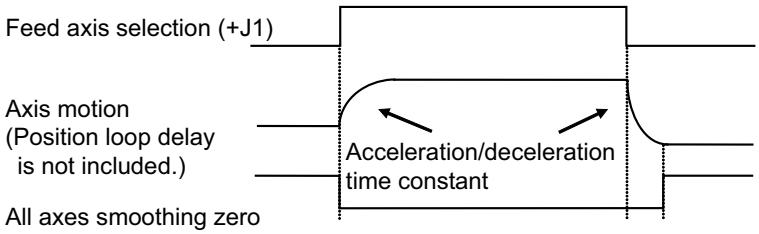
This signal informs the PLC that there is no delay (caused by the acceleration/deceleration time constants) in any of the controller control axis command system.

The PLC axis is not included in the control axis.

[Operation]

The signal turns ON when the movement amount commanded in automatic or manual operation, including delay amount of acceleration/deceleration time constant, is successfully output.

The signal turns OFF during execution of movement command, or if delay exists in acceleration/deceleration time constant.



(Note 1) The signal can turn ON even during machine lock.

(Note 2) The signal may turn ON during motion if the motion is an extremely low speed.

(Note 3) "In axis plus/minus motion" signals are OFF while "All axes smoothing zero" is ON.

[Related signals]

(1) All axes in-position (TIMP: XC19)

(2) In axis plus motion n-th axis (MVP1 to MVP8: X7C0 to 7)

(3) In axis minus motion n-th axis (MVM1 to MVM8: X7E0 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED COMPLETION	CXFIN	XC1C	XD5C	XE9C	XFDC

[Function]

This signal is output when motion commanded in manual arbitrary feed mode is completed.

[Operation]

The signal turns ON when:

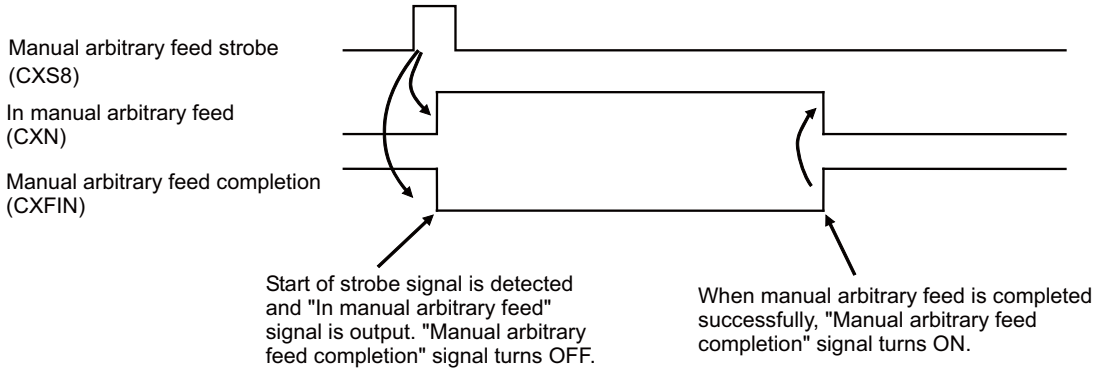
(1) The motion commanded in manual arbitrary feed mode is completed.

The signal turns OFF when:

(1) During motion in manual arbitrary feed mode.
(The signal stays OFF when motion is interrupted by a reset & rewind signal.)

(2) The power is turned ON.

[Timing chart]



[Related signals]

(1) Manual arbitrary feed strobe (CXS8: YCBF)

(2) In manual arbitrary feed (CXN: XC16)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN RAPID TRAVERSE	RPN	XC20	XD60	XEA0	XFE0

[Function]

This signal is output during rapid traverse motion in automatic operation (memory, MDI, tape).

[Operation]

(1) The signal is ON when:
- Rapid traverse motion in automatic operation.
  Fixed cycle positioning and reference position return (G28), etc., are included in the automatic operation rapid traverse besides the motion command by the G00 command.

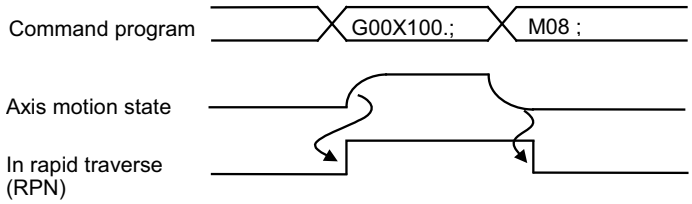
(2) The signal turns OFF when:
- The block in rapid traverse motion is completed during automatic operation.
- Rapid traverse motion is stopped by "Automatic operation "pause" command (Feed hold)" (*SPn) signal during automatic operation.
- Rapid traverse motion axis is stopped by interlock during automatic operation.
- The ratio of the "Cutting feedrate override code m" (*FVmn) becomes 0% during automatic rapid traverse operation.
- A stroke end (hardware or software) occurs during automatic rapid traverse operation.
- Reset condition occurs.

(Note 1) "In rapid traverse" (RPNn) signal can turn ON and OFF even during machine lock.

(Note 2) The signal is not output in manual operation.

(Note 3) For reset condition, refer to the section on "In automatic operation "run"" (OPn) signal.

The timing chart for "In rapid traverse" (RPNn) signal is shown below.



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN CUTTING FEED	CUT	XC21	XD61	XEA1	XFE1

[Function]

This signal informs that given motion command is executed for cutting feed in automatic operation (memory, MDI, tape).

[Operation]

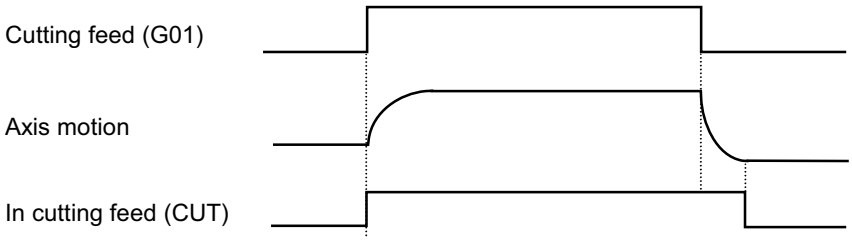
The signal turns ON when:

(1) Motion command is given for cutting feed in automatic operation.

The signal turns OFF when:

(1) The block in cutting feed in automatic operation is completed.
(2) Execution of cutting feed is suspended by "Automatic operation "pause" command" signal (*SP).
(3) Execution of cutting feed is stopped by interlock during automatic operation.
(4) The ratio of the cutting feedrate override becomes 0% during automatic cutting feed operation.
(5) A stroke end (hardware or software) occurs during automatic cutting feed operation.
(6) Reset condition occurs.

(Note 1) The signal (CUT) can be turned ON and OFF during cutting feed even if machine interlock is applied.
(Note 2) Cutting feed commands in automatic operation include G01, G02, G03 and G31.
(Note 3) The signal is not output in manual operation.
(Note 4) For reset condition, refer to the section on "In automatic operation "run"" signal (OP).



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN TAPPING	TAP	XC22	XD62	XEA2	XFE2

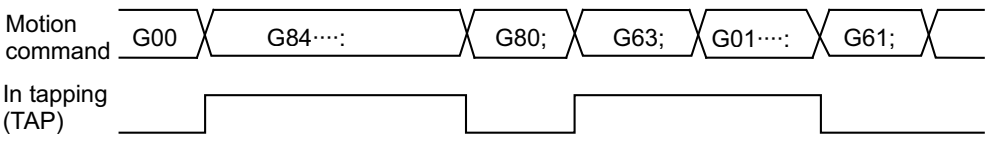
[Function]

This signal informs that commanded motion in automatic operation (memory, MDI, tape) is executed in canned tapping cycle, or tapping mode is selected for execution of commanded motion.

[Operation]

(1) The signal turns ON when:
- Commanded motion in automatic operation is being executed in canned tapping cycle.
- Commanded motion in automatic operation is being executed in tapping mode (G63).

(2) The signal turns OFF when:
- Commanded motion is not being executed in fixed tapping cycle, nor in tapping mode.
  The signal is reset by G80 or "01" group G command (G00, G01, G02, G03, G33) during canned tapping cycle, and by G61, G62 and G64 during tapping mode.



(Note 1) This signal is output even during machine lock.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN THREAD CUTTING	THRD	XC23	XD63	XEA3	XFE3

[Function]

This signal is output during execution of thread cutting command.

[Operation]

The signal turns ON when:

(1) Thread cutting command is given.

The signal turns OFF when:

(1) Motion command other than thread cutting command is given.

(2) Reset condition occurs during thread cutting.

(Note) Spindle override is invalid (100%) during thread cutting.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN SYNCHRONOUS FEED	SYN	XC24	XD64	XEA4	XFE4

[Function]

This signal is output during execution of synchronous feed command.

[Operation]

The signal turns ON when:

(1) Synchronous feed command (G94) is given.

The signal turns OFF when:

(1) Asynchronous feed command (G95) is given.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN CONSTANT SURFACE SPEED	CSS	XC25	XD65	XEA5	XFE5

[Function]

This signal informs that automatic operation is under constant circumferential (surface) speed control.

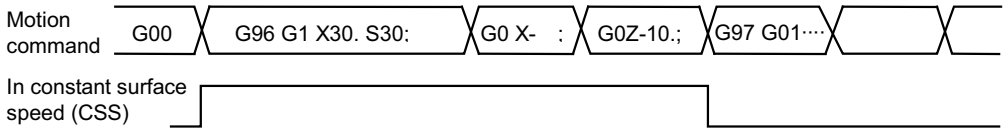
[Operation]

The signal turns ON when:

(1) Constant surface speed control mode (G96) is selected during automatic operation.

The signal turns OFF when:

(1) Constant surface speed control off command (G97) is given.



(Note 1) This signal (CSS) is output even during machine lock.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN SKIP	SKIP	XC26	XD66	XEA6	XFE6

[Function]

This signal is output while skip command (G31) is being executed.

[Operation]

The signal turns ON when:

(1) Skip command (G31) is being executed with automatic operation.

The signal turns OFF when:

(1) Block having a skip command is completed.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN REFERENCE POSITION RETURN	ZRNN	XC27	XD67	XEA7	XFE7

[Function]

This signal is output while reference position return command is being executed.

[Operation]

The signal turns ON when:

(1) G28 command is executed.
(2) G30 command is executed.
(3) Manual reference position return mode is selected.

The signal turns OFF when:

(1) All cases other than above.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN INCH UNIT SELECTION	INCH	XC28	XD68	XEA8	XFE8

[Function]

This signal informs that the controller uses inch unit for data input.

[Operation]

This signal turns ON when inch unit is selected.
During G20 (Inch unit command) modal, "In inch unit selection" signal turns ON.
change with machine parameter "#1041 I_inch".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN DISPLAY LOCK	DLNK	XC29	XD69	XEA9	XFE9

[Function]

This signal informs that the results of the movement command executed by the control unit are not reflected onto POSITION screen (display locked).

[Operation]

This signal turns ON while the display lock signal (DLK) is input.
The display lock operation is validated immediately after the display lock signal (DLK) turns ON.

[Related signals]

(1) Display lock (DLK: YC29)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	F1-DIGIT COMMANDED	F1DN	XC2A	XD6A	XEAA	XFEA

[Function]

This signal informs that the controller uses F1-digit commands (F1 to 5) to control operation.

[Operation]

The signal turns ON when:

(1) F1-digit command (F1 to 5) is selected for feedrate command currently being executed.

The signal turns OFF when:

(1) Block having a motion command specified with F1-digit code is completed.
(2) Operation is stopped by "Automatic operation "pause" command" signal (*SP) during execution of motion command by F1-digit command.
(3) Operation is stopped by "Interlock" signal during execution of motion command by F1-digit command.
(4) Reset condition occurs.
(For details of reset conditions, refer to the description about "In automatic operation "run"" signal (OP).)

(Note 1) The machine parameter, base specification parameter "#1079 F1digt" must be validated and "#1185 to 89 F1-digit feedrate" must be set to use the F1-digit command.

[Related signals]

(1) F1-digit No. code (F11 to 18: XC30 to XC33)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN TOOL LIFE MANAGEMENT	TLFO	XC2B	XD6B	XEAB	XFEB

[Function]

This signal is output during the tool life management.

[Operation]

In tool life management signal turns ON when the tool life management (#1103 T_Life) on the parameter is ON.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE OVER	TLOV	XC2E	XD6E	XEAE	XFEE

[Function]

<For M system and tool life management I for L system>

This signal notifies that a tool has reached to its lifetime (Usage data ≧ Life data).

<For tool life management II for L system>

This signal notifies that all tools in the tool group have reached to their lifetimes.

[Operation]

<For M system and tool life management I for L system>

The signal turns ON when usage data of tool is same as or has exceeded the life data. Note that this signal is only output and does not stop automatic operation or other operations of the controller.

<For tool life management II for L system>

This signal turns ON when usage data of tools in a same group is same as or has exceeded the life data. Note that this signal is only output and does not stop automatic operation or other operations of the controller.

The signal turns ON when:

(1) The last tool in the group currently selected has reached to its lifetime (Usage data ≧ life data). (Same timing as count up of usage data)
(2) "Tool skip" signal has been input in respect to the last tool in the group currently selected.
(3) All tools in the group have reached to their lifetimes at the time of group selection. (Same timing as tool function strobe 1 signal)

The signal turns OFF when:

(1) The group selection has been completed. (At T command. Note that if the next selected group is a life group, the signal remains ON.)
(2) The usage data for the group currently selected is cleared. (In case of "tool change reset signal" (TRST) is input, etc.)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL GROUP LIFE OVER		XC2F	XD6F	XEAF	XFEF

[Function]

This signal notifies that all tools in the tool group have reached to their lifetimes.

This signal is valid only for tool life management II.

[Operation]

The signal turns ON when all tools in the group mounted on the spindle have reached to their lifetimes or malfunction.

Note that this signal is only output and does not stop automatic operation or other operations of the controller.

The signal turns ON when:

(1) The last tool in the group mounted to the spindle has reached to its lifetime (Usage data ≧ life data). (Same timing as count up of usage data)

(2) Tool error signal has been input in respect to the last tool in the group mounted on the spindle.

(3) All tools in the group have reached to their lifetimes at time of mounting tools on the spindle.

The signal turns OFF when:

(1) Another group of tools is mounted on the spindle.(Note that if all tools of the group mounted have reached to their lifetimes, the signal remains ON.)

(2) The usage data for the group mounted on the spindle is cleared.

(3) The tool life management has been invalidated.

[Caution]

When this signal is used in the tool life management II, refer to the next ladder cycle after the spindle tool is changed. (This signal will not change in the same cycle in which the spindle tool was changed.)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	F1-DIGIT NO. CODE (1, 2, 4, 8)	F11 to F18	XC30 to 3	XD70 to 3	XEB0 to 3	XFF0 to 3

[Function]

F1-digit feed function No. is output.

[Operation]

When F1-digit feed command specified in memory, MDI or tape operation is executed, No. of that F1-digit feed function is set with a code.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	WAITING BETWEEN PART SYSTEMS		XC34	XD74	XEB4	XFF4

[Function]

This signal informs that the waiting between part systems is being executed.

[Operation]

1 : This signal is output while the waiting between part systems is commanded in one part system to when the corresponding waiting between system command is commanded in the other part system (during the waiting function between part systems).

0 : When the waiting between part systems is not executed, this signal is not output.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN PLC INTERRUPT	PCINO	XC35	XD75	XEB5	XFF5

[Function] [Operation]

This signal turns ON at the beginning of a PLC interruption. Turns OFF when the PLC interruption is completed by M99 or a reset.

[Related signals]

(1) PLC interrupt (PIT: YC2E)

(2) PLC interrupt program number (R2518, R2519)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ILLEGAL AXIS SELECTED	ASLE	XC37	XD77	XEB7	XFF7

[Function]

This signal is output if axis (No.) selected in handle mode or manual arbitrary feed mode is illegal.

[Operation]

The signal turns ON when:

(1) For handle mode.If specified handle axis No. is beyond the maximum number of control axes.

(2) For manual arbitrary feed mode.If specified manual arbitrary feed axis No. is beyond the maximum number of control axes.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE INDEPENDENT OUTPUT M00	DM00	XC40	XD80	XEC0	X1000

[Function]

This signal informs that a special miscellaneous function (M00) is selected and commanded. When a special M function is specified, "Normal miscellaneous function strobe" signal and "M code data" are output.

M code independent outputs include M01, M02 and M30.

[Operation]

When M00, M01, M02 or M30 is specified during auto operation (memory, MDI or tape), or by manually set numerical command, this signal turns ON. The signal turns OFF when M function finish signal, reset signal or reset & rewind signal is given.

Machining program	M code independent output	Abbr.	Answer back to controller
M00	M00	DM00	Fin 1 or Fin 2
M01	M01	DM01	Fin 1 or Fin 2
M02	M02	DM02	Reset & rewind signal ("Fin" is not sent back)
M30	M30	DM30	Reset & rewind signal ("Fin" is not sent back)

If motion command and/or dwell is present in the same block, the signal turns ON after completion of dwell.However, the signal is not output if M function finish signal turns ON before completion of motion command or dwell.

Generally, each M code is used for the following purpose:

M00 Program stop

M01 Optional stop

M02,M30Program end

Operation on user PLC side

(1) For M00

When M00 is input, single block signal (SBK) is turned ON and M function finish signal (Fin 1 or Fin 2) is sent back.

(2) For M01

When M01 is input, optional stop switch setting (ON or OFF) is checked. If the setting is "ON", single block signal is turned ON and M function finish signal is sent back, like the case with M00. If the setting is "OFF", M function finish signal is sent back immediately.

(3) For M02, M30

When motion where M02 or M30 was input (spindle stop, coolant stop, etc.) is completed, reset & rewind signal (RRW) is sent back instead of M function finish signal. If M function finish (Fin 1, Fin 2) signal is sent back, "program error" may occur.

[Related signals]

(1) M code independent output M01 (DM01: XC41)

(2) M code independent output M02 (DM02: XC42)

(3) M code independent output M30 (DM30: XC43)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE INDEPENDENT OUTPUT M01	DM01	XC41	XD81	XEC1	X1001

[Function][Operation]

Refer to "M CODE INDEPENDENT OUTPUT M00".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE INDEPENDENT OUTPUT M02	DM02	XC42	XD82	XEC2	X1002

[Function][Operation]

Refer to "M CODE INDEPENDENT OUTPUT M00".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE INDEPENDENT OUTPUT M30	DM30	XC43	XD83	XEC3	X1003

[Function][Operation]

Refer to "M CODE INDEPENDENT OUTPUT M00".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MANUAL SPEED COMMAND VALID		XC48	XD88	XEC8	X1008

[Function]

This signal indicates that the "Manual speed command valid" signal has turned ON and the manual speed command is valid in the controller.

[Operation]

This signal turns ON when the "Manual speed command valid" signal has turned ON and the manual speed command has been enabled in NC.

This signal turns OFF when the "Manual speed command valid" signal has turned OFF and the manual speed command has been disabled in NC.

[Related signals]

(1) Manual speed command valid (YC9D)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL NUMERICAL COMMAND	MMS	XC49	XD89	XEC9	X1009

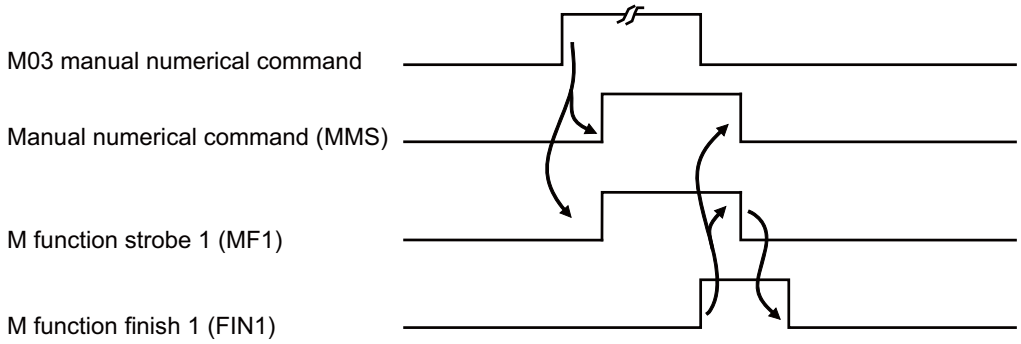
[Function]

This signal informs that M, S, T or B (2nd miscellaneous function) command is given with a specific display format selected on the setting and display unit.With the signal, user PLC discriminates the command from that given in normal automatic operation.

[Operation]

The signal turns ON when M, S, T or B signal is specified with a specific display format in manual or automatic operation (other than auto start). Like M function strobe signal, the signal turns OFF when M function finish 1 or 2 signal turns ON, or in case of reset.

(Example)



[Related signals]

(1) M function strobe (MFn: XC60)
(2) S function strobe (SFn: XC64)
(3) T function strobe 1 (TF1: XC68)
(4) 2nd M function strobe 1 (BF1: XC6C)
(5) M function finish 1 (FIN 1: YC1E)
(6) M function finish 2 (FIN 2: YC1F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN TOOL ESCAPE AND RETURN MODE		XC4A	XD8A	XECA	X100A

[Function]

This signal indicates in tool escape and return mode.

[Operation]

In order to designate a halted point, turn ON a transit point switch when operation is stopped by feed hold or single block. When recognition of the halted point is completed, this signal turns ON and the tool escape and return mode will be established.

Statuses of each signal after the machining program is halted are explained below.

The following (a) to (e) correspond to (a) to (e) in the figure below.

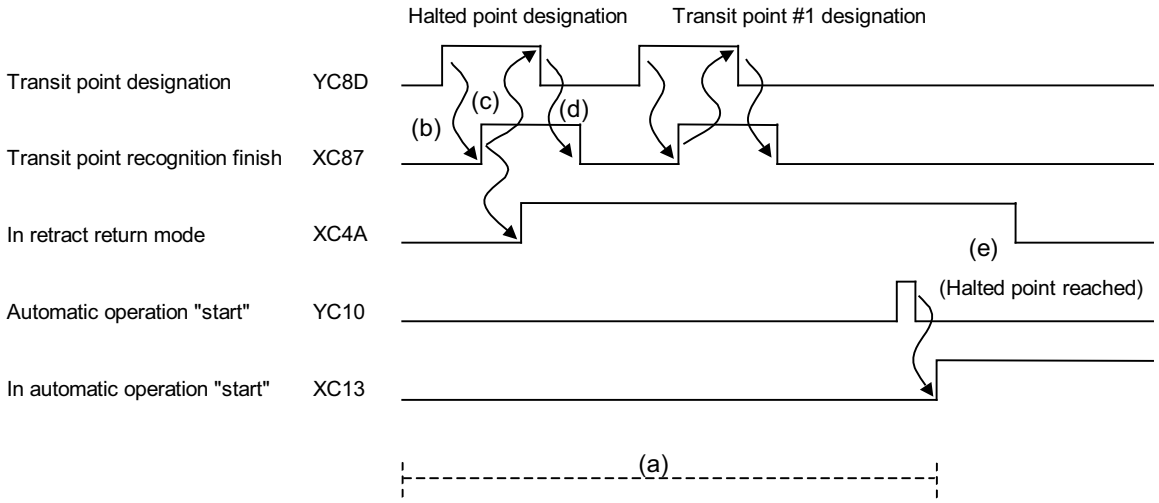
(a) The recognition of the transit point is performed in automatic operation but not in automatic operation start.

(b) When a user turns ON the "tool escape and return transit point designation" signal (YC8D), NC turns on the "tool escape and return transit point recognition finish" signal (XC87) and recognition will be completed.

(c) When the "tool escape and return transit point recognition finish" signal (XC87) turns ON, the user turns OFF the "tool escape and return transit point designation" signal (YC8D).

(d) When the "tool escape and return transit point designation" signal (YC8D) is OFF, NC also turns OFF the "tool escape and return transit point recognition finish" signal (XC87).

(e) The "in tool escape and return mode" signal turns OFF when a tool reaches the halted point, or when reset1/reset2 or reset & rewind or emergency stop is performed.



(Note) When reset1, reset2, reset & rewind or emergency stop is attempted during the escape and return mode, the memorized transit point and halted point will be canceled. The in escape and return mode will be reset and finished.

[Related signals]

(1) Tool escape and return transit point recognition finish (XC87)

(2) Tool escape and return transit point designation (YC8D)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	IN CIRCULAR FEED IN MANUAL MODE		XC4F	XD8F	XECF	X100F

[Function]

This signal indicates that the circular feed in manual mode is valid.

[Operation]

This signal turns ON when the "Circular feed in manual mode valid" signal turns ON.

[Caution]

This signal does not turn ON in the following conditions.

(1) Either X axis or Y axis is in machine lock.
(In this case, even machine lock is not performed.)
(2) Either X axis or Y axis is not completed the reference position return.
(3) Either X axis or Y axis is in servo OFF.
(4) When the NC is in one of the following states.
- Automatic operation (OP)
- Emergency stop
- Reset
(5) The current position is outside of the specified movable range.
(6) The setting value which is specified with R register is illegal.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)
(2) Circular feed in manual mode operation mode data (R2636,7)
(3) Circular feed in manual mode basic point X data (R2644,5)
(4) Circular feed in manual mode basic point Y data (R2648,9)
(5) Circular feed in manual mode gradient/arc center X data (R2668,9)
(6) Circular feed in manual mode gradient/arc center Y data (R2672,3)
(7) Circular feed in manual mode travel range X+ data (R2652,3)
(8) Circular feed in manual mode travel range X- data (R2656,7)
(9) Circular feed in manual mode travel range Y+ data (R2660,1)
(10) Circular feed in manual mode travel range Y- data (R2664,5)
(11) Circular feed in manual mode current position X (R636,7)
(12) Circular feed in manual mode current position Y (R640,1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M FUNCTION STROBE 1	MF1	XC60	XDA0	XEE0	X1020

[Function]

This signal informs that the 1st set of miscellaneous functions (M code) is commanded with the automatic operation (memory, MDI, tape) machining program or manual numerical command input.

The miscellaneous function is also called the M function, and is used to issue miscellaneous functions such as ON/OFF of the cutting oil, and normal/reverse/stop of the spindle, etc., for the target machine.

[Operation]

This signal turns ON when:

(1) The 1st set of M function (M code) is specified in automatic operation (memory, MDI or tape mode).

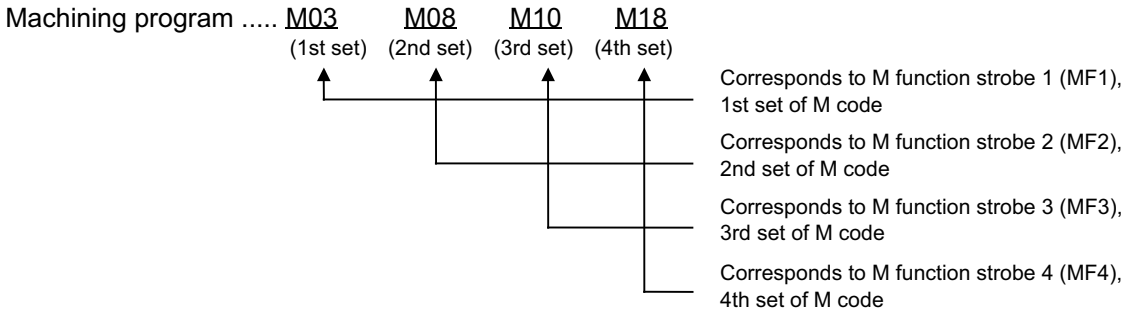
(2) M function (M code) is specified by manual numerical command input.

The signal turns OFF when:

(1) M function finish 1 signal (FIN1) or M function finish 2 signal (FIN2) turns ON.

(2) Reset condition occurs.(Refer to the "In automatic operation "run"" signal (OP) section for details on the reset conditions.)

(Note 1) When built-in PLC is used, four sets of M functions can be specified at the same time. The relation of the machining program and M function strobe is shown below.

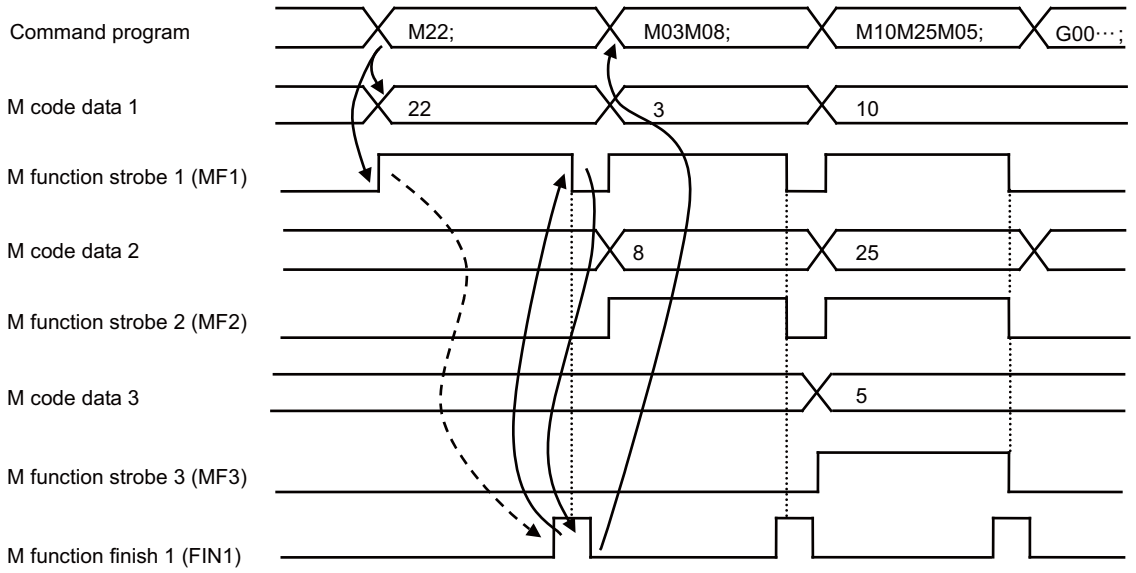


(Note 2) During operation with miscellaneous function lock (AFL signal ON), the "M function strobe" (MF1, MF2, MF3, MF4) will not be output. However, this signal will be output when the M code is commanded independently (M00, M01, M02, M30).

(Note 3) Since M98 (read of subprogram call), M99 (return from subprogram), etc. are handled within the controller, "M function strobe" is not output.

(Note 4) The "M function strobe" will not be output when the M function is output if the "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN 2) is ON.

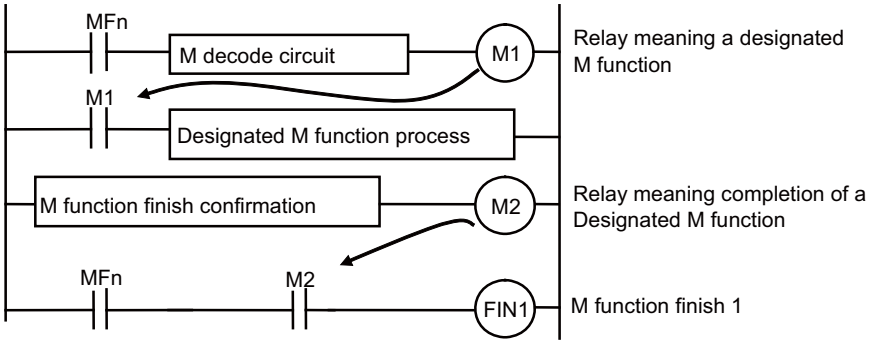
An example of the timing chart for the M function strobe signal (MF1, MF2 and MF3) is shown below.



Point: The following points must be observed in the sequence process.

(a) When the M function is commanded, the MFn and M code data n is output.
(b) MFn is always the trigger in the sequence process to start the M function process.
(c) When the designated M function process is completed, the "M function finish" signal is returned to the controller.
(d) The controller waits for the rising of the M function finish signal and then turns MFn OFF.
(e) MFn OFF is confirmed in the sequence process and then the "M function finish" signal is turned OFF. This completes the series of M function processes.

Handshaking with the controller and an accurate sequence process possible if the Mfn conditions are inserted at the M function start and completed signals.



[Related signals]

(1) M function strobe 2 (MF2: XC61)
(2) M function strobe 3 (MF3: XC62)
(3) M function strobe 4 (MF4: XC63)
(4) M function finish 1 (FIN1: YC1E)
(5) M function finish 2 (FIN2: YC1F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M FUNCTION STROBE 2	MF2	XC61	XDA1	XEE1	X1021

[Function]

This signal informs that the 2nd set of M function (M code) is specified in automatic operation.

[Operation]

The signal turns ON when:

(1) Two or more M function commands (M code) are specified for one block in automatic operation (memory, MDI or tape mode).

The signal turns OFF when:

(1) "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN2) turns ON.

(2) Reset condition occurs.

Other details are the same as those of "M function strobe 1" signal (MF1).Refer to "M function strobe 1".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M FUNCTION STROBE 3	MF3	XC62	XDA2	XEE2	X1022

[Function]

This signal informs that the 3rd set of M function (M code) is specified in automatic operation.

[Operation]

The signal turns ON when:

(1) Three or more M function commands (M code) are specified for one block in automatic operation (memory, MDI or tape mode).

The signal turns OFF when:

(1) "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN2) turns ON.

(2) Reset condition occurs.

Other details are the same as those of "M function strobe 1" signal (MF1).

Refer to "M function strobe 1".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M FUNCTION STROBE 4	MF4	XC63	XDA3	XEE3	X1023

[Function]

This signal informs that the 3rd set of M function (M code) is specified in automatic operation.

[Operation]

The signal turns ON when:

(1) Three or more M function commands (M code) are specified for one block in automatic operation (memory, MDI or tape mode).

The signal turns OFF when:

(1) "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN2) turns ON.

(2) Reset condition occurs.

Other details are the same as those of "M function strobe 1" signal (MF1).Refer to "M function strobe 1".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	S FUNCTION STROBE 1 to 4	SF1 to 4	XC64 to 7	XDA4 to 7	XEE4 to 7	X1024 to 7

[Function]

This signal informs that S (spindle) function (S code) is specified in automatic operation (memory, MDI or tape mode) machining program or by manual numerical command input.

The spindle function is also called the S function, and is used to command the spindle speed.

With the signal (SF1 to 4), user PLC receives S code data (1 to 4) respectively.

[Operation]

The signal turns ON when:

(1) S function (S code) is specified in automatic operation (memory, MDI or tape mode).

(2) S function is specified by manual numerical command input.

The signal turns OFF when:

(1) "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN2) turns ON.

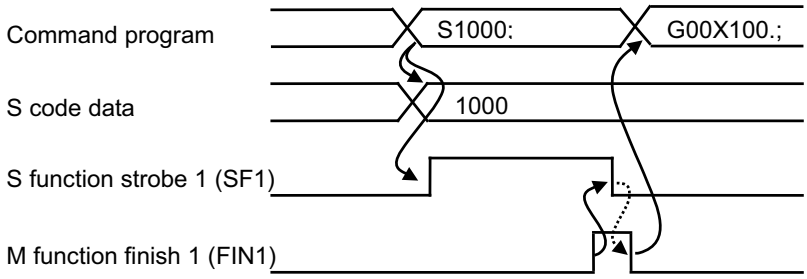
(2) Reset condition occurs.(Refer to the "In automatic operation "run"" signal (OP) section for details on the reset conditions.)

(Note 1) The S function strobe is not output during operation with M function lock (AFL signal ON).

(Note 2) When the S function is commanded, the "Spindle gear shift" signal (GR1, GR2) and "S command no gear selected" signal (SNGE) are output in addition to this signal (SFn). Refer to the sections of each signal for details.

(Note 3) By combining this signal (SFn), "Spindle gear selection code 1,2" signal (GI1, GI2) and "Gear shift completion" signal (GFIN), the data can be converted into S command data.(Data is transferred when the spindle controller is the high-speed serial connection specification type.)

An example of the timing chart for the "S function strobe" signal (SF1) is shown below.



[Related signals]

(1) S code data (R512)

(2) Spindle gear shift (GR1, GR2: X1885, 6)

(3) S command no gear selected (SNGE: X1884)

(4) Spindle gear selection code 1,2 (GI1, GI2: Y1890, Y1891)

(5) Gear shift completion (GFIN: Y1885)

(6) M function finish 1 (FIN1: YC1E)

(7) M function finish 2 (FIN2: YC1F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	T FUNCTION STROBE 1 to 4	TF1 to 4	XC68 to B	XDA8 to B	XEE8 to B	X1028 to B

[Function]

This signal informs that the tool function (T code) is specified in automatic operation (memory, MDI or tape mode) machining program or by manual numerical command input.

The tool function is also called the T function, and is used to command the tool No. In the lathe specification controller, the tool compensation (tool length compensation, tool nose wear compensation) Nos. are also indicated.

The user PLC receives the T code data 1 to 4 with this signal.

[Operation]

The signal turns ON when:

(1) The T function (T code) is specified in automatic operation (memory, MDI or tape mode).

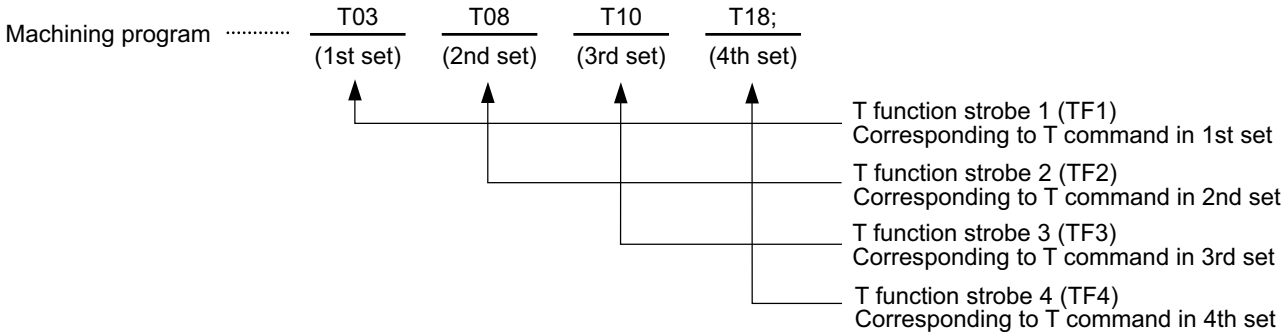
(2) T function (T) is specified by manual numerical command input.

The signal turns OFF when:

(1) "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN2) turns ON.

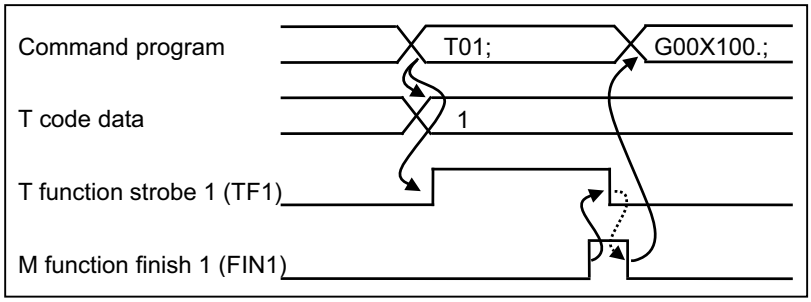
(2) Reset condition occurs.(Refer to the "In automatic operation "run"" signal (OP) section for details on the reset conditions.)

(Note 1) Up to four T commands can be issued in one block.
The relationship between machining program and T function strobe is shown below.



(Note 2) The "T function strobe 1 to 4" (TF1 to 4) is not output during operation with the M function lock (AFL signal ON).

An example of the timing chart for the "T function strobe 1" signal (TF1) is shown below.



[Related signals]

(1) T code data (R536)

(2) M function finish 1 (FIN1: YC1E)

(3) M function finish 2 (FIN2: YC1F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND M FUNCTION STROBE 1 to 4	BF1 to 4	XC6C to F	XDAC to F	XEEC to F	X102C to F

[Function]

This signal informs that the 1st set of 2nd M function is selected in automatic operation (memory, MDI or tape) machining program or by manual numerical command input.

The 2nd M function is also called the B function.

With the signal (BF1), user PLC receives 2nd M function data 1 to 4.

[Operation]

The signal turns ON when:

(1) The 2nd M function (B code) is specified in automatic operation (memory, MDI or tape).

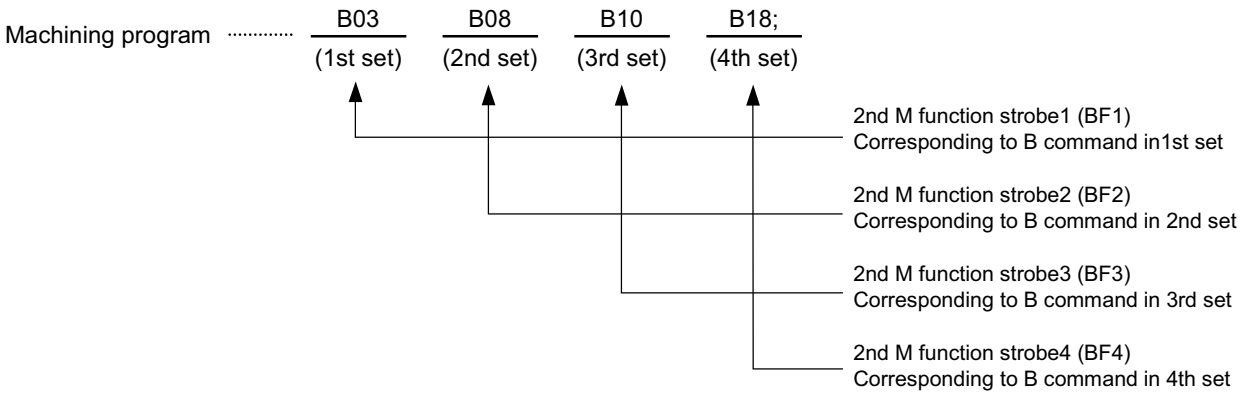
(2) 2nd M function (B code) is issued by manual numerical command input.

The signal turns OFF when:

(1) "M function finish 1" signal (FIN1) or "M function finish 2" signal (FIN2) is turned ON.

(2) Reset condition occurs.(Refer to the "In automatic operation "run"" signal (OP) section for details on the reset conditions.)

(Note 1) Four 2nd M functions can be issued in one block at a time.
The relationship between machining program and 2nd M function strobe is shown below.



(Note 2) The "2nd M function strobe 1 to 4" (BF1 to 4) is not output during operation with M function lock (AFL signal ON).

(Note 3) In the case of manual numerical command input, outputs are in accordance with "2nd M function strobe 1" (BF1).

(Note 4) Address for 2nd M function can be selected from addresses A, B and C by using machine parameter. Set so that the address is different from the axis address.

[Related signals]

(1) M function finish 1 (FIN1: YC1E)

(2) M function finish 2 (FIN2: YC1F)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING COMPENSATION UPDATED PREVENTED	CHPRCC	XC7F	XDBF	XEFF	X103F

[Function]

This signal indicates that the machine is in the state where it does not update the chopping compensation amount.

[Operation]

While this signal is turned ON:

- The chopping compensation amount is not updated.
- The stroke compensation completion signal does not OFF.

When the control data is updated, turn this signal OFF and then update the chopping compensation amount.

[Related signals]

(1) Chopping compensation update prevention request (CHPRCR:YCD7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN CHOPPING START	CHOP	XC80	XDC0	XF00	X1040

[Function][Operation]

This signal turns ON in the state of chopping start.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	BASIC POSITION→ UPPER DEAD POINT PATH FLAG	CHP1	XC81	XDC1	XF01	X1041

[Function][Operation]

This signal turns ON while moving from the basic position to the upper dead center point.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	UPPER DEAD POINT → BOTTOM DEAD POINT PATH FLAG	CHP2	XC82	XDC2	XF02	X1042

[Function][Operation]

This signal turns ON while moving from the upper dead center point to the bottom dead center point.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	BOTTOM DEAD POINT → UPPER DEAD POINT PATH FLAG	CHP3	XC83	XDC3	XF03	X1043

[Function][Operation]

This signal turns ON while moving from the bottom dead center point to the upper dead center point.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	UPPER DEAD POINT → BASIC POSITION PATHBASIC POSITION PATH	CHP4	XC84	XDC4	XF04	X1044

[Function][Operation]

This signal turns ON while moving from the upper dead center point to the basic position.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN CHOPPING MODE	CHPMD	XC85	XDC5	XF05	X1045

[Function][Operation]

This signal turns ON in the state of chopping mode.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	STROKE COMPENSATION COMPLETION		XC86	XDC6	XF06	X1046

[Function][Operation]

This signal turns ON when the difference between the commanded stroke and the actual stroke has reached the tolerance specified with the parameter (#2080 chwid) as a result of compensation of the commanded position.
When speed fluctuates, such as when movement is stopped or chopping control data is changed, this signal is turned OFF.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL ESCAPE AND RETURN TRANSIT POINT RECOGNITION COMPLETED		XC87	XDC7	XF07	X1047

[Function]

With the tool escape and return function, a transit point can be designated by pressing the transit point switch while tool escapes. The tool returns to the machining halted point, passing through the transit point designated.

This signal notifies that NC memorized the transit point.

[Operation]

Refer to the section on "In tool escape and return mode signal" (XC4A).

[Related signals]

(1) In tool escape and return mode (XC4A)

(2) Tool escape and return transit point designation (YC8D)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SEARCH & START ERROR	SSE	XC8A	XDCA	XF0A	X104A

[Function]

This signal is output when the program No. to be searched with search & start is illegally designated.

[Operation]

This signal is output when the No. of the program to be searched with search & start is illegal. Automatic operation start will not be carried out if this signal is output. This signal will turn OFF if the program No. is correctly input to execute search & start again, or when the reset signal is issued.

Refer to the "Search & start" signal (RSST) for details.

When the multi-part system program management is valid, the signal for $1 is output as common signal for all part systems.

[Related signals]

(1) Search & start (RSST: YC31)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SEARCH &START SEARCH	SSG	XC8B	XDCB	XF0B	X104B

[Function]

This signal is output when searching for a program is started with search & start.

[Operation]

Informs the PLC that the NC is searching for the program with search & start.

Hold the "search & start" signal until the "search & start (search)" signal turns ON.

If the No. of the program to be searched is illegal, the "search & start (error)" signal (SSE) will be output.

When the multi-part system program management is valid, the signal for $1 is output as common signal for all part systems.

[Related signals]

(1) Search & start program No. (R2562, 2563)

(2) Search & start Error (SSE: XC8A)

(3) Search & start (RSST: YC31)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL CHANGE POSITION RETURN COMPLETION	TCP	XC93	XDD3	XF13	X1053

[Function]

This signal notifies that the axis commanded with the tool change position return command has completed return to the tool change position.

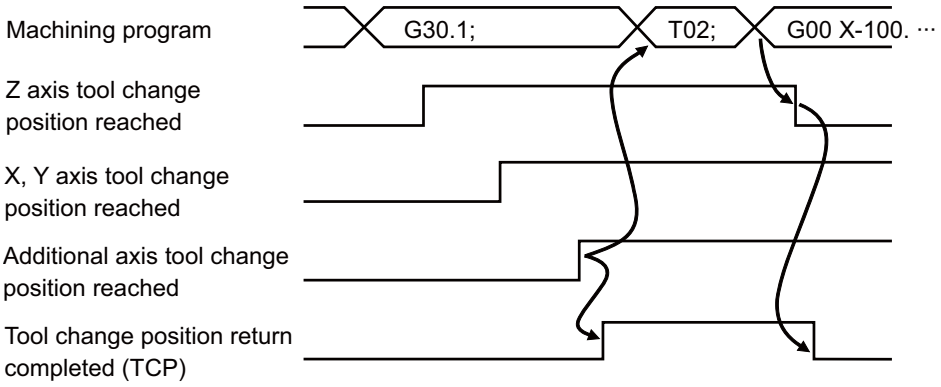
[Operation]

This signal turns ON when all axes commanded with the tool change position return command (G30.n) have moved to the tool change position. This signal turns OFF when even one of the axes moved to the tool change position with the command has moved from the tool change position.

Refer to the Programming Manual for details on the tool change return command.

[Timing chart]

Example: When G30.1 command, additional axis tool change position return is valid



Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	NEW TOOL CHANGE	TCRQ	XC94	XDD4	XF14	X1054

[Function]

This signal notifies that a new tool (unused tool) in the group is selected in the tool life management II.

[Operation]

The signal turns ON when:

(1) The tool selected by T command tool selection is unused (status 0).

The signal turns OFF when:

(1) When T command is completed due to the M function finish signal (FIN1, FIN2).

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	LIFE PREDICTION		XC96	XDD6	XF16	X1056

[Function]

This signal notifies when remaining data, which is calculated by subtracting usage data from service life data, has reached its remaining life set value.

[Operation]

The life prediction is valid when the basic specification parameter "#1277 ext13 bit1" is 1. The signal will not be output when the remaining life data is 0 or larger than the life data.

Signal output judgment condition varies depending on the following parameter setting.

#1277 ext13 bit2 Switching the timing of the life prediction signal output

0: "Life data - usage data = remaining life data"

1: "Life data - usage data ≦ remaining life data"

#1277 ext13 bit3 Tool for which the life prediction signal is output

0: The signal is output for each tool.

1: The signal is output for the last tool of a group.

The signal turns ON when:

(1) Remaining life (life data - usage data) of the tool has reached to its remaining life setting value. (Same timing as count up of usage data)

(2) Remaining life (life data - usage data of the tool has reached to its remaining life setting value at the time of tool selection. (Same timing as TF output)

The signal turns OFF when:

(1) Group selection has completed. (At T command. Note that if the next selected group has a condition of turning ON the signal, the signal remains ON.)

(2) Tool has reached to its lifetime. (Same timing as count up of usage data)

(3) The usage data for the group currently selected is cleared. (In case that "tool change reset signal" (TRST) is input, etc.)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC ALARM 1	AL1	XC98	XDD8	XF18	X1058

[Function]

This signal informs that system error occurred in the controller.

[Operation]

If "watch dog error", "memory parity check error", etc. occurs on the controller side, the signal turns ON.

The system error can be reset by turning OFF.

(Note 1) "NC alarm 1" (AL1) may not be detected as signal.

(Note 2) For details of system alarms, refer to the relevant Instruction Manual or Setup Manual.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC ALARM 2 (Servo alarm)	AL2	XC99	XDD9	XF19	X1059

[Function]

This signal informs that the controller is in servo alarm condition.

If servo alarm occurs, "Servo ready completion" signal (SA) turns OFF.

[Operation]

The signal turns ON when:

(1) Servo alarm occurs. Servo alarms include the following:
- Servo failure 1 (no signal, overcurrent, overvoltage, etc.)
- Servo failure 2 (motor overheat, excessive error, drive unit external emergency stop, etc.)
- Initial parameter error (parameter transferred to drive unit when the power is turned ON is illegal)
- Drive unit not mounted (cable is not connected between controller and servo controller).
- Parameter error (a parameter that will disrupt movement of the control axis was found).

Alarm can be reset by turning OFF the power, or using controller reset, or by setting parameter again, etc., depending on type of alarm.

For details of alarm resetting, and servo alarm, refer to the relevant Instruction Manual or Setup Manual.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC ALARM 3 (Program error)	AL3	XC9A	XDDA	XF1A	X105A

[Function]

This signal informs that the controller is in program error condition.

[Operation]

This type of alarm occurs during automatic operation in memory, MDI or tape mode, mainly due to use of faulty machining program, or program incompatible with the controller specifications.

Some typical examples of program error are shown below. For details, refer to the relevant Instruction Manual or Setup Manual.

(1) Illegal address (address not covered by the specifications is used)
(2) Absence of F command
(3) Arc end point excessive deviation
(4) Return incomplete axis found (a motion command was issued to an axis that has not completed reference position return)
(5) Program end error (M02 or M30 command is not inserted or reset & rewind process has not been performed)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC ALARM 4 (Operation error)	AL4	XC9B	XDDB	XF1B	X105B

[Function]

This signal informs that the controller is in operation error condition.

[Operation]

The signal turns ON in case of operation alarm, and OFF when the alarm condition is removed.

Some typical examples of operation errors are shown below. For details, refer to the relevant Instruction Manual or Setup Manual.

(1) Hardware axis motion stroke end
(2) Software axis motion stroke end
(3) No operation mode set
(4) Cutting feedrate override set to "zero"
(5) Manual feedrate zero
(6) External interlock axis found
(7) Warning regarding absolute position detection

(Note) When the "NC alarm 5" (XCB1) is valid, the following alarms are not output to the "NC alarm 4".

Error No.	Details
0004	External interlock
0102	Cutting override zero
0103	External feed speed zero
0109	Block start interlock
0110	Cutting block start interlock
0125	Rapid traverse override zero
1033	Spindle-Spindle polygon (G51.2) cutting interlock

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	NC WARNING (SERVO WARN-ING)	WR1	XC9C	XDDC	XF1C	X105C

[Function]

This signal notifies that the servo waring (S52) occurs in the drive unit.

[Operation]

(1) For servo drive unit

This signal turns ON when:

- There is more than one axis within the part system where the warning occurs in the servo drive unit.

This signal turns OFF when:

- There is no axis within the part system where the warning occurs in the servo drive unit.

(2) For spindle/PLC axis drive unit

When the warning occurs, the signal for the 1st part system is output.

(Note) This signal is not output if the servo warning "S52 Control axis detach warning 00E6" or "S52 In NC emergency stop state 00E7" occurs.

[Related signals]

(1) Servo alarm/warning No. (R5332 to R5339)
(2) Spindle alarm/warning No. (R6529)
(3) PLC axis alarm warning No. n-th axis (R168 to R173)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR IN EXECUTION		XCA0	XDE0	XF20	X1060

[Function]

This signal indicates that teaching or monitor is being executed.

[Operation]

This signal turns ON when the teaching/monitor execution signal is input.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor Teaching mode valid, Monitor mode valid (XCA1, XCA2)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR TEACHING MODE VALID		XCA1	XDE1	XF21	X1061

[Function]

This signal indicates that the teaching mode is selected.

[Operation]

This signal turns ON when the teaching mode signal is input.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Monitor mode valid (XCA0, XCA2)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR MONITOR MODE VALID		XCA2	XDE2	XF22	X1062

[Function]

This signal indicates that the monitor mode is selected.

[Operation]

This signal turns ON when the monitor mode signal is input.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid (XCA0, XCA1)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ADAPTIVE CONTROL IN EXECUTION		XCA3	XDE3	XF23	X1063

[Function]

This signal indicates that adaptive control is selected.

[Operation]

This signal turns ON when the adaptive control execution signal is turned ON during monitor execution.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Adaptive control execution (YCC9)
(2) Adaptive control override (R571)
(3) Adaptive control basic axis selection (R2983)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TAP RETRACT POSSIBLE	TRVE	XCA5	XDE5	XF25	X1065

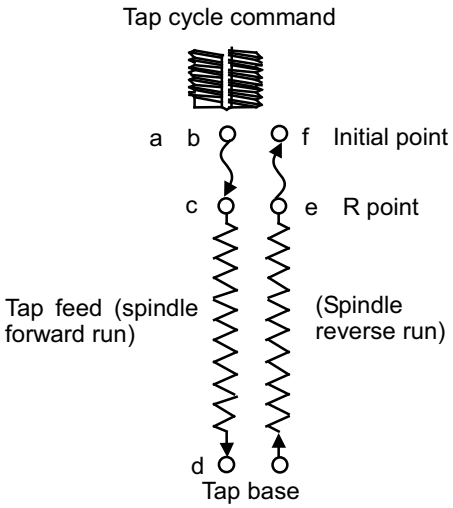
[Function]

This signal informs that tap retract is possible, and is output if operation is stopped during tap cycle execution.
The "Tap retract" signal (TRV) will be valid when this signal (TRVE) is ON.

(Note) When the parameter "#1234 set06/bit3" is set to "0", the axis movement before starting the tap retract becomes the interlock state by turning this signal ON. To cancel the interlock state, input the "Tap retract possible state cancel" signal (TRVEC) and then turn this signal OFF.

[Operation]

(1) This signal turns ON when tap cycle is stopped in the cutting feed area (between c-d-e in the drawing) due to the following causes:
- Emergency stop.
- Reset stop.
- Power OFF (only in absolute position detection system).



(2) This signal turns OFF in the following cases:
- Tap retract is executed and completed.
- The target axis for the tap retract is moved automatically or with manual mode.
  However, it is moved only when the following conditions are met:
  - The parameter "#1234 set06/bit3" is set to "1".
  - The "Tap retract" (TRV) is OFF.
  - The target axis for the tap retract is stopped.
- After confirming the rising edge of the "Tap retract possible state cancel" (TRVEC).

[Caution]

If the parameter "#1234 set06/bit3" is set to "0", the axis movement which has been operated with the automatic operation/manual operation before starting the tap retract becomes interlocked when turning this signal ON. To cancel the interlocked state, turn the "Tap retract possible state cancel" (TRVEC) ON and then turn this signal OFF.

[Related signals]

(1) Tap retract (TRV: YC5C)
(2) Tap retract possible state cancel (TRVEC:YCD6)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NO. OF WORK MACHINING OVER	PCNT	XCA6	XDE6	XF26	X1066

[Function]

This signal is output when the No. of work machining matches or exceeds the maximum No. of work machining.

[Operation]

This signal turns ON when the No. of work machining matches or exceeds the maximum work value (WRK LIMIT) set in the [Process parameter] screen.

(Note 1) This signal turns ON when the No. of work machining matches or exceeds the maximum work value regardless of the count up by the controller or user PLC.

(Note 2) This signal is not output when "0" is set for the maximum work value.

[Related signals]

(1) No. of work machining (current value) (R606, 7)

(2) No. of work machining (maximum value) (R608, 9)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ABSOLUTE POSITION WARNING	ABSW	XCA7	XDE7	XF27	X1067

[Function]

This signal notifies that the amount moved while the power is OFF has exceeded to the tolerable amount when using the absolute position detection system.

[Operation]

This signal turns ON when the difference of the machine position at power OFF and at power ON exceeds the tolerable value ([ABS. POSI PARAM] "#2051 check" setting value) when using the absolute position detection system.

(Note) The movement amount during power OFF depends on the "PON POS (power ON position)" and "POF POS (power OFF position)" on the [ABS SERVO MONITOR (absolute position monitor)] screen.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN AXIS NAME SWITCH		XCA9	XDE9	XF29	X1069

[Function]

This signal informs that the axis name is being switched.

[Operation]

This signal turns ON by the axis name switch command (G111).

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN SPINDLE-NC AXIS POLYGON MODE		XCB0	XDF0	XF30	X1070

[Function]

This signal informs the PLC that polygon machining (spindle-NC axis) mode is entered.

(Note) Refer to the "In spindle-spindle polygon mode" signal for details on the spindle-spindle polygon.

#1501 polyax $\neq$ 0: Polygon machining (spindle-NC axis)

#1501 polyax = 0: Spindle-spindle polygon (spindle-spindle)

[Operation]

This signal turns ON by the polygon machining start command (G51.2), and is held during the polygon machining mode. This signal turns OFF when the polygon machining mode is canceled (G50.2, reset, etc.), and remains OFF in modes other than the polygon machining mode.

[Related signals]

(1) In spindle-spindle polygon mode (XCB2)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC ALARM 5	AL5	XCB1	XDF1	XF31	X1071

[Function]

This signal informs that the controller is in operation alarm (error) condition.

[Operation]

The signal turns ON when:

- The parameter "#1238 set10/bit7" is ON and the operation alarms below occur.

The signal turns OFF when:

- The parameter "#1238 set10/bit7" is OFF.
- The parameter "#1238 set10/bit7" is ON and the operation alarm conditions below do not exist.

For details on the operation alarms, refer to "Alarm/Parameter Manual".

<Operation alarms output to NC alarm 5>

- External interlock (M01 0004)
- Override zero (M01 0102)
- External feed speed zero (M01 0103)
- Block start interlock (M01 0109)
- Cutting block start interlock (M01 0110)
- Rapid traverse override zero (M01 0125)
- Spindle-spindle polygon (G51.2) cutting interlock (M01 1033)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN SPINDLE-SPINDLE POLYGON MODE		XCB2	XDF2	XF32	X1072

[Function]

This signal informs that the spindle-spindle polygon machining mode is being executed.

(Note) Refer to the explanation of "In Spindle-NC axis polygon mode" signal for details on the spindle-NC axis polygon.

#1501 polyax $\neq$ 0: Polygon machining (spindle-NC axis)

#1501 polyax = 0: Spindle-spindle polygon (spindle-spindle)

[Operation]

The signal turns ON when:

- The G51.2 is commanded, and the spindle-spindle polygon machining is executed.

The signal turns OFF when:

- The G50.2 is commanded, and the spindle-spindle polygon machining is canceled.
- The "Spindle synchronization cancel" signal is input, and the spindle-spindle polygon machining is canceled.
- "Emergency stop" occurs.
- "Reset" is input.

When this signal turns ON and the spindle-spindle polygon synchronization is completed, "spindle-spindle polygon synchronization completion" signal turns ON.

[Related signals]

(1) Spindle-spindle polygon cancel (YCD1)
(2) Spindle-spindle polygon synchronization completion (XCB3)
(3) In Spindle-NC axis polygon mode (XCB0)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SPINDLE-SPINDLE POLYGON SYNCHRONIZATION COMPLETION		XCB3	XDF3	XF33	X1073

[Function]

This signal informs that the workpiece spindle and rotary tool spindle are in the synchronized rotation state.

[Operation]

The signal turns ON when:

- The rotary tool spindle rotation speed, in respect to the rotation speed following the rotary tool spindle and workpiece spindle rotation ratio command, reaches the value set for the spindle-spindle polygon synchronization rotation speed attainment level during the spindle-spindle polygon machining mode.

The signal turns OFF when:

- The rotary tool spindle rotation speed, in respect to the rotation speed following the rotary tool spindle and workpiece spindle rotation ratio command, deviates from the value set for the spindle-spindle polygon synchronization rotation speed attainment level during the spindle-spindle polygon machining mode.
- The spindle-spindle polygon synchronization mode is canceled.

[Related signals]

(1) Spindle-spindle polygon cancel (YCD1)
(2) In spindle-spindle polygon mode (XCB2)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN 3-DIMENSIONAL COORDINATE CONVERSION		XCB9	XDF9	XF39	X1079

[Function]

This signal notifies that the controller is in 3-dimensional coordinate conversion.

[Operation]

This signal turns ON when:

G68 (3-dimensional coordinate conversion) is commanded

This signal turns OFF when:

(1) G69 (3-dimensional coordinate conversion cancel) is commanded
(2) G68 (3-dimensional coordinate conversion) modal is cleared by reset

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	N SYNCHRONIZED TAPPING SELECTION (M COMMAND)	RTAP	XCC0	XE00	XF40	X1080

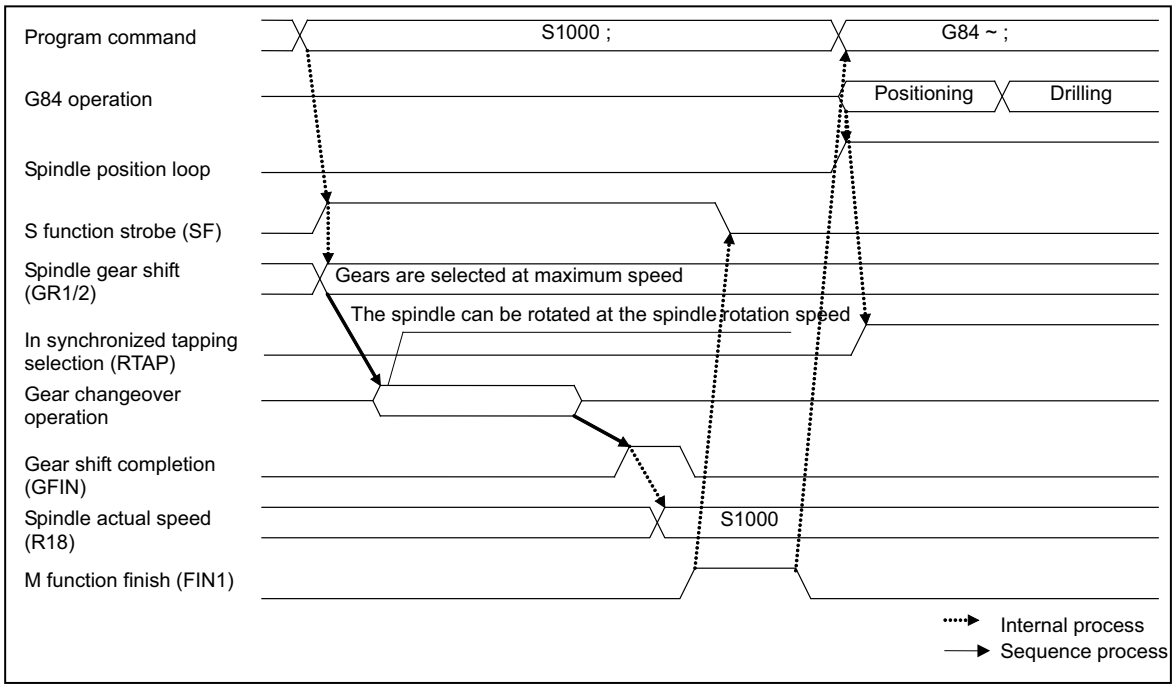
[Function]

This signal informs that the synchronized tapping mode is active.

(This signal is output only when the M function synchronized tapping cycle valid parameter (#1272 ext08 bit1) is ON.)

[Operation]

(1) ON timing

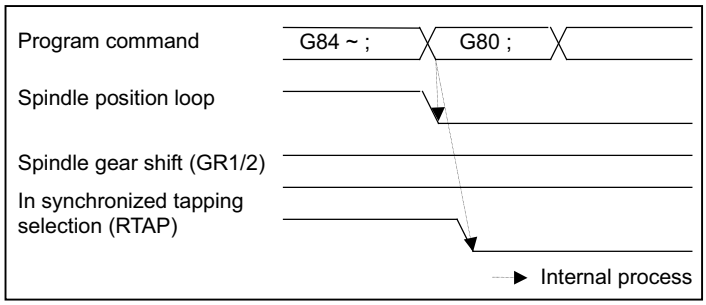


(Note 1) Spindle position loop and in synchronized tapping selection turn ON only during synchronized tapping.

(Note 2) If synchronized tapping is applied even during tap retract, "in synchronized tapping selection" signal will turn ON.

(2) OFF timing

This signal turns OFF when reset, G80 (hole drilling fixed cycle cancel), 01 group G codes or other fixed cycle G codes are commanded.



(Note 1) The gears are not selected until the S command is issued again.

(Note 2) This signal turns OFF when tap retract is canceled or completed.

[Related signals]

(1) Gear shift completion (GFIN: Y1885)

(2) Spindle actual speed (R6506)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	In small diameter deep hole cycle		XCC1	XE01	XF41	X1081

[Function]

This signal outputs the state of "in drilling operation" of small diameter deep hole cycle.

[Operation]

This signal is output between the positioning to the R point for drilling axis and returning to the R point/initial point after finishing the drilling.

[Related signals]

(1) Small diameter deep hole drilling cycle (YCCA)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	HIGH-SPEED RETRACT FUNCTION VALID STATE		XCC2	XE02	XF42	X1082

[Function]

This signal informs that the high-speed retract function is valid.

[Operation]

This signal turns ON when the high-speed retract function valid signal is ON.

This signal turns OFF when the high-speed retract function valid signal turns OFF, or when the high-speed retract function option is not provided.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) In High-speed retract function operation (XCC3)

(2) High-speed retract function valid (YCCC)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN HIGH-SPEED RETRACT FUNCTION OPERATION		XCC3	XE03	XF43	X1083

[Function]

This signal informs that the high-speed retract function is in operation.

[Operation]

This signal turns ON when the high-speed retract function is valid, and a fixed cycle program (G81, G82, G83, G73), which carries out high-speed retract, is being executed. If this signal is ON while executing a fixed cycle program, high-speed retract operation will be executed.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) High-speed retract function valid state (XCC2)

(2) High-speed retract function valid (YCCC)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN BARRIER VALID (LEFT)		XCC8	XE08	XF48	X1088

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN BARRIER VALID (RIGHT)		XCC9	XE09	XF49	X1089

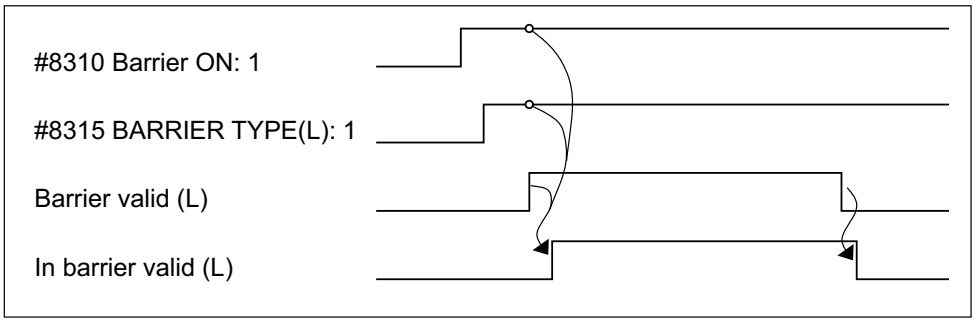
[Function]

This signal informs that the barrier area of left side (right side) is valid in the chuck/tailstock barrier function.

[Operation]

When all conditions below are satisfied and the barrier area is valid, this signal is turned ON. (When this signal is OFF, the barrier check is not executed.)

- The option of chuck barrier check function is valid.
- The setting of parameter "#8310 Barrier ON" on the barrier data screen is "1". (Excluding when using the special display unit)
- The setting of parameter "#8315 BARRIER TYPE (L)" ("#8316 BARRIER TYPE (R)") on the barrier data screen is other than "0".
- The "Barrier valid" signal input above is ON, or the G22 modal is valid.



[Related signals]

(1) Barrier valid (left) (YCD8)
(2) Barrier valid (right) (YCD9)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DOOR OPEN ENABLE	DROPNS	XCD8	XE18	XF58	X1098

[Function]

This signal informs the PLC that the drive power to all axes is turned OFF due to the "Door open I/II" (DOOR1/2) signal, or that the same status is canceled.

[Operation]

This signal turns ON when the drive power to all axes is turned OFF due to the "Door open I/II" (DOOR1/2) signal turning ON.

This signal turns OFF at all axes ready ON and at all servo axes servo ON, due to the "Door open I/II" (DOOR1/2) signal turning OFF.

Release of the door lock is enabled at the rising edge of the "Door open enable" signal.

The operation is in a READY status at the falling edge of the "Door open enable" signal.

[Caution]

(1) Handling of the PLC axis

Set so the "Door open I/II" (DOOR1/2) signal is output to the NC after the PLC axis is stopped by the PLC.

If the "Door open I/II" (DOOR1/2) signal is input without stopping the PLC axis, the axis will stop with a dynamic brake method due to the ready OFF state.

The remaining distance will be held in the R register being used in the PLC axis control.

(2) Handling of the analog spindle

When an analog spindle is connected, it is not possible to confirm that the spindle has completely stopped with the NC. Thus, confirm that the spindle has completely stopped using the PLC, before opening the door.

Because the spindle may start rotating again immediately after the door is closed, for safety turn the forward run and reverse run signals OFF when the door is open.

(3) Opening the door during ATC operation

When opening the door during ATC operation, apply an interlock with the user PLC.

[Related signals]

(1) Door open I (DOOR1: Y768)

(2) Door open II (DOOR2: YCE1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (JOG,INC)	MJST	XD18	XE58	XF98	X10D8
A	Table coordinate system in manual feed for 5-axis machining (JOG,INC)	MJSB	XD19	XE59	XF99	X10D9
A	Feature coordinate system in manual feed for 5-axis machining (JOG,INC)	MJSF	XD1A	XE5A	XF9A	X10DA

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out by the jog or incremental feed.

When this signal is ON, jog feed or incremental feed is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The hypothetical coordinate system for the manual feed for 5-axis machining (JOG, INC) has been selected during jog feed or incremental feed.

This signal turns OFF when:

(1) The hypothetical coordinate selection for the manual feed for 5-axis machining (JOG, INC) is turned OFF.

(2) The jog feed or incremental feed mode is turned OFF.

[Related signals]

(1) In jog mode (JO:XC00)

(2) In incremental mode (SO:XC02)

(3) Manual feed for 5-axis machining (JOG,INC) in tool axis coordinate system

(4) Manual feed for 5-axis machining (JOG,INC) in table coordinate system

(5) Manual feed for 5-axis machining (JOG,INC) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (1st handle)	MH1ST	XD1B	XE5B	XF9B	X10DB
A	Table coordinate system in manual feed for 5-axis machining (1st handle)	MH1SB	XD1C	XE5C	XF9C	X10DC
A	Feature coordinate system in manual feed for 5-axis machining (1st handle)	MH1SF	XD1D	XE5D	XF9D	X10DD

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out on the 1st handle axis.

When this signal is ON, the feed on the 1st handle axis is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The 1st handle feed is valid, the axis selection signal is ON and the hypothetical coordinate system for manual feed for 5-axis machining (1st handle) is selected.

This signal turns OFF when:

(1) The selection of the hypothetical coordinate system for manual feed for 5-axis machining (1st handle) is turned OFF.

(2) The 1st handle valid signal is turned OFF.

(3) The axis selection signal is turned OFF.

[Related signals]

(1) 1st handle axis selection code (HS11 to HS116:YC40 to 4)

(2) 1st handle valid (HS1S:YC47)

(3) Manual feed for 5-axis machining (1st handle) in tool axis coordinate system

(4) Manual feed for 5-axis machining (1st handle) in table coordinate system

(5) Manual feed for 5-axis machining (1st handle) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (2nd handle)	MH2ST	XD1E	XE5E	XF9E	X10DE
A	Table coordinate system in manual feed for 5-axis machining (2nd handle)	MH2SB	XD1F	XE5F	XF9F	X10DF
A	Feature coordinate system in manual feed for 5-axis machining (2nd handle)	MH2SF	XD20	XE60	XFA0	X10E0

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out on the 2nd handle axis.

When this signal is ON, the feed on the 2nd handle axis is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The 2nd handle feed is valid, the axis selection signal is ON and the hypothetical coordinate system for manual feed for 5-axis machining (2nd handle) is selected.

This signal turns OFF when:

(1) The selection of the hypothetical coordinate system for manual feed for 5-axis machining (2nd handle) is turned OFF.

(2) The 2nd handle valid signal is turned OFF.

(3) The axis selection signal is turned OFF.

[Related signals]

(1) 2nd handle axis selection code (HS21 to HS216:YC48 to C)

(2) 2nd handle valid (HS2S:YC4F)

(3) Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system

(4) Manual feed for 5-axis machining (2nd handle) in table coordinate system

(5) Manual feed for 5-axis machining (2nd handle) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (3rd handle)	MH3ST	XD21	XE61	XFA1	X10E1
A	Table coordinate system in manual feed for 5-axis machining (3rd handle)	MH3SB	XD22	XE62	XFA2	X10E2
A	Feature coordinate system in manual feed for 5-axis machining (3rd handle)	MH3SF	XD23	XE63	XFA3	X10E3

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out on the 3rd handle axis.

When this signal is ON, the ual feed on the 3rd handle axis is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The 3rd handle feed is valid, the axis selection signal is ON and the hypothetical coordinate system for manual feed for 5-axis machining (3rd handle) is selected.

This signal turns OFF when:

(1) The selection of the hypothetical coordinate system for manual feed for 5-axis machining (3rd handle) is turned OFF.

(2) The 3rd handle valid signal is turned OFF.

(3) The axis selection signal is turned OFF.

[Related signals]

(1) 3rd handle axis selection code (HS31 to HS316:YC50 to 4)

(2) 3rd handle valid (HS3S:YC57)

(3) Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system

(4) Manual feed for 5-axis machining (3rd handle) in table coordinate system

(5) Manual feed for 5-axis machining (3rd handle) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	In tool center point rotation	TCPRS	XD27	XE67	XFA7	X10E7

[Function]

This signal informs the operation of the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle).

[Operation]

It operates with keeping the positional relationship of tool center point looking from the workpiece, when the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle) is operated.

[Related signals]

(1) Tool axis coordinate system in manual feed for 5-axis machining (JOG,INC)

(2) Table coordinate system in manual feed for 5-axis machining (JOG,INC)

(3) Feature coordinate system in manual feed for 5-axis machining (JOG,INC)

(4) Tool axis coordinate system in manual feed for 5-axis machining (1st handle)

(5) Table coordinate system in manual feed for 5-axis machining (1st handle)

(6) Feature coordinate system in manual feed for 5-axis machining (1st handle)

(7) Tool axis coordinate system in manual feed for 5-axis machining (2nd handle)

(8) Table coordinate system in manual feed for 5-axis machining (2nd handle)

(9) Feature coordinate system in manual feed for 5-axis machining (2nd handle)

(10) Tool axis coordinate system in manual feed for 5-axis machining (3rd handle)

(11) Table coordinate system in manual feed for 5-axis machining (3rd handle)

(12) Feature coordinate system in manual feed for 5-axis machining (3rd handle)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	EDIT/SEARCH WINDOW DISPLAYED		X1878

[Function]

This signal indicates that the "Edit/Search" window is displayed.

[Operation]

This signal is ON while the "Edit/Search" window is displayed.

[Related signals]

(1) Edit/Search (Y1878)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	S COMMAND GEAR NO. ILLEGAL	SIGE	X1882	X18E2	X1942	X19A2	X1A02	X1A62

[Function]

This signal is output if specified gear No. is illegal.

[Operation]

The signal turns ON if gear No. specified by user is beyond the maximum system gear No.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	S COMMAND MAX./MIN. COMMAND VALUE OVER	SOVE	X1883	X18E3	X1943	X19A3	X1A03	X1A63

[Function]

This signal is output when S command value is clamped to the maximum or minimum value.

[Operation]

The signal turns ON if S command value is larger than spindle maximum speed parameter (Smaxn) value, or smaller than spindle minimum speed parameter (Smin) value.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	S COMMAND NO GEAR SELECTED	SNGE	X1884	X18E4	X1944	X19A4	X1A04	X1A64

[Function]

This signal is output if gear is not present for S function (S code) issued by automatic operation.

[Operation]

This signal will turn ON when the S function (S code) is issued during automatic operation, and the S code does not match any gear set in the spindle maximum speed parameters.

This signal (SNGE) is output simultaneously with spindle function strobe signal (SF).

[Related signals]

(1) Spindle function strobe (SFn: XC64)

(2) Spindle gear shift (GR1, GR2: X1885, 6)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE GEAR SHIFT 1,2	GR1,2	X1885,6	X18E5,6	X1945,6	X19A5,6	X1A05,6	X1A65,6

[Function]

This signal informs which gear stage in the spindle applies to the S command (S code) issued in the automatic operation (memory, MDI or tape) machining program.

For machines that have gear stage shift, the gear will be shifted on the machine side when this signal is received.

Note that the gear will not be shifted if the S command is not issued with a synchronous tapping cycle command in the same block.

[Operation]

When the S command (S code) is issued in automatic operation, the gear stage for the commanded S code is output with a 2-bit (GR1, GR2) code from the preset parameters (spindle max. speed).

The relation of the spindle max. speed parameter (Smax1 to Smax4) and the "Spindle gear shift" (GR1, GR2) signal output is shown below.

Gear stage	Max. spindle speed	Spindle gear shift		
		GR2	GR1	
1	Smax1	0	0	← Range "S0 to S (Smax1)"
2	Smax2	0	1	← Range "S (Smax1)+1 to S (Smax2)"
3	Smax3	1	0	← Range "S (Smax2)+1 to S (Smax3)"
4	Smax4	1	1	← When range over "S (Smax3)+1" is specified.

This signal (GR1, GR2) is output simultaneously with the "Spindle function strobe" (SFn).

(Note 1) If the commanded S code does not match any of the gear stages, the "S command no gear selected" (SNGE) signal will be output separately from this signal.

[Related signals]

(1) Spindle function strobe (SFn: XC64)

(2) S command no gear selected (SNGE: X1884)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE 2ND IN-POSITION	ORA2O	X1888	X18E8	X1948	X19A8	X1A08	X1A68

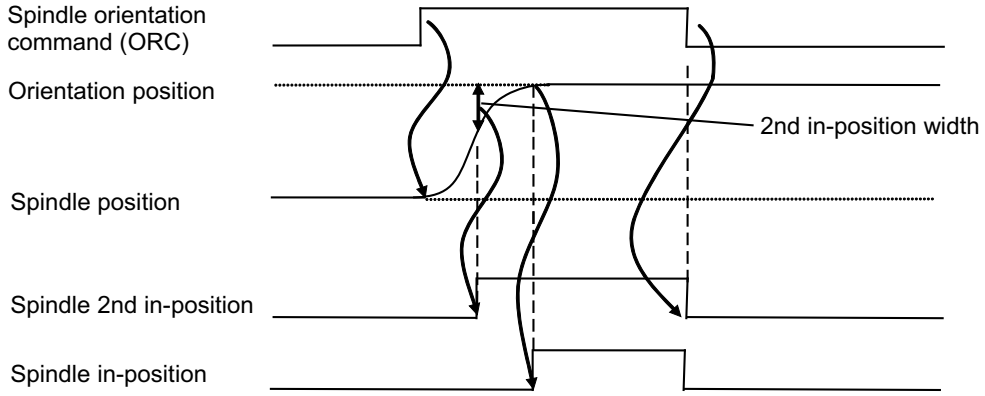
[Function]

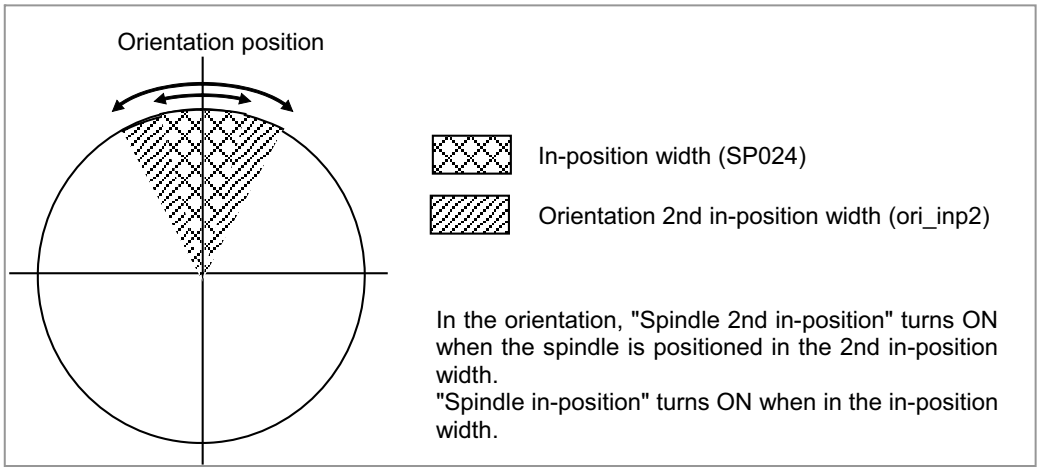
This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle is positioned in the set range in accordance with spindle orientation command.
The information is sent faster than by the "Spindle in-position" signal. This signal allows predicting the orientation completion and preventing the sequence delay time caused by the tool exchange and so on, which helps the takt time reduction.

[Operation]

This signal turns ON when the spindle positioning in the set range completes, and the difference between the orientation position and the feedback position reaches the 2nd in-position range.

(1) The in-position range is set with the spindle parameter "#3132 ori_inp2".
(2) The signal is turned OFF when the "Spindle orientation command" (ORC) is turned OFF.





(Note 1) When spindle orientation command is given, orientation starts regardless of the "Spindle forward run start (SRN)" or "Spindle reverse run start (SRI)".
(Note 2) This signal is not available when an analog connection is used.
(Note 3) While the spindle is in position, it is under servo lock condition. However, if the spindle is rotated by external force, the signal may be turned OFF.

[Related signals]

(1) Spindle in-position (ORAO: X188E)
(2) Spindle orientation command (ORC: Y189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	CURRENT DETECTION	CDO	X1889	X18E9	X1949	X19A9	X1A09	X1A69

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that drive motor current is about to reach the permissible maximum current. The signal can be used to prevent stabbing of cutter into workpiece, for example.

[Operation]

The signal (CDO) turns ON if motor current goes up to a level (110% output) close to the permissib le maximum current (120%).

(Note 1) This signal is valid only for the system that is high-speed serial connection with the controller.

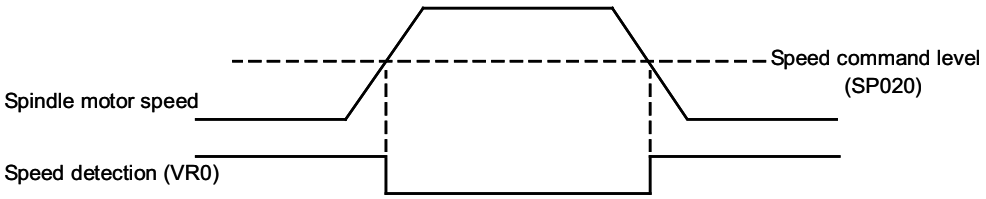
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPEED DETECTION	VRO	X188A	X18EA	X194A	X19AA	X1A0A	X1A6A

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that motor speed is dropped below the speed specified by parameter.

[Operation]

The signal (VRO) turns ON when motor speed (motor rotation speed) drops below the speed specified by the spindle parameter "#13028 SP028 (Speed detection set value)".



(Note 1) This signal is valid only for the system that is high-speed serial connection with the controller.

[Related signals]

(1) Speed detection 2 (SD2: X189D)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN SPINDLE ALARM	FLO	X188B	X18EB	X194B	X19AB	X1A0B	X1A6B

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that failure occurs in spindle controller.

[Operation]

The signal turns ON if alarm which occurs in the spindle controller is detected.

To cancel alarm, reset the controller (by reset & rewind), turn the controller power OFF or turn the spindle controller power supply OFF. Note that reset method depends on type of alarm.

Typical examples of alarm are listed below. For details of alarm contents and cancel procedure, refer to the Instruction Manual for the spindle drive unit.

(1) Overcurrent
(2) Breaker trip
(3) Motor overheat

(Note 1) This signal is valid only for the system that is high-speed serial connected with the controller.

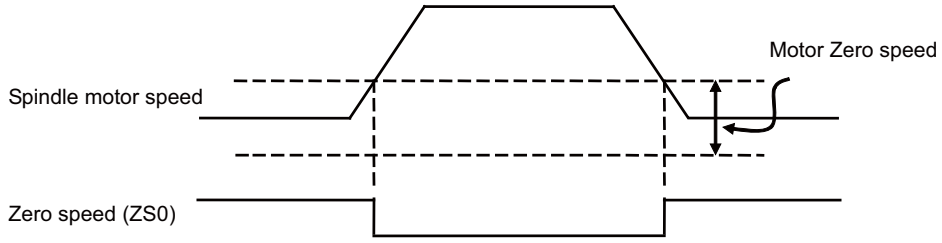
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	ZERO SPEED	ZSO	X188C	X18EC	X194C	X19AC	X1A0C	X1A6C

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that motor speed has dropped below the set speed level.

[Operation]

This signal turns ON when the actual spindle motor speed drops below the speed specified by the spindle parameter "#13027 SP027 (motor zero speed)".



(Note 1) The signal is output, no matter whether direction of rotation is "Spindle forward run start" (SRN) or "Spindle reverse run start" (SRI).

(Note 2) Minimum output pulse width of the signal is about 200ms.

(Note 3) Speed at which the signal is output can be set within range from 1r/min to 1000r/min with the spindle parameters.

(Note 4) This signal is valid only for the system that is high-speed serial connected with the controller.

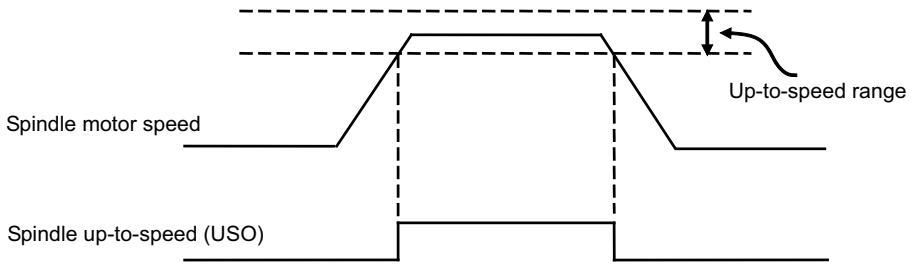
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE UP-TO-SPEED	USO	X188D	X18ED	X194D	X19AD	X1A0D	X1A6D

[Function]

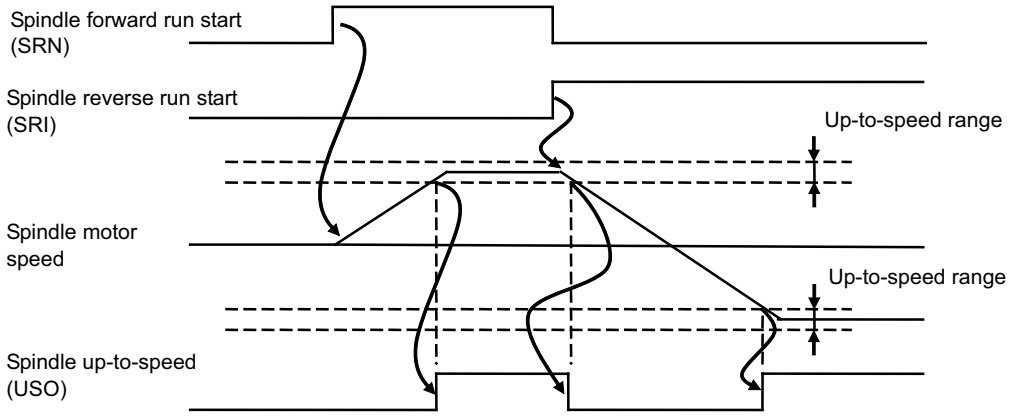
This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that actual spindle motor speed reaches the range set with the parameter "#3105 sut"(standard setting ±15%).

This signal is used for the S command completion conditions or control axis interlock during automatic operation.

[Operation]



When a command is given to change motor rotation from "forward" to "reverse", spindle motor speed starts going down and the signal (USO) is turned OFF. When motor speed enters the specified detection range, the signal turns ON.



(Note 1) The signal cannot be output if neither "Spindle forward run start" (SRN) signal nor "Spindle reverse run start" (SRI) signal is ON.

(Note 2) This signal is not output when operating with a command that is not a speed command such as synchronous tap.

(Note 3) This signal is valid only for the system that is high-speed serial connected with the controller.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE IN-POSITION	ORAO	X188E	X18EE	X194E	X19AE	X1A0E	X1A6E

[Function]

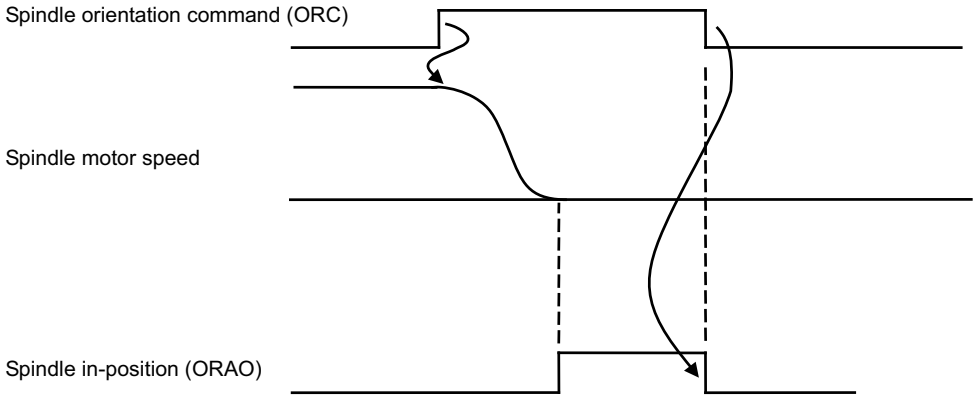
This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle is positioned in the set range in accordance with spindle orientation command.

[Operation]

When the spindle positioning in the set range completes, this signal will turn ON. The spindle orientation is started by "Spindle orientation command" signal (ORC).

(1) The in-position range is set with the spindle parameter "#13024 SP024 (INP) ".

(2) The signal is turned OFF when the "Spindle orientation command" (ORC) is turned OFF.



(Note 1) When spindle orientation command is given, orientation starts regardless of the "Spindle forward run start (SRN)" or "Spindle reverse run start (SRI)".

(Note 2) This signal is not available when an analog connection is used.

(Note 3) While the spindle is in position, it is under servo lock condition. However, if the spindle is rotated by external force, the signal (ORAO) may be turned OFF.

[Related signals]

(1) Spindle 2nd in-position (ORA20: X1888)

(2) Spindle orientation command (ORC: Y189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN L COIL SELECTION	LCSA	X188F	X18EF	X194F	X19AF	X1A0F	X1A6F

[Function]

This signal indicates that the low-speed coil is being selected in the spindle coil changeover function.

[Operation]

The high-speed coil and low-speed coil are changed over only with the "L coil selection" (LRSL) in the 2-step coil changeover specification. The high-speed coil, middle-speed coil and low-speed coil are changed over with the combination of the "L coil selection" (LRSL) and "M coil selection" (LRSM) in the 3-step coil changeover specification.

(1) 2-step coil changeover

Selected coil	L coil selection(LRSL)	In L coil selection(LCSA)
High-speed (H)	OFF	OFF
Low-speed (L)	ON	ON

(2) 3-step coil changeover

Selected coil	L coil selection (LRSL)	M coil selection (LRSM)	In L coil selection (LCSA)	In M coil selection (MCSA)
High-speed (H)	OFF	OFF	OFF	OFF
Middle-speed(M)	OFF	ON	OFF	ON
Low-speed(L)	ON	OFF	ON	OFF
	ON	ON	ON	ON

[Related signals]

(1) L coil selection (LRSL: Y189F)
(2) M coil selection (LRSM: Y18A6)
(3) In M coil selection (MCSA: X189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE READY-ON	SMA	X1890	X18F0	X1950	X19B0	X1A10	X1A70

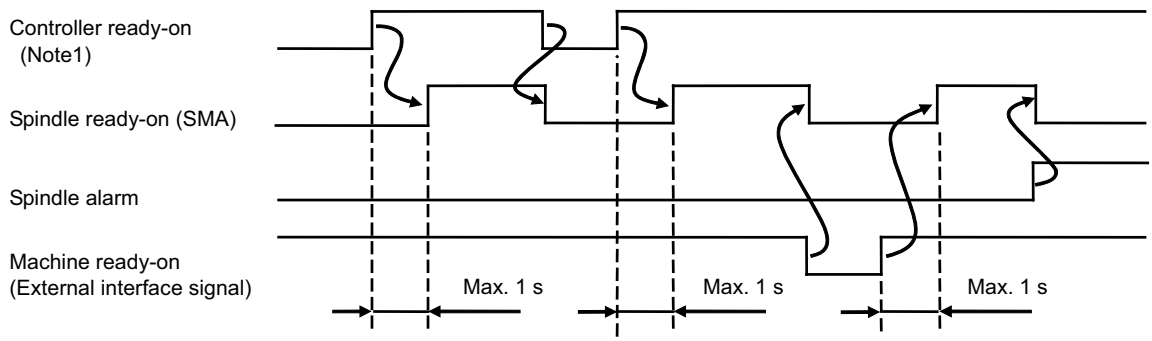
[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle can operate.

[Operation]

This signal (SMA) turns ON when the spindle controller is ready for operation. The signal turns OFF (ready off) in the following conditions.

(1) A spindle alarm is generated.
(2) "Ready-on" signal (internal signal) from controller is OFF.



(Note 1) The ready on signal is output from the controller to the spindle controller.
(Note 2) This signal is valid only for the system that is high-speed serial connected with the controller.

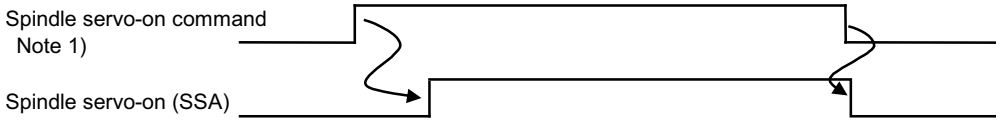
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SERVO-ON	SSA	X1891	X18F1	X1951	X19B1	X1A11	X1A71

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle is under the position control state (synchronous tap control, C-axis control).

[Operation]

The "Spindle servo-on" signal (SSA) turns ON when the spindle is ready (SMA signal is ON), the servo-on command has been transferred from the controller to the spindle controller, and the spindle controller is in the servo-on state.
Note that this signal turns OFF during rotation with "spindle forward run start"(SRN)/"spindle reverse run start"(SRI) (except during spindle synchronization) or spindle orientation.
This signal (SSA) turns OFF when the servo-on command is canceled.



(Note 1) The spindle servo-on command is output from the controller to the spindle controller, and is mainly output during synchronous tap control.

(Note 2) While the "Spindle servo-on" signal is ON, all input signals for "Spindle forward run start" (SRN), "Spindle reverse run start" (SRI), and "Spindle orientation command" (ORC) are ignored.

(Note 3) This signal is valid only for the system that is high-speed serial connected with the controller.

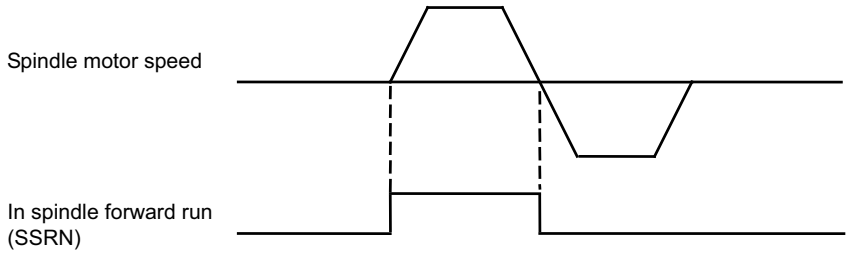
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN SPINDLE FORWARD RUN	SSRN	X1893	X18F3	X1953	X19B3	X1A13	X1A73

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle is rotating in the forward direction.

[Operation]

The "In spindle forward run" signal (SSRN) turns ON when the spindle motor is rotating in the forward direction. This will also turn ON if the spindle motor is rotating in the forward direction during orientation or synchronous tap.



(Note 1) The "In spindle forward run" signal (SSRN) turns ON and OFF while the spindle motor is in the stop state with servo rigidity during oriented motion or synchronous tap.

(Note 2) This signal is valid only for the system that is high-speed serial connected with the controller.

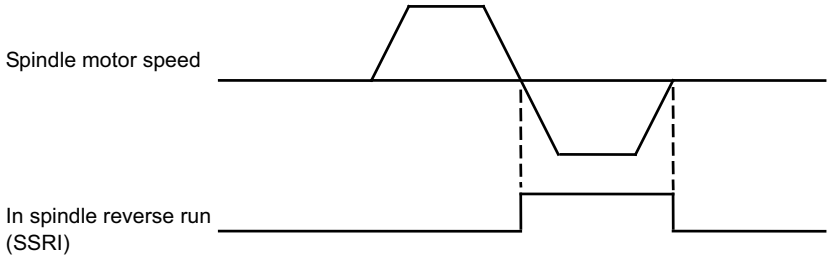
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN SPINDLE REVERSE RUN	SSRI	X1894	X18F4	X1954	X19B4	X1A14	X1A74

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle motor is rotating in the reverse direction.

[Operation]

The "In spindle reverse run" (SSRI) signal turns ON when the spindle motor rotates in the reverse direction. It also turns ON even during oriented motion or synchronous tap if the spindle motor rotates in the reverse.



(Note 1) The "In spindle reverse run" (SSRI) signal turns ON and OFF while the spindle motor is in the stop state with servo rigidity during oriented motion or synchronous tap.

(Note 2) This signal is valid only for the system that is high-speed serial connected with the controller.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	POSITION LOOP IN-POSITION	SIMP	X1896	X18F6	X1956	X19B6	X1A16	X1A76

[Function]

If the spindle controller is connected with high-speed serial connection, this signal will inform that the spindle is in the in-position state during synchronous tap.

[Operation]

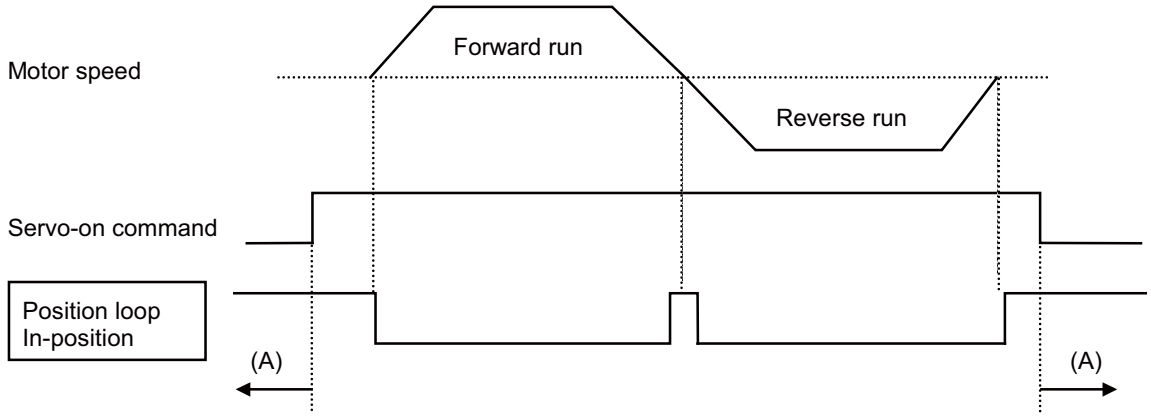
The signal will turn ON when:

(1) The droop amount (servo tracking delay error) is within the in-position range during synchronous tap control (servo on).

(2) Synchronous tap control is not commanded. ((A)in following drawing)

The signal will turn OFF when:

(1) The droop amount (servo tracking delay error) has exceeded the in-position range during synchronous tap control (servo on).



Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN SPINDLE TORQUE LIMIT	STLQ	X1897	X18F7	X1957	X19B7	X1A17	X1A77

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that the spindle is in position under C-axis control or synchronous tap control.

[Operation]

The "STLQ" signal turns ON when:

(1) "Spindle torque limit 1" (TL1) or "Spindle torque limit 2" (TL2) signal is ON.

The "STLQ" signal turns OFF when:

(1) "Spindle torque limit 1" (TL1) or "Spindle torque limit 2" (TL2) signal is OFF.

(Note 1) This signal is valid only for the system that is high-speed serial connected with the controller.

[Related signals]

(1) Spindle torque limit 1 (TL1: Y189A)

(2) Spindle torque limit 2 (TL2: Y189B)

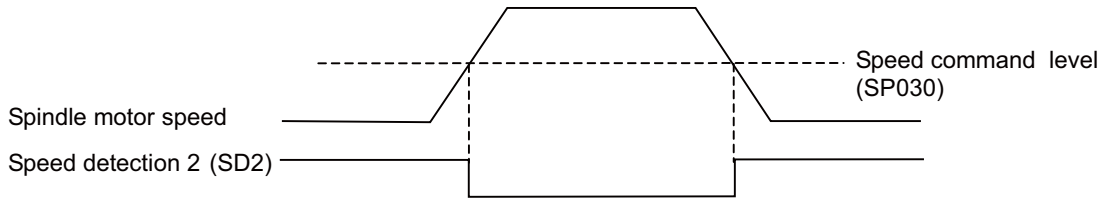
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPEED DETECTION 2	SD2	X189D	X18FD	X195D	X19BD	X1A1D	X1A7D

[Function]

This signal is output from the high-speed serial connection specification spindle controller (spindle drive) and informs that motor speed is dropped below the speed specified by the parameter.

[Operation]

This signal (SD2) turns ON if the motor speed (motor rotation speed) drops the detection level specified by the parameter "#13030 SP030".



(Note 1) This signal is valid only with the system that is high-speed serial connection with the spindle controller.

[Related signals]

(1) Speed detection (VRO: X188A)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN M COIL SELECTION	MCSA	X189E	X18FE	X195E	X19BE	X1A1E	X1A7E

[Function]

This signal indicates that the middle-speed coil is being selected in the 3-step coil changeover specification of the spindle coil changeover function.

[Operation]

The state of the selected coil is combined with the "In L coil selection" (LCSA), and that is output.

Selected coil	L coil selection (LRSL)	M coil selection (LRSM)	In L coil selection (LCSA)	In M coil selection (MCSA)
High-speed (H)	OFF	OFF	OFF	OFF
Middle-speed (M)	OFF	ON	OFF	ON
Low-speed (L)	ON	OFF	ON	OFF
	ON	ON	ON	ON

[Related signals]

(1) L coil selection (LRSL: Y189F)

(2) M coil selection (LRSM: Y18A6)

(3) In L coil selection (LCSA: X188F)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	INDEX POSITIONING COMPLETION		X189F	X18FF	X195F	X19BF	X1A1F	X1A7F

[Function]

This signal informs that positioning for the spindle forward run and reverse run indexing functions has been completed.

[Operation]

(1) Orient the spindle.
If values are set in the parameters and multi-point orientation position data at this time, the spindle will be positioned to an angle shifted by the amount obtained by adding the two values.
If there is multi-point orientation position data during orientation, the spindle will be positioned to the angle shifted by that amount during forward run/reverse run indexing.
The basic orientation shift is carried out with parameters.

(2) Next, carry out positioning to an arbitrary angle using the forward run/reverse run indexing function.
At this time, set the angle data before turning the "Spindle forward run/reverse run index" signal ON. (Note 1)
The "Index positioning completion" signal will turn OFF when forward run/reverse run is started (turned ON), but it will take some time for the signal to turn OFF once, wait at least 100ms before confirming that the index positioning is completed after forward run/reverse run is completed. (Note 2)

When the spindle is at the multi-point orientation position:

(a) Turning the "Spindle forward/reverse run index" signal ON will turn OFF the "Index positioning completion" signal.

(b) The "Index positioning completion" signal will go ON again after the index positioning complete signal OFF time which is designated with "#3126 tret_fin_off".

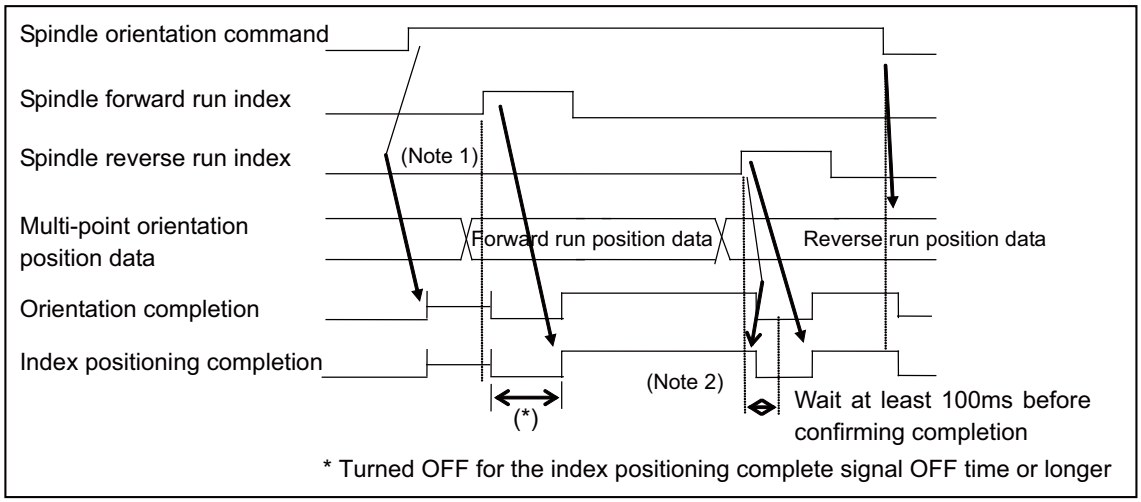
When the spindle is not at the multi-point orientation position:

(a) Turning the "Spindle forward/reverse run index" signal ON will turn OFF the "Index positioning completion" signal.

(b) The "Index positioning completion" signal will go ON again after the spindle has moved.
The signal will not go ON before the index positioning complete signal OFF time passes, even when the spindle has moved.

Consider the set value for index positioning complete signal OFF time when using the "Index positioning completion" signal.

(3) If the spindle orientation holding torque forces are overlapped, the torque limit function will be used.
An example of the spindle indexing timing is shown below.



[Related signals]

(1) Spindle orientation command (ORC: Y189E)
(2) Spindle forward run index (WRN: Y189C)
(3) Spindle reverse run index (WRI: Y189D)
(4) Multi-point orientation position data (R7009)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE ENABLE	ENB	X18A0	X1900	X1960	X19C0	X1A20	X1A80

[Function]

This signal informs whether there are command outputs to the spindle or not.
0: No command output to spindle
1: With command output to spindle

[Related signals]

(1) Spindle selection (SWS: Y18A8)
(2) Spindle command selection (SLSP: R7002)
(3) Spindle stop (SSTP: Y1894)
(4) Encoder selection (R2567)
(5) Spindle forward run start (SRN: Y1898)
(6) Spindle reverse run start (SRI: Y1899)

Con-tact	Signal name	Signal abbreviation	1stSP
A	IN SPINDLE SYNCHRONIZATION	SPSYN1	X18A8

[Function]

This signal informs that the spindle synchronous control mode has been entered.

[Operation]

The signal turns ON when:

- The G114.1 is commanded, and spindle synchronous control is entered. (Spindle synchronization control I)
- The spindle synchronous control signal (SPSY) turns ON. (Spindle synchronization control II)

The signal turns OFF when:

- Spindle synchronous control is canceled with the G113 command. Or, when the spindle synchronization cancel signal (SPSYC) turns ON. (Spindle synchronization control I)
- When the spindle synchronous control signal (SPSY) turns OFF. (Spindle synchronization control II)

[Related signals]

(1) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(2) Spindle phase synchronization completion (FSPPH: X18AA)
(3) Spindle synchronization (SPSY: Y18B0)
(4) Spindle phase synchronization (SPPHS: Y18B1)
(5) Spindle synchronization cancel (SPSYC: Y18B8)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE ROTATION SPEED SYNCHRONIZATION COMPLETION	FSPRV	X18A9

[Function]

This signal informs that the spindle synchronization state mode is entered.

[Operation]

The signal turns ON when:

- The rotation speed difference of the basic spindle and synchronous spindle reaches the value set for the spindle rotation speed attainment level in spindle synchronization mode. (Spindle synchronization I)
- The workpiece axis rotation speed reaches the value set for the spindle synchronization rotation speed attainment level corresponding to the workpiece axis and rotary tool axis rotation ratio command in spindle synchronization (no R command) mode. (Polygon)
- The workpiece axis rotation speed completes phase alignment at the rotation speed corresponding to the rotation ratio command for the workpiece axis and rotary tool axis in spindle synchronization (with R command) mode. (Polygon)
- Parameter #1239 bit 3 is reset (reset1, reset2, reset & rewind) at 1. (Polygon)

The signal turns OFF when:

- The actual rotation speed of the basic spindle or synchronous spindle, in respect to the spindle synchronous rotation speed command value, widely exceeds or deviates value set for the spindle synchronization rotation speed attainment level during the rotation synchronization mode.
- The spindle synchronous control mode is canceled.

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle phase synchronization completion (FSPPH: X18AA)
(3) Spindle synchronization (SPSY: Y18B0)
(4) Spindle phase synchronization (SPPHS: Y18B1)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE PHASE SYNCHRONIZATION COMPLETION	FSPPH	X18AA

[Function]

This signal informs that the spindle synchronization state is entered.

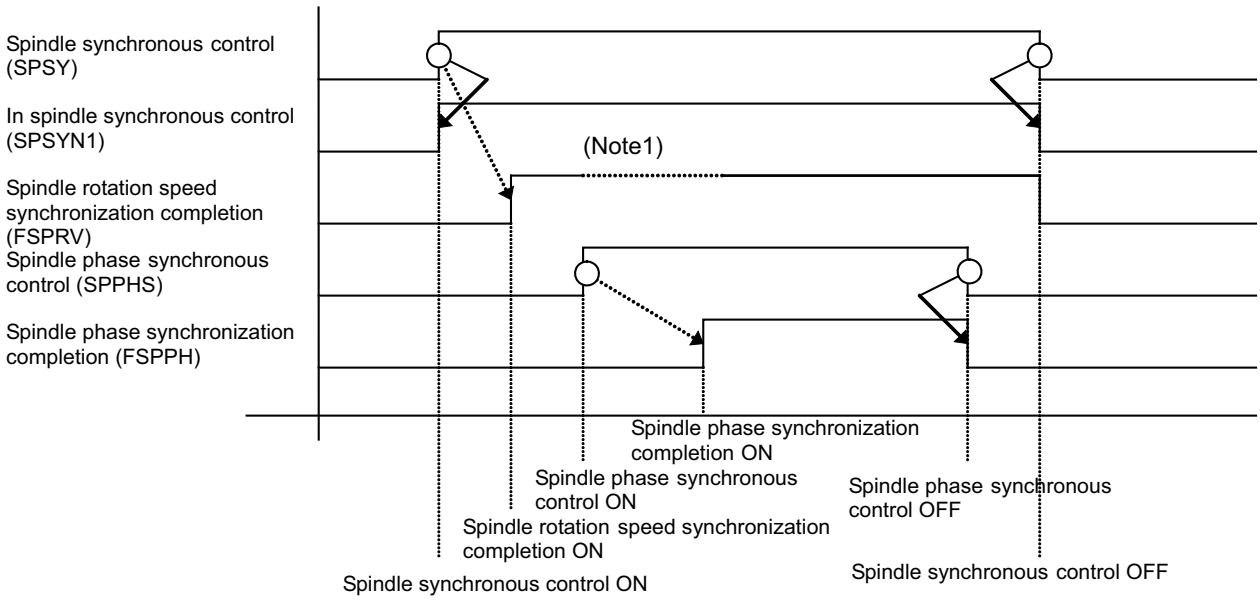
[Operation]

The signal turns ON when:

- The phase alignment of the basic spindle and synchronous spindle is completed during the phase synchronization mode.

The signal turns OFF when:

- The phase difference of the basic spindle and synchronous spindle exceeds the value set for the spindle synchronization phase attainment level during the phase synchronization mode.
- The spindle synchronous control mode is canceled.



(Note1) Temporary turn OFF to change the rotation speed during the phase synchronization.

⚠ **CAUTION**	**Always turn the spindle phase synchronization completion signal ON before chucking both ends of the workpiece to the basic spindle and synchronous spindle. If the spindle phase synchronization signal is turned ON when both ends of the workpiece are chucked to the basic spindle and synchronous spindle, the chuck or workpiece could be damaged by the torsion that occurs during phase alignment.**

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle synchronization (SPSY: Y18B0)
(4) Spindle phase synchronization (SPPHS: Y18B1)

Con-tact	Signal name	Signal abbreviation	1stSP
A	IN SPINDLE SYNCHRONIZATION 2	SPSYN2	X18AB

[Function]

This signal informs that the spindle-spindle polygon machining is started.

[Operation]

This signal turns ON when:

- G114.2 is commanded, and the spindle-spindle polygon machining is started.

This signal turns OFF when:

- G113 is commanded, and the spindle-spindle polygon machining is canceled.
- When the spindle synchronization cancel signal (SPSYC) is input, and spindle-spindle polygon machining is canceled.

[Related signals]

(1) Spindle synchronization cancel (SPSYC: Y18B8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)

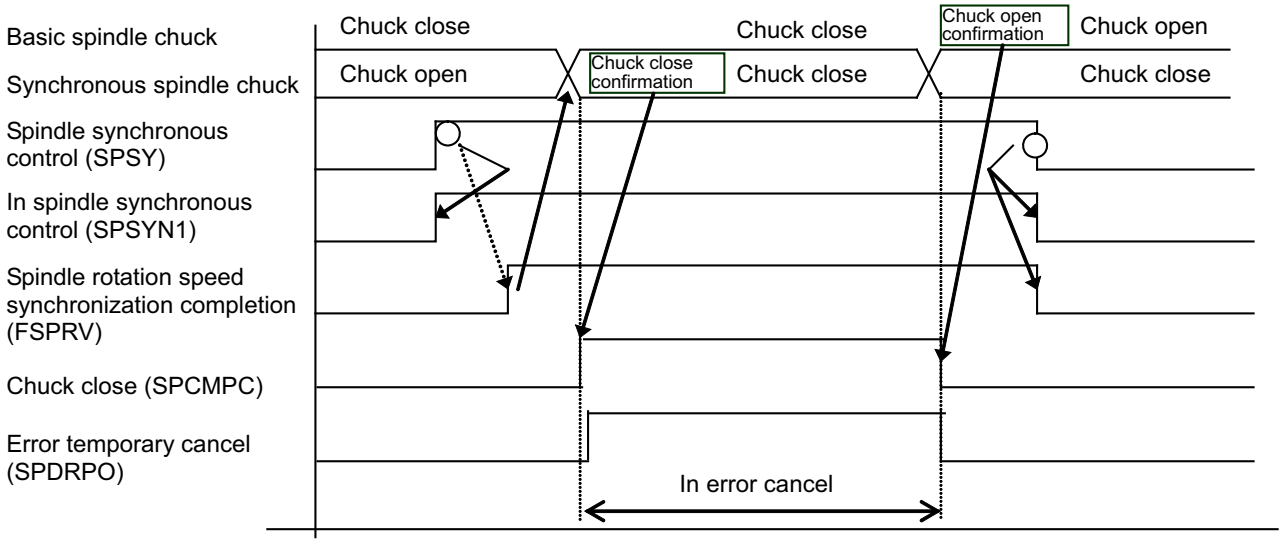
Con-tact	Signal name	Signal abbreviation	1stSP
A	CHUCK CLOSE CONFIRMATION	SPCMP	X18AC

[Function]

This signal informs that chuck close (SPCMPC) is input during spindle synchronous control.

[Operation]

This signal turns ON when the "Chuck close" (SPCMPC) is ON.
This signal turns OFF when the "Chuck close" (SPCMPC) is OFF.
This signal turns OFF when the spindle synchronous control is canceled.



(Note) Use "error temporary cancel" signal only when the position error between two spindles still occurs even after the "Chuck close" signal is turned ON.

[Related signals]

(1) Chuck close (SPCMPC: Y18B9)
(2) In spindle synchronization (SPSYN1: X18A8)
(3) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(4) Spindle synchronization (SPSY: Y18B0)
(5) Error temporary cancel (SPDRPO: Y18B5)

Con-tact	Signal name	Signal abbreviation	1stSP
A	IN TOOL SPINDLE SYNCHRONIZATION II	SPSYN3	X18AE

[Function]

This signal informs that the tool spindle synchronization II (hob machining) is being executed.

[Operation]

This signal turns ON when:

- Tool spindle synchronization II (hob machining) is started with a G114.3 command.

This signal turns OFF when:

- Spindle synchronous control is canceled with a G113 command or when the "Spindle synchronization cancel" (SPSYC) signal turns ON.

[Related signals]

(1) Spindle synchronization/superimposition cancel (SPSYC: Y18B8)

Con-tact	Signal name	Signal abbreviation	1stSP
A	HOB AXIS DELAY EXCESS	PHOVR	X18B3

[Function]

This signal informs that, after the spindle rotation speed synchronization completion in the tool spindle synchronization II (Hobbing), the hob axis tracking delay between the actual position and the commanded position exceeds the delay allowable angle.

[Operation]

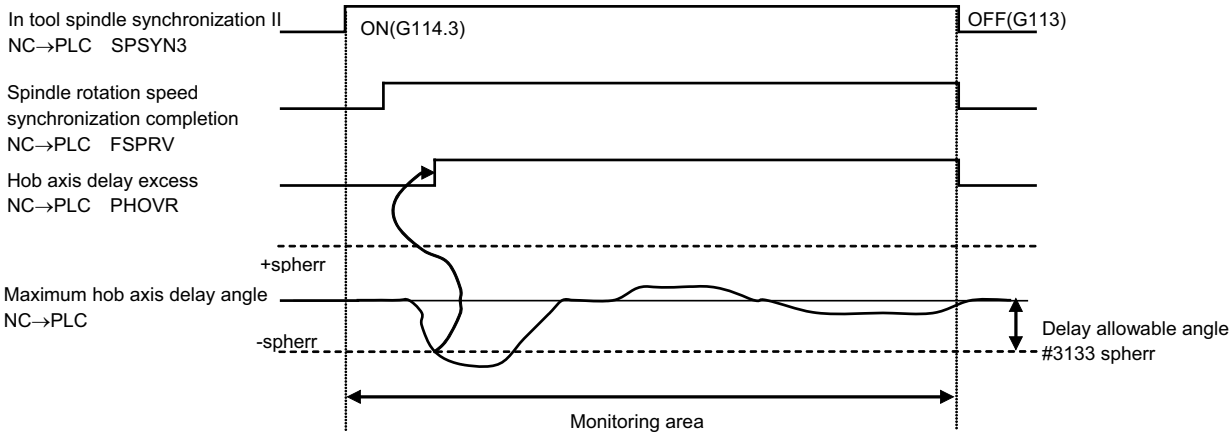
This signal turns ON when:

- The spindle rotation speed synchronization has been completed and the maximum delay angle of the hob axis (spindle) exceeds the delay allowable angle designated with "#3133 spherr".

This signal turns OFF when:

- The tool spindle synchronization II is canceled.

[Timing chart]



[Related signals]

(1) In tool spindle synchronization II (SPSYN3: X18AE)
(2) Spindle phase synchronization completion (FSPRV: X18A9)
(3) Spindle synchronization Maximum phase error/Maximum hob axis delay angle (R6517)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	IN SPINDLE HOLDING FORCE UP	EXOFN	X18B5	X1915	X1975	X19D5	X1A35	X1A95

[Function]

The spindle holding force up (disturbance observer) state is output to this signal.

[Operation]

This signal turns ON when the "Spindle holding force up" (EXOBS) signal turns ON and the spindle drive unit validates the disturbance observer.

Turning OFF the "Spindle holding force up" (EXOBS) signal turns this signal OFF.

[Related signals]

(1) Spindle holding force up (EXOBS: Y1893)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	HANDY TERMINAL KEY 1 TO 45		X1CD0 to FC

[Function] [Operation]

This signal indicates the status of handy terminal key 1 to 45.

[Related signals]

(1) Handle pulse encoder communication connector priority (Y70D)
(2) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)
(3) Handle/incremental feed magnification method selection (MPS: YC87)
(4) Handy terminal Data area top address (R297)
(5) Handy terminal Data valid number of registers (R298)
(6) Handy terminal Cause of communication error (R299)
(7) 1st handle/incremental feed magnification (R2508, R2509)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	POSITION SWITCH 1 to 24	PSW1 to 24	X1D00 to 17	X1D20 to 37	X1D40 to 57	X1D60 to 77

[Function]

This signal notifies that the machine position is within the area set by the parameters.

[Operation]

This signal turns ON when the control axis machine position reaches the range set by the parameters, and turns OFF when the range is left. The axis name and range are set in parameters #7501 to #7573.

The validity of this signal differs in the following manner depending on the absolute position detection or incremental detection.

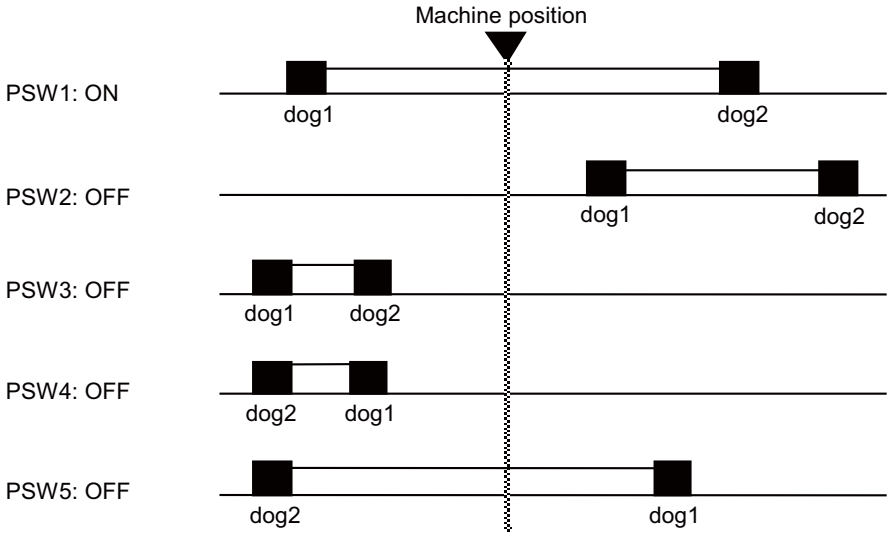
<For absolute position detection system>

This signal is valid when the power is turned ON after zero point initialization is completed.

<For incremental position detection system>

This signal is not validated until the first reference position return is completed after the power is turned ON. (PSW1 to PSW24 will all remain OFF until this signal is validated.)

Example of signal output



The setting range of the position switch uses the basic machine coordinate system as a reference.

The dog1 and dog2 setting values can be set to any size, and the area between the smaller setting and the larger setting will be used as the signal output range.

A slight delay will occur in the output signal fluctuation due to the actual machine position. The maximum delay time is as follows.

$$tmax = 0.06 \quad -TP \ [s]$$

TP: Position loop time constant ($\frac{1}{PGN}$ [s])

PNG: Position loop gain

6.2 PLC Input Signals (Data Type: R***)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	ANALOG INPUT m	AIn	R0 to 7

[Function]

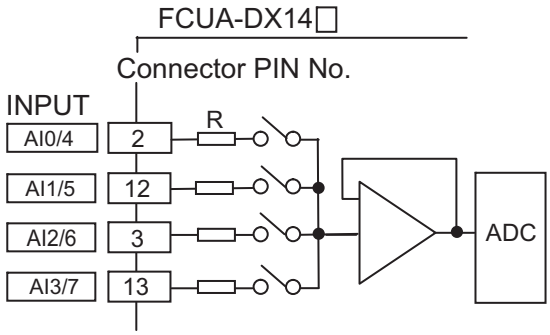
When an analog voltage is input to the remote I/O unit FCUA-DX140/141, which has the analog input function, the corresponding data can be read into the specified file register. The data can be used for load meter display, thermal displacement compensation, and so on.

[Operation]

The following shows the interfaces and the sampling cycle.

Channel	File register	Signal abbreviation	Sampling cycle
1	R0	AI0	M700/M700V: 14.2ms M70A: 14.2ms M70B: 28.4ms Data is input to each channel every quarter of the cycle later. There is no time difference between channels 1 and 5, 2 and 6, 3 and 7, 4 and 8.
2	R1	AI1	
3	R2	AI2	
4	R3	AI3	
5	R4	AI4	
6	R5	AI5	
7	R6	AI6	
8	R7	AI7	

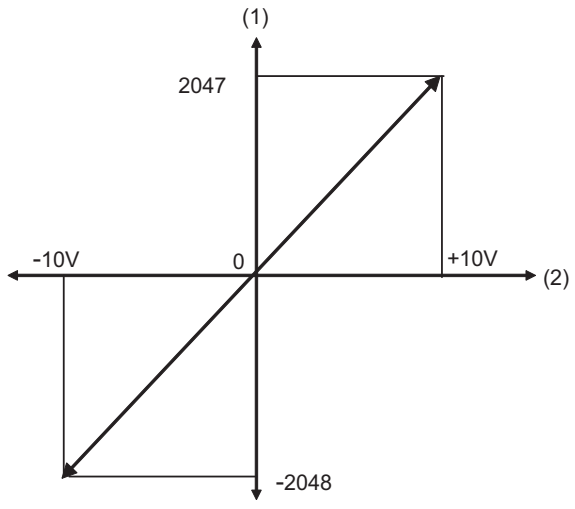
File registers AI4 to AI7 are the channels of the second unit.



For electrical connections, refer to "Connection Manual"

A FCUA-DX14* unit has four points for analog input. Channles 5 to 8 are the input points of the second unit.

<How input voltages are read into the file registers>



Resolution: 20V/4095=4.88mv
Precision: Within +/-25mV
Max. input rating: ± 15V

(1) Value in the file register
(2) Analog input voltage

(Example 1)
An input of +5V enters the value "1024" (400 in hexadecimal) into the file register.

(Example 2)
An input of -6V enters the value "-1229" (FB33 in hexadecimal) into the file register.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	KEY IN 1		R8

[Function]

Operator's key operation can be monitored on the user PLC side.

This signal is available with 70 Series only.

[Operation]

While operator is using the keyboard, the corresponding data is set to KEY-IN 1.

[Related signals]

(1) KEY OUT 1 (R212)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CLOCK DATA YEAR/MONTH		R11
A	CLOCK DATA DATE/HOUR		R12
A	CLOCK DATA MINUTE/SECOND		R13

[Function]

The year, month, date, hour, minute, second and millisecond data is informed by the controller to the PLC as the current clock information.

[Operation]

The date and time data is output as shown below. The data is output as binary data.

R11	Month	Year
R12	Hour	Date
R13	Second	Minute

(Example) For September 26, 2004, 14:56:36.

R11 ... 0 0 0 0 1 0 1 0 | 0 0 0 0 0 0 1 0 = 0A02H
October 2002

R12 ... 0 0 0 0 1 1 1 0 | 0 0 0 1 1 0 1 0 = 0E1AH
14 hundred hours 26th day

R13 ... 0 0 1 0 0 1 0 0 | 0 0 1 1 1 0 0 0 = 2438H
36 seconds 56 minutes

(Note 1) The time is displayed with the 24-hour system.

(Note 2) The data and time are set with the [TIME] screen on the setting and display unit.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CNC SOFTWARE VERSION CODE		R16 to 9

[Function]

This indicates the CNC software version.

[Operation]

The version displayed at "MP" on the [Software Directory] screen is indicated.

```
[S/W MODULE TREE]      ALARM/DIAGN  8.1/2
MP BND -  1003W002 - A0A    SV1   BND-
OFFM
```

The file registers R16 to 19 are set to the following data.

(Example) BND-1003W002-A0A

(1) (2) (3)

Item		File register	Type	Example
(1)	Model function No.	R19	Binary	1003=03EBH
(2)	Serial No.	R18	Binary	002=0002H
(3)	Version	Bits F to 8 of R17	ASCII code	A=41H
		Bits 7 to 0 of R17	ASCII code	0=30H
		Bits F to 8 of R16	ASCII code (Note1)	A=41H
-	-	Bits 7 to 0 of R16	Always 20H (Note2)	

(Note 1) If the version is a 2-digit No., bits F to 8 of R16 are set to "20H".

(Note 2) Bits 7 to 0 on the R16 are always "20H".

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	REMOTE PROGRAM INPUT ERROR INFORMATION		R30

[Function][Operation]

Refer to the section on "Remote program input start" signal for the function and operation.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) In remote program input (X724)
(2) Remote program input completion (X725)
(3) Remote program input error (X726)
(4) Remote program input start (Y76C)
(5) Remote program input No. (R352,R353)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	BATTERY DROP CAUSE		R56

[Function]

This notifies a drop in the battery voltage.

[Operation]

A drop in voltage of the data storage battery located on the front door of the controller is checked when the power is turned ON. If the voltage is below the specified voltage (approx. 2.6V), the battery alarm (BATAL) signal turns ON, and bit 0 of this data is set to "1".

(Note) This data will not change until the battery voltage is recovered to a normal value.

[Related signals]

(1) Battery alarm (BATAL: X70F)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TEMPERATURE WARNING CAUSE		R57

[Function]

If the internal temperature of the control unit rises above 80°C, the overheat will be detected, and the following states will occur.

(1) The "Temperature rise" (SM16) is turned ON.
(2) The "Temperature warning cause" (R57) is turned ON.
(3) The alarm message (Z53) is displayed on the screen.

If the machine is in automatic operation, the operation will be continued, but restarting will not be possible after resetting or stopping with M02/M30. (Starting will be possible after block stop or feed hold.)

[Operation]

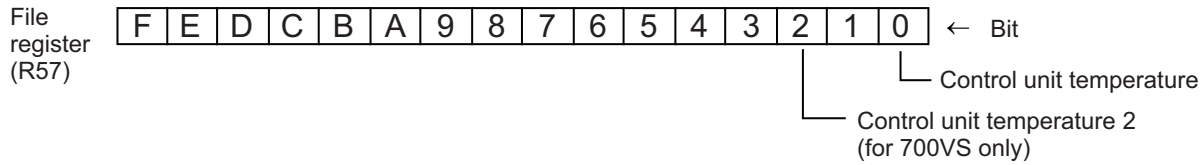
<The "Temperature warning cause" is turned ON when:>

- The internal temperature of the control unit rises above 80°C.

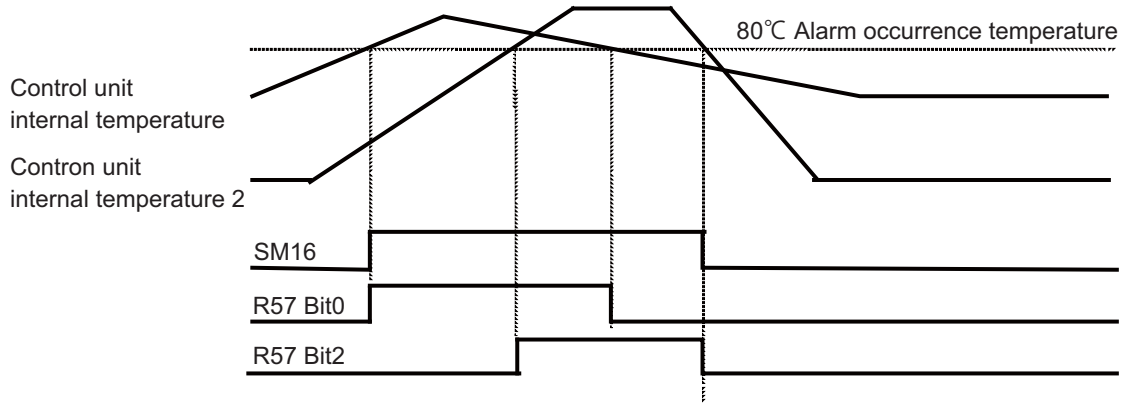
<The "Temperature warning cause" is turned OFF when:>

- The internal temperature of control unit drops below 80°C.

The "Temperature warning cause" is a bit unit signal.



<Operation example>



[Related signals]

(1) Temperature rise (SM16)
(2) Control unit temperature (R60)
(3) Control unit temperature 2 (R59)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CONTROL UNIT TEMPERATURE 2		R59

[Function]

This signal indicates the temperature in the control unit. Available only for 700VS Series.

[Operation]

This signal indicates the temperature in the control unit. The unit is "°C".

[Related signals]

(1) Temperature rise (SM16)
(2) Temperature warning cause (R57)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CONTROL UNIT TEMPERATURE		R60

[Function]

This signal indicates the temperature in the control unit.

[Operation]

This signal indicates the temperature in the control unit. The unit is "°C".

[Related signals]

(1) Temperature rise (SM16)

(2) Temperature warning cause (R57)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL ID COMMUNICATION ERROR INFORMATION		R62

[Function]

The error information at the transmission and reception with the tool ID controller is set.

[Operation]

Whether an error has occurred in finishing the transmission and reception with the tool ID controller (falling edge of X727) or not is set. "0" is set in normally ending, a code other than "0" is set when an error occurs.

The error information is cleared (set to "0") in starting the transmission and reception with the tool ID controller.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

(2) For details on error, refer to the table below.

Error code	Error details	Remedies
0	Normal	-
1	Host -> controller Flaming	Confirm whether the connection and setting are correct.
2	Host -> controller Parity error in one character	Confirm whether the connection and setting are correct.
3	Host -> controller Communication format error	Confirm whether the connection and setting are correct.
4	Host -> controller Check sum error	Confirm whether the connection and setting are correct.
5	Host designated writing to the protect area.	Confirm whether the connection and setting are correct.
6	ID label incompatible error	The tool No. of data to be written is different from the tool No. in the ID label. Confirm the data to be written and the tool. When the tool data is written newly, designate an unset tool.
7	Controller’s hardware error	The body of the tool ID may be damaged.
8	Reading error between controller and ID label	Confirm the distance between the ID antenna and the ID chip.
9	Writing error between controller and ID label	Confirm the distance between the ID antenna and the ID chip. If the distance has no problem, the verify error is occurring. Execute writing repeatedly until writing is executed normally.
10	Unformatted error	Execute the "#1060" (SETUP).
11	Tool position acquirement error	Confirm that the value designated in R336 is correct. Confirm that the designated tool No. exists.
12	No reply error	Confirm whether the connection and setting are correct. *1
13	No. of received characters over error	Confirm whether the connection and setting are correct. *1
14	Received character check sum error	Confirm whether the connection and setting are correct. *1
15	Sort executing error	Execute the writing operation at some intervals.
16	No. of tools over error	The No. of registered tools reaches the maximum value.
17	T4-digit designation error	Change the program T command to the T8-digit.
18	Tool No. duplication error	The same tool No. as the tool No. of the data to be read already exists in the NC. Confirm the data to be read and the tool.
19	Tool ID option invalid error	Validate the tool ID option.
20	Tool ID incompatible format error	After validating the tool ID option, execute the #1060 (SETUP).
-2	Channel duplication open error	Confirm whether the connection and setting are correct. *1
-4	Time out error	Confirm whether the connection and setting are correct. *1
-5	Physical error	Confirm whether the connection and setting are correct. *1
-7	Reset end error	Confirm whether the connection and setting are correct. *1
-10	Input/output device connection error	Confirm whether the connection is correct. *1
-15	Parity H error	Confirm whether the connection and setting are correct. *1
-16	Parity V error	Confirm whether the connection and setting are correct. *1
-17	Over run error	Confirm whether the connection and setting are correct. *1
-18	Code translation error 1	Confirm whether the connection and setting are correct. *1
-20	Code translation error 2	Confirm whether the connection and setting are correct. *1

*1: Retry first. If the same error occurs after retrying, confirm that the connection and setting are correct.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC MAIN SCAN TIME		R68

[Function]

Time taken for scanning in user PLC can be monitored.

[Operation]

Scanning time for user PLC main processing is continuously updated and set.

<File register contents and time calculation>

File register	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

Time calculation

$$\frac{\boxed{\text{Data}}}{256} \times 3.5\ (\text{ms})$$

(Example)

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0

$$\frac{\boxed{\text{Data}=208}}{256} \times 3.5\ (\text{ms})$$

(Note 1) For this data, mean scanning time is about 0.9sec.

(Note 2) I/O processing time for PLC control software (PLC BASIC) is included in this data processing time.

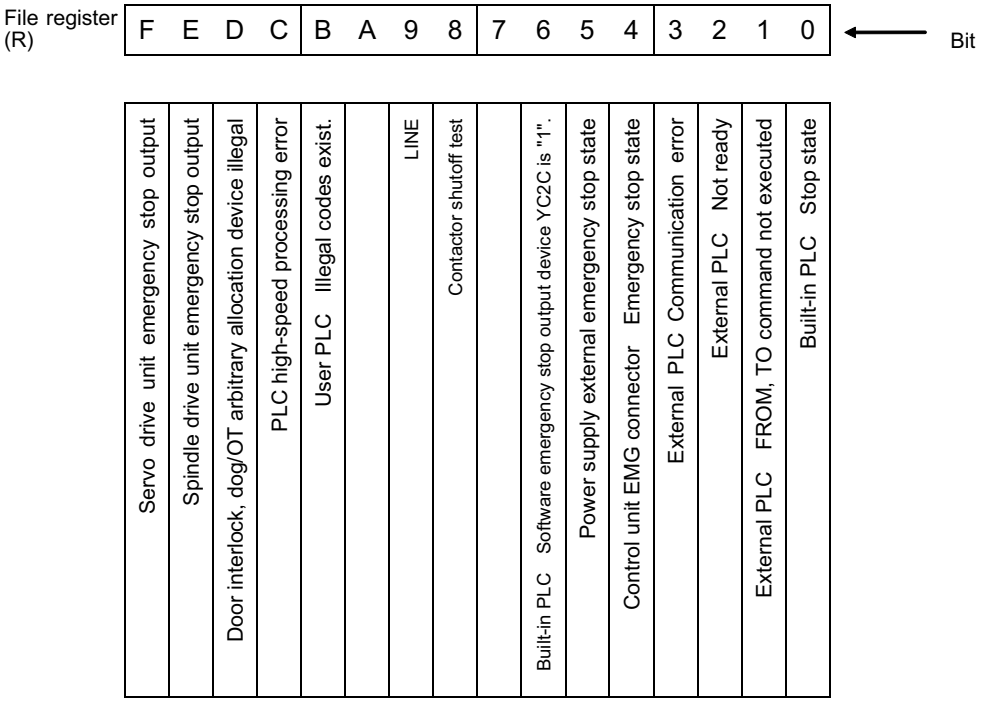
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	EMERGENCY STOP CAUSE		R69

[Function]

The causes of emergency stop are shown with bit correspondence.

[Operation]

The cause of the emergency stop state is shown as follows with bit correspondence.
If there are multiple causes, the multiple bits corresponding to each cause are output.
The bit of this signal that is set to "0" is the emergency stop cause.



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	DIO CARD INFORMATION		R70

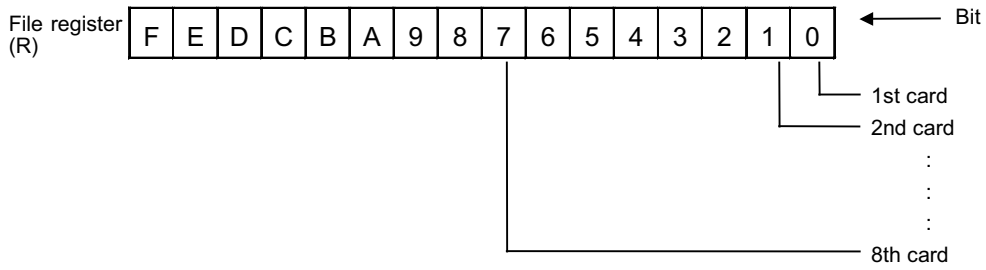
[Function]

The remote I/O unit connected to the controller can be found with the user PLC.

The user PLC finds the connection state of the remote I/O unit with this data.

[Operation]

(1) When a remote I/O card is connected "1" is set, and when not connected "0" is set. Note that for remote I/O unit, DX120/121 and DX140/141, two cards are used per unit, so the two bits corresponding to the connected unit will be set to "1".



(2) No. of cards mounted in remote I/O unit (DX***)

Unit	No. of cards
DX100/101	1 card
DX110/111,DX120/121,DX140/141	2 cards

(3) The position of the bit that turns ON depends on the rotary switch on the remote I/O unit.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	BALL SCREW THERMAL DISPLACEMENT COMPENSATION COMPENSATION AMOUNT n-TH AXIS		R72 to 5

[Function] [Operation]

Thermal expansion compensation amount for the current machine position is set by NC.

Refer to the section on "Ball screw thermal displacement compensation offset amount" (R400) for details.

Device No.	Signal name
R72	Ball screw thermal displacement compensation compensation amount 1st axis
R73	Ball screw thermal displacement compensation compensation amount 2nd axis
R74	Ball screw thermal displacement compensation compensation amount 3rd axis
R75	Ball screw thermal displacement compensation compensation amount 4th axis

[Related signals]

(1) Ball screw thermal displacement compensation offset amount n-th axis (R400)

(2) Ball screw thermal displacement compensation max. compensation amount n-th axis (R401)

(3) Ball screw thermal displacement compensation part system, axis No. n-th axis (R402)

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus/RTU RECEIVED PACKET MONITOR		R83

[Function]

This signal monitors the number of packets received from Modbus/RTU master station.

The communication cycle can be calculated from the count of received packets per unit time.

[Operation]

The number of packets is counted as the packet is received from each Modbus/RTU master station.

When the power is turned ON, it is initialized to "0".

It returns to "0" when counting from "65535".

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus/RTU COMMUNICA-TION ERROR MONITOR		R84

[Function]

This signal indicates the error state of Modbus/RTC communication.

[Operation]

If the Modbus/RTU communication error is detected, the error cord will be stored.

The error cord is overwritten when another error is detected so that it always stores the latest error code.

When the power is turned ON, it is initialized to "0".

Error code value	Error type	Error description
1	RS232C port in use	Other function is using the RS232C port.
3	Device preparation is incomplete	The other side's device is not ready.
4	Frame error	RS232C's frame is illegal.
6	Parity error	Parity is illegal.
9	Time-out error	Time-out error occurs.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus/TCP CONNECTION RE-QUEST MONITOR		R90

[Function]

This signal monitors the connection request from Modbus and TCP master station.

If an error, such as time-out, occurs and then reconnect, the count for the connection request increases.

Normally, the number of connected stations is counted.

[Operation]

Every time the connection is requested from Modbus/TCP master station, the count increases by one.

When the power is turned ON, it is initialized to "0".

It returns to "0" when counting from "65535".

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus/TCP NUMBER OF CONNECTIONS MONITOR		R91

[Function]

This signal monitors the number of connected Modbus/TCP master stations.

If it does not match with the number of master stations to connect, it checks the connection destinations.

When "0" is set, it means that no connected master station exists.

[Operation]

The count increases by one when the connection to Modbus/TCP master is established. When the connection is terminated, the count decreases by one.

When the power is turned ON, it is initialized to "0".

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus/TCP RECEIVED PACKET MONITOR		R92

[Function]

This signal monitors the number of packets received from Modbus/TCP master station.

The communication cycle can be calculated from the count of received packets per unit time.

[Operation]

The number of packets is counted as the packet is received from each Modbus/TCP master station.

The count increases by one every time 100 packets are received. It is commonly counted for each station.

When the power is turned ON, it is initialized to "0".

It returns to "0" when counting from "65535".

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus/TCP COMMUNICATION ERROR MONITOR		R93

[Function]

This signal indicates the error state during Modbus/TCP communication.

[Operation]

If an error is detected during Modbus/TCP communication, the error cord will be stored.

The error cord is overwritten when another error is detected so that it always stores the latest error code.

When the power is turned ON, it is initialized to "0".

Error code value	Error type	Error description
1	Socket open error	An error occured when connecting to Ethernet I/F.
2	bind error	An error occurred when allocating the address.
3	listen error	An error occurred during transition to the connection request acceptance state.
4	accept error	An error occurred when answering the connection request (server).
5	Data receive error	An error occurred while receiving data.
6	Number of data receive errors	The number of received data is illegal.
7	Number of data receive errors	An error occurred while sending data.
8	Number of concurrent connection over	Number of connection requests exceeded the concurrent connection limit.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus PROTCOL ERROR PACKET MONITOR		R94

[Function]

This signal monitors the Modbus protocol packet error.

This signal is used commonly for Modbus/TCP and Modbus/RTU.

[Operation]

An exceptional response is returned when an error occurred to the received Modbus packet. This signal stores the exceptional code of that time.

The error cord is overwritten when another error is detected so that it always stores the latest error code.

When the power is turned ON, it is initialized to "0".

Exceptional code	Name	Description
01	Illegal function	Illegal function code that is not supported.
02	Illegal data address	Specified data address does not exist in the slave.
03	Illegal data	Data is out of range or illegal value
04	Device access failed	Some failure occurred when accessing to the slave device.

[Caution]

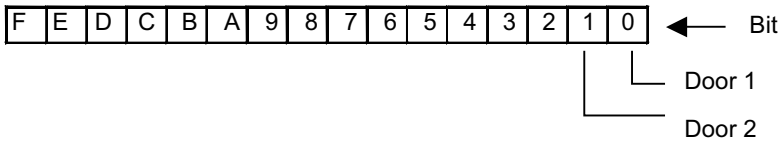
(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	SPEED MONITOR DOOR OPEN POSSIBLE	SMDOEN	R96

[Function]

This signal executes speed monitor function for the control axis for which a valid door No. is selected with parameter "#2118 SscDrSel" and the spindle for which a valid door No. is selected with parameter "#3071 SscDrSelSP". Then the signal notifies that the selected door can be opened.

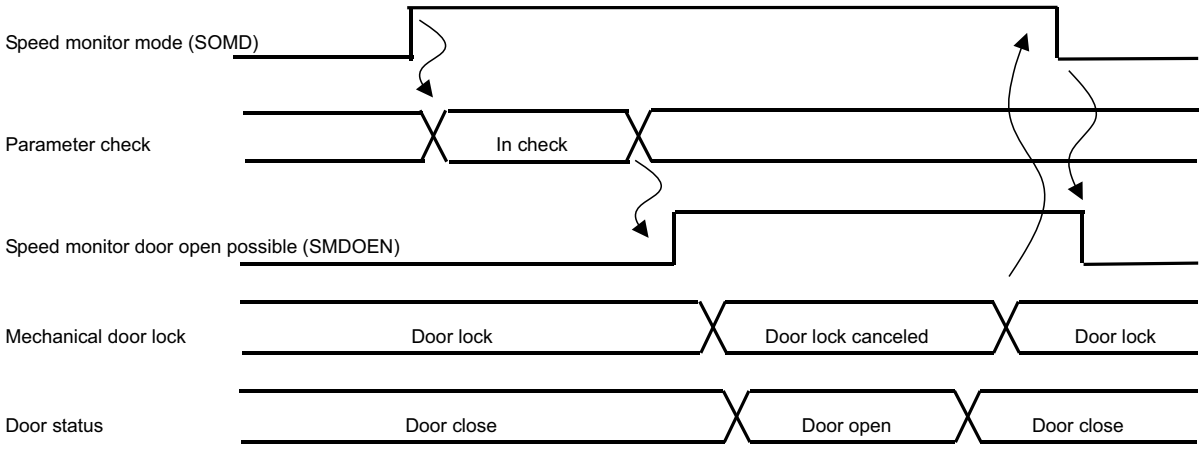
The door No. corresponds to the following bits.



[Operation]

When both NC and drive unit start the speed monitor function with the speed monitor mode turned ON and speed monitor parameter check completed, the speed monitor door open signal will turn ON.

When the speed monitor mode is OFF, the speed monitor door open possible signal is OFF as well.



[Caution]

When using the speed monitor function, create user PLC that enables door open when the speed monitor door open possible signal is ON.

[Related signals]

(1) Speed monitor mode (SOMD:R296)

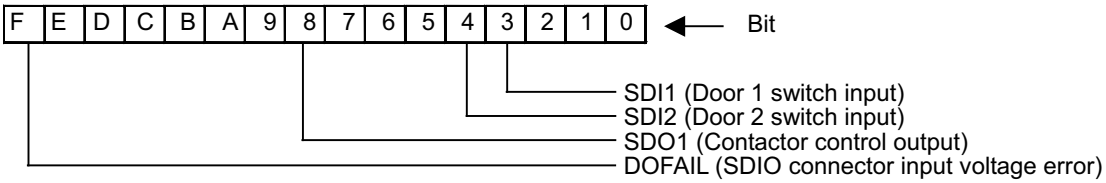
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	SAFETY OBSERVATION I/O SIGNAL STATUS	SODIO	R97

[Function]

This signal notifies I/O signal status of the SDIO connecter.

[Operation]

Each bit of the file register corresponds to the following signals. A signal bit where 24V is input in a signal pin turns ON.



[Caution]

(1) The safety observation input/output status changes only when the safety observation option is valid.

(2) This device is for monitoring. Inputting or outputting signals by setting register value is not possible.

(3) When DOFAIL (SDIO connector input voltage error) is ON, 24VDC power is not supplied to SDIO connector. If this signal is ON while using the safety observation function, "SDIO connector input voltage error" alarm occurs. In this case, "contactor control output" signal cannot be controlled, resulting in the "power supply instant stop" alarm. Check the wiring.(Only for M700 Series)

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	PLC AXIS ALARM/WARNING NO. N-TH AXIS		R168 to R173

[Function]

This signal indicates the alarm No./warning No. of the servo drive unit for PLC axis. (hexadecimal 2 digits)

This signal sets the 4-digit alarm No. which is displayed on the NC screen.

[Operation]

This signal is set up when the alarm/waring occurs in the servo drive unit for PLC axis.

This signal will be cleared when the alarm/warning is canceled.

This signal does not set if the servo warning "S52 Control axis detach warning 00E6" or "S52 In NC emergency stop state 00E7" occurs.

If more than one alarm/warning occurs, the value displayed in the [LED display] of [Drive motor]-[Servo unit] screen is set.

[Related signals]

(1) NC warning (servo warning) (XC9C)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE DATA 1		R504,5	R704,5	R904,5	R1104,5

[Function]

When M function is specified, value following address "M" can be identified. The M code data output from the controller is a max. 8-digit BCD code.

[Operation]

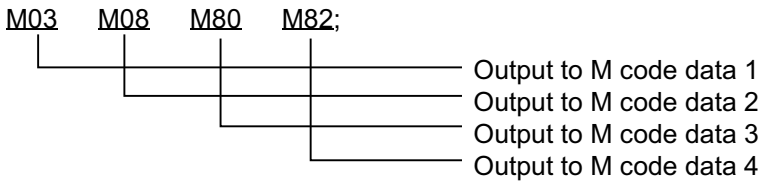
M code data are updated when:

(1) "M**" is issued in automatic operation (tape, memory or MDI).
(2) "M**" in fixed cycle causes motion during execution of the fixed cycle.
(3) "M**" is executed by manual numerical command input.

M code data is also updated when an "M code independent output" command is issued even during M function lock. The data is kept unchanged after "M function finish" signal (FIN1, FIN2) is sent back. "Reset" or "Emergency stop" does not clear the data.

[Caution]

(1) Commands can be defined up to four in a block with parameters. When plural M functions are placed in one block, the signals are output in the order at programming.



(2) M98 (read of subprogram), M99 (return to main program), etc. are processed within the CNC, and not output as M code data.

[Related signals]

(1) M function strobe (MFn: XC60)
(2) M code data 2, 3, 4 (R506 to 11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE DATA 2		R506,7	R706,7	R906,7	R1106,7

[Function]

When M function is specified, value following address "M" can be identified. The M code data output from the controller is a max. 8-digit BCD code.

[Operation]

M code data 2 are updated when:

(1) Two or more M functions are placed in one block in automatic operation (tape, memory or MDI).

For other details, refer to the section on "M CODE DATA 1"

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE DATA 3		R508,9	R708,9	R908,9	R1108,9

[Function]

When M function is specified, value following address "M" can be identified. The M code data output from the controller is BCD code.

[Operation]

M code data 3 are updated when:

(1) Three or more M functions are placed in one block in automatic operation (tape, memory or MDI).

For other details, refer to the section on "M CODE DATA 1".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE DATA 4		R510,1	R710,1	R910,1	R1110,1

[Function]

When M function is specified, value following address "M" can be identified. The M code data output from the controller is a max. 8-digit BCD code.

[Operation]

M code data 4 are updated when:

(1) Four or more M functions are placed in one block in automatic operation (tape, memory or MDI).

For other details, refer to the section on "M CODE DATA 1".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	S CODE DATA 1 to 4		R512 to 9	R712 to 9	R912 to 9	R1112 to 9

[Function]

When S function is specified, value following address "S" can be identified. Whether the S code (32-bit binary data) output from the controller is unsigned or not can be selected with parameter.

[Operation]

S code data (1 to 4) are updated when:

(1) "S**" is specified in automatic operation (tape, memory or MDI).

(2) "S**" is executed by manual numerical command input.

Data remain unchanged even when "M function finish" signal (FIN1 or FIN2) is sent back. "Reset" and "Emergency stop" does not clear this data.

The S code data is issued in the following manner.

Signal name	Register			
	$1	$2	$3	$4
S code data 1	R512,3	R712,3	R912,3	R1112,3
S code data 2	R514,5	R714,5	R914,5	R1114,5
S code data 3	R516,7	R716,7	R916,7	R1116,7
S code data 4	R518,9	R718,9	R918,9	R1118,9

[Caution]

(1) If two or more S codes for one spindle are issued in a block, the S code defined last will be valid.

[Related signals]

(1) S function strobe (SFn: XC64)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	T CODE DATA 1 to 4		R536 to 43	R736 to 43	R936 to 43	R1136 to 43

[Function]

When T function is specified, value following address "T" can be identified. The T code data output from the controller is a max. 8-digit BCD code.

[Operation]

T code data (1 to 4) are updated when:

(1) "T**" is specified in automatic operation (tape, memory or MDI).

(2) "T**" is executed by manual numerical command input.

Data remain unchanged even when "M function finish" signal (FIN1 or FIN2) is sent back. "Reset" and "Emergency stop" does not clear this data.

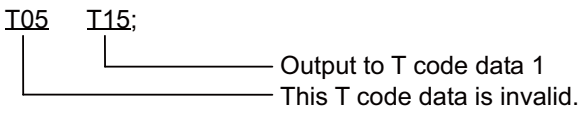
T code data is issued in the following manner.

Signal name	Register			
	$1	$2	$3	$4
T code data 1	R536,7	R736,7	R936,7	R1136,7
T code data 2	R538,9	R738,9	R938,9	R1138,9
T code data 3	R540,1	R740,1	R940,1	R1140,1
T code data 4	R542,3	R742,3	R942,3	R1142,3

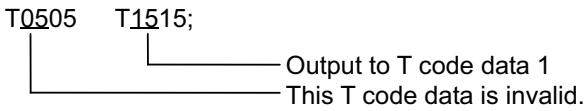
[Caution]

(1) Up to four T codes can be commanded in one block. The latter code will be valid if more than one code is commanded in one block.

[M system]



[L system]



[Related signals]

(1) Tool function strobe 1 (TF1: XC68)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND M FUNCTION DATA 1 to 4		R544 to 51	R744 to 51	R944 to 51	R1144 to 51

[Function]

When 2nd M function is specified, value following address "B" can be identified.
The 2nd M function data output from the controller is a max. 8-digit BCD code.
Signed binary data can also be output by setting "#1045 nskno".

(Note 1) Select an address for the 2nd M function address from the machine parameters basic specification parameter "#1170 M2name" A, B or C address that is not being used for "#1013 axname" or "#1014 incax".

[Operation]

2ND M FUNCTION DATA (1 to 4) are updated when:

(1) "B (A, C)**" is specified in automatic operation (tape, memory or MDI).

(2) "B (A, C)**" is executed by manual numerical command input.

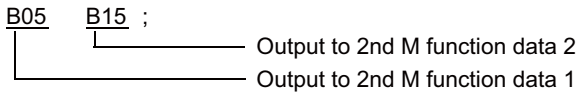
Data remain unchanged even when "M function finish" signal (FIN1 or FIN2) is sent back. "Reset" and "Emergency stop" does not clear this data.

2nd M function data is allocated as shown below.

Signal name	Register			
	$1	$2	$3	$4
2nd M function data 1	R544,5	R744,5	R944,5	R1144,5
2nd M function data 2	R546,7	R746,7	R946,7	R1146,7
2nd M function data 3	R548,9	R748,9	R948,9	R1148,9
2nd M function data 4	R550,1	R750,1	R950,1	R1150,1

[Caution]

(1) Up to four 2nd M functions can be commanded in one block. The latter code will be valid if more than five codes are commanded in one block.



[Related signals]

(1) 2nd M function strobe 1 (BF1: XC6C)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING ERROR NO.		R554	R754	R954	R1154

[Function]

This signal notifies the user PLC the alarm details when an alarm occurs during chopping operation.

[Operation]

Chopping error No. and the details are as shown below.

Error No.	Details	Classification
0	No error	-
1	Number of cycles for chopping is zero. (Operates when the number of cycles is 1)	A
2	(Chopping axis feedrate) > (Cutting feed clamp speed) (The feedrate is clamped at the cutting feed clamp speed.)	A
3	(Acceleration of chopping axis) > (Cutting feed clamp speed)/(Cutting feed time constant) (The acceleration is clamped at (Cutting feed clamp speed)/(Cutting feed time constant))	A
4	(Number of cycles for chopping) > (1056/min) (The number of cycles for chopping is clamped at 1056/min.)	A
5	Chopping axis zero point return is not completed.	B
6	Chopping override is zero.	B
7	Commanded axis is the chopping axis.	B
8	The bottom dead center point position is zero.	B
9	The chopping axis is a manual feed axis.	B
10	Interlock	B
11	Stored stroke limit or stroke end	B
20	There is no specification for chopping.	-
21	Chopping control data area exceeds the R register area designated for the chopping control data. Chopping control data area and compensation amount record area are overlapped. Compensation amount record area exceeds R register's backup area (R8300 to R9799). ((Rm+14 x N sets+4) > 9799)	C
22	Multiple chopping axes are specified by the PLC interface.	C
23	Chopping axis is not specified by either PLC interface or parameter.	C
24	Compensation method is set to other than 0/1.	C
25	The mode for the compensation value fixed method is set to other than 0(playback mode) or 1(record mode).	C
26	Data No. for the control data is a negative value.	C
27	Chopping axis's "#2081 chclsp" (Chopping clamp speed) and "#2002 clamp" (Cutting clamp speed) are both set to "0".	C
28	Chopping axis was changed during chopping operation. (Chopping axis cannot be changed during chopping.)	C
29	Rotary axis was specified as chopping axis.	C
30	Rapid traverse override valid/invalid is set to other than 0(invalid) or 1(valid).	A

Classification A:	The error is retained during chopping operation. The error is cleared at the rising edge of the chopping parameter valid signal after the chopping control data is corrected, or when the NC is reset.
Classification B:	The error is cleared after the alarm factor is removed, or when the NC is reset.
Classification C:	The error is cleared at the falling edge of the chopping parameter valid signal, or when the NC is reset.

[Related signals]

(1) Chopping signal (CHPS: YC30)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL MEASUREMENT STATUS		R555	R755	R955	R1155

[Function]

This signal indicates measurement status during measurement corresponding to bit.

[Operation]

Measurement status during manual measurement is indicated corresponding to bit.

This register value is displayed on the screen during manual measurement shown as below.

R555	Display	Meaning
bit0	On mea0	Status other than "On mea1 to 6".
bit1	On mea1	Status when a skip signal is input during manual measurement. It will shift to "On mea2" state after deceleration stop is confirmed.
bit2	On mea2	Status during the first retract operation. It will shift to "On mea3" state after completing retraction by the retract amount.
bit3	On mea3	Status in which retract has completed by the retract amount. If the skip signal is ON after confirming deceleration stop, a warning will appear, and status display will remain the same. It will shift to "On mea0" state by resetting.
bit4	On mea4	Status during the second measurement. If the skip signal is not input, even if moving to the designated position, a warning will appear, and status display will remain the same. It will shift to "On mea0" state by resetting.
bit5	On mea5	Status when a skip signal is input during the second measurement. It will shift to "On mea6" state after deceleration stop is confirmed.
bit6	On mea6	Status during the second retract operation. It will shift to "On mea0" state after completing retraction by the retract amount.

[Related signals]

(1) Tool length measurement 1 (TLM: YC20)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR WARNING AXIS		R564	R764	R964	R1164

[Function]

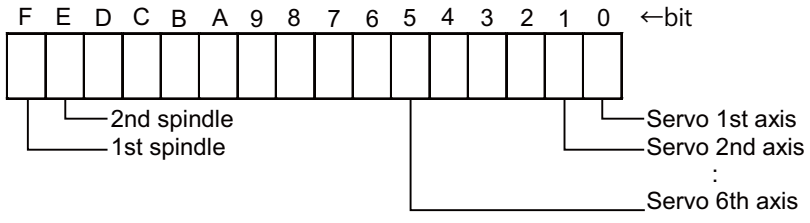
This signal indicates the axis for which a warning occurred during monitor operation.

[Operation]

The bit corresponding to the axis for which the effective load exceeded the warning value during monitor operation is set to "1".

This signal is reset when the alarm reset or warning reset signal is input.

This signal is also reset when the teaching/monitor execution signal is turned OFF.



[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)

(2) Load monitor Alarm axis, Data alarm information (R565, R566)

(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, warning reset (YCC3 to YCC7)

(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)

(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR ALARM AXIS		R565	R765	R965	R1165

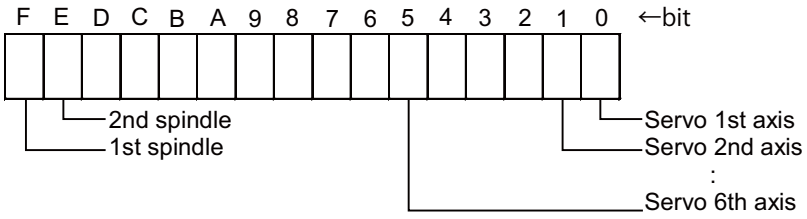
[Function]

This signal indicates the axis for which an alarm occurred during monitor operation.

[Operation]

The bit corresponding to the axis for which the effective load exceeded the alarm value during monitor operation is set to "1".

This signal is reset when the alarm reset signal is input.



[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)
(2) Load monitor Warning axis, Data alarm information (R564, R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR DATA ALARM INFORMATION		R566	R766	R966	R1166

[Function]

This signal indicates the error that occurred during teaching and monitor operation.

[Operation]

The corresponding bit shown below is set when an error occurs during teaching and monitor operation.

This signal is reset when the alarm reset signal is input.

Bit0: The teaching data designated during monitoring is not registered.
Bit1: The teaching data alarm value designated during monitoring is smaller than the warning value.
Bit2: The number of teaching data items has exceeded the registration capacity.
Bit3: The teaching data cannot be registered during teaching because there is no teaching time.
Bit8: The upper tolerable value is smaller than the lower tolerable value when executing adaptive control.
Bit9: The override maximum value is smaller than the override minimum value when executing adaptive control.
BitA: The adaptive control basic axis selection command is illegal.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)
(2) Load monitor Warning axis, Alarm axis (R564, R565)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	GROUP IN TOOL LIFE MANAGEMENT		R567	R767	R967	R1167

[Function][Operation]

This signal outputs group No. currently in life management with the tool life management II.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ADAPTIVE CONTROL OVERRIDE		R571	R771	R971	R1171

[Function]

The override controlled with adaptive control is output.

[Operation]

The override based on the results controlled with adaptive control is output.

100% is always output except during adaptive control.

Output unit: 1/100

(Example) "10000" is output for a 100% override.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Adaptive control in execution (XCA3)

(2) Adaptive control execution (YCC9)

(3) Adaptive control basic axis selection (R2583)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CNC COMPLETION STANDBY STATUS		R572	R772	R972	R1172

[Function]

The NC's operation state when the machine seems to be not operated in automatic operation without alarms occurring is output by the bit unit. The alarm messages can be displayed using this signal in the user PLC.

[Operation]

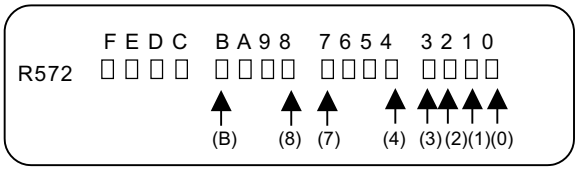
The corresponding bit below turns ON.

Bit0 :Complete standby status of M,S,T,B
Bit1 :In rapid traverse deceleration check
Bit2 :In cutting feed deceleration check
Bit3 :Waiting for spindle orientation complete
Bit4 :Waiting for spindle position loop
Bit7 :Door opened
Bit8 :In executing dwell
BitB :Waiting for unclamp signal

The right figure shows the bit correspondence.

Bit0 :Complete standby status of M,S,T,BBit1 :In rapid traverse deceleration checkBit2 :In cutting feed deceleration checkBit3 :Waiting for spindle orientation completeBit4 :Waiting for spindle position loopBit7 :Door openedBit8 :In executing dwellBitB :Waiting for unclamp signal

Bit0 :Complete standby status of M,S,T,BBit1 :In rapid traverse deceleration checkBit2 :In cutting feed deceleration checkBit3 :Waiting for spindle orientation completeBit4 :Waiting for spindle position loopBit7 :Door openedBit8 :In executing dwellBitB :Waiting for unclamp signal



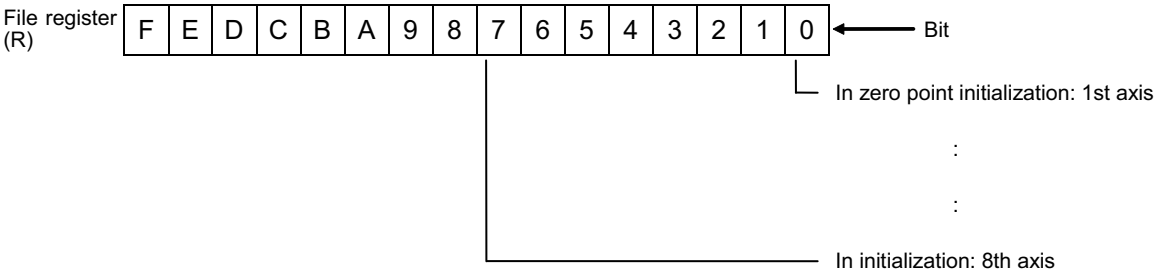
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	N INITIALIZATION		R574	R774	R974	R1174

[Function]

This signal is output when zero point initialization is being carried out in the absolute position detection system.

[Operation]

The axis for which "1" is set in #0 INIT. SET on the [ABS. POSITION SET] screen is set to "1", and is held until the power is turned OFF.The stored stroke limit and stroke end signals are invalid while this signal is set to "1", and the current limit during initialization is valid.This signal is also set to "1"
when the "Zero point initialization mode" (AZS1 to 8) signal is ON.



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	INITIALIZATION INCOMPLETION		R575	R775	R975	R1175

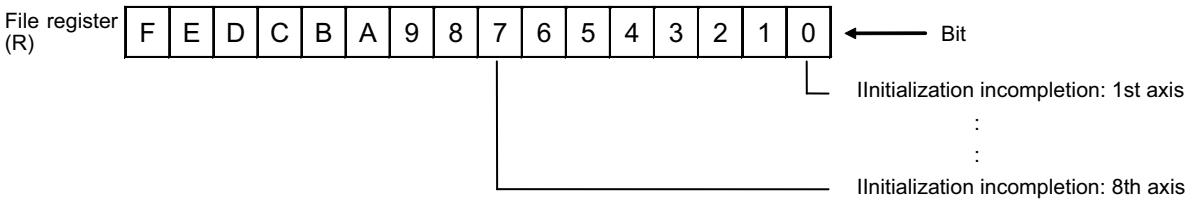
[Function]

This signal is output when the absolute position is not established in the absolute position detection system.

[Operation]

This signal indicates that the zero point initialization has not been established once or that the absolute position has been lost.

The stored stroke limit of the axis for which this signal is set to "1" in the absolute position detection system is invalid.



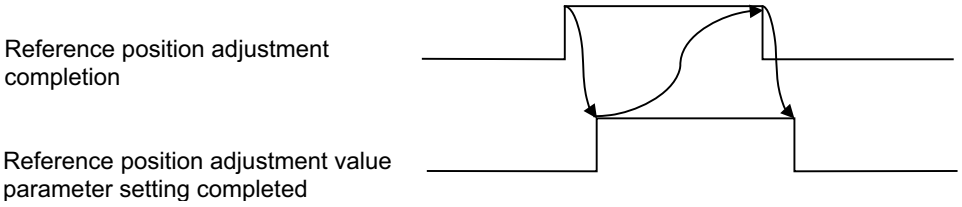
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION ADJUSTMENT VALUE PARAMETER SETTING COMPLETED		R576	R776	R976	R1176

[Function] [Operation]

NC receives the "Reference position adjustment completion" signal's ON from PLC. If the axis is controlled for the dog-type reference position return in the synchronization at zero point initialization ("#1493 ref_syn=1"), NC sets the reference position adjustment value to "#2036 slv_adjust" and then turns ON the bit corresponding to the master axis in the part system.

Turn OFF the "Reference position adjustment value completion" signal after this signal is ON.

NC turns this signal OFF when the "Reference position adjustment completion" signal is changed from ON to OFF.



[Caution]

Parameter screen is also available to change the reference position adjustment value (#2036 slv_adjust), which does not turn this signal ON.

[Related signals]

(1) Reference position adjustment completion (R2592)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NEAR REFERENCE POSITION (PERREFERENCE POSITION)		R580,1	R780,1	R980,1	R1180,1

[Function]

This signal indicates that the control axis is near the reference position when using the absolute position detection system.

This signal is output for the 1st reference position to the 4th reference position.

Near the 1st reference position, the time for outputting the signal is shorter than the "near reference position n-th axis (NRFn)" signal (the ON/OFF timing accuracy during axis movement is improved).

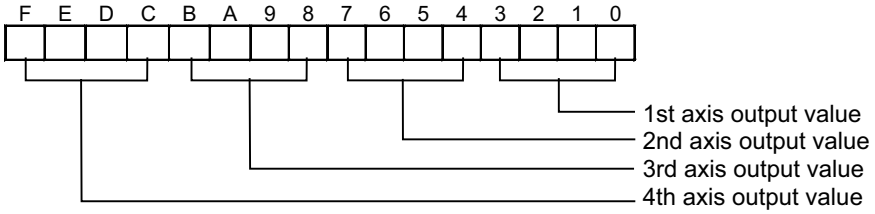
[Operation]

(1) Using the n-th reference position as a reference, when the control axis is in the range set with the parameters, this signal turns ON, and turns OFF when the axis is not within the range.

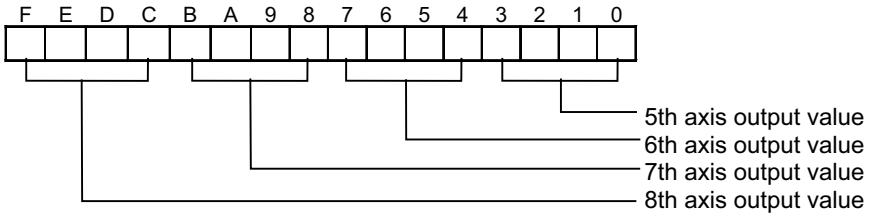
(2) The near reference position signal is output with four bits for each axis.

(a) R register and corresponding axes

R580



R581



(b) Output value and near n-th reference position

High-order bit	<---------->		Low-order bit	Near n-th reference position
0	0	0	1	Near 1st reference position
0	0	1	0	Near 2nd reference position
0	1	0	0	Near 3rd reference position
1	0	0	0	Near 4th reference position

(Note 1) The near reference position signal devices include X devices (NRF1 and following) which output signal only for the 1st reference position, and the R registers (R580/R581) which outputs a signal for each reference position (1st reference position to 4th reference position).

(Note 2) The near reference position signal output width is set with the absolute position parameters "#2057 nrefp" and "#2058 nrefn". The near reference position signal output width is the same width for the 1st reference position to the 4th reference position.

(Note 3) Near the 1st reference position, the signals are output to the conventional X device (NRF1 and following) and the R registers (R580/R581) which output signals to each reference position.

[Related signals]

(1) Near reference position n-th axis (NRF1 to 8: X880 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PRESETTER CONTACT		R582	R782	R982	R1182

[Function]

The axis movement direction at the moment when the "Skip" signal is entered is output in the tool presetter.

[Operation]

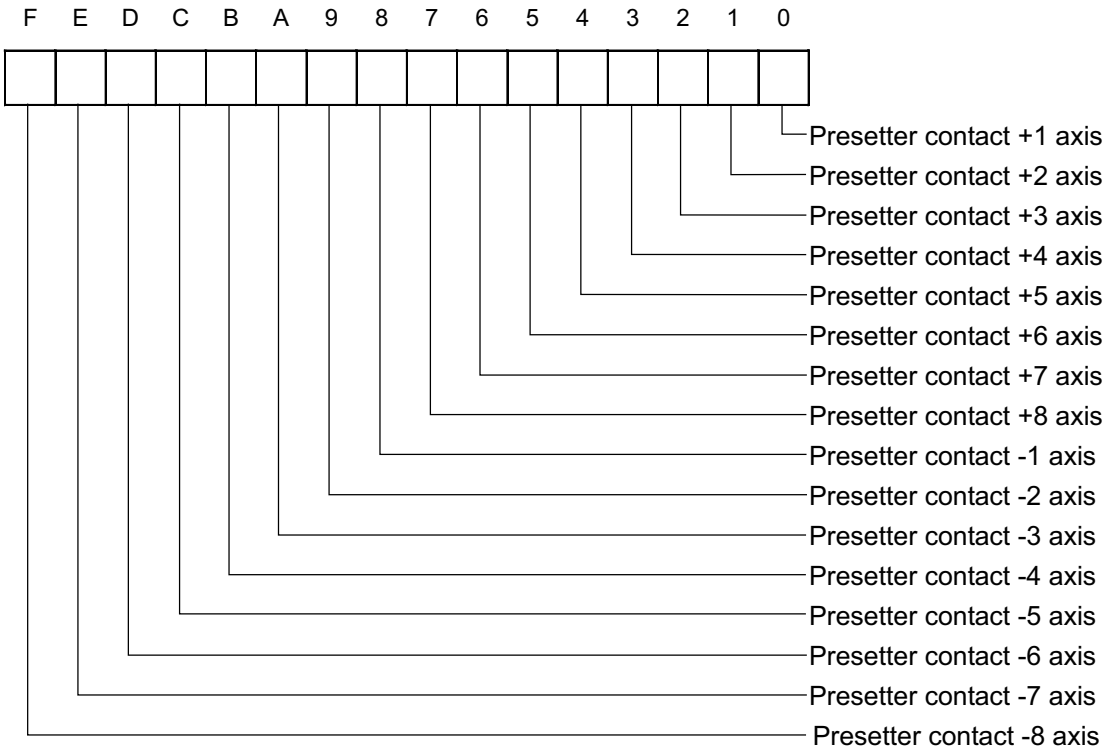
The axis movement direction at the moment when the tool contacts the sensor ("Skip" signal ON) during the tool measurement mode (TLMS ON) is set to the corresponding bit.

This signal is turned OFF by the sensor OFF.

This signal turns OFF when the "Tool measurement mode" signal is turned OFF.

This signal is not output when the tool measurement mode is not entered.

This signal is "0xFFFF" when an axis with no movement contacts the sensor.



1:Sensor ON

0:Sensor OFF or tool measurement mode OFF

[Related signals]

Tool length measurement 2 (TLMS: YC21)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PRESETTER INTERLOCK		R583	R783	R983	R1183

[Function]

The interlock direction in the CNC is output after the sensor is entered in the tool presetter.

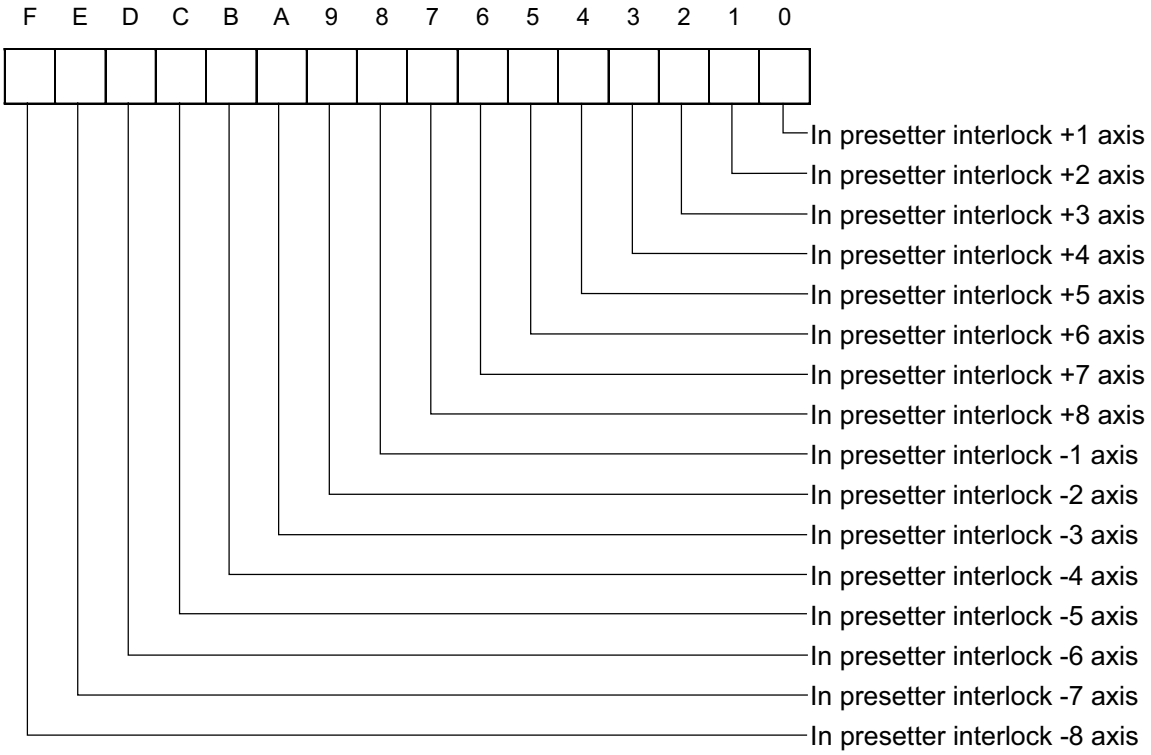
[Operation]

The interlock direction to the entrance direction in the CNC is output after the sensor is entered during the tool measurement mode (TLMS ON).

This signal is turned OFF when the escape operation completion conditions are satisfied.

This signal turns OFF when the "Tool measurement mode" signal is turned OFF.

This signal is not output when the tool measurement mode is not entered.



1:In interlock

0:Interlock cancel or tool measurement mode OFF

[Related signals]

(1) Tool length measurement 2 (TLMS: YC21)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR STATUS (1) to (10)		R596 to 605	R796 to 805	R996 to 1005	R1196 to 1205

[Function]

The status of teaching and monitor execution for the load monitor, and the previous status is output. (In the case of 1st part system)

R596		R597		R598		R599		R600	
Low-order	High-order	Low-order	High-order	Low-order	High-order	Low-order	High-order	Low-order	High-order
Current	Previous	Two times prior	Three times prior	Four times prior	Five times prior	Six times prior	Seven times prior	Eight times prior	Nine times prior

R601		R602		R603		R604		R605	
Low-order	High-order	Low-order	High-order	Low-order	High-order	Low-order	High-order	Low-order	High-order
Ten times prior	Eleven times prior	Twelve times prior	Thirteen times prior	Fourteen times prior	Fifteen times prior	Sixteen times prior	Seventeen times prior	Eighteen times prior	Nineteen times prior

[Operation]

The following values are output according to each status.

Output value	Status	Details
0 (00)	Teaching/monitor not executed	
13(0D)	Teaching	In sampling prohibit time
14(0E)		In no-load monitor time
15(0F)		Waiting for cutting start point detection
16(10)		Waiting for cutting start point detection after interruption
17(11)		In monitoring prohibit time
18(12)		Monitoring prohibit time end
19(13)		Monitoring prohibit time end after interruption
23(17)	Monitoring (adaptive control invalid)	In sampling prohibit time
24(18)		Waiting for cutting start point detection
25(19)		In monitoring prohibit time
26(1A)		In monitoring prohibit time after interruption
27(1B)		Monitoring prohibit time end
28(1C)		Monitoring prohibit time end after interruption
33(21)	Monitoring (adaptive control valid)	In sampling prohibit time
34(22)		Waiting for cutting start point detection
35(23)		In monitoring prohibit time
36(24)		In monitoring prohibit time after interruption
37(25)		Monitoring prohibit time end
38(26)		Monitoring prohibit time end after interruption

(Note 1) The values shown in parentheses in the Output value field are hexadecimal notations.

(Note 2) "Interruption" refers to when teaching/monitoring is interrupted for rapid traverse during teaching/monitoring.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)

(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)

(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, warning reset (YCC3 to YCC7)

(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NO. OF WORK MACHINING (current value)		R606,7	R806,7	R1006,7	R1206,7
A	NO. OF WORKS MACHINING (maximum value)		R608,9	R808,9	R1008,9	R1208,9

[Function]

The No. of work machining current value and maximum value are notified by the controller to the PLC.

[Operation]

If data is set in the No. of work machining (WRK COUNT M) and work machining maximum value (WRK LIMIT) of the [Process parameters], the current value or maximum value of the No. of work machining is output.

(For 1st part system)

R606	No. of work machining	Low-order side
R607	Current value	High-order side

R608	No. of work machining	Low-order side
R609	Maximum value	High-order side

(Note 1) If data is not set in "WRK COUNT M" and "WRK LIMIT" on the [Process Parameter] screen, data will not be output to the file register.

(Note 2) If the No. of work machining matches or exceeds maximum value, the No. of work machining over signal (XCA6) turns ON.

<Counting of No. of work machining using user PLC>

(1) Set "0" in "WRK COUNT M" on the [Process Parameter] screen. With this setting, the controller side will not count up.

(2) Add "1" to R606, 7 with the user PLC

(3) The controller will display R606, 7 as the No. of work machining on the [COORDINATE] screen. Even in this case, if the No. of work machining matches or exceeds the work maximum value, the No. of work machining over signal (XCA6) will turn ON.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL LIFE USAGE DATA		R628,9	R828,9	R1028,9	R1228,9

[Function][Operation]

This signal output usage data of tools currently being used with the tool life management II. (When multiple compensation Nos. are used, the total usage data per compensation No. is output.)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	NUMBER OF REGISTERED TOOL LIFE CONTROL TOOLS		R630	R830	R1030	R1230

[Function] [Operation]

This signal indicates number of tools currently in life management.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE CURRENT POSITION X		R636,7	R836,7	R1036,7	R1236,7
A	CIRCULAR FEED IN MANUAL MODE CURRENT POSITION Y		R640,1	R840,1	R1040,1	R1240,1

[Function]

The current positions of X' and Y' axes on the hypothetical coordinate are set when the circular feed in manual mode is valid.

[Operation]

The current positions of X' and Y' axes on the hypothetical coordinate are set while the "Circular feed in manual mode valid" signal is ON.

In the "circular-linear" mode, the current position of X' on the hypothetical coordinate is set by the angle (0.000° to 360.000°) from the basic point.

The hypothetical coordinate value to be set is in the following state.

"Linear-linear" hypothetical coordinate	Y' axis: mirror image is not valid
"Circular-linear" hypothetical coordinate	X' axis: "+" indicates the inverse (CW) direction Y' axis: mirror image is not valid

[Caution]

(1) This data is valid only when the "Circular feed in manual mode being valid" signal is ON. If the signal is OFF, the current position data is uncertain (the value is not ensured).
(2) The current positions are output with "0.5*PLC setting unit".
(3) When "1" is set to the parameter "#1040 M_inch", this data is output by inch.

[Related signals]

(1) In circular feed in manual mode (XC4F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MACHINE POSITION n-TH AXIS		R4500,1 to R4528,9	R4532,3 to R4560,1	R4564,5 to R4592,3	R4596,7 to R4624,5

[Function]

This signal outputs the position (n-th axis) on the machine coordinate system by the PLC setting unit.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	FEEDBACK MACHINE POSITION n-TH AXIS		R4628,9 to R4656,7	R4660,1 to R4688,9	R4692,3 to R4720,1	R4724,5 to R4552,3

[Function]

This signal outputs motor feedback position (n-th axis) on the machine coordinate system by the PLC setting unit.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SERVO DEFLECTION AMOUNT n-TH AXIS		R4756 to 71	R4772 to 87	R4788 to 803	R4804 to 19

[Function]

The deflection amount of the servo n-th axis is output always in the command unit.

[Operation]

Servo 1st part system 1st axis: R4756 (LOW) R4757 (HIGH)
:
Servo 1st part system 8th axis: R4770 (LOW) R4771 (HIGH)
Servo 2nd part system 1st axis: R4772 (LOW) R4773 (HIGH)
:
Servo 2nd part system 8th axis: R4786 (LOW) R4787 (HIGH)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MOTOR ROTATION SPEED n-TH AXIS		R4820,1 to R4834,5	R4836,7 to R4850,1	R4852,3 to R4866,7	R4868,9 to R4882,3

[Function]

This signal outputs motor rotation speed (n-th axis) with r/min.

[Operation]

The motor rotation speed is assigned as below.

Signal name	File register			
	$1	$2	$3	$4
Motor rotation speed 1st axis	R4820,1	R4836,7	R4852,3	R4868,9
Motor rotation speed 2nd axis	R4822,3	R4838,9	R4854,5	R4870,1
Motor rotation speed 3rd axis	R4824,5	R4840,1	R4856,7	R4872,3
Motor rotation speed 4th axis	R4826,7	R4842,3	R4858,9	R4874,5
Motor rotation speed 5th axis	R4828,9	R4844,5	R4860,1	R4876,7
Motor rotation speed 6th axis	R4830,1	R4846,7	R4862,3	R4878,9
Motor rotation speed 7th axis	R4832,3	R4848,9	R4864,5	R4880,1
Motor rotation speed 8th axis	R4834,5	R4850,1	R4866,7	R4882,3

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MOTOR LOAD CURRENT n-TH AXIS		R4884,5 to R4898,9	R4900,1 to R4914,5	R4916,7 to R4930,1	R4932,3 to R4946,7

[Function]

This signal outputs motor load current (n-th axis) with continuous current (%) during stalling.

[Operation]

The motor load current is assigned as below.

Signal name	File register			
	$1	$2	$3	$4
Motor load current 1st axis	R4884,5	R4900,1	R4916,7	R4932,3
Motor load current 2nd axis	R4886,7	R4902,3	R4918,9	R4934,5
Motor load current 3rd axis	R4888,9	R4904,5	R4920,1	R4936,7
Motor load current 4th axis	R4890,1	R4906,7	R4922,3	R4938,9
Motor load current 5th axis	R4892,3	R4908,9	R4924,5	R4940,1
Motor load current 6th axis	R4894,5	R4910,1	R4926,7	R4942,3
Motor load current 7th axis	R4896,7	R4912,3	R4928,9	R4944,5
Motor load current 8th axis	R4898,9	R4914,5	R4930,1	R4946,7

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SKIP COORDINATE POSITION n-TH AXIS		R4948,9 to R4976,7	R4980,1 to R5008,9	R5012,3 to R5040,1	R5044,5 to R5072,3

[Function]

This signal outputs skip coordinate position Y (n-th axis) with PLC setting unit.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SYNCHRONOUS ERROR AMOUNT n-TH AXIS		R5076,7 to R5090,1	R5092,3 to R5106,7	R5108,9 to R5122,3	R5124,5 to R5138,9

[Function]

The synchronization error amount during the synchronous control is output. (Unit: command unit)

[Operation]

The synchronization error amount between the basic axis and synchronous axis during the synchronous control is output to the synchronous axis.

(The axis Nos. are not for each part system, but for the entire system.)

Synchronization error amount	R register	Synchronization error amount	R register
1st axis	R5076(L)/R5077(H)	8th axis	R5090(L)/R5091(H)
2nd axis	R5078(L)/R5079(H)	9th axis	R5092(L)/R5093(H)
3rd axis	R5080(L)/R5081(H)	10th axis	R5094(L)/R5095(H)
4th axis	R5082(L)/R5083(H)	11th axis	R5096(L)/R5097(H)
5th axis	R5084(L)/R5085(H)	12th axis	R5098(L)/R5099(H)
6th axis	R5086(L)/R5087(H)	13th axis	R5100(L)/R5101(H)
7th axis	R5088(L)/R5089(H)	14th axis	R5102(L)/R5103(H)

[Related signals]

(1) Synchronous control request (SYNC1 to 8: YA80 to 7)

(2) Superimposition control request (PILE1 to 8: YAA0 to 7)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	SERVO ALARM/WARNING NO.		R5332 to R5339	R5340 to R5347	R5348 to R5355	R5356 to R5363

[Function]

This signal indicates the alarm No./warning No. of servo drive unit. (hexadecimal 2 digits)

This signal sets the 4-digit alarm No. which is displayed on the NC screen.

[Operation]

This signal is set up when the alarm/waring occurs in the servo drive unit.

This signal will be cleared when the alarm/warning is canceled.

This signal is not set if the servo warning "S52 Control axis detach warning 00E6" or "S52 In NC emergency stop state 00E7" occurs.

If more than one alarm/warning occurs, the value displayed in the [LED display] of [Drive motor]-[Servo unit] screen is set.

[Related signals]

(1) NC warning (servo warning) (XC9C)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	SKIP COORDINATE POSITION N-TH AXIS FEATURE COORDINATE		R5364,5 to R5392,3	R5396,7 to R5424,5	R5428,9 to R5456,7	R5460,1 to R5488,9

[Function]

This signal outputs skip coordinate position (n-th axis) by the PLC setting unit.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO OUTPUT #1132 (NC -> PLC)		R6372,3	R6380,1	R6388,9	R6396,7

[Function]

This is interface function used to coordinate user PLC to user macro.

[Operation]

When a value is set in the system variables #1100 to #1131 or #1132 with the user macro system, the user PLC output to the file register Rn and Rn+1 corresponding to the user PLC can be referred to with that value.

The relationship between system variable and file register is as follows:

System variable	Points	Interface output signal	System variable	Points	Interface output signal
#1100	1	Register R6372 bit 0	#1116	1	Register R6373 bit 0
#1101	1	Register R6372 bit 1	#1117	1	Register R6373 bit 1
#1102	1	Register R6372 bit 2	#1118	1	Register R6373 bit 2
#1103	1	Register R6372 bit 3	#1119	1	Register R6373 bit 3
#1104	1	Register R6372 bit 4	#1120	1	Register R6373 bit 4
#1105	1	Register R6372 bit 5	#1121	1	Register R6373 bit 5
#1106	1	Register R6372 bit 6	#1122	1	Register R6373 bit 6
#1107	1	Register R6372 bit 7	#1123	1	Register R6373 bit 7
#1108	1	Register R6372 bit 8	#1124	1	Register R6373 bit 8
#1109	1	Register R6372 bit 9	#1125	1	Register R6373 bit 9
#1110	1	Register R6372 bit 10	#1126	1	Register R6373 bit 10
#1111	1	Register R6372 bit 11	#1127	1	Register R6373 bit 11
#1112	1	Register R6372 bit 12	#1128	1	Register R6373 bit 12
#1113	1	Register R6372 bit 13	#1129	1	Register R6373 bit 13
#1114	1	Register R6372 bit 14	#1130	1	Register R6373 bit 14
#1115	1	Register R6372 bit 15	#1131	1	Register R6373 bit 15

System variable	Points	Interface output signal
#1132	32	Register R6372, R6373
#1133	32	Register R6374, R6375
#1134	32	Register R6376, R6377
#1135	32	Register R6378, R6379

This correspondence table shows the example for file registers R6372 and R6373.

File registers R6372 and R6373 correspond to system variables #1100 to #1131, and #1132 (32-bit data).

To use the R register of the 2nd and subsequent part system, set "1" to "#1230 set02/bit7".

[Related signals]

(1) User macro output #1133, #1134, #1135 (R6374/6375, R6376/6377, R6378/6379)

(2) User macro input #1032, #1033, #1034, #1035 (R6436/6437, R6438/6439, R6440/6441, R6442/66443)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO OUTPUT #1133 (NC -> PLC)		R6374,5	R6382,3	R6390,1	R6398,9

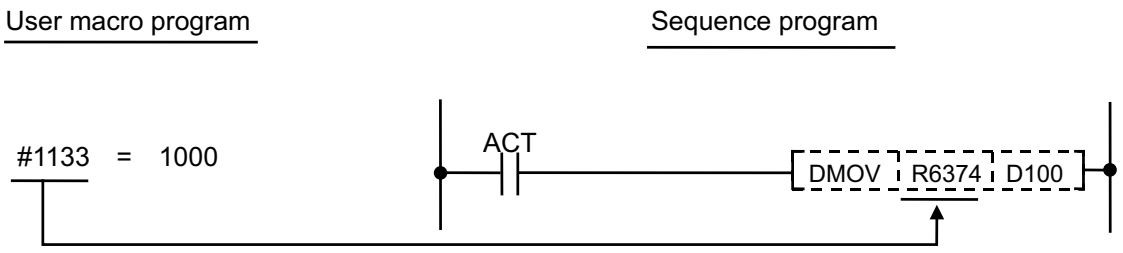
[Function]

This provides interface function used to coordinate user PLC to user macro.

[Operation]

When a value is set in the system variable #1133 with the user macro system, the user PLC output to the file register Rn and Rn+1 corresponding to the user PLC can be referred to with that value.

(Example)



1000 is input in D100 and 101 when the ACT signal turns ON.

[Related signals]

(1) User macro output #1132, #1134, #1135, #1100 to #1131 (R6372/6373, R6376/6377, R6378/6379)

(2) User macro input #1032, #1033, #1034, #1035, #1000 to #1031 (R6436/6437, R6438/6439, R6440/6441, R6442/66443)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO OUTPUT #1134 (NC -> PLC)		R6376,7	R6384,5	R6392,3	R6400,1

[Function][Operation]

The function operation, etc. are the same as those of "USER MACRO OUTPUT #1133".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO OUTPUT #1135 (NC -> PLC)		R6378,9	R6386,7	R6394,5	R6402,3

[Function][Operation]

The function operation, etc. are the same as those of "USER MACRO OUTPUT #1133".

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE COMMAND ROTATION SPEED INPUT		R6500,1	R6550,1	R6600,1	R6650,1	R6700,1	R6750,1

[Function]

This signal informs that spindle speed reference signal (S) specified in automatic operation (memory, MDI or tape) or by manual numerical data input. "Spindle command rotation input" speed output from the controller is binary data. Under the S command mode, the data can be monitored in the "S display" on the command value screen.

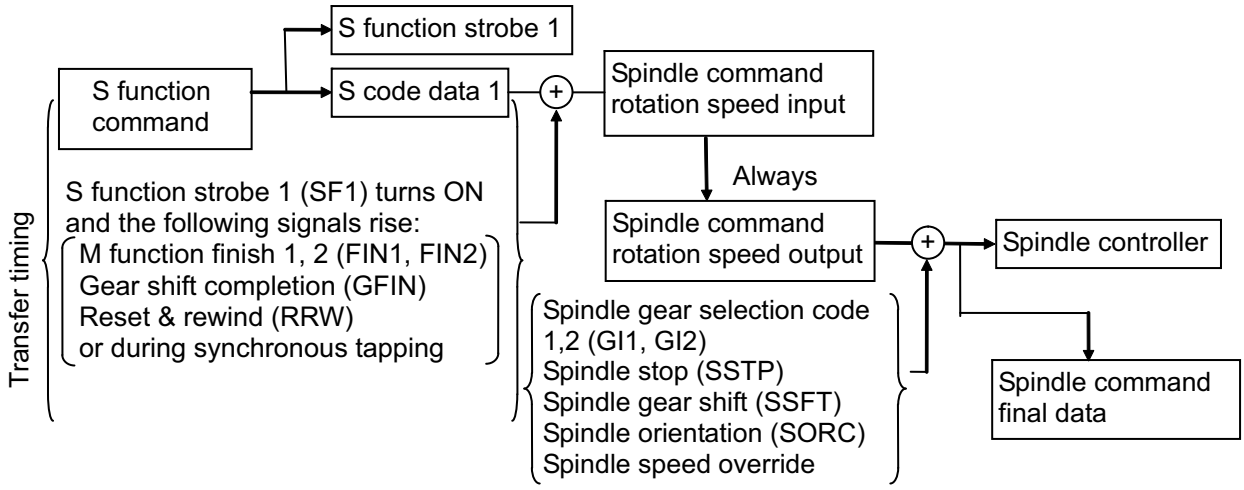
[Operation]

Set "Spindle command rotation speed input" is renewed when:

(1) "S**" is specified in automatic operation (memory, MDI or tape) and "M function finish 1 or 2" signal (FIN1 or FIN2) or "Gear shift completion" signal (GFIN) is sent back to the controller.

(2) "S**" is specified by manual numerical command input and "M function finish 1 or 2" signal (FIN1 or FIN2) or "Gear shift completion" signal (GFIN) is sent back to the controller.

(Note 1) Data cannot be cleared by "Reset" or "Emergency stop".



When the system is under constant surface speed control, constant surface speed data is set for "Spindle command rotation speed input".

(Note 2) "Spindle command rotation speed input" directly denotes spindle speed (r/min) specified as S function command.

[Related signals]

(1) Spindle speed command rotation output (R7000, 1)

(2) Spindle command final data (R6502, 3)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE COMMAND FINAL DATA (rotation speed)		R6502,3	R6552,3	R6602,3	R6652,3	R6702,3	R6752,3

[Function]

The command value is indicated to the spindle controller.

[Operation]

The "Spindle command rotation speed input" indicates the value for the spindle function (S) data commanded with the automatic operation or manual numeric value command, whereas this data indicates a value to which the "Spindle override", "Spindle gear selection code 1,2" (GI1, GI2), "Spindle stop" (SSTP), "Spindle gear shift" (SSFT) and "Spindle orientation" (SORC) conditions have been considered.

[Related signals]

(1) Spindle command rotation speed input (R6500, 1)

(2) Spindle command rotation speed output (R7000, 1)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE ACTUAL SPEED		R6506,7	R6556,7	R6606,7	R6656,7	R6706,7	R6756,7

[Function]

When the system has spindle equipped with encoder, actual spindle speed can be monitored.

[Operation]

True spindle speed is always set by feedback signal from spindle encoder.

Data are multiplied by 1000, and stored.

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE SYNCHRONIZATION PHASE ERROR/HOB AXIS DELAY ANGLE		R6516

[Function]

The synchronous spindle delay to the basic spindle is output in the spindle synchronous function.

The delay of the workpiece axis to the hob axis is output in the tool spindle synchronization II (Hobbing).

The 1st spindle signal is normally used.

[Operation]

The synchronous spindle delay to the basic spindle is output.

Unit: 360 /4096The delay of the workpiece axis to the hob axis is output in the tool spindle synchronization II (Hobbing).

(Note 1) If the phase can not be calculated because, for instance, the basic spindle or synchronous spindle (hob axis or workpiece axis) has not passed the Z-phase, "-1" will be output.

(Note 2) This data is output only during the phase shift calculation or the spindle phase synchronization.

[Related signals]

(1) Phase shift calculation request (SSPHM: Y18B3)

(2) Phase offset request (SSPHF: Y18B4)

(3) Spindle synchronization phase offset data (R6518)

(4) Spindle synchronization Maximum phase error/Maximum hob axis delay angle (R6517)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE SYNCHRONIZATION MAXIMUM PHASE ERROR /MAXIMUM HOB AXIS DELAY ANGLE		R6517

[Function]

In spindle synchronization, the maximum value of the phase error between the basic spindle and the synchronous spindle is output.

In tool spindle synchronization II (Hobbing), when the hob axis and work axis rotate in synchronization, the maximum delay (advance) of the hob axis from the commanded position is output by angle.

[Operation]

In spindle synchronization, the maximum value of the "Spindle synchronization phase error" (R6516) is output.

In the tool spindle synchronization II (Hobbing), when the hob axis and work axis rotate in synchronization, the maximum delay (advance) of the hob axis from the commanded position is output by angle.

The maximum value output is retained until the next spindle synchronization / tool spindle synchronization II turns ON or until the power turns OFF.

[Related signals]

(1) Hob axis delay excess (PHOVR: X18B3)

(2) Spindle synchronization phase error/Hob axis delay angle (R6516)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE OFFSET DATA		R6518	R6568	R6618	R6668	R6718	R6768

[Function]

With the spindle phase shift amount calculation function, the phase error of the basic spindle and synchronous spindle is obtained and memorized by turning the PLC signal ON at executing the spindle synchronization. The synchronous spindle can be rotated with the handle during the spindle phase shift calculation, so the phase relation between two spindles can be adjusted by seeing.

If the "Spindle phase synchronous control" (SPPHS) signal is input while the "Phase offset request" signal (SSPHF) is ON, the phase error will be aligned based on the position shifted by the memorized phase shift amount.

Such operation makes the phase alignment easy when clamping an irregular material over.

[Operation]

The phase error memorized by the phase shift calculation is output.

Unit: 360 /4096

(Note 1) This data is output only during the spindle synchronous control.

[Related signals]

(1) Spindle phase synchronization (SPPHS: Y18B1)
(2) Phase shift calculation request (SSPHM: Y18B3)
(3) Phase offset request (SSPHF: Y18B4)
(4) Spindle synchronization phase error/Hob axis delay angle (R6516)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE ERROR MONITOR		R6519	R6569	R6619	R6669	R6719	R6769

[Function]

The phase error during the spindle phase synchronous state can be monitored.

[Operation]

The phase error during the spindle phase synchronous control is output by the pulse unit.

[Related signals]

(1) Spindle synchronization phase error monitor (lower limit) (R6520)
(2) Spindle synchronization phase error monitor (upper limit) (R6521)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE ERROR MONITOR (lower limit)		R6520	R6570	R6620	R6670	R6720	R6770

[Function]

The phase error during the spindle phase synchronous state can be monitored.

[Operation]

The lower limit value of the phase error during the spindle phase synchronous control is output by the pulse unit.

[Related signals]

(1) Spindle synchronization phase error monitor (R6519)
(2) Spindle synchronization phase error monitor (upper limit) (R6521)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE ERROR MONITOR (upper limit)		R6521	R6571	R6621	R6671	R6721	R6771

[Function]

The phase error during the spindle phase synchronous state can be monitored.

[Operation]

The upper limit value of the phase error during the spindle phase synchronous control is output by the pulse unit.

[Related signals]

(1) Spindle synchronization phase error monitor (R6519)

(2) Spindle synchronization phase error monitor (lower limit) (R6520)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE ERROR 1		R6522	R6572	R6622	R6672	R6722	R6772

[Function]

(1) During spindle synchronous function (G114.1)
This signal informs the phase error (value including the phase error memorized with the spindle synchronization phase shift calculation function) when the phase synchronization (with R command) or the "Phase shift calculation request" signal (SSPHM) is ON. The phase error is output by 1 increment.

(2) During phase synchronization of polygon machining between spindles (G114.2)
This signal informs the phase error corresponding to the commanded phase shift amounts by 1 increment.

The data has no meaning in cases other than above.

[Operation]

(1) During spindle synchronous function (G114.1)
When the phase synchronization (with R command) or the "Phase shift calculation request" signal (SSPHM) is ON, and when the speeds of the basic spindle and the synchronous spindle are constant, the phase error between the basic spindle and the synchronous spindle is output.

(2) During phase synchronization of polygon machining between spindles (G114.2)
This signal informs the phase error corresponding to the commanded phase shift amounts by 1 increment.

[Related signals]

(1) Phase shift calculation request (SSPHM: Y18B3)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE ERROR 2		R6523	R6573	R6623	R6673	R6723	R6773

[Function]

(1) During spindle synchronous function (G114.1)
This signal informs the phase error (value excluding the phase error memorized with the spindle synchronization phase shift calculation function) when the phase synchronization (with R command) or the "Phase shift calculation request" signal (SSPHM) is ON. The phase error is output by 1 increment.

(2) During phase synchronization of polygon machining between spindles (G114.2)
This signal informs the phase error corresponding to the commanded phase shift amounts by 1 increment. (Same as R6522.)

The data has no meaning in cases other than above.

[Operation]

(1) During spindle synchronous function (G114.1)
When the phase synchronization (with R command) or the "Phase shift calculation request" signal (SSPHM) is ON, and when the speeds of the basic spindle and the synchronous spindle are constant, the phase error between the basic spindle and the synchronous spindle is output.

(2) During phase synchronization of polygon machining between spindles (G114.2)
This signal informs the phase error corresponding to the commanded phase shift amounts by 1 increment. (Same as R6522.)

[Related signals]

(1) Phase shift calculation request (SSPHM: Y18B3)

Con-tact	Signal name	Signal ab-breviation	1st SP	2nd SP	3rd SP	4th SP	5th SP	6th SP
A	SPINDLE ALARM/WARNING NO.		R6529	R6579	R6629	R6679	R6729	R6779

[Function]

This signal indicates the alarm No./warning No. of spindle drive unit. (hexadecimal 2 digits)
This signal sets the 4-digit alarm No. which is displayed on the NC screen.

[Operation]

This signal is set up when the alarm/waring occurs in the spindle drive unit.
This signal will be cleared when the alarm/warning is canceled.
This signal is not set if the servo warning "S52 Control axis detach warning 00E6" or "S52 In NC emergency stop state 00E7" occurs.
If more than one alarm/warning occurs, the value displayed in the [LED display] of [Drive motor]-[Spindle unit] screen is set.

[Related signals]

(1) NC warning (servo warning) (XC9C)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SYNCHRONOUS TAPPING CURRENT ERROR WIDTH		R6532,3	R6582,3	R6632,3	R6682,3	R6732,3	R6782,3

[Function] [Operation]

The current value of the synchronous tapping error width (motor tracking delay from each position commands on the spindle and the tapping axis) is output during the synchronous tapping.

Positive output value means that the tapping axis is delayed, while negative output value means that the spindle is delayed. The output range is -99999.999 to 99999.999mm.

[Caution]

(1) The synchronous tapping error is not output during the spindle orientation or the R point positioning.
(2) The current value is kept retrieved during the synchronous tapping.
(3) If the synchronous tapping error is over the output range, the maximum value of the range is output.
(4) Execute the synchronous tap R-point in-position check before using this signal. Unless the synchronous tap R-point in-position check is executed, an illegal value of the synchronous tapping error may be detected.

[Related signals]

(1) Synchronous tapping Maximum error width (R6534, 6535)
(2) Synchronous tapping Current error angle (R6536, 6537)
(3) Synchronous tapping Maximum error angle (R6538, 6539)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SYNCHRONOUS TAPPING MAXIMUM ERROR WIDTH		R6534,5	R6584,5	R6634,5	R6684,5	R6734,5	R6784,5

[Function] [Operation]

The largest absolute value of the synchronous tapping error width (-99999.999 to 99999.999mm) is output during the synchronous tapping.

The value is initialized to "0" when the synchronous tapping starts or the power turns ON again.

[Caution]

(1) The synchronous tapping error is not output during the spindle orientation or the R point positioning.
(2) This output value is the largest one throughout the synchronous tapping mode.
(3) If the synchronous tapping error is over the output range, the maximum value of the range is output.
(4) Execute the synchronous tap R-point in-position check before using this signal. Unless the synchronous tap R-point in-position check is executed, an illegal value of the synchronous tapping error may be detected.

[Related signals]

(1) Synchronous tapping Current error width (R6532, 6533)
(2) Synchronous tapping Current error angle (R6536, 6537)
(3) Synchronous tapping Maximum error angle (R6538, 6539)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SYNCHRONOUS TAPPING CURRENT ERROR ANGLE		R6536,7	R6586,7	R6636,7	R6686,7	R6736,7	R6786,7

[Function] [Operation]

The synchronous tapping error (motor tracking delay from each position commands on the spindle and the tapping axis) is output with angle during the synchronous tapping.

Positive output value means that the tapping axis is delayed, while negative output value means that the spindle is delayed. The output range is -99999.999 to 99,999.999°.

[Caution]

(1) The synchronous tapping error is not output during the spindle orientation or the R point positioning.
(2) The current value is kept retrieved during the synchronous tapping.
(3) If the synchronous tapping error is over the output range, the maximum value of the range is output.
(4) Execute the synchronous tap R-point in-position check before using this signal. Unless the synchronous tap R-point in-position check is executed, an illegal value of the synchronous tapping error may be detected.

[Related signals]

(1) Synchronous tapping Current error width (R6532, 6533)
(2) Synchronous tapping Maximum error width (R6534, 6535)
(3) Synchronous tapping Maximum error angle (R6538, 6539)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SYNCHRONOUS TAPPING MAXIMUM ERROR ANGLE		R6538,9	R6588,9	R6638,9	R6688,9	R6738,9	R6788,9

[Function][Operation]

The largest absolute value of the synchronous tapping error angle (-99999.999 to 99,999.999°) is output during the synchronous tapping.

The value is initialized to "0" when the synchronous tapping starts or the power turns ON again. The value is kept retrieved and displayed during the synchronous tapping.

[Caution]

(1) The synchronous tapping error is not output during the spindle orientation or the R point positioning.
(2) This output value is the largest one throughout the synchronous tapping mode.
(3) If the synchronous tapping error is over the output range, the maximum value of the range is output.
(4) Execute the synchronous tap R-point in-position check before using this signal. Unless the synchronous tap R-point in-position check is executed, an illegal value of the synchronous tapping error may be detected.

[Related signals]

(1) Synchronous tapping Current error width (R6532, 6533)
(2) Synchronous tapping Maximum error width (R6534, 6535)
(3) Synchronous tapping Current error angle (R6536, 6537)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 4	AUXST4	R8000	R8006	R8012	R8018	R8024	R8030

Con-tact	Signal name	Signal abbreviation	bit
A	Position switch 1 to 15	PSW1 to PSW15	AUXST4/bit0 to 7 AUXST3/bit9 to F

[Function][Operation]

This signal turns ON when the axis is within the setting range of the respective position switches.

Con-tact	Signal name	Signal abbreviation	bit
A	Start not possible	NST	AUXST4/bitB

[Function][Operation]

This signal turns ON when the Operation start signal is turned ON for non PLC indexing axis.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 3	AUXST3	R8001	R8007	R8013	R8019	R8025	R8031

Contact	Signal name	Signal abbreviation	bit
A	Station position 1 to 256	STO1 to STO256	AUXST3/bit0 to 8

[Function][Operation]

This signal shows a 9-digit binary No. of the present station.

This signal outputs the station position when Set position reached (JST) is ON, "0" when Set position reached is OFF.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 2	AUXST2	R8002	R8008	R8014	R8020	R8026	R8032

Contact	Signal name	Signal abbreviation	bit
A	In automatic operation mode	AUTO	AUXST2/bit0

[Function][Operation]

This signal indicates that the automatic operation mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In manual operation mode	MANO	AUXST2/bit1

[Function][Operation]

This signal indicates that the manual operation mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In JOG operation mode	JO	AUXST2/bit2

[Function][Operation]

This signal indicates that the JOG operation mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In reference position return	ARNN	AUXST2/bit3

[Function][Operation]

This signal indicates that the machine is in the reference position return.

Contact	Signal name	Signal abbreviation	bit
A	In reference position return mode	ZRNO	AUXST2/bit4

[Function][Operation]

This signal indicates that the reference position return mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In basic point initialization setting mode	AZSO	AUXST2/bit6

[Function][Operation]

This signal indicates that the basic point initialization setting mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In incremental mode	SO	AUXST2/bit7

[Function][Operation]

This signal indicates that the incremental mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	Alarm 1	AL1	AUXST2/bit8

[Function][Operation]

This signal indicates that an alarm has occurred requiring the power to be turned ON again after the cause is removed.

Contact	Signal name	Signal abbreviation	bit
A	Alarm 2	AL2	AUXST2/bit9

[Function][Operation]

This signal indicates that an alarm has occurred which can be released by the Master reset (MRST) signal after the cause is removed.

Contact	Signal name	Signal abbreviation	bit
A	Alarm 4	AL4	AUXST2/bitA

[Function][Operation]

This signal indicates that an operation alarm or absolute position alarm has occurred.

Contact	Signal name	Signal abbreviation	bit
A	Absolute position power shutoff movement over	ABS	AUXST2/bitC

[Function][Operation]

This signal indicates that the axis moved beyond the tolerable amount while the control power was OFF in the absolute position system.

Contact	Signal name	Signal abbreviation	bit
A	Absolute position data loss	ZSN	AUXST2/bitD

[Function][Operation]

This signal indicates that the absolute position data has been lost in the absolute position system.

Contact	Signal name	Signal abbreviation	bit
A	Initialization setting completed	ZSF	AUXST2/bitE

[Function][Operation]

This signal indicates that in the absolute position system the basic point initialization setting has completed normally, and that the absolute position coordinates have been established.

Contact	Signal name	Signal abbreviation	bit
A	Initialization setting error completed	ZSE	AUXST2/bitF

[Function][Operation]

This signal indicates that the basic point initialization setting has not finished normally in the absolute position system.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 1	AUXST1	R8003	R8009	R8015	R8021	R8027	R8033

Contact	Signal name	Signal abbreviation	bit
A	Servo ready	RDY	AUXST1/bit0

[Function]

This signal indicates that the servo system is in an operable status.

[Operation]

This signal turns ON when:

(1) The servo system diagnosis is normally completed after turning the power ON.
(2) The servo alarm, which had occurred, has been released by Master reset (MRST).
(3) The emergency stop has been released.
(4) Ready OFF (RDF) or Servo OFF (SVF) has been released.

This signal turns OFF when:

(1) Servo ready completion (SA) is turned OFF.
(2) The Servo OFF signal is input and the drive unit is in a servo OFF state.

[Related signals]

(1) Master reset (MRST: AUXCM1/bit3)
(2) Ready OFF (RDF: AUXCM1/bit6)
(3) Servo OFF (SVF: AUXCM1/bit0)
(4) Servo ready completion (SA: AUXST1/bitC)

Contact	Signal name	Signal abbreviation	bit
A	In-position	INP	AUXST1/bit1

[Function]

This signal notifies that the control axis is in-position.

[Operation]

This signal turns ON when:

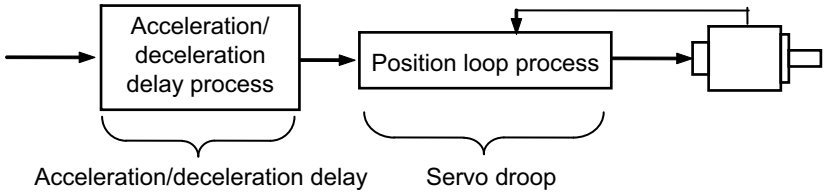
(1) Smoothing zero (SMZ) is turned ON and the droop is within the range set in the parameters.

This signal turns OFF when:

(1) Smoothing zero (SMZ) is turned OFF. (When there is a movement command.)
(2) The droop exceeds the range set in the parameters.

[Caution]

(1) In-position (INP) may turn ON, even during movement, when the axis is moving at extremely low speeds.
(2) The in-position detection range is set in the parameter "#2224 SV024 In-position detection width".
(3) In the servo ready OFF state, Smoothing zero (SMZ) turns OFF when the travel amount of servomotor is detected. Therefore, In-position (INP) also turns OFF. In axis plus motion (MVP) or In axis minus motion (MVN) turns ON depending on the detected movement direction. Note that Smoothing zero (SMZ), In axis plus motion (MVP) and In axis minus motion (MVN) will not change in the servo OFF state without error correction, because detected servomotor travel amount becomes a droop amount.



[Related signals]

(1) Smoothing zero (SMZ: AUXST1/bit2)

Contact	Signal name	Signal abbreviation	bit
A	Smoothing zero	SMZ	AUXST1/bit2

[Function][Operation]

This signal indicates that the acceleration/deceleration process in the built-in controller is finished, and that no command to the control section remains.

Contact	Signal name	Signal abbreviation	bit
A	Axis selection output	AX1	AUXST1/bit3

[Function]

This signal indicates that the control axis has received the movement command.

[Operation]

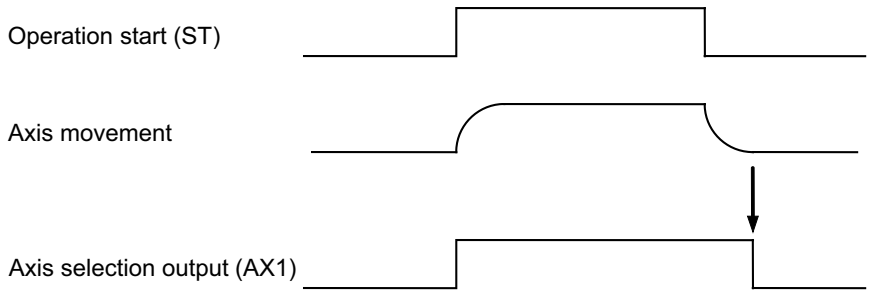
This signal turns ON in the following cases, and turns OFF after Smoothing zero (SMZ) is detected.

(1) In automatic operation mode
This signal turns ON while Operation start (ST) is ON and the axis is moving.

(2) In manual operation mode
This signal turns ON while Operation start (ST) is ON and the axis is moving.

(3) In JOG operation mode
This signal turns ON while Operation start (ST) is ON and the axis is moving.

(4) In reference poisition return mode
This signal turns ON while Operation start (ST) is ON and the axis is moving.
When an interlock is applied, this signal remains ON even when the servo is OFF. This signal turns OFF atthe emergency stop.



[Related signals]

(1) Operation start (ST: AUXCM2/bit0)

Contact	Signal name	Signal abbreviation	bit
A	In axis plus motion	MVP	AUXST1/bit4

[Function]

This signal indicates that the axis is moving in the (+) direction.

[Operation]

This signal turns ON when the axis starts moving in the (+) direction, turns OFF after Smoothing zero (SMZ) is detected or the axis starts moving in the (-) direction.

[Related signals]

(1) Smoothing zero (SMZ: AUXST1/bit2)

Con-tact	Signal name	Signal ab-breviation	bit
A	In axis minus motion	MVM	AUXST1/bit5

[Function]

This signal indicates that the axis is moving in the (-) direction.

[Operation]

This signal turns ON when the axis starts moving in the (-) direction, turns OFF after Smoothing zero (SMZ) is detected or the axis starts moving in the (+) direction.

[Related signals]

(1) Smoothing zero (SMZ: AUXST1/bit2)

Con-tact	Signal name	Signal ab-breviation	bit
A	In torque limit	TLQ	AUXST1/bit6

[Function][Operation]

This signal indicates that the control axis is at the current limit value. This signal turns ON when the motor output torque (motor current) is limited at the torque limit value of the selected operation parameter group.

Con-tact	Signal name	Signal ab-breviation	bit
A	Reference position reached	ZP	AUXST1/bit8

[Function]

Thsi signal indicates that the control axis is on the reference position.

[Operation]

This signal turns ON when the reference position is reached in the reference position return mode.

If the reference position is reached in other operation modes or by other commands, the signal will not turn ON.

This signal turns OFF when:

(1) The axis is moved by a travel command, etc.

(2) An emergency stop has been activated due to an emergency stop input or a servo alarm occurrence, etc.

(3) The axis has moved in the servo OFF state.

[Related signals]

(1) Reference position return mode (ZRN: AUXCM1/bitB)

Con-tact	Signal name	Signal ab-breviation	bit
A	In reset	RST	AUXST1/bit9

[Function]

This signal indicates that the built-in controller is being reset.

[Operation]

The signal turns ON when:

(1) Master reset (MRST) is turned ON.

(2) Master reset (MRST) is turned ON and the built-in controller is being reset.

(3) In an emergency stop status.

[Related signals]

(1) Master reset (MRST: AUXCM1/bit3)

Con-tact	Signal name	Signal ab-breviation	bit
A	In handle feed operation mode	HO	AUXST1/bitA

[Function][Operation]

This signal indicates that handle feed operation mode is selected.

Con-tact	Signal name	Signal ab-breviation	bit
A	Controller ready completion	MA	AUXST1/bitB

[Function]

This signal indicates that the controller is in a status to carry out normal operation.

[Operation]

This signal turns ON when:

(1) Normal operation has begun after the power ON.

This signal turns OFF when:

(1) The power is turned OFF.

(2) An error with the controller, such as CPU error or memory error, has been detected.

(3) A servo error, which cannot be released unless the controller is first turned OFF, has occurred.

Con-tact	Signal name	Signal ab-breviation	bit
A	Servo ready completion	SA	AUXST1/bitC

[Function]

This signal indicates that the servo system is ready for normal operation. In other words, the servo system (position control) is not working when the signal is OFF.

[Operation]

The signal turns ON when:

(1) The servo system diagnosis is normally completed after the power ON.

(2) The servo alarm, which had occurred, has been released by Master reset (MRST).

(3) The emergency stop has been released.

(4) Ready OFF (RDF) is turned ON.

This signal turns OFF when:

(1) Controller ready completion (MA) is turned OFF.

(2) A servo alarm has occurred.

(3) Emergency stop is issued.

(4) Ready OFF (RDF) is turned OFF.

[Caution]

(1) With Servo OFF (SVF), Servo ready completion (SA) will not turn OFF as long as there are no separate conditions for turning the SA OFF.

(2) In an emergency stop status, all I/O output points will turn OFF.

[Related signals]

(1) Master reset (MRST: AUXCM1/bit3)

(2) Ready OFF (RDF: AUXCM1/bit6)

(3) Controller ready completion (MA: AUXST1/bitB)

Con-tact	Signal name	Signal ab-breviation	bit
A	Automatic set position reached	JSTA	AUXST1/bitD

[Function]

In the automatic operation, this signal notifies that the positioning to the commanded station No. is completed. The tolerable ON width is as same as that of Set position reached (JST).

[Operation]

The signal turns ON when:

(1) The positioning to the designated station No. is completed in the automatic operation mode. The signal actually turns ON before the positioning is completed, when the tolerable width is entered.

The signal turns OFF when:

(1) When the Operation start signal is input in any of the operation modes.
(2) When the axis deviates outside the tolerable width.

[Caution]

(1) In automatic operation, this signal does not turn ON when positioning to the nearest station is carried out by the Operation start signal OFF.
(2) When this signal is ON, it does not turn OFF if the same station No. index is started.
(3) When the positioning to the station is completed in manual mode and the same station No. index is started, this signal turns ON. However, there is no movement.
(4) Once turned OFF, this signal does not turn ON again even if the axis returns within the tolerable width.
(5) During the emergency stop or the servo OFF, the axis movement, once deviated outside the output width of Set position reached, returns within the tolerable width, turns this signal ON again if "#12802 aux_Cont1/bit4" is OFF; does not turn it ON if "#12802 aux_Cont1/bit4" is ON.

Con-tact	Signal name	Signal ab-breviation	bit
A	Set position reached	JST	AUXST1/bitE

[Function]

This signal notifies that the positioning to the station position has been completed. It is ON when the machine position is at any of the station positions. The tolerable ON width is set with a parameter.

[Operation]

The signal turns ON when:

(1) The positioning to the station is completed in automatic or manual operation. The signal actually turns ON before the positioning is completed, when the tolerable width is entered.
(2) The stop position after JOG operation is the station position or within the tolerable width.
(3) The reference position return position corresponds to those of the stop position in (2).

Other than the above conditions, this signal normally monitors the machine position, and carries out comparisons between stations. Therefore, this signal is output even when the machine moves to a station position outside the operation.

The signal turns OFF when:

(1) The Operation start signal is input in any of the operation modes. When the operation is started by the Operation start signal, this signal will not turn ON, even when a station position is passed during operation.
(2) The axis deviates outside the tolerable width.

Con-tact	Signal name	Signal ab-breviation	bit
A	Near set position	NEAR	AUXST1/bitF

[Function]

This signal notifies that the machine position is near the station.

[Operation]

It operates in the same manner as the Set position reached (JST), but the tolerable width is set with a different parameter. The tolerable width is generally set larger than that of Set position reached. This signal is generally used at the mechanical clamp or the like just before the completion of the positioning.

Con-tact	Signal name	Signal ab-breviation	1st SP	2nd SP	3rd SP	4th SP
A	OPTIMUM ACCELERATION/DE-CELERATION ESTIMATED INERTIA LEVEL N-TH AXIS	SPEST1 to 4	R8290	R8291	R8292	R8293

[Function]

This signal outputs the estimated inertia level that is stored by inertia teaching.

[Operation]

- The output range for the estimated inertia level is from 0 to 3.
  - 0: Standard (standard inertial mass)
  - 1: Level 1 (medium inertial mass)
  - 2: Level 2 (big inertial mass)
  - 3: Level 3 (huge inertial mass)
- The estimated inertia level is kept even the power is turned OFF.
- "0: Standard" is applied for the spindle whose inertial level is not estimated.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	RIOn NO. OF ERROR OCCURRENCES n-TH CH		R10000 to 23

[Function]

Counts communication errors occurred between control unit and remote I/O unit (channel) and outputs.

[Operation]

R register's high-order 8 bits output the number of CRC error occurrences (highest value), and the low-order 8 bits output the number of connection error occurrences (highest value).

R register allocations are as shown below.

Remote I/O unit connection system	1st ch	2nd ch	3rd ch	4th ch	5th ch	6th ch	7th ch	8th ch
RIO1	R10000	R10001	R10002	R10003	R10004	R10005	R10006	R10007
RIO2	R10008	R10009	R10010	R10011	R10012	R10013	R10014	R10015
RIO3	R10016	R10017	R10018	R10019	R10020	R10021	R10022	R10023

[Caution]

(1) Control unit cannot identify the remote I/O unit with no power cable or communication cable connected, or with no power supplied. Therefore, issuance of remote I/O error will not be carried out even if a malfunction exists in those remote I/O units.

(2) Performance check for the physically existed remote I/O unit can be done, using either "Connection status output" or "No. of error occurrences output".

(3) Once the number of error occurrences exceeds 255, a remote I/O error occurs and "Error occurrences output" is clamped to 255.

(4) "No. of error occurrences output" is saved in full when rebooting.
However, when the value exceeds the specified value to lead a remote I/O error, the data of the channel is cleared.

[Related signals]

(1) Connection status of each channel RIO1,2 (R10064)

(2) Connection status of each channel RIO3 (R10065)

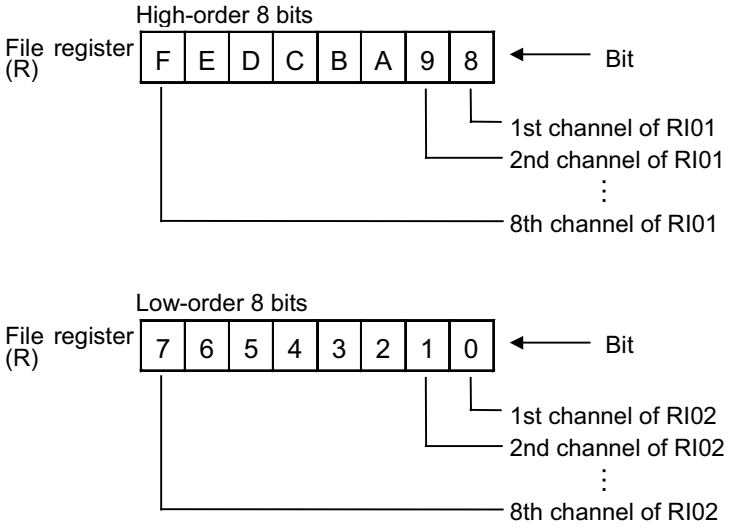
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CONNECTION STATUS OF EACH CHANNEL RIO1,2		R10064

[Function]

Connection status of remote I/O unit channel 1 & 2 is constantly output to R register.

[Operation]

When remote I/O unit is connected, "1" is set; when not connected, "0" is set.R register's high-order 8 bits output the connection status of each channel within RI01, and the lower 8 bits output the connection status of each channel within RI02.



[Caution]

(1) Control unit cannot identify the remote I/O unit with no power cable or communication cable connected, or with no power supplied. Therefore, the "Connection status output" for those remote I/O units is "0".

(2) Performance check for the physically existed remote I/O unit can be done, using either "Connection status output" or "No. of error occurrences output".

[Related signals]

(1) Connection status of each channel RIO3 (R10065)

(2) No. of error occurrences (R10000 to 23)

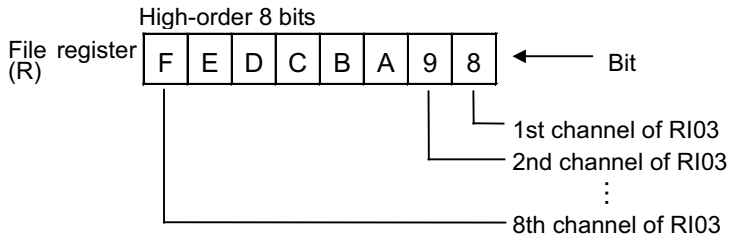
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CONNECTION STATUS OF EACH CHANNEL RIO3		R10065

[Function]

Connection status of remote I/O unit channel 3 is constantly output to R register.

[Operation]

When remote I/O unit is connected, "1" is set; when not connected, "0" is set.R register's high-order 8 bits output the connection status of each channel within RI03.



[Caution]

(1) Control unit cannot identify the remote I/O unit with no power cable or communication cable connected, or with no power supplied. Therefore, the "Connection status output" for those remote I/O units is "0".

(2) Performance check for the physically existed remote I/O unit can be done, using either "Connection status output" or "No. of error occurrences output".

[Related signals]

(1) Connection status of each channel RIO1,2 (R10064)

(2) No. of error occurrences (R10000 to 23)

6.3 PLC Output Signals (Bit Type: Y***)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	INTEGRATION TIME INPUT 1	RHD1	Y704

[Function]

The total duration of a signal specified by a user PLC can be counted and displayed. For this, integration time input 1 and 2 are available.

[Operation]

The INTEGRAL TIME during this signal (RHD1) has been ON is displayed in hours, minutes, and seconds.

The counted (integrated) time is held even when the power is turned OFF. The integration time can be preset or reset.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	INTEGRATION TIME INPUT 2	RHD2	Y705

[Function][Operation]

Both functions and operations are the same as those of "Integration time input 1 (RHD1)". See the descriptions on "Integration time input 1 (RHD1)".

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus TIME-OUT 1 CANCEL	MDBUSRST1	Y706

[Function]

This signal cancels the detection of Modbus time-out 1.

[Operation]

When this signal turns ON, the Modbus time-out 1 signal (MDBUSER2) turns OFF.

When the detection of Modbus time-out signal 1 is canceled by this signal, the transfer of the stopped block will restart.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus TIME-OUT 2 CANCEL	MDBUSRST2	Y707

[Function]

This signal cancels the detection of Modbus time-out 2.

[Operation]

When this signal turns ON, the Modbus time-out 2 signal (MDBUSER2) turns OFF.

When the detection of Modbus time-out signal 2 is canceled by this signal, the transfer of the stopped block will restart.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
B	DATA PROTECT KEY 1	*KEY1	Y708

[Function]

Data pertinent to tool functions, and coordinate data (origin reset) can be protected with this signal.

[Operation]

When this signal is turned OFF (set to "0"), the tool data setting operation is prohibited.

[Caution]

(1) If a setting is changed while the signal (KEY1) is OFF, DATA PROTECT appears in the message section of screen. Manual numerical command input is not applicable in "TOOL/OFFSET" display mode.

(2) The signal (KEY1) is ON (set to "1") when the power is turned ON (data are not protected). Therefore, if the signal is not turned OFF in sequential control program, it remains turned ON ("1").

[Related signals]

(1) Data protect key 2 (*KEY2: Y709)

(2) Data protect key 3 (*KEY3: Y70A)

Con-tact	Signal name	Signal abbreviation	Common for part systems
B	DATA PROTECT KEY 2	*KEY2	Y709

[Function]

Data pertinent to user parameters and common variables can be protected.

[Operation]

When this signal (KEY2) is turned OFF (0), the parameter and common variable setting operation is prohibited.

[Caution]

(1) If a setting is changed while the signal (KEY2) is OFF (0), DATA PROTECT appears in the message section of CRT screen.

(2) The signal (KEY2) is ON (set to "1") when the power is turned ON (data are not protected). Therefore, if the signal is not turned OFF in sequential control program, it remains turned ON ("1").

[Related signals]

(1) Data protect key 1 (*KEY1: Y708)

(2) Data protect key 3 (*KEY3: Y70A)

Con-tact	Signal name	Signal abbreviation	Common for part systems
B	DATA PROTECT KEY 3	*KEY3	Y70A

[Function]

Data pertinent to machining program can be protected.

[Operation]

When this signal (KEY3) is turned OFF (0), the editing of the machining program is prohibited.

[Caution]

(1) If data is edited when the data protect key 3 is OFF (0), DATA PROTECT will appear in the message section.

(2) The signal (KEY3) is ON (set to "1") when the power is turned ON (data are not protected). Therefore, if the signal is not turned ON in sequential control program, it remains turned ON ("1").

[Related signals]

(1) Data protect key 1 (*KEY1: Y708)

(2) Data protect key 2 (*KEY2: Y709)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PROGRAM DISPLAY DURING OPERATION	PDISP	Y70C

[Function]

This signal is used to display a program ON the Word Edit screen during operation.

[Operation]

When the program display during operation signal (PDISP) turns ON, the program being operated will appear in the program display of the EDIT screen.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	HANDLE PULSE ENCODER COMMUNICATION CONNECTOR PRIORITY		Y70D

[Function][Operation]

Priority of handle input pulse is determined when the parameter "#1239 set11 bit1(handle I/F selection)" is OFF.

0: Remote I/O connecting handle priority

1: Handle pulse encoder communication connector connecting handle priority

[Related signals]

(1) Handy terminal key 1 to 45 (X1CD0 to X1CFC)
(2) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)
(3) Handle/incremental feed magnification method selection (MPS: YC87)
(4) Handy terminal Data area top address (R297)
(5) Handy terminal Data valid number of registers (R298)
(6) Handy terminal Cause of communication error (R299)
(7) 1st handle/incremental feed magnification (R2508, R2509)

Con-tact	Signal name	Signal abbreviation	Common for part systems
B	PLC AXIS NEAR POINT DETECTION n-TH AXIS	*PCD1 to 6	Y718 to D

[Function]

The near point dog signal of the PLC axis reference position return is input.

[Operation]

Set the near point dog signal of the PLC axis reference position return for the following devices in the PLC.

Device No.		Signal name
Y718	PCD1	PLC axis near point detection 1st axis
Y719	PCD2	PLC axis near point detection 2nd axis
Y71A	PCD3	PLC axis near point detection 3rd axis
Y71B	PCD4	PLC axis near point detection 4th axis
Y71C	PCD5	PLC axis near point detection 5th axis
Y71D	PCD6	PLC axis near point detection 6th axis

(Note) If the dog signal is set during the PLC middle-speed process, the response will be poorer than when the dog signal is set with the PLC high-speed process.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS n-TH HANDLE VALID	PCHn	Y720 to 2

[Function]

This is designated when handle feed is to be carried out with the PLC axis.

[Operation]

Designate with the following devices when carrying out handle feed with the PLC axis.

Device No.		Signal name
Y720	PCH1	PLC axis 1st handle valid
Y721	PCH2	PLC axis 2nd handle valid
Y722	PCH3	PLC axis 3rd handle valid

(Note 1) When this signal is ON, each handle will be exclusive for the PLC axis. The handle will not be valid for the NC control axis.
The "1st handle axis selection code" (HS11 to 116, HS11S), the "2nd handle axis selection code" (HS21 to 216, HS21S) and "3rd handle axis selection code" (HS31 to 316, HS31S) are used to select each handle axis.

(Note 2) The handle feed magnification is common with that for the NC control axis.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS CONTROL BUFFERING MODE VALID	PABMI	Y723

[Function] [Operation]

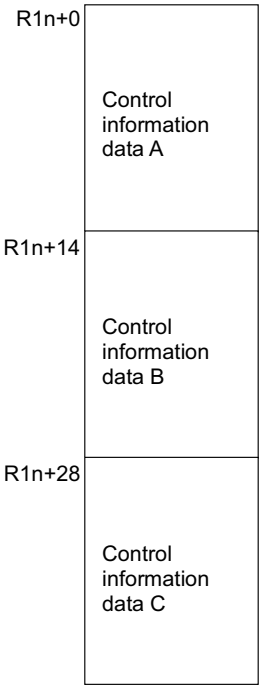
In buffering mode, the PLC axis command (control information data) can be commanded to multiple blocks. This enables a smooth changeover of commands.

<Control information data>

The control data for the buffering mode is set in three blocks. The contents of each control information data have the same configuration as the normal control information data.

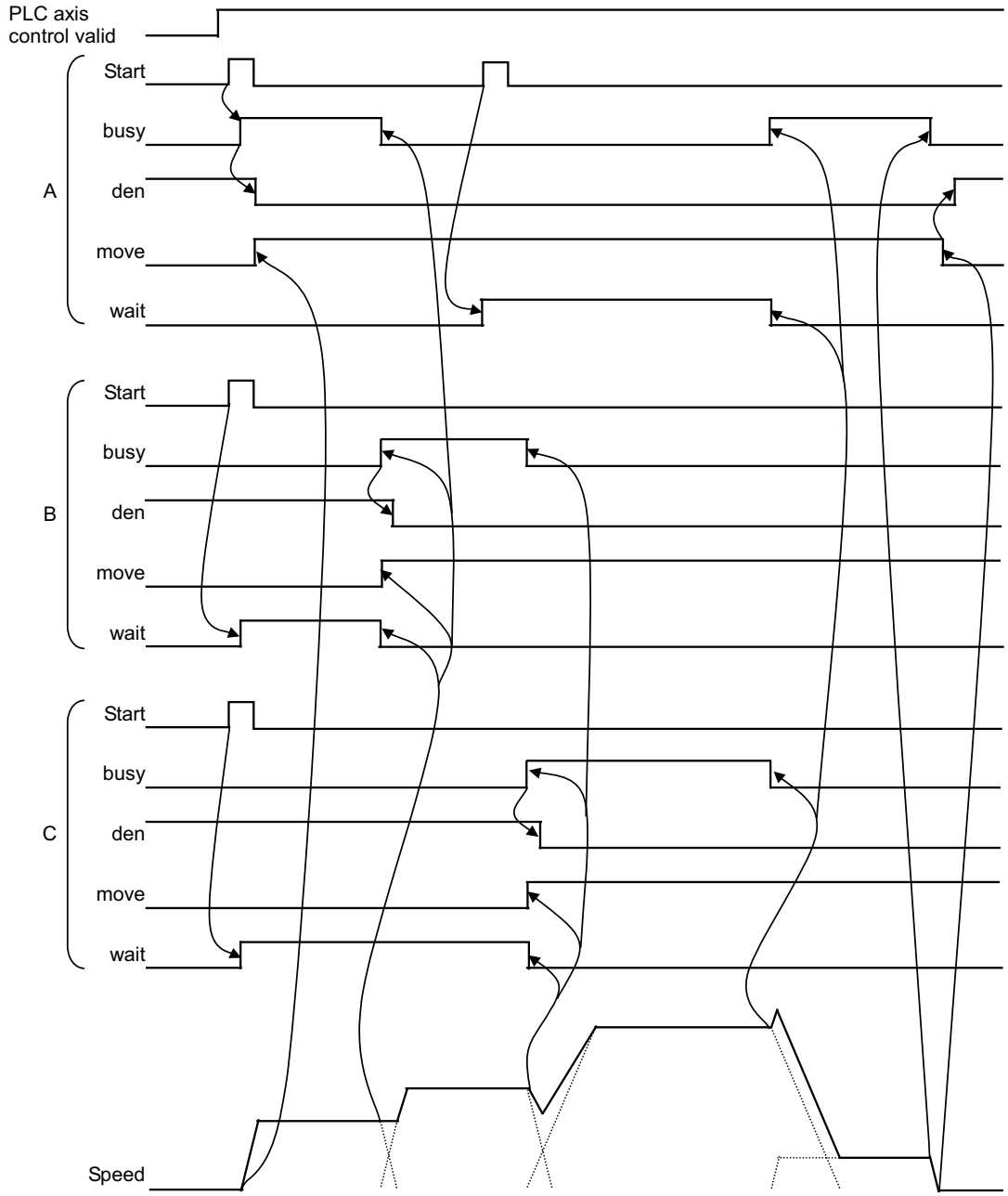
When executing, the axis moves in the order that each control information data has been started. When the movement is completed, it will move to the next block.

(If the start signals are turned ON simultaneously, it will be performed in the order of A, B, and C.)



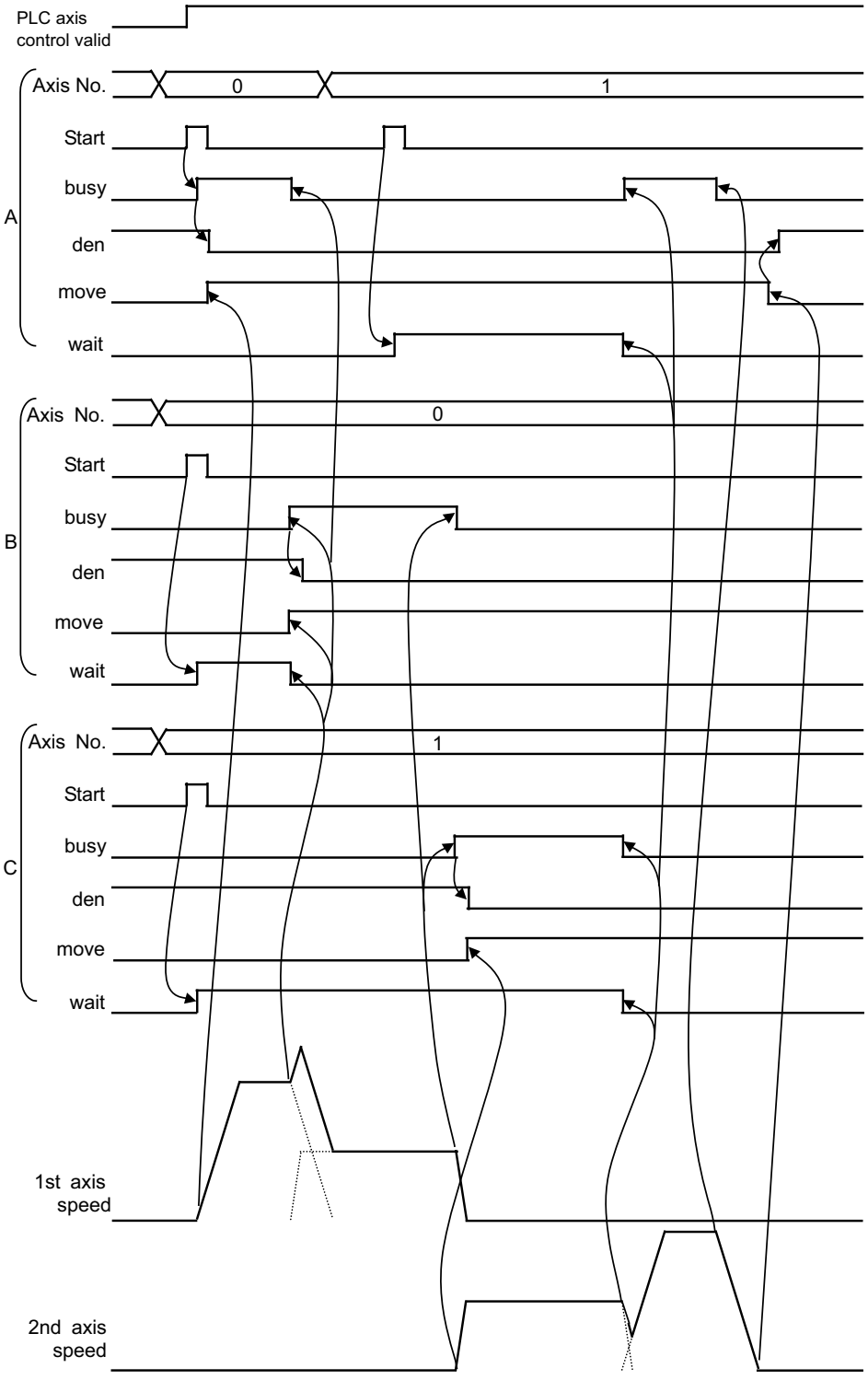
[Timing chart]

G1 → G1 → G0 → G1 (Same axis)



(Note) Change and start the data after the busy signal turns OFF. Starting while the busy signal is ON will be ignored.

G0 → G1 → G1 → G0 (Two axes)



[Caution]

Only one set of buffering mode can be commanded. When two or more sets are commanded simultaneously, the sets commanded later will cause an alarm.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CRT CHANGEOVER COMPLETION	CRTFN	Y728

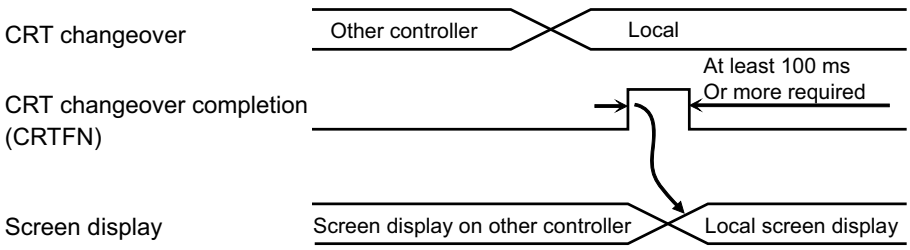
[Function]

When using one setting and display unit for multiple controller display units, this signal is used to inform the controller that it has been changed as a display unit.

[Operation]

When this signal turns ON, the currently selected screen will display at the rising edge. For the setting and display unit screen, the screen on the controller before the changeover will remain, so when this signal is input, the local screen display will be changed to.

[Timing chart]



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	SCREEN DISPLAY REQUEST	SCRON	Y729

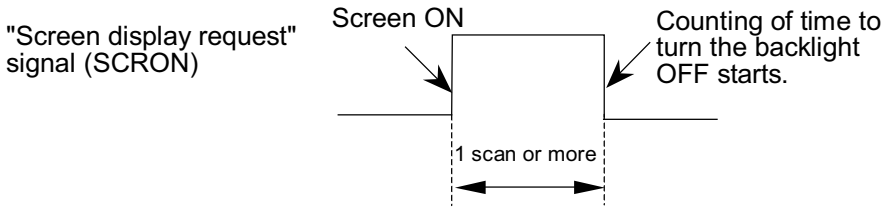
[Function]

The screen backlight, which was turned OFF with the screen saver function, can be turned ON again.

[Operation]

(1) The backlight is turned ON again when this signal turns ON. Counting of the time to turn the backlight OFF will start when this signal turns OFF.

(2) If this signal is output to the CNC while the screen is ON, counting of the time to turn the screen OFF will restart.



(Note 1) The backlight is not turned OFF with "#8078 Screen saver time" while the "Screen display request" signal is ON, but the backlight can be turned OFF using the and keys.

(Note 2) If the "Screen display request" signal (Y729) is changed again after that has changed once, intervals of 1scan or more must be taken.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	COLLECTING DIAGNOSIS DATA STOP		Y72B

[Function]

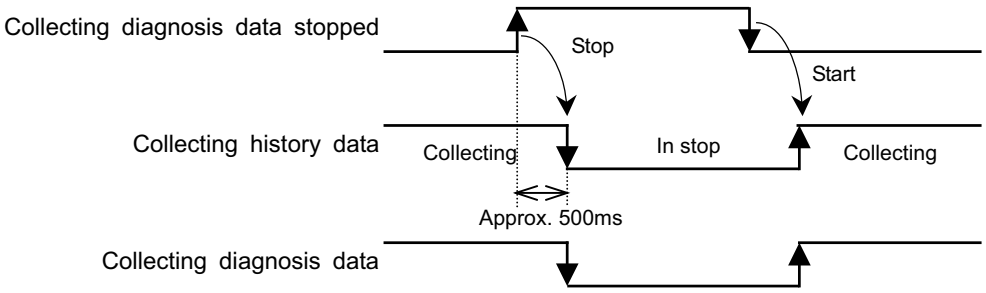
Data collection will be stopped by turning this signal ON while collecting history data using operation history function. Data collection will be started (resumed) by turning the signal OFF in data stop mode.

[Operation]

(1) "Collecting diagnosis data stop" signal stops data collection during rising edge movement following the signal turned ON from OFF.
This signal starts data collection during falling edge movement following the signal turned OFF from ON.

(2) Data collection will be stopped when this signal is turned ON while executing diagnosis data collection (when "collecting diagnosis data" signal is turned ON). Data collection will be stopped in approx. 500ms after the signal is turned ON. "Collecting diagnosis data" signal is turned OFF when data collection is stopped.

(3) Data collection will be started when this signal is turned OFF while diagnosis data collection is stopped (when "collecting diagnosis data" signal is turned OFF). Data collection will be started in approx. 500ms after the signal is turned OFF. "Collecting diagnosis data" signal is turned ON when data collection is started.



(Note 1) This signal will be ignored even if issued at the first one scan after turning the power ON.

[Related signals]

(1) Collecting diagnosis data (X723)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	NC DATA SAMPLING TRIGGER	SMPTRG	Y72C

[Function]

The start and end of data sampling are controlled.

[Operation]

If PLC device is selected as the conditions for starting and ending data sampling, the start and end of data sampling will be controlled with this signal (Y72C). Note that if an arbitrary device is designated (#24) as the condition, the data sampling will start and end by turning the designated device ON and OFF.
The following parameters are set on the screen.

Name	Detail
Start condition	When this parameter is set to "2", the condition for starting data sampling is the PLC device ON (OFF when using B contact).
End condition	When this parameter is set to "2", the condition for ending data sampling is the PLC device OFF (ON when using B contact).
PLC-DEVICE	When start condition or end condition is set to "2", the device for controlling the start and end of data sampling is set.When this parameter is set to "0", the device for controlling the start and end of data sampling is the data sampling trigger (Y72C).

Con-tact	Signal name	Signal ab-breviation	Common for part sys-tems
A	PALLET PROGRAM REGISTRATION EXT. WORKPIECE COORDINATE TRANSFER READY		Y72F

[Function][Operation]

When transferring external workpiece coordinate offset (EXT) in the pallet 4 page registration, turn this signal ON. NC starts transfer processing at the rising edge of this signal.

When the external workpiece coordinate transfer completion signal is turned ON, turn this signal OFF.

It takes approx. 8ms from the start to the end of transfer processing. If the transfer completion signal is not turned ON even after 8ms has passed since the transfer ready signal was turned ON, reconsider the value of R register 4100 and 4102.

NC turns the external workpiece coordinate transfer completion signal OFF at the falling edge of this signal.

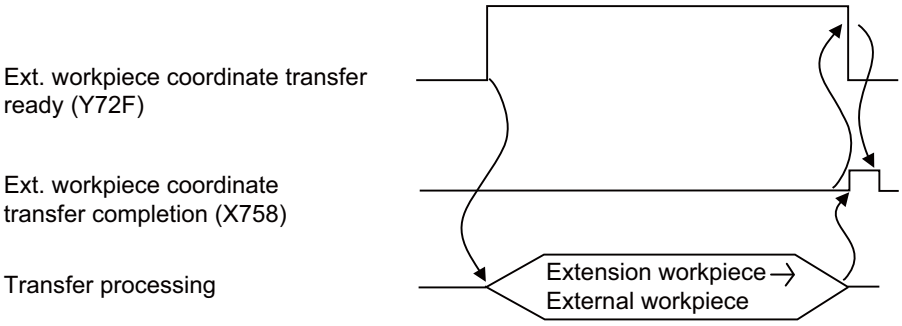
When turning the transfer ready signal ON from the machining program, recalculation request and M function finish (FIN1 or FIN2) must be turned ON after the external workpiece coordinate transfer completion signal is turned ON.

When recalculation is not requested, operation of the pre-read machining program will be carried out using the external workpiece coordinate offset prior to the change.

When M function has been completed before transfer is completed, the external workpiece coordinate offset data to be used in the machining program will not be changed from the one prior to the change until the transfer completion signal is turned ON.

This signal must be turned ON while the external workpiece coordinate transfer completion signal is OFF.

[Timing chart]



[Related signals]

(1) Pallet program registration Ext. workpiece coordinate transfer completion (X758)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	DISPLAY CHANGEOVER $1 to $4	DISP1 to 4	Y730 to 3

[Function]

The displayed part system of the multiple part systems can be changed.

[Operation]

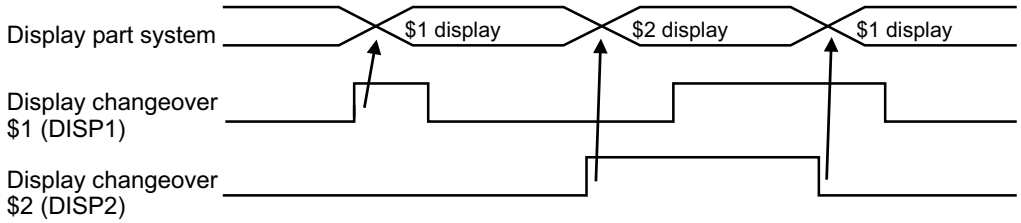
The displayed part system is changed at the rising edge of each display changeover signal.

The screen display for the multiple part systems is a screen for displaying one of the part systems. Thus, which part system to be displayed is determined by these signals.

If both of these signals are started up simultaneously, they will be invalid.

If "#11035 Sys. change limit" is set to "2", this signal will be invalid.

[Timing chart]



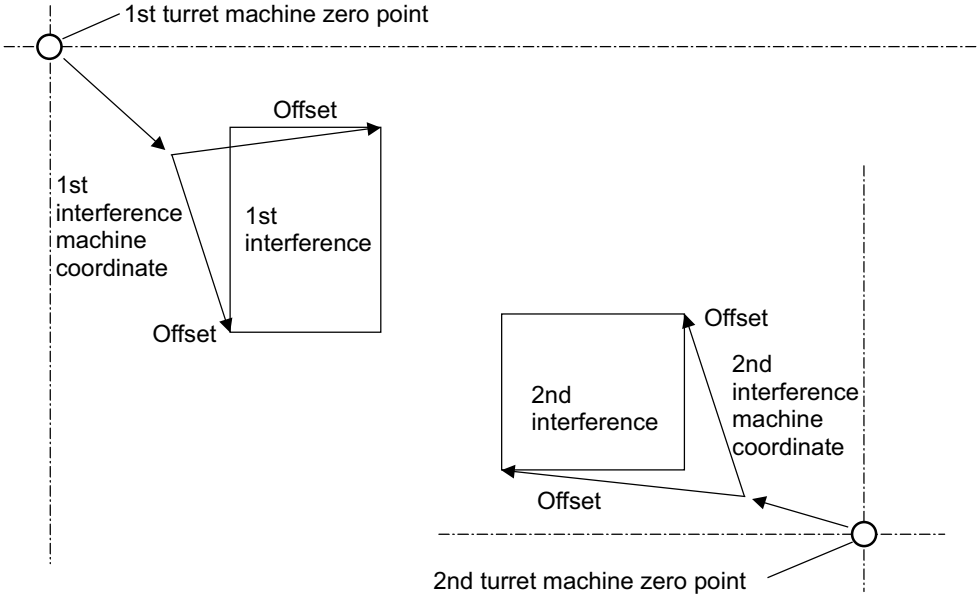
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	INTERFERENCE CHECK VALID	CCHK	Y73F

[Function]

This signal constantly checks relative position of interference. When interfering, the signal validates a function that stops axis movement.

[Operation]

When the "interference check valid" signal (CCHK) is ON, command of the interference check is validated.



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL IC NEW READ		Y740

[Function]

The tool information is read from the IC code chip, and registration of the tool starts.

[Operation]

When the rising edge (OFF to ON) of this signal is detected, a data send request is sent to the IC code reader. The received data is stored in the area corresponding to the tool No. in the received data.

The "in tool ID communication" signal is output while communicating with the IC code reader.

After the data is received, the received tool No. is stored in the pot No. designated in "Tool ID R/W pot No.".

(Note) This signal will be ignored even if it is turned ON during communication with the IC code reader.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Tool IC exchange read (Y741)
(2) Tool ID data erase (Y76F)
(3) Tool ID R/W pot No. (R336)
(4) In tool ID communication (X727)
(5) Tool ID communication error information (R62)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL IC EXCHANGE READ		Y741

[Function]

The tool information is read from the IC code chip, and updating of the tool information starts.

[Operation]

When the rising edge (OFF to ON) of this signal is detected, the tool information is read, and is compared with the tool No. stored in the pot No. If the numbers match, the tool information is updated.

If the numbers do not match, an error is output to "Tool ID communication error information".

The in "Tool ID communication" signal is output while communicating with the IC code reader.

(Note) This signal will be ignored even if it is turned ON during communication with the IC code reader.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Tool IC new read (Y740)
(2) Tool ID data erase (Y76F)
(3) Tool ID R/W pot No. (R336)
(4) In tool ID communication (X727)
(5) Tool ID communication error information (R62)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	CONTACTOR SHUTOFF TEST	MCT	Y742

[Function]

This signal carries out a contactor shutoff test.

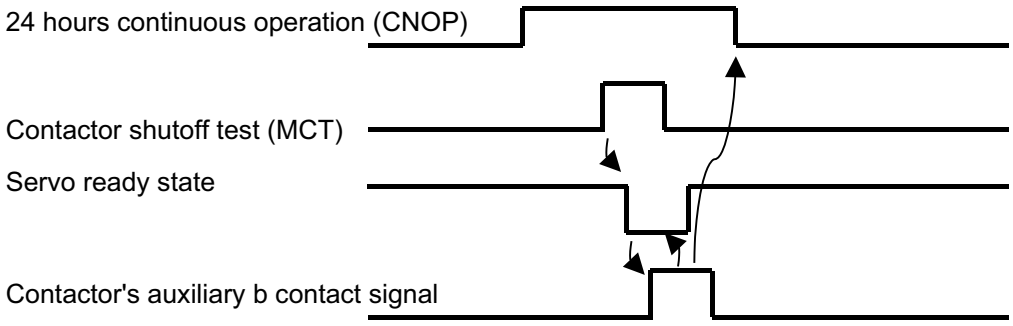
[Operation]

Send a "ready OFF" command to the drive unit at the contactor shutoff test signal's rising edge and shut the drive unit side contactor OFF. Then, turn the SDIO connector's SDO1 (contactor control output 1) output OFF and shut the NC side contactor OFF.

Confirm that the contactor's status is OFF by monitoring contactor's auxiliary b contact signal, then send a "ready ON" command to the drive unit to turn the drive unit side contactor ON. Turn ON the safety monitor connector output, then the NC side contactor. After that, turn the 24 hours continuous operation signal OFF.

If the contactor shutoff could not be confirmed within 5 seconds, "contactor welding detected" alarm is output and the status turns to the emergency stop.

[Timing chart]



[Caution]

Contactor shutoff test must be carried out when the drive power can be shut off without causing any problem.

Vertical axis requires brake circuit, etc. for a drop prevention.

[Related signals]

(1) 24 hours continuous operation (X752)

(2) Emergency stop cause (R69)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC SKIP 1 to 8		Y748 to F

[Function]

This is the skip input signal from the PLC.

[Operation]

This can be used for the skip related functions. (G31 skip, tool length measurement, etc.)

[Caution]

(1) The "PLC skip" signal is output to the skip input.

(2) When PLC skip is used, the coasting amount from the skip signal input will be slightly longer than the high speed skip.

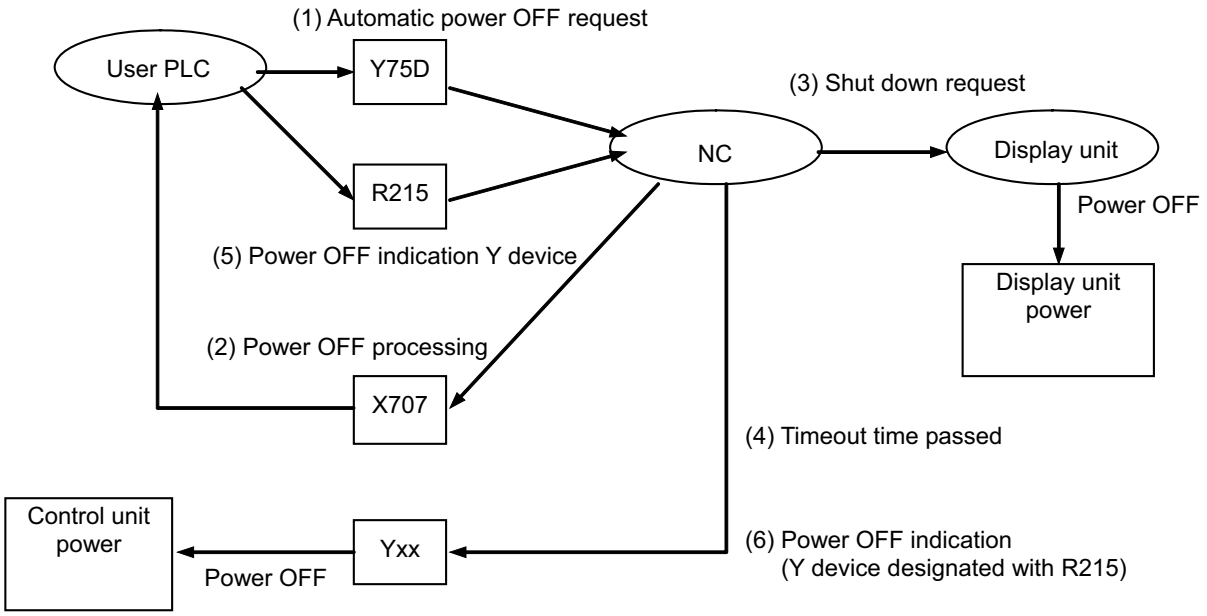
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	AUTOMATIC POWER OFF REQUEST		Y75D

[Function]

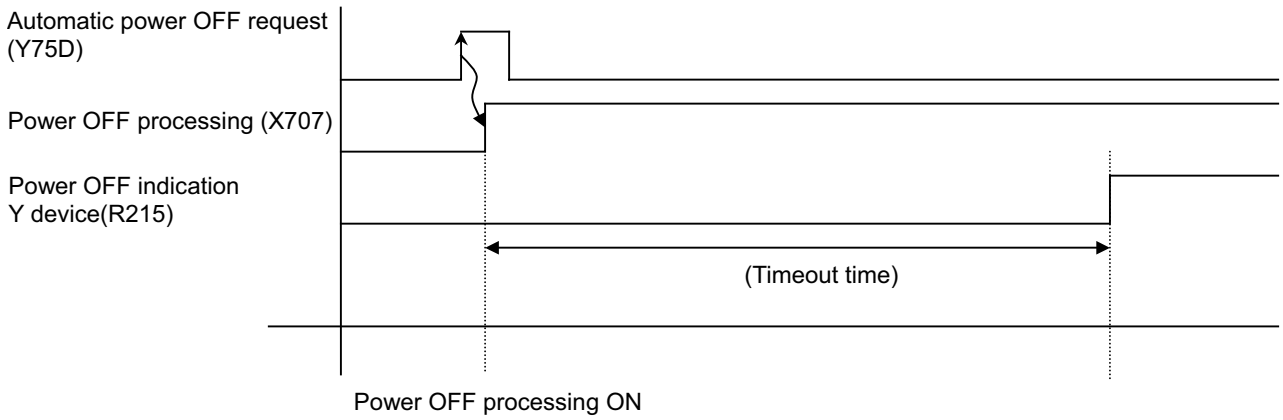
Automatic power OFF function notifies that the control unit's power can be turned OFF after shutting the display unit down by entering "automatic power OFF" signal from user PLC to NC.

[Operation]

(1) User PLC turns the "automatic power OFF request" signal ON.
(2) NC turns the "power OFF processing" signal ON.
(3) NC requests the display unit to be shut down.
(4) Timeout time is passed.
(5) The device has been specified by the "power OFF indication Y device No." signal.
(6) The specified device is turned ON.
When control unit and display unit use a different power supply, turn the control unit's power OFF after confirming the "power OFF indication Y device No." signal is turned ON.



[Timing chart]



[Caution]

(1) Time including the time required for HMI application termination and Windows shutdown has to be set in the machine parameter "#11007 PC Timeout".
(2) Normal power OFF processing is executed when the control unit's power is turned OFF during automatic power OFF processing.
(3) When an illegal IP address is set to the machine parameter "#11005 PC IP address", the PC on the network may be turned OFF.
(4) Do not execute the automatic power OFF function during editing or file I/O operation, etc.
(5) The automatic power OFF function is carried out to the display unit set to the machine parameter "#11005 PC IP address".
(6) During spindle rotation/traveling, execute automatic power OFF after stopping those spindle movements.

[Related signals]

(1) Power OFF processing (X707)
(2) Power OFF indication Y device No. (R215)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	ENCODER 1 ARBITRARY PULSE SELECTION		Y764
A	ENCODER 2 ARBITRARY PULSE SELECTION		Y765

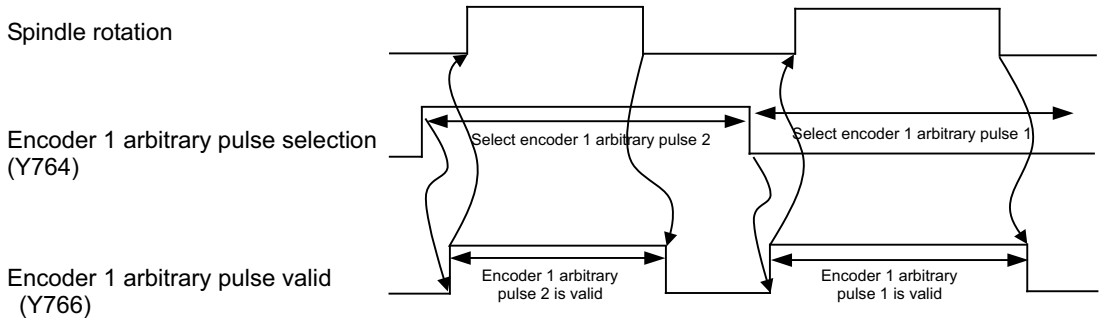
[Function]

These signals select encoder arbitrary pulse.

[Operation]

Device No.	Signal name	Details
Y764	ENCODER 1 ARBITRARY PULSE SELECTION	Select arbitrary pulse input 1 and 2 set in R register when entering arbitrary pulse with encoder input 1. 0: Encoder 1 arbitrary pulse 1 1: Encoder 1 arbitrary pulse 2
Y765	ENCODER 2 ARBITRARY PULSE SELECTION	Select arbitrary pulse input 1 and 2 set in R register when entering arbitrary pulse with encoder input 2. 0: Encoder 2 arbitrary pulse 1 1: Encoder 2 arbitrary pulse 2

[Timing chart]



[Caution]

Switching each encoder's arbitrary pulse selection (Y764 and 765) must be carried out during the spindle stop.

[Related signals]

(1) Encoder 1 arbitrary pulse valid (Y766)
(2) Encoder 2 arbitrary pulse valid (Y767)
(3) Encoder 1 arbitrary pulse 1 (R456)
(4) Encoder 1 arbitrary pulse 2 (R457)
(5) Encoder 2 arbitrary pulse 1 (R458)
(6) Encoder 2 arbitrary pulse 2 (R459)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	ENCODER 1 ARBITRARY PULSE VALID		Y766
A	ENCODER 2 ARBITRARY PULSE VALID		Y767

[Function]

These signals select valid/invalid for encoder arbitrary pulse.

[Operation]

Device No.	Signal name	Details
Y766	ENCODER 1 ARBITRARY PULSE VALID	Select valid/invalid for arbitrary pulse with the encoder input 1. 0: Invalid (conventional 1024 pulse fixed input) 1: Valid (arbitrary pulse input)
Y767	ENCODER 2 ARBITRARY PULSE VALID	Select valid/invalid for arbitrary pulse with the encoder input 2. 0: Invalid (conventional 1024 pulse fixed input) 1: Valid (arbitrary pulse input)

Turn OFF the arbitrary pulse valid signal when using the conventional 1024 pulse encoder.

[Caution]

Turning ON/OFF the encoder arbitrary pulse valid (Y766 and Y767) of the each encoder must be carried out during the spindle stop.

[Related signals]

(1) Encoder 1 arbitrary pulse selection (Y764)
(2) Encoder 2 arbitrary pulse selection (Y765)
(3) Encoder 1 arbitrary pulse 1 (R456)
(4) Encoder 1 arbitrary pulse 2 (R457)
(5) Encoder 2 arbitrary pulse 1 (R458)
(6) Encoder 2 arbitrary pulse 2 (R459)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	DOOR OPEN I	DOOR1	Y768

[Function]

This signal stops all axes, and cuts OFF contactor power.

[Operation]

The NC carries out the following operations when the "Door open I" signal turns ON.

(1) A deceleration stop is carried out for all axes (servo axes and spindles).
(2) A ready OFF state occurs after all axes stop, and the contactor power of each drive unit is cut OFF.
(3) The "Door open enable" signal turns ON.

The NC carries out the following operations when the "Door open I" signal turns OFF.

(1) A ready ON and servo ON state occurs for all axes.
(2) The "Door open enable" signal turns OFF.

[Caution]

(1) Handling of the PLC axis
Set so a "Door open I" signal is output to the NC after the PLC axis is stopped by the PLC.
If a "Door open I" signal is input without stopping the PLC axis, the axis will stop with a dynamic brake method due to the ready OFF state.

(2) Handling of the analog spindle
When an analog spindle is connected, it is not possible to confirm that the spindle has completely stopped with the NC. Thus, confirm that the spindle has completely stopped using the PLC, before opening the door. Because the spindle may start rotating again immediately after the door is closed, for safety turn the forward run and reverse run signals OFF when the door is open.

(3) Opening the door during ATC operation
When opening the door during ATC operation, apply an interlock with the user PLC.

[Related signals]

(1) Door open enable (DROPNS:XCD8)

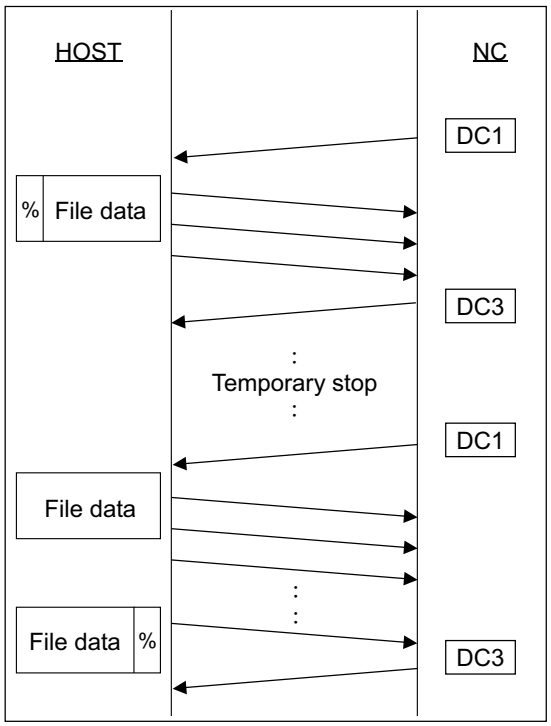
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	REMOTE PROGRAM INPUT START		Y76C

[Function]

With this "remote program input start" signal, machining program can be input from a personal computer, etc.

[Operation]

The remote program input communicates in Xon/Xoff control (DC code method) between a personal computer, etc. (hereinafter called HOST) and NC.

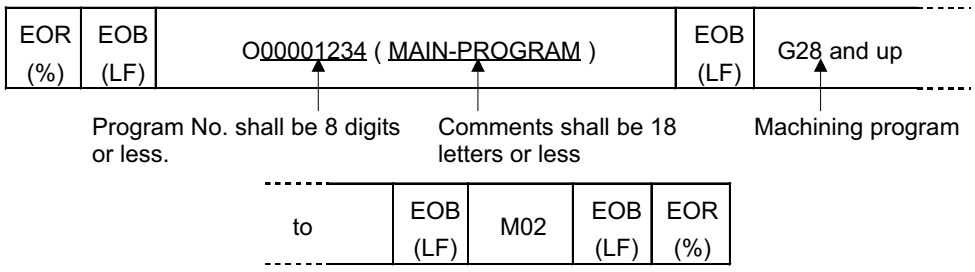


List of transmission control code

Control code	Code	Meaning
DC1	11H	Commands transfer start and temporary stop release to the HOST
DC3	13H(93H)	Commands transfer temporary stop to the HOST

(Note) The code of DC3 switches, depending on the setting of the DC code parity.
(Parity valid:93H, Parity invalid:13H)

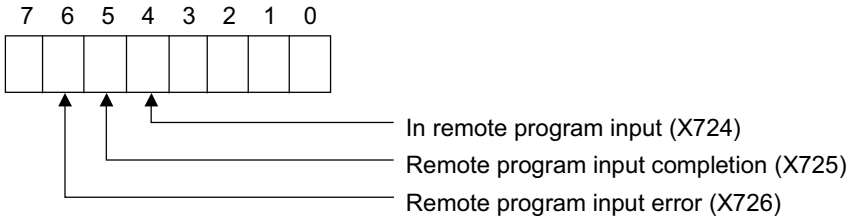
File data



The format is same as conventional input/output data (machining program).
The program No. and comments are not always necessary. When the program No. omitted, remote program input No. described later will be input.

(1) Remote program input start (Y76C)
This signal is for starting remote program input. When the signal is turned ON, NC sends DC1.

(2) Status (X724, X725, X726)
Status of remote program input is indicated. The status is set by NC and checked by PLC.



(3) Remote program input No. (R352[L]/R353[H])
If no program No. is found in the machining program, value in R352/R353 will be input as program No. However, if the value is "0", an error will occur.
If program No. is found in the machining program, the value in R352/R353 will be changed to that program No.

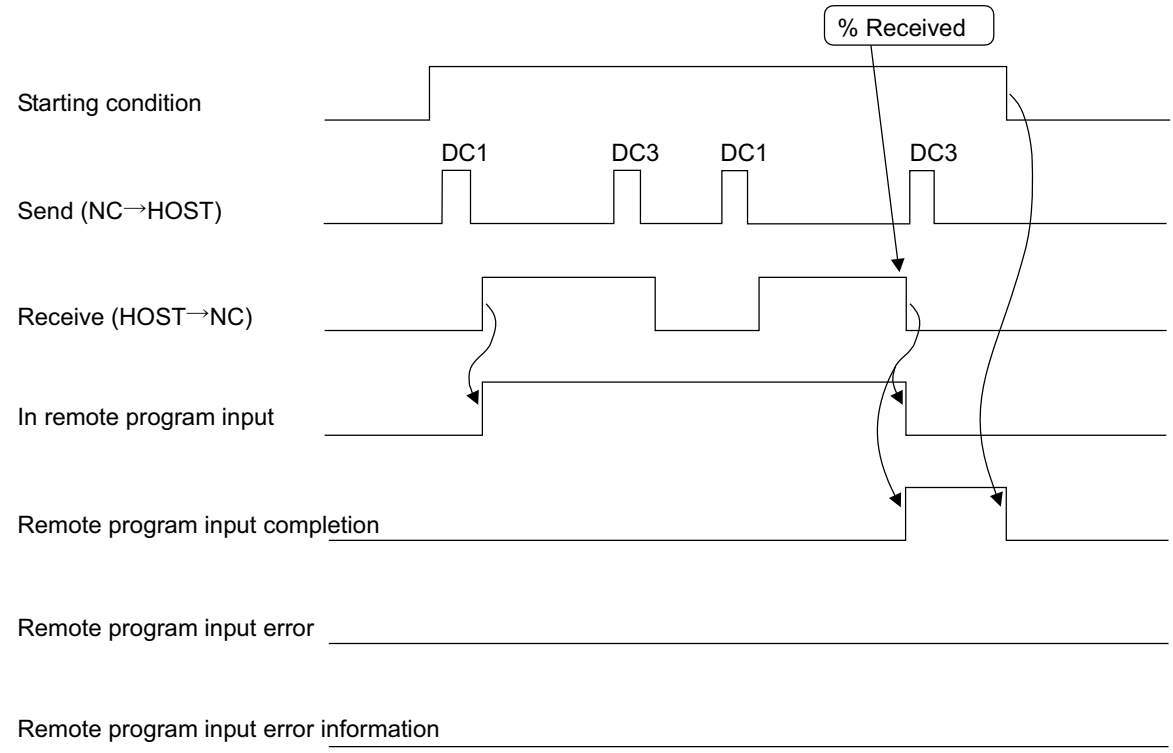
(4) Remote program input error information (R30)
When an error occurs, an error value will be set in the remote program input error information (R30) and saved till the next start.
The error information will be cleared on NC side at the rising edge of a trigger signal.

Error No.(HEX)	Error name	Details
04,22	Memory capacity over	Cannot input because the memory capacity will be exceeded
06	Number of programs registered over	Attempted to input machining program exceeding number specified in the specification
08,26	No applicable program	Program designated does not exist in the memory
09	Edit lock B	Attempted to input in respect to the inhibited machining program B
0A	Edit lock C	Attempted to input in respect to the inhibited machining program C
20	Delete error	Attempted to delete opened file
25	Write protect error	File is write-protected
33	Over run error	Over run error occurred
35	Parity H error	Character code is not ISO code
3D	Reset and finished	Input was forcibly terminated by reset signal(DC3 will not be sent after reset and finished)
40	Timeout finish	After the input start, input data was not received after set "time out time" of I/O parameters passed
48	No program No.	Machining program cannot be registered because program No. is not set in R352/R353 and not found in the machining program input by NC
49	In program operation	Attempted to overwrite on the machining program in operation
4C	No option	Remote program input function is not added as an option(When no-option error occurred, no communication is performed at all)
52	Input/Output not available	Attempted to input new remote program while another input/output function is running
54	Input data illegal	Machining program cannot be registered because there is no EOB in the machining program input by NC.
57	Label No. error	Program No. in the input program is not correct

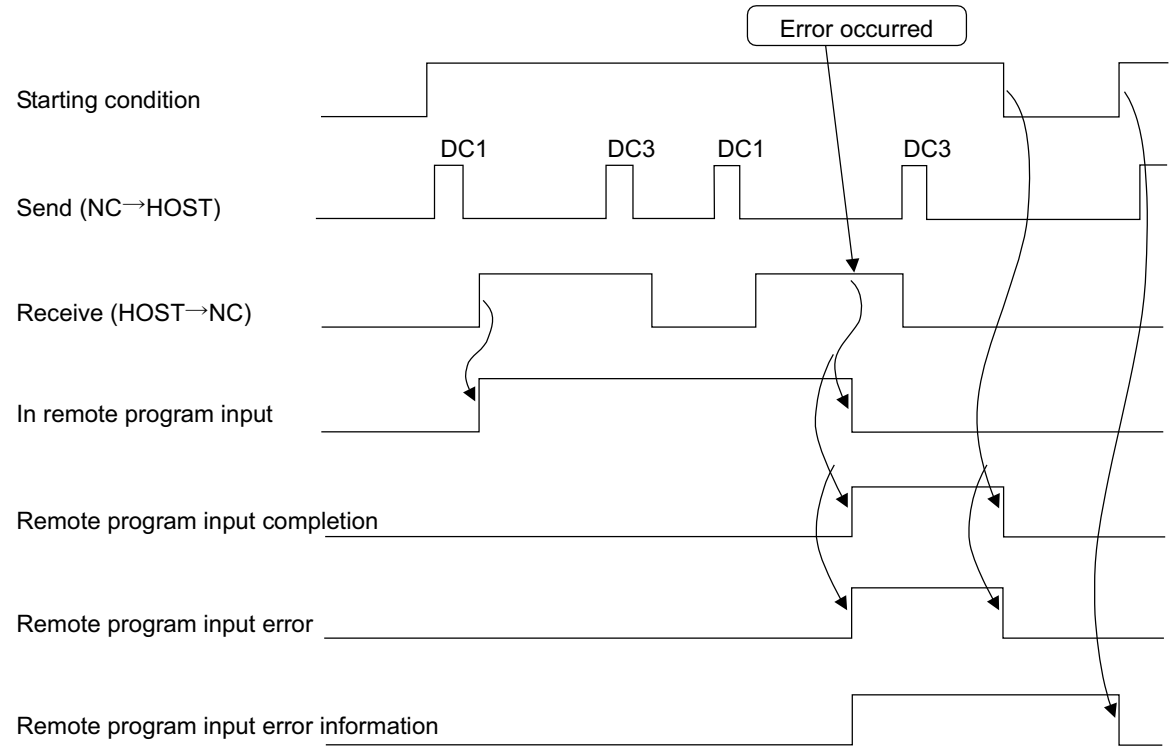
(Note) Program No. duplication error will not occur. When same number is found, it will be overwritten.

[Timing chart]

Case of normal completion



Case of input error completion



When an error occurred, turn OFF the "in input" signal and turn ON the "input completion" signal and "input error" signal.DC3 will be sent when % is received after error occurred or when reception buffer of NC is full.

[Caution]

(1) The remote program input can be canceled by the reset signal.
(It will be an error completion "reset and finished".)

(2) Remote program input and normal input/output (I/O on NC side input screen) cannot be performed simultaneously. The one started first will be prioritized.
If normal input/output is started in remote program input mode, an error message "E84 CAN'T IN/OUT" will be displayed and the normal input/output would not be performed. If remote program input is started in normal input/output mode, it will be an error completion "input/output not available".

(3) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) In remote program input (X724)
(2) Remote program input completion (X725)
(3) Remote program input error (X726)
(4) Remote program input error information (R30)
(5) Remote program input No. (R352,R353)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL ID DATA READ		Y76D

[Function]

This signal starts reading of the tool information from the tool ID label.

[Operation]

When the rising edge (OFF to ON) of this signal is detected, transmission of data is requested to the tool ID controller. The received data is stored in the area corresponding to the tool No. in the reception data.
The "In tool ID communication" signal (X727) is output when communicating with the tool ID controller.
After the data is received, the received tool No. is stored in the pot No. designated by R336.

[Caution]

(1) This signal will be ignored even if it is turned ON during tool ID communication.
(2) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL ID DATA WRITE		Y76E

[Function]

This signal starts writing of the tool information to the tool ID label.

[Operation]

When the rising edge (OFF to ON) of this signal is detected, the tool information corresponding to the tool No. stored in the pot No. designated by R336 is sent to the tool ID controller.
The "In tool ID communication" signal (X727) is output when communicating with the tool ID controller.

[Caution]

(1) This signal will be ignored even if it is turned ON during tool ID communication.
(2) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL ID DATA ERASE		Y76F

[Function]

This signal erases the tool information stored in the CNC.

[Operation]

When the rising edge (OFF to ON) of this signal is detected, the tool information corresponding to the tool No. stored in the pot No. designated by R336 is erased, and the pot No. tool No. is set to "0".

[Caution]

(1) This signal will be ignored even if it is turned ON during tool ID communication.
(2) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS CONTROL VALID n-TH AXIS	PLCAEn	Y770 to 5

[Function]

PLC axis control process is executed with the control information data while the PLC axis control valid signal is ON.

[Operation]

When turning ON the PLC axis control valid signal, designate with the following device.

Device No.	Signal name
Y770	PLC axis control valid 1st axis
Y771	PLC axis control valid 2nd axis
Y772	PLC axis control valid 3rd axis
Y773	PLC axis control valid 4th axis
Y774	PLC axis control valid 5th axis
Y775	PLC axis control valid 6th axis

(Note) Reset state is activated when the PLC axis control valid signal is turned OFF.

[Related signals]

(1) PLC axis control buffering mode valid (PABMI:Y723)

(2) PLC axis control information address (R440 to R443)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CONTROL AXIS DETACH n-TH AXIS	DTCH1 to 8	Y780 to 7	Y788 to F	Y790 to 7	Y798 to F

[Function]

Desired control axis can be specified to be exempted from control function.

Each control axis is provided with this signal. The last numeric of signal name indicates axis No. to be detached.

DTCHn
- 1 ..... 1st axis is detached
- :
- :
- 8 ..... 8th axis is detached

[Operation]

When "Control axis detach" signal (DTCHn) turns ON, the corresponding axis is exempted from control.

(1) Specified axis is not under any positioning control (oriented spindle stop, index, etc.)

(2) "Servo alarm", "Stroke end alarm" and other alarms are not applied to specified axis.

(3) Interlock signal applied to specified axis is deemed to be ON.

(4) Specified axis is displayed by the setting and display unit.

(Note 1) The same function can be used by setting parameter on the setting and display unit. (See below)

The control axis detach is valid when the following are valid:

Basic specification parameter "#1070 axoff" (axis detach), and control axis detach n-th axis(DTCHn)

or

Basic specification parameter "#1070 axoff" (axis detach), and axis parameter of machining parameter "#8201 AX. RELEASE"

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	SERVO OFF n-TH AXIS	*SVF1 to 8	Y7A0 to 7	Y7A8 to F	Y7B0 to 7	Y7B8 to F

[Function]

Control axis (axis motion under control) can be set to "Servo OFF" (i.e., servo motor remains still).
In servo OFF condition, positioning control is impossible but the position detect function is alive.
Each control axis is provided with this signal. The last number (n = 1, 2, 3...) of the signal abbreviation indicates the control axis No.

[Operation]

When "Servo OFF" signal (*SVFn) turns OFF, the corresponding control axis is set to servo OFF condition.
Whether displacement which was caused during servo OFF by external force is corrected when "Servo ON" signal is given, or not, can be determined by setting parameter. (#1064 svof Error correction)

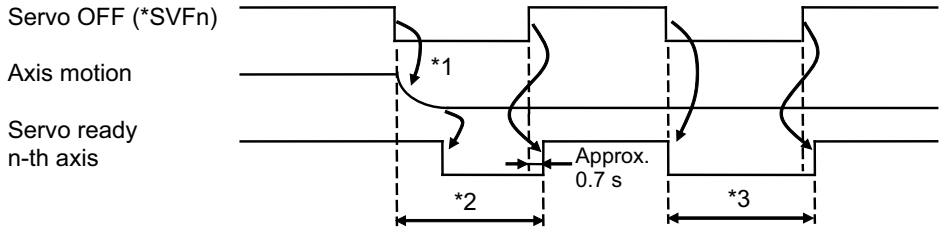
(1) When displacement is corrected (follow-up):

- An amount of motion equal to the displacement is commanded so that positioning error becomes zero.
- In this case, machine position remains deviated from in-position when "Servo OFF" signal is restored. The current position read by position counter is corrected and the machine position is corrected when the next absolute motion command is given ("Manual absolute" (ABSn) signal is turned ON when manual operation is selected).

(2) When displacement is not corrected:

- In this case, machine position should be corrected when "Servo OFF" signal is restored.

(Example) Servo-OFF during motion



*1: Servo turns OFF after deceleration and stopping during axis motion.
*2, 3: Controller internal interlock by servo OFF (axis motion not possible)

[Caution]

These signals are all handled as B contacts.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MIRROR IMAGE n-TH AXIS	MI1 to 8	Y7C0 to 7	Y7C8 to F	Y7D0 to 7	Y7D8 to F

[Function]

This signal is used to machine a symmetrical shape by reversing the sign for the movement amount per block.
Each control axis is provided with this signal. The last number of signal name indicates No. of control axis.

M I n

1: Mirror image is applied ON 1st axis.
:
:
8: Mirror image is applied ON 8th axis.

[Operation]

Symmetrical cutting is enabled by reversing the sign of the value commanded for memory or MDI operation.

(1) Regardless of whether the coordinate is commanded with an incremental mode or absolute mode, the mirror image is applied ON the incremental amount to be executed for all axes that can be controlled.

(Note) The mirror image is changed after block stop.

[Related signals]

(1) In mirror image n-th axis (MIR1 to 8: X9C7 to F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	EXTERNAL DECELERATION+ n-TH AXIS	*+EDT1 to 8	Y7E0 to 7	Y7E8 to F	Y7F0 to 7	Y7F8 to F

[Function]

The feedrate when the control axis is moving in the + direction can be controlled while this signal (*+EDTn) is OFF, at a constant speed set with the parameters.

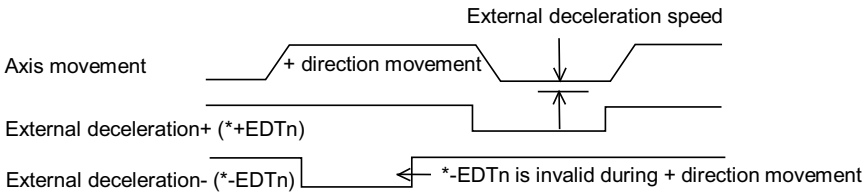
This signal is present for each control axis. The end numbers in the signal name indicate the control axis No.

*+EDTn
- 1 ... The 1st axis is decelerated.
- :
- :
- 8 ... The 8th axis is decelerated.

[Operation]

During manual mode when the "External deceleration" signal (*+EDTn) turns OFF, each axis decelerates independently. However, during automatic mode, all axes will decelerate at the same deceleration speed when even one axis matches the external deceleration conditions. The deceleration occurs when the movement axis direction matches the "External deceleration" signal direction of the corresponding axis.

(1) The external deceleration speed can be randomly set with the parameters. (#1216 extdcc)
(2) When the speed is less than the external deceleration speed, it will not be affected even if this signal is OFF.
(3) The deceleration speed during automatic operation will be the combined deceleration speed, if the deceleration conditions match and the external deceleration speed is exceeded.
(4) When returning in the reverse direction, the speed will immediately return to the correct command speed.
(5) For G28, G29 and G30 commands, the speed will become the external deceleration speed for that axis only, even in automatic operation.
(6) The speed will become the external deceleration speed even in rapid traverse during synchronous tapping.



[Caution]

(1) The external deceleration signal is handled as a B contact (*) signal, but changes to 1 (ON) when the power is turned ON. When not being used, it is not necessary be concerned with external deceleration when programming.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	EXTERNAL DECELERATION- n-TH AXIS	*-EDT1 to 8	Y800 to 7	Y808 to F	Y810 to 7	Y818 to F

[Function][Operation]

The functions and operations of this signal are the same as those of "External deceleration+ n-th axis" signal (*+EDTn). The deceleration occurs when the movement is in the minus direction and the "External deceleration- n-th axis" signal (*-EDTn) is OFF.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	AUTOMATIC INTERLOCK+ n-TH AXIS	*+AIT1 to 8	Y820 to 7	Y828 to F	Y830 to 7	Y838 to F

[Function]

All axis motions of machine can be decelerated and stopped immediately during automatic operation when motion of a specific axis (n-th axis) in plus direction activates the interlock function.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

*+AITn
- 1 ..... Automatic interlock+ 1st axis
- :
- :
- 8 ..... Automatic interlock+ 8th axis

[Operation]

When this signal turns OFF for a specific axis in motion in the plus direction under automatic operation mode (memory, MDI, tape), motion of all axis decelerates and stops with "M01 operation error code 004" displayed.

With this signal set OFF from the beginning, the system completes calculation for axis motion but makes it remain stopped with the same operation error code displayed. In either case, setting the signal ON resumes or starts axis motion.

[Caution]

(1) All automatic interlock signals are for B contact.

(2) The "Automatic interlock" signal is set to 1 when the power is turned ON, so an interlock cancel state in the sequence program does not need to be created for the axis not being used.

[Related signals]

(1) Automatic interlock- n-th axis (*-AITn: Y840)

(2) Manual interlock+/- n-th axis (*+/-MITn: Y860/Y880)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	AUTOMATIC INTERLOCK- n-TH AXIS	*-AIT1 to 8	Y840 to 7	Y848 to F	Y850 to 7	Y858 to F

[Function][Operation]

The details are the same as the "Automatic interlock+ n-th axis" signal, except that the direction is opposite.

The "Automatic interlock+ n-th axis" signal is valid for the axis moving in the plus direction, and this signal is valid for the axis moving in the minus direction.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

*-AITn
- 1 ..... Automatic interlock- 1st axis
- :
- :
- 8 ..... Automatic interlock- 8th axis

[Related signals]

(1) Automatic interlock+ n-th axis (*+AITn: Y820)

(2) Manual interlock+/- n-th axis (*+/-MITn: Y860/Y880)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	MANUAL INTERLOCK+ n-TH AXIS	*+MIT1 to 8	Y860 to 7	Y868 to F	Y870 to 7	Y878 to F

[Function]

When the corresponding axis is moving in the plus direction with manual operation (jog, manual, incremental, reference position return), only the corresponding axis can be decelerated and stopped by turning OFF this signal that corresponds to that axis.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

*+MITn
- 1 ..... Manual interlock+ 1st axis
- :
- 8 ..... Manual interlock+ 8th axis

[Operation]

When this signal turns OFF (0) for a specific axis in motion in the plus direction under manual operation mode (jog, handle, incremental, reference position return), motion of the axis decelerates and stops with NC alarm "M01 OPERATION ERROR 0004" displayed.

With this signal set OFF from the beginning, the system completes calculation for axis motion but makes it remain stopped with the same operation error code displayed. In either case, setting the signal ON (1) resumes or starts axis motion.

[Caution]

(1) All interlock signals are for B contact.

(2) The "Manual interlock" signal is set to 1 when the power is turned ON, so an interlock cancel state in the sequence program does not need to be created for the axis not being used.

[Related signals]

(1) Manual interlock- n-th axis (*-MITn: Y880)

(2) Automatic interlock+/- n-th axis (*+/-AITn: Y820/Y840)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	MANUAL INTERLOCK- n-TH AXIS	*-MIT1 to 8	Y880 to 7	Y888 to F	Y890 to 7	Y898 to F

[Function][Operation]

The details are the same as the "Manual interlock+ n-th axis" signal, except that the direction is opposite.

The "Manual interlock+ n-th axis" signal is valid for the axis moving in the plus direction, and this signal is valid for the axis moving in the minus direction.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

*-MITn
- 1 ..... Manual interlock- 1st axis
- :
- 8 ..... Manual interlock- 8th axis

[Related signals]

(1) Manual interlock+ n-th axis (*+MITn: Y860)

(2) Automatic interlock+/- n-th axis (*+/-AITn: Y820/Y840)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	AUTOMATIC MACHINE LOCK n-TH AXIS	AMLK1 to 8	Y8A0 to 7	Y8A8 to F	Y8B0 to 7	Y8B8 to F

[Function]

During automatic operation, current position (counter) can be changed without actual machine motion to check program. These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

AMLKn
- 1 ..... Automatic machine lock 1st axis
- :
- :
- 8 ..... Automatic machine lock 8th axis

[Operation]

In the automatic operation (memory, MDI or tape), when this signal is ON, the current position (counter) can be changed on a specific axis (for which the signal is ON) without actual machine motion. If the signal turns ON in the middle of a block (during motion), block termination occurs after the completion of that block, and then the machine lock will be valid for the following blocks.

[Caution]

(1) If "Automatic machine lock" signal changes during automatic operation, block stop occurs after completion of the block in execution.

(2) To move only the table without drilling to confirm the drilling position, turn ON the signal for the 3rd axis (AMLK3) if the drilling axis is the 3rd axis. (Equivalent to Z axis cancel)

[Related signals]

(1) Manual machine lock, n-th axis (MMLKn: Y8C0)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL MACHINE LOCK n-TH AXIS	MMLK1 to 8	Y8C0 to 7	Y8C8 to F	Y8D0 to 7	Y8D8 to F

[Function]

During manual operation, current position (counter) can be changed without actual machine motion to check program.

[Operation]

When this signal is ON, current position can be changed on a specific axis (n-th axis) without actual machine motion. If the signal turns ON or OFF during execution of a block, the operation continues until it is completed. It is required to stop motion of all axes to validate the machine lock.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

MMLKn
- 1 ..... Manual machine lock 1st axis
- :
- :
- 8 ..... Manual machine lock 8th axis

[Related signals]

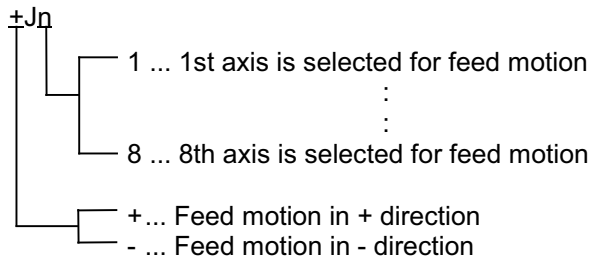
(1) Automatic machine lock n-th axis (AMLKn: Y8A0)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	FEED AXIS SELECTION+ n-TH AXIS	+J1 to 8	Y8E0 to 7	Y8E8 to F	Y8F0 to 7	Y8F8 to F

[Function]

This signal is used to start motion (jog feed, incremental feed or reference position return mode) in plus direction during manual operation.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No.

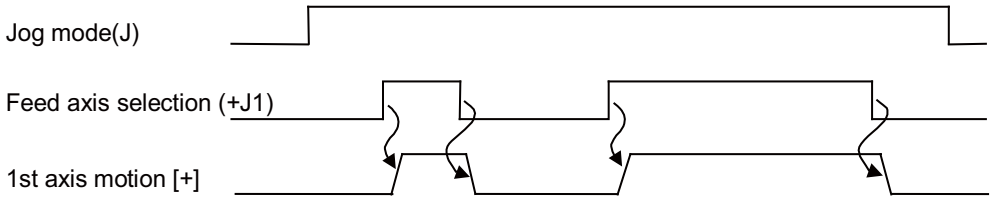


[Operation]

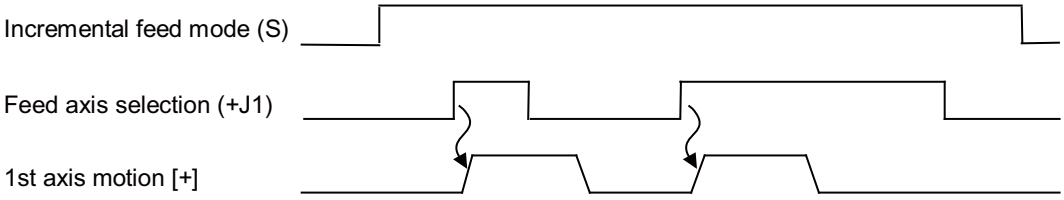
When "Feed axis selection" signal (+Jn) turns ON, the following motion occurs.

(1) When jog feed, incremental feed or reference position return is possible, motion in plus direction occurs on the selected axis.

(2) In jog feed, motion continues while the signal is ON.



(3) In incremental feed, amount (length) of motion depends on setting of "Handle/Incremental feed magnification code m". The motion is in plus direction. Even when signal (+Jn) turns OFF during motion, the motion (feed) does not stop. To start the motion again, turn ON the signal after the preceding motion has been completed.



(4) After reference position return mode is decelerated to approach speed by the near point detection dog, the motion continues, even after the feed axis selection signal is turned OFF, until motion reaches the reference position.

(Note 1) If feed axis selection plus [+] and minus [-] signals turn ON at the same time, neither plus signal nor minus signal is selected (same as the case where feed axis selection signal is OFF.)

(Note 2) If "Feed axis selection" signal turns ON before jog, incremental or reference position return mode is selected, the "Feed axis selection" signal is ignored. In this case, the signal should be turned OFF and then ON.

(Note 3) If reset is exerted while "Feed axis selection" signal is ON, or "Feed axis selection" signal turns ON during reset, the "Feed axis selection" signal is ignored even when the reset condition is canceled. In this case, the signal should be turned OFF and then ON.

(Note 4) The "Feed axis selection" signal will be invalid even if turned ON while the corresponding axis is decelerating (when command output is not completed). The signal must be turned OFF and ON again after the deceleration has completed completely (command output is completed). Special care is required when the feed axis direction changes.

(Note 5) In the 2nd part system specifications, even if the 1st part system and 2nd part system feed axis selection turn ON in the same cycle (scan) of the sequence, the start up may not be completely simultaneous.

[Related signals]

(1) Feed axis selection- n-th axis (-Jn: Y900)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	FEED AXIS SELECTION- n-TH AXIS	-J1 to 8	Y900 to 7	Y908 to F	Y910 to 7	Y918 to F

[Function]

This signal is used to feed the axis in the minus (-) direction during jog feed, incremental feed or reference position return mode in manual operation.

These signals are for each control axis, and the number at the end of the signal name indicates the control axis No. (Refer to the "Feed axis selection+ n-th axis" for details.)

[Operation]

The operation is the same as the feed axis selection+.

Use this signal to move in the minus (-) direction.

[Related signals]

(1) Feed axis selection+ n-th axis (+Jn: Y8E0)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL/AUTOMATIC SIMULTANEOUS VALID n-TH AXIS	MAE1 to 8	Y920 to 7	Y928 to F	Y930 to 7	Y938 to F

[Function]

The automatic mode (tape, MDI, memory) and manual mode (handle, step, jog, manual reference position return) can be simultaneously selected allowing manual operation during automatic operation. (Arbitrary feed with the PLC is also possible.)

[Operation]

The manual/automatic simultaneous mode is entered when the automatic mode and manual mode are selected simultaneously. The manual operation axis is selected with this signal during the manual/auto mode. The manual operation axes (MAEn) are selected individually for the 1st to 8th axes.

The axis selected with this signal can be operated in the manual mode during automatic operation.

(Note 1) If an axis command is issued to a manual operation axis from the automatic mode, the "M01 OPERATION ERROR 0005" will occur. The automatic operation will be interlocked until the operation error is canceled.

(Note 2) During the automatic mode (when manual is not selected and manual/automatic simultaneous mode is not entered), this signal will be invalid and the interlock will not be applied.

(Note 3) If this signal turns ON in respect to an axis commanded with automatic during the manual/automatic simultaneous mode, an interlock will be applied on the axis, and the axis will immediately decelerate and stop. (The "M01 OPERATION ERROR 0005" will occur.)
After decelerating and stopping, operation with the manual mode will be possible. Note that the interlock will also be applied during the tap modal.

(Note 4) During the manual/automatic simultaneous mode and the automatic mode, the manual axis command for which this signal is OFF will be invalid. Note that interruption with the manual handle will be possible.

(Note 5) The feedrates for the automatic command axis and the manual command axis are different. The acceleration/deceleration mode (rapid traverse, cutting feed) are also independent.

(Note 6) The rapid traverse override, cutting feed override and 2nd cutting feedrate override are valid for both the automatic command axis and manual command axis. (Note that the cutting and 2nd cutting overrides to the manual command axis are valid when the manual cutting override is valid.) Override cancel is valid for the automatic command axis.

(Note 7) The manual interlock is valid for the manual command axis, and the automatic interlock is valid for the automatic command axis.

(Note 8) The in-cutting feed and in-rapid traverse signals will follow the automatic command axis movement mode.

(Note 9) The axis moving with manual movement will not stop with single block stop or feed hold.

(Note 10) If the G92 and G53 commands are issued in the manual mode to an axis for which this signal is ON, the G92 and G53 commands will be executed after the manual axis movement stops. (An axis command with G53 will cause an operation error after the manual axis movement stops.)

(Note 11) If a soft limit or OT is applied on the manual command axis during the manual/automatic simultaneous mode, the automatic command axis will also decelerate to a stop, and will enter the feed hold state.

<Relation with manual handle interrupt>

The operation of the automatic handle interruption during the manual/auto mode is as follows.

		Axis for which manual/automatic valid signal is ON	Axis for which manual/automatic valid signal is OFF
Handle mode selection	Automatic handle interrupt	The specifications of the manual/automatic simultaneous mode will be followed.The automatic axis command will cause an operation error, and only the manual axis command will be valid.	The specifications of the automatic handle interruption will be followed. Interruption with the handle can be applied in respect to the automatic axis movement.
Manual mode other than handle		Same as above	Same as above

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL FEEDRATE B VALID n-TH AXIS	FBEn	Y940 to 7	Y948 to F	Y950 to 7	Y958 to F

[Function]

This signal validates manual feed using the manual feedrate B.

[Operation]

If this signal is validated when carrying out manual feed in the jog mode, the axis will move at the speed commanded by manual feedrate B which is commanded separately from the manual feedrate.

This signal is independent for the axes.

<Using the manual feedrate B> (Example for 1st part system)

(1) To set the feedrate common for all axes as the manual feedrate B
  (a) Select the JOG mode signal (J).
  (b) Turn ON the "Manual feedrate B valid n-th axis" signal (this signal) for the axis to be moved at the manual feedrate B.
  (c) Set the feedrate set as manual feedrate B in the "Manual feedrate B" register.
  (d) Turn ON the "Feed axis selection+" signal or "Feed axis selection-" signal for the axis to be moved at the manual feedrate B.

(2) To set the feedrate independent for each axis as the manual feedrate B
  (a) Select the JOG mode signal (J).
  (b) Turn ON the "Manual feedrate B valid n-th axis" signal (this signal) for the axis to be moved at the manual feedrate B. Also turn ON the "Each axis manual feedrate B valid" signal.
  (c) Set the feedrate set as each axis manual feedrate B in the "Each axis manual feedrate B n-th axis" register.
  (d) Turn ON the "Feed axis selection+" signal or "Feed axis selection-" signal for the axis to be moved at the each axis manual feedrate B.

(Note 1) Manual feedrate B is valid only for JOG feed, and is invalid in all other manual modes.

(Note 2) The rapid traverse mode is invalid for the manual feedrate B valid axis.

(Note 3) Manual override is invalid for the manual feedrate B valid axis.

(Note 4) The axis moving at the manual feedrate B will decelerate and stop when NC reset is input. To move the axis at the manual feedrate B again, cancel the NC reset, and then turn the axis selection signal OFF and ON.

(Note 5) Even if the feed axis selection signal is turned ON when the command speed is "0", an error will occur and the manual feedrate B valid axis will not move.

(Note 6) The manual/automatic simultaneous signal must be valid to move a random axis at the manual feedrate B during automatic operation.

(Note 7) The JOG mode signal must be validated simultaneously to move a random axis at the manual feedrate B during a manual operation mode other than the JOG mode.

(Note 8) During synchronous control, the "Manual feedrate B valid n-th axis" signal is invalid for the synchronous axis. The manual feedrate B signal issued for the basic axis is also valid for the synchronous axis.

[Related signals]

(1) JOG MODE (J: YC00)
(2) MANUAL FEEDRATE B (R2506 to 7)
(3) Each axis manual feedrate B valid (YC7C)
(4) Each axis manual federate B n-th axis (R5764 to 79)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ZERO POINT INITIALIZATION SET MODE n-TH AXIS	AZS1 to 8	Y960 to 7	Y968 to F	Y970 to 7	Y978 to F

[Function]

This selects the zero point initialization set with the marked point alignment method in the absolute position detection system.

[Operation]

The zero point initialization set is selected with this signal.

Refer to the section on "Zero point initialization set completed" (ZSFn) signal for details on the operations.

(Note 1) This signal is a function signal for zero point initialization set, and is not a signal that selects the operation mode. Select the jog mode or handle mode to move the axis to a required position.

(Note 2) This signal is valid for the following specifications.- When servo detection specification (motor detector, servo system) is the absolute position detection system.- When "TYPE" on the [ABS. POSI PARAM] screen is set to "2".

[Related signals]

(1) Zero point initialization set completed (ZSFn: X8C0 to 7)
(2) Zero point initialization set error completed (ZSEn: X8E0 to 7)
(3) In initialization (R574)
(4) Initialization incompletion (R575)
(5) Zero point initialization set start (ZSTn: Y980 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ZERO POINT INITIALIZATION SET START n-TH AXIS	ZST1 to 8	Y980 to 7	Y988 to F	Y990 to 7	Y998 to F

[Function]

This is used to set a random position as the origin during zero point initialization set using the marked point alignment method in the absolute position detection system.

[Operation]

This signal turns ON when a corresponding axis is moved in the zero point initialization set mode, and the position to be set as the zero point is reached.

Refer to the section on "Zero point initialization set completed" (ZSFn) signal for details on the operations.

(Note 1) This signal is a function signal for zero point initialization set, and is not a signal that selects the operation mode. Select the jog mode or handle mode to move the axis to a required position.

(Note 2) This signal is valid for the following specifications.
- When servo detection specification (motor detector, servo system) is the absolute position detection system.
- When "TYPE" on the [ABS. POSI PARAM] screen is set to "2".

(Note 3) This signal will be invalid in the following states.
- During emergency stop
- During reset
- When the "Zero point initialization set start" (ZSTn) signal is turned ON before the "Zero point initialization set mode" (AZSn) signal.

  In this case, turn this signal OFF once, and then turn it ON again.
- When the grid (Z-phase signal provided per motor rotation) has not been passed once after the power is turned ON.

[Related signals]

(1) Zero point initialization set completed (ZSFn: X8C0 to 7)
(2) Zero point initialization set error completed (ZSEn: X8E0 to 7)
(3) In initialization (R574)
(4) Initialization incompletion (R575)
(5) Zero point initialization set mode (AZSn: Y960 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CURRENT LIMIT CHANGEOVER n-TH AXIS	ILC1 to 8	Y9A0 to 7	Y9A8 to F	Y9B0 to 7	Y9B8 to F

[Function][Operation]

This signal turns on when validating the current limit.

The current limit parameter switches from SV013 to SV014.

[Related signals]

(1) In current limit n-th axis (ILI1 to 8: X900 to 7)

(2) Current limit reached n-th axis (ILA1 to 8: X920 to 7)

(3) Droop release request n-th axis (DOR1 to 8: Y9C0 to 7)

(4) Current limit mode 1 and 2 (ILM1,2: YCC0,1)

(5) Current limit changeover (R2593)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DROOP RELEASE REQUEST n-TH AXIS	DOR1 to 8	Y9C0 to 7	Y9C8 to F	Y9D0 to 7	Y9D8 to F

[Function][Operation]

During the current limit control, the droop generated by the current limit can be released.

[Related signals]

(1) In current limit n-th axis (ILI1 to 8: X900 to 7)

(2) Current limit reached n-th axis (ILA1 to 8: X920 to 7)

(3) Current limit changeover n-th axis (ILC1 to 8: Y9A0 to 7)

(4) Current limit mode 1 and 2 (ILM1,2: YCC0,1)

(5) Current limit changeover (R2593)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	WORKPIECE COORDINATE MEASUREMENT 2ND AXIS		Y9E1	Y9E9	Y9F1	Y9F9

[Function] (L system)

The Z axis external workpiece coordinate offset data can be set by cutting the workpiece face with manual operations and inputting workpiece coordinate measurement 2nd axis.

[Operation]

(1) Mode selection

Set the mode selection switch to the manual mode ([Handle], [Jog] or [Rapid Traverse]).

(2) Tool measurement mode signal input

Set the tool measurement mode signal to "1".

(3) Main/sub selection

Using the tool presetter sub-side valid signal, select whether to measure the workpiece coordinates on the main spindle side or sub-spindle side.

<Tool presetter sub-side valid signal>

OFF : The compensation No. is retrieved from the main spindle side R registers.

ON : The compensation No. is retrieved from the sub-spindle side R registers.

(Note 1) Hold the state of this signal until the measurement with the selected tool is completed.

(4) Tool selection

Issue the T command with MDI operation, etc., and select the tool.

(Note 1) Set the selected tool compensation No. in the R register.
The set R register differs according to the parameter setting and the state of the tool presetter sub-side valid signal.

(Note 2) Set the "tool length/wear data" for the tool being used beforehand.

Compensation No. R registers

#1098 Tlno.	#1130 set_t	#1218 aux02 bit4	Tool length compensation No.		Tool nose wear compensation No.	
			Main side	Sub-side	Main side	Sub-side
0	0	0/1	R2600,R2601	R2604,R2605	R2600,R2601	R2604,R2605
	1	0/1				
1	0	0	R536,R537		R2600,R2601	R2604,R2605
		1	R2602,R2603	R2606,R2607	R2600,R2601	R2604,R2605
	1	0/1	R2602,R2603	R2606,R2607	R2600,R2601	R2604,R2605

- When the compensation No. is 0, the compensation amount will be calculated as "0".
- If the compensation No. exceeds the number of specified offset sets, the "Compensation No. illegal" error will occur.
- Whether to use the main side or sub-side is selected with the tool presetter sub-side valid signal. (OFF: Main side, ON: Sub-side)

(5) Cutting the workpiece face

If the workpiece face has not been cut, cut the workpiece face slightly to even it.

(Note 1) Do not move the tool in the detection of Z axis after cutting the workpiece face.

(Note 2) If the workpiece does not need to be cut, carry out positioning to the measurement position.

(6) Setting the Z axis external workpiece coordinate offset data with the workpiece coordinate measurement 2nd axis signal input

Input the workpiece coordinate measurement 2nd axis signal (this signal). The Z axis external workpiece coordinate offset data is automatically calculated from the tool compensation data of the used tool and the machine value at the point this signal is input. The results are set as the data.

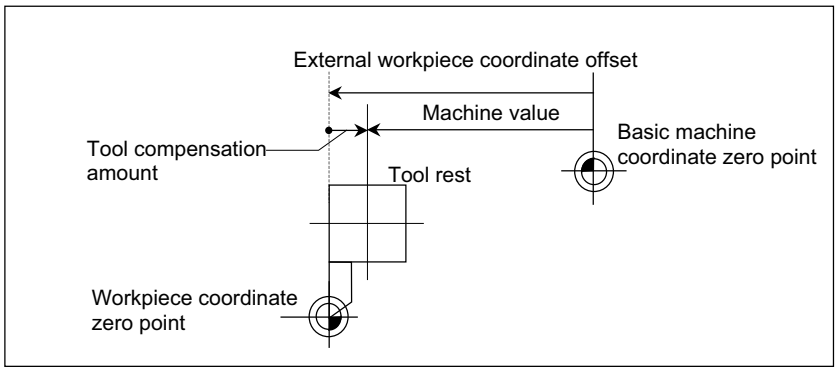
(a) Details of automatic calculation expression

The external workpiece coordinate offset data is automatically calculated with the following expression.

External workpiece coordinate offset = Machine coordinate value - tool compensation data

The tool compensation data used for the measurement is selected with the base specification parameter "#1226 aux10 bit0".

aux10 bit0	Tool compensation data
0	Tool length data + nose wear data
1	Tool length data



(7) Turning the tool measurement mode signal OFF

Measurement of the external workpiece coordinate offset is completed.

[Related signals]

(1) Tool presetter sub-side valid (YCDA)
(2) Tool compensation No. (Main side: R2600 to R2603, Sub side: R2604 to R2607)
(3) Tool length measurement 2 (TLMS: YC21)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CONTROL AXIS DETACH 2 n-TH AXIS	DTCH21 to 28	YA00 to 7	YA08 to F	YA10 to 7	YA18 to F

[Function]

A control axis can be excluded from the control targets with this function.

This signal is present for each control axis. The end numbers in the signal name indicate the control axis No.

DTCH2n
- 1: The 1st axis is set as axis detach 2.
- :
- :
- 8: The 8th axis is set as axis detach 2.

[Operation]

When the "Control axis detach 2" signal (DTCH2n) turns ON, the corresponding axis is excluded from the control targets.

(1) Position control cannot be carried out, but the position is not lost because the position detection is valid.
(2) The "Interlock" signal of the corresponding axis is considered turned ON.
(3) The corresponding axis also appears in the CRT position display.

[Related signals]

(1) Control axis detach n-th axis (DTCHn: Y780)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	UNCLAMP COMPLETION n-TH AXIS	UCLPFn	YA20 to 7	YA28 to F	YA30 to 7	YA38 to F

[Function]

This signal indicates that unclamping has been completed in respect to the unclamp command from the CNC.

[Operation]

When the unclamp command signal turns ON, the clamp on the corresponding axis is released by the PLC, and then this signal turns ON.

When the unclamp command turns OFF, the corresponding axis is clamped by the PLC, and then this signal turns OFF.

[Related signals]

(1) Unclamp command (UCLPn:X960 to X967)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MIXED CONTROL (CROSS AXIS CONTROL) REQUEST n-TH AXIS	CRS1 to 8	YA60 to 7	YA68 to F	YA70 to 7	YA78 to F

[Function]

The mixed control (cross axis control) is turned ON and OFF with the PLC signal. By using parameter, designate which axis enters mixed control (cross axis control) state by this signal.

[Operation]

(1) Mixed control (cross axis control) control command using PLC signals

There are "mixed control (cross axis control) request" signals (CRS1 to CRS8) for eight axes in each part system. (There are signals for eight axes regardless of the actual number of axes.)

Cross machining is carried out by exchanging the axis for which the PLC signal is input and the axis designated with parameter at the rising edge (0 to 1) of this signal. If an axis is not mounted at the section where the PLC signal is input, the axis designated with the parameter will be moved from another part system.

The axis cross machining state is canceled at the falling edge (1 to 0) of this signal, and normal control is applied.

(2) Commanding in the machining program

Turn the "mixed control (cross axis control) " signal ON/OFF using M or T command, etc. to carry out the mixed control (cross axis control).

Carry out waiting-and-simultaneous operation before the M command and T command, etc., for mixed control (cross axis control) so that the timing for the mixed control (cross axis control) matches.

[Related signals]

(1) In mixed control (cross axis control)(X980 to X987)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SYNCHRONOUS CONTROL REQUEST n-TH AXIS	SYNC1 to 8	YA80 to 7	YA88 to F	YA90 to 7	YA98 to F

[Function]

Whether to start or cancel synchronous control is selected with a signal corresponding to the synchronous axis.

1 → 0 (falling edge) Synchronous control cancel

0 → 1 (rising edge) Synchronous control start

[Operation]

Synchronous control is started and canceled with the rising edge (OFF to ON) or falling edge (ON to OFF) of the PLC signal (SYNC1 to 8) corresponding to the synchronous axis.

Thus, if synchronous control is canceled by a cause other than the PLC signal turning OFF, such as by emergency stop, and synchronous control is to be started again, turn the PLC signal OFF and then ON again.

The synchronization basic axis corresponding to each synchronous axis is set with the parameter "#2088 bsax_sy".

The movement direction of the synchronous axis in respect to the movement of the synchronous basic axis is determined by the value set for parameter "#2087 syncnt".

When syncnt is 0, moves in the same direction as the basic axis

When syncnt is 1, moves in the opposite direction of the basic axis

[Caution]

(1) The two axes related to control (synchronous/superimposition control) are both controlled in the smoothing zero state. Control is started after the axis movement has ended and smoothing zero is established.

(2) Control (synchronous/superimposition control) are affected by the state of the two target part systems. Thus, attention must be paid to the timing between the part systems. Always command synchronization before commanding the control PLC signal.

(3) Control (synchronous/superimposition control) cannot be commanded to an axis in inclined axis control. An operation error will occur if this type of command is issued.

(4) Before control (synchronous/superimposition control) is started, the target axis must have completed reference position return after the power was turned ON, or the absolute position must be established. An operation error will occur if the above state is not established.

(5) A movement command cannot be issued to a synchronous axis during synchronous control. An operation error will occur if movement is commanded.

(6) An axis in synchronous control cannot be commanded as the superimposition control axis. An operation error will occur if this type of command is issued.

(7) A synchronous axis in synchronous control cannot be commanded as the synchronous axis for other synchronous control. An operation error will occur if this type of command is issued. Note that a single axis can be designated as the synchronous basic axis for several synchronous controls.

[Related signals]

(1) In synchronous/superimposition control (X9A0 to X9A7)

(2) Synchronous error amount (R5076 to R5091)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SUPERIMPOSITION CONTROL REQUEST n-TH AXIS	PILE1 to 8	YAA0 to 7	YAA8 to F	YAB0 to 7	YAB8 to F

[Function]

Whether to start or cancel superimposition control is selected with a signal corresponding to the superimposing axis.

1 → 0 (falling edge) Superimposition control cancel

0 → 1 (rising edge) Superimposition control start

[Operation]

Superimposition control is started and canceled with the rising edge (OFF to ON) or falling edge (ON to OFF) of the PLC signal (PILE1 to 8) corresponding to the superimposing axis.

Thus, if superimposition control is canceled by a cause other than the PLC signal turning OFF, such as by emergency stop, and superimposition control is to be started again, turn the PLC signal OFF and then ON again.

The superimposing basic axis corresponding to each superimposing axis set with the parameter "#2089 bsax_sy".

The movement direction of the superimposing axis in respect to the movement of the superimposing basic axis is determined by the value set for parameter "#2087 syncnt".

When syncnt is 0, moves in the same direction as the basic axis

When syncnt is 1, moves in the opposite direction of the basic axis

[Caution]

(1) The two axes related to control (synchronous/superimposition control) are both controlled in the smoothing zero state. Control is started after the axis movement has ended and smoothing zero is established.

(2) Control (synchronous/superimposition control) are affected by the state of the two target part systems. Thus, attention must be paid to the timing between the part systems. Always command synchronization before commanding the control PLC signal.

(3) Control (synchronous/superimposition control) cannot be commanded to an axis in inclined axis control. An operation error will occur if this type of command is issued.

(4) Before control (synchronous/superimposition control) is started, the target axis must have completed reference position return after the power was turned ON, or the absolute position must be established. An operation error will occur if the above state is not established.

(5) An axis in superimposition control cannot be commanded as the synchronous control axis. An operation error will occur if this type of command is issued.

(6) A superimposing axis in superimposition control cannot be commanded as the superimposing axis for other superimposition control. An operation error will occur if this type of command is issued. Note that a single axis can be designated as the superimposing basic axis for several superimposition controls.

[Related signals]

(1) In synchronous/superimposition control signal (X9A0 to 7)

(2) Synchronous error amount (R5076 to R5091)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	NC AXIS CONTROL SELECTION n-TH AXIS	-	YAC0 to 7	YAC8 to F	YAD0 to 7	YAD8 to F

[Function]

This signal is used to select the control method over the NC axes which can be operated under PLC control.

0: PLC control

1: NC control

[Operation]

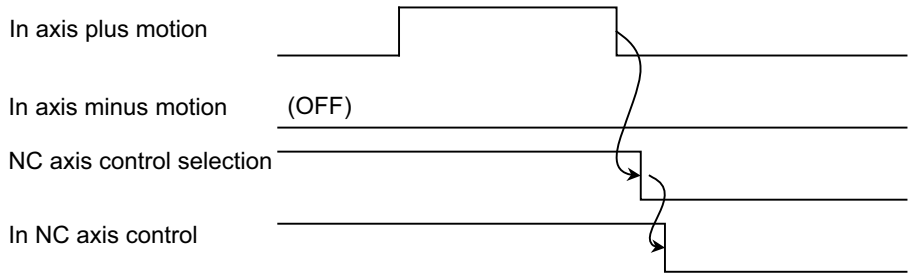
When this signal is ON, the axis is controlled with a machining program. (The axis is handled as NC axis.)

When this signal is OFF, the axis is controlled with the PLC axis indexing interfaces. (The axis is handled as PLC axis.)

The following shows the correspondence of axis Nos. and device Nos.

Device No.	Signal name	Device No.	Signal name
YAC0	NC axis control selection 1st axis	YAC4	NC axis control selection 5th axis
YAC1	NC axis control selection 2nd axis	YAC5	NC axis control selection 6th axis
YAC2	NC axis control selection 3rd axis	YAC6	NC axis control selection 7th axis
YAC3	NC axis control selection 4th axis	YAC7	NC axis control selection 8th axis

[Timing chart]



[Caution]

(1) This signal is available only for the NC axis which can be operated under PLC control. "The NC axis which can be operated under PLC control" has the axis No. for PLC axis indexing, designated by "#12800 chgauxno".

(2) Turn ON/OFF this signal after confirming that the axis is not moving.
Turning this signal ON/OFF during the axis movement leads an operation error. The axis decelerates and stops then.
(Usage example) When the parameters are set as follows

Axis No.	1	2	3	4	5
#1013 axname	X	Y	Z	A	C
#12800 chgauxno	0	0	0	1	2

A-axis and C-axis can be operated under PLC control. To operate the A-axis under NC control, turn the signal YAC3 ON. The signals YAC0 to YAC2 and YAC5 to YAC7 are not available.

[Related signals]

(1) In NC axis control n-th axis (XA20 to XA27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	VERTICAL AXIS PULL-UP PRE-VENTION REQUEST n-TH AXIS		YAE0 to 7	YAE8 to F	YAF0 to 7	YAF8 to F

[Function]

This signal prevents the vertical axis pull-up function: the vertical axis will not be pulled up.

[Operation]

When this signal turns ON, NC will operate as follows.

(1) Command the drive unit to prevent vertical axis pull-up.
(2) Turns ON the "Vertical axis pull-up prevented" signal.

When this signal turns OFF, NC will operate as follows.

(1) Command the drive unit to cancel the prevention of vertical axis pull-up.
(2) Turns OFF the "Vertical axis pull-up prevented" signal.

[Related signals]

(1) Vertical axis pull-up prevented (XA60 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	JOG MODE	J	YC00	YD40	YE80	YFC0

[Function]

JOG operation mode (manual operation) is selected.

[Operation]

When JOG mode signal (J) turns ON, JOG operation mode is selected.

Axis motion is started by turning ON the "Feed axis selection+ (+J1 to 8) or Feed axis selection- (-J1 to 8)" signal after turning ON the jog mode and setting the manual federate code (*JV1 to 16).

For rapid traverse, "Rapid traverse" signal (RT) is turned ON together with this signal (J).

If the operation mode duplicates the other mode or if it is removed, the NC alarm "M01 OPERATION ERROR 0101" will occur.

[Related signals]

(1) Feed axis selection (+J1 to 8: Y8E0, -J1to 8: Y900)
(2) Manual feedrate code m (*JV1 to 16: YC70 to 4)
(3) Rapid traverse (RT: YC26)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	HANDLE MODE	H	YC01	YD41	YE81	YFC1

[Function]

"Handle feed operation" mode (manual operation) is selected.

[Operation]

When HANDLE mode signal (H) is turned ON, HANDLE FEED mode is selected.

Axis motion starts when the manual pulse generator handwheel is rotated after axis is selected by handle axis selection code (HS11 to 116, HS1S, HS21 to 216, HS2S, HS31 to 316, HS3S) and this signal is turned ON. Speed of the axis motion depends on setting of feedrate magnification (MP1 to 4).

If the operation mode duplicates the other mode or if it is removed, the NC alarm "M01 OPERATION ERROR 0101" will occur.

[Related signals]

(1) 1st handle axis selection code (HS11 to 116: YC40), 1st handle valid (HS1S: YC47)
(2) 2nd handle axis selection code (HS21 to 216: YC48), 2nd handle valid (HS2S: YC4F)
..... Valid only for handle 2-axis spec.
(3) 3rd handle axis selection code (HS31 to 316: YC50), 3rd handle valid (HS3S: YC57)
..... Valid only for handle 3-axis spec.
(4) Handle/Incremental feed magnification code m (MP1 to 4: YC80 to YC82)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	INCREMENTAL MODE	S	YC02	YD42	YE82	YFC2

[Function]

INCREMENTAL FEED mode (manual operation) is selected.

[Operation]

When incremental mode command signal (S) is turned ON, INCREMENTAL FEED mode is selected.

Each time "Feed axis selection" signal (+J1 to 8, -J1 to 8) for desired axis is turned ON, axis motion starts. Speed of the axis motion (incremental feed) depends on setting of "Handle/Incremental feed magnification code m" (MP1 to 4).

When "Rapid traverse" signal (RT) is ON, speed is the rapid traverse speed. When signal (RT) is OFF, speed is equal to "Manual federate" (*JV1 to 16).

If the signal is the same as another operation mode or if it is removed, the NC alarm "M01 OPERATION ERROR 0101" will occur.

(Note 1) The incremental mode is also called as step mode.

[Related signals]

(1) Handle/Incremental feed magnification code m (MP1 to 4: YC80 to YC82)
(2) Feed axis selection (+J1 to 8: Y8E0, -J1 to 8: Y900)
(3) Manual feedrate code m (*JV1 to 16: YC70)
(4) Rapid traverse (RT: YC26)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED MODE	PTP	YC03	YD43	YE83	YFC3

[Function]

MANUAL ARBITRARY FEED mode in manual operation is selected.

[Operation]

MANUAL ARBITRARY FEED mode is selected when this signal is turned ON ("1").

[Caution]

To turn the MANUAL ARBITRARY FEED mode ON, the rest of the manual modes and the automatic mode must be OFF (0).

Otherwise, this mode cannot be selected. (Note that this mode can be selected simultaneously when manual/automatic simultaneous is valid.)

[Related signals]

(1) Signals from PLC to controller

Device No.					
$1	$2	$3	$4	Abbreviation	Signal name
YCA0	YDE0	YF20	Y1060	CX11	Manual arbitrary feed 1st axis selection code 1
YCA1	YDE1	YF21	Y1061	CX12	Manual arbitrary feed 1st axis selection code 2
YCA2	YDE2	YF22	Y1062	CX14	Manual arbitrary feed 1st axis selection code 4
YCA3	YDE3	YF23	Y1063	CX18	Manual arbitrary feed 1st axis selection code 8
YCA4	YDE4	YF24	Y1064	CX116	Manual arbitrary feed 1st axis selection code 16
YCA5	YDE5	YF25	Y1065		
YCA6	YDE6	YF26	Y1066		
YCA7	YDE7	YF27	Y1067	CX1S	Manual arbitrary feed 1st axis valid

Device No.					
$1	$2	$3	$4	Abbreviation	Signal name
YCA8	YDE8	YF28	Y1068	CX21	Manual arbitrary feed 2nd axis selection code 1
YCA9	YDE9	YF29	Y1069	CX22	Manual arbitrary feed 2nd axis selection code 2
YCAA	YDEA	YF2A	Y106A	CX24	Manual arbitrary feed 2nd axis selection code 4
YCAB	YDEB	YF2B	Y106B	CX28	Manual arbitrary feed 2nd axis selection code 8
YCAC	YDEC	YF2C	Y106C	CX216	Manual arbitrary feed 2nd axis selection code 16
YCAD	YDED	YF2D	Y106D		
YCAE	YDEE	YF2E	Y106E		
YCAF	YDEF	YF2F	Y106F	CX2S	Manual arbitrary feed 2nd axis valid

Device No.					
$1	$2	$3	$4	Abbreviation	Signal name
YCB0	YDF0	YF30	Y1070	CX31	Manual arbitrary feed 3rd axis selection code 1
YCB1	YDF1	YF31	Y1071	CX32	Manual arbitrary feed 3rd axis selection code 2
YCB2	YDF2	YF32	Y1072	CX34	Manual arbitrary feed 3rd axis selection code 4
YCB3	YDF3	YF33	Y1073	CX38	Manual arbitrary feed 3rd axis selection code 8
YCB4	YDF4	YF34	Y1074	CX316	Manual arbitrary feed 3rd axis selection code 16
YCB5	YDF5	YF35	Y1075		
YCB6	YDF6	YF36	Y1076		
YCB7	YDF7	YF37	Y1077	CX3S	Manual arbitrary feed 3rd axis valid

Device No.					
$1	$2	$3	$4	Abbreviation	Signal name
YCB8	YDF8	YF38	Y1078	CXS1	Manual arbitrary feed smoothing off
YCB9	YDF9	YF39	Y1079	CXS2	Manual arbitrary feed axis independent
YCBA	YDFA	YF3A	Y107A	CXS3	Manual arbitrary feed EX. F/MODAL.F
YCBB	YDFB	YF3B	Y107B	CXS4	Manual arbitrary feed G0/G1
YCBC	YDFC	YF3C	Y107C	CXS5	Manual arbitrary feed MC/WK
YCBD	YDFD	YF3D	Y107D	CXS6	Manual arbitrary feed ABS/INC
YCBE	YDFE	YF3E	Y107E	*CXS7	Manual arbitrary feed stop
YCBF	YDFF	YF3F	Y107F	CXS8	Manual arbitrary feed strobe

Device No.					
$1	$2	$3	$4	Abbreviation.	Signal name
R2508	R2708	R2908	R3108		1st handle/incremental feed magnification
R2509	R2709	R2909	R3109		
R2510	R2710	R2910	R3110		2nd handle feed magnification
R2511	R2711	R2911	R3111		
R2512	R2712	R2912	R3112		3rd handle feed magnification
R2513	R2713	R2913	R3113		
R2544	R2744	R2944	R3144		Manual arbitrary feed 1st axis travel amount
R2545	R2745	R2945	R3145		
R2546	R2746	R2946	R3146		
R2547	R2747	R2947	R3147		
R2548	R2748	R2948	R3148		Manual arbitrary feed 2nd axis travel amount
R2549	R2749	R2949	R3149		
R2550	R2750	R2950	R3150		
R2551	R2751	R2951	R3151		
R2552	R2752	R2952	R3152		Manual arbitrary feed 3rd axis travel amount
R2553	R2753	R2953	R3153		
R2554	R2754	R2954	R3154		
R2555	R2755	R2955	R3155		

(2) Signals from controller to PLC
  (a) In manual arbitrary feed mode (PTPO: XC03)
  (b) In manual arbitrary feed (CXN: XC16)
  (c) Manual arbitrary feed completion (CXFIN: XC1C)

(3) Other
  (a) Feedrate least increment code 1,2 (PCF1: YC78, PCF2: YC79)
  (b) Manual/Automatic simultaneous valid n-th axis (MAE1 to 8)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION RETURN MODE	ZRN	YC04	YD44	YE84	YFC4

[Function]

REFERENCE POSITION RETURN mode is selected.

"Reference position return" is that axis motion component (tool, table, etc.) is returned to the position previously determined for individual machine.

[Operation]

The reference position return mode is selected when the "Reference position return mode" signal (ZRN) is turned ON. Select the reference position return mode, and turn ON the "Feed axis selection" signal (+J1 to 8, -J1 to 8) of designated axis to return to the reference position.

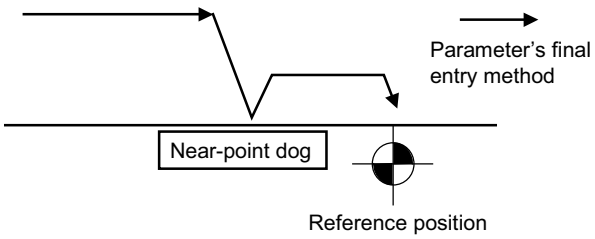
If the signal is the same as another operation mode or if it is removed, the NC alarm "M01 OPERATION ERROR 0101" will occur.

The first reference position return after the controller power is turned ON is the dog-type return (excluding when the basic machine coordinate system is established for the absolute position detection specifications). After the second manual reference position return (when basic machine coordinate system is established), the dog-type or high-speed return is selected with the machine parameters, basic specification parameter "#1063 mandog".

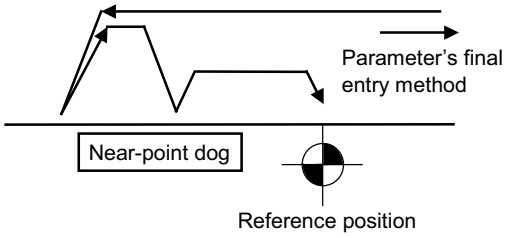
(1) Dog-type reference position return pattern

The return pattern is determined by the final entry method of the machine parameter reference position return.

(a) Operation when axis is moved in same direction as the final entry method, and dog is tripped.



(b) When axis is moved in opposite direction from final entry method, and dog is tripped.



- After the near-point dog is detected and the approach speed is applied, the axis will move to the reference position even if the "Feed axis selection" signal is turned OFF. Thus, after the approach speed is applied, another axis can be switched to and reference position return executed.
- The entry direction (final entry direction) after the near-point dog is tripped is set with parameters.
- The feedrate before the approach speed is the reference position return feedrate if the "Rapid traverse" signal (RT) is ON, and the "Manual feedrate" (*JV1 to 16) is OFF.
- The approach speed is set with the parameters.
- When the reference position is reached, the movement will stop even if the feed axis selection signal is ON, and the "1st reference position reached" signal (ZP1n) will turn ON.

(2) High-speed reference position return

- The axis will move toward the reference position. The motion speed will be rapid traverse if the rapid traverse signal is ON, and manual feedrate if OFF.
- When the reference position is reached, the movement will stop even if the feed axis selection signal is ON, and the "1st reference position reached" signal (ZP1n) will turn ON.
- The feed axis selection signal for high-speed return is valid only in the reference position direction. If the opposite direction signal is designated, the NC alarm "M01 Operation error 0003" will occur.

[Related signals]

(1) Feed axis selection (+J1 to 8: Y8E0, -J1 to 8: Y900)
(2) Manual feedrate code m (*JV1 to 16: YC70)
(3) Rapid traverse (RT: YC26)
(4) 1st reference position reached (ZP11 to 18: X800 to 7)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	AUTOMATIC INITIALIZATION MODE	AST	YC05	YD45	YE85	YFC5

[Function]

The automatic initialization mode is selected.

[Operation]

This mode is selected when automatic initialization is to be carried out with the machine end stopper method of absolute position detection.

The initialization is started when the automatic initialization mode is selected, and the "Feed axis selection" (+Jn, -Jn) signal in the direction of the machine end of the axis to be initialized is turned ON.

(Note 1) The automatic initialization mode is invalid when the absolute position detector is not provided and when the machine end stopper method is not selected for the absolute position detection.
(During feed axis selection, "M01 OPERATION ERROR 0024" will occur.)

(Note 2) This mode will not start in the following cases of the machine end stopper method absolute position detection. (The message "Start not possible" will display.
- When "#0 Absolute posn set" on the [ABS. POSITION SET] screen is not set to "1".
- When "#2 Zero-P" on the [ABS. POSITION SET] screen has not been set.
- When "#2055 pushf" on the [ABS. POSITION PARAMETER] screen has not been set.
- When "Z71 0005" has occurred.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MEMORY MODE	MEM	YC08	YD48	YE88	YFC8

[Function]

MEMORY mode of automatic operation is selected.

In this mode of operation, automatic operation is based on programs stored in the memory.

[Operation]

- MEMORY mode is selected when "Memory mode" signal (MEM) turns ON.
- The program is started with the "Automatic operation "start" command" signal (ST).
- If the automatic operation mode is duplicated or canceled during automatic operation, the NC alarm "M01 OPERATION ERROR 0101" will occur, and the block will stop.
- If the manual operation mode is entered or the program is duplicated with the manual operation mode during automatic operation, the NC alarm will occur, and automatic operation will stop. However, the manual and automatic programs can be duplicated if manual/automatic simultaneous operation is valid.

(Note 1) Even when operation mode is other than automatic operation, illegal mode, if selected, causes operation error.

[Related signals]

(1) Automatic operation "start" command (ST: YC10)
(2) Automatic operation "pause" command (*SP: YC11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TAPE MODE	T	YC09	YD49	YE89	YFC9

[Function]

TAPE mode of automatic operation is selected.

In this mode of operation, automatic operation is based on tape command (RS232-C input) programs stored in NC tape.

[Operation]

- Tape mode is selected when "Tape mode" (T) signal turns ON.
- The program is started with the "Automatic operation "start" command" signal (ST).
- If the automatic operation mode is duplicated or canceled during automatic operation, the NC alarm "M01 OPERATION ERROR 0101" will occur, and the block will stop.
- If the manual operation mode is entered or the program is duplicated with the manual operation mode during automatic operation, the NC alarm will occur, and automatic operation will stop. However, the manual and automatic programs can be duplicated if manual/automatic simultaneous operation is valid.

(Note 1) Even when operation mode is other than automatic operation, illegal mode, if selected, causes operation error.

[Related signals]

(1) Automatic operation "start" command (ST: YC10)

(2) Automatic operation "pause" command (*SP: YC11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MDI MODE	D	YC0B	YD4B	YE8B	YFCB

[Function]

MDI (Manual Data Input) mode of automatic operation is selected.

Automatic operation is performed with the program set in the MDI screen.

[Operation]

- MDI mode is selected when "MDI mode" (D) signal turns ON.
- The program is started with the "Automatic operation "start" command" signal (ST).
- If the automatic operation mode is duplicated or canceled during automatic operation, the NC alarm "M01 OPERATION ERROR 0101" will occur, and the block will stop.
- If the manual operation mode is entered or the program is duplicated with the manual operation mode during automatic operation, the NC alarm will occur, and automatic operation will stop. However, the manual and automatic programs can be duplicated if manual/automatic simultaneous operation is valid.

(Note 1) Even when operation mode is other than automatic operation, illegal mode, if selected, causes operation error.

[Related signals]

(1) Automatic operation "start" command (ST: YC10)

(2) Automatic operation "pause" command (*SP: YC11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	AUTOMATIC OPERATION "START" COMMAND (Cycle start)	ST	YC10	YD50	YE90	YFD0

[Function]

This signal is used to start automatic operation in MEMORY mode, MDI mode or TAPE mode, or to restart after automatic operation pause (halt) or block stop.

[Operation]

(1) "Automatic operation "start" command" (ST) signal arises when the pressed "auto operation start" pushbutton is released (i.e. at the time the signal turns OFF). The signal must be ON for a min. of 100msec.

(2) "In automatic operation "start"" signal (status signal "STL") turns ON when the pressed "auto operation start" pushbutton is released, and turns OFF when "auto operation pause (or halt)" pushbutton is pressed or block stop occurs in single-block operation.

(3) Signal (ST) is invalid when:
- Automatic operation starts.
- Automatic operation "pause" command" (*SP) signal is OFF.
- During reset ("Reset & rewind" signal is ON).
- During alarm.
- Sequence No. is being searched for.

(4) Automatic operation stops or is suspended or block stops when:
- Automatic operation "pause" command" (*SP) signal turns OFF.
- Reset occurs ("Reset & rewind" signal turns ON).
- Alarm which causes stop to automatic operation occurs.
- Automatic operation mode is changed to manual operation mode.
- Mode is changed to other automatic operation mode and then the block in execution is completed.
- Block in execution is completed after "Single-block" (SBK) signal turns ON.
- Block in execution is completed after "Automatic machine lock" signal (AMKL) turns ON.
- Program specified in MDI mode has been executed completely.

[Related signals]

(1) Memory mode (MEM: YC08)

(2) Tape mode (T: YC09)

(3) MDI mode (D: YC0B)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	AUTOMATIC OPERATION "PAUSE" COMMAND (Feed hold)	*SP	YC11	YD51	YE91	YFD1

[Function]

During automatic operation, axis motion can be decelerated and stopped with this command signal. To restart, press "Automatic operation "start" command" (ST) signal pushbutton.

[Operation]

(1) When "Automatic operation "pause" command" (*SP) signal turns OFF, automatic operation stops.
- During automatic operation, the operation stops. "In automatic operation "pause"" (SPL) occurs.
- Restart with the automatic start (ST) button. (Press after turning *SP signal.)

(2) In the following cases, automatic operation does not immediately stop.
- During tapping in fixed cycle.
  Automatic operation stops when tapping is completed and the tool returns to "R" point.
- During thread cutting.
  Automatic operation stops when a block for axis motion (other than thread cutting), which comes first after the "Automatic operation "pause" command" (*SP) signal turns OFF, is completed. If the "Automatic operation "pause" command" (*SP) signal remains OFF, however, automatic operation stops immediately after a block (other than thread cutting) is given.
- When control variable "feed hold invalid" has been set by user macro.Automatic operation stops immediately after a block where the control variable "feed hold invalid" is cleared starts.

(3) "Automatic operation "pause" command" (*SP) signal is valid even during machine lock.

[Related signals]

(1) Memory mode (MEM: YC08)
(2) Tape mode (T: YC09)
(3) MDI mode (D: YC0B)
(4) Automatic operation "start" command (ST: YC10)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SINGLE BLOCK	SBK	YC12	YD52	YE92	YFD2

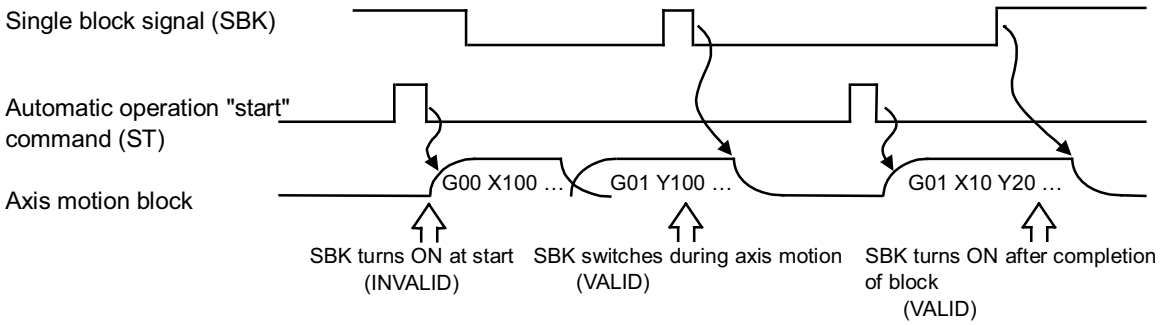
[Function]

Machining program can be executed block by block in automatic operation.

[Operation]

(1) When "Single block" signal (SBK) turns ON, operation of controller is as follows:
- During automatic operation
  After the block in execution has been completed, automatic operation stops. To start execution of the next block, "Automatic operation "start" command" (ST) must be turned ON to OFF.
- There will be no operation when automatic operation is not being executed but if automatic operation is started with the "Single block" signal (SBK) ON, one block will be executed and then will stop. This allows the commanded program to be executed one block at a time.

(2) If the "Single block" signal (SBK) is ON at the end of a block, operation will normally stop immediately. However, in the following case, operation will continue to where stopping is possible, and then will stop.
- During cycle operation such as a fixed cycle.
  The block where single block is being received will differ according to each cycle. Refer to the cycle sections in the Programming Manual.



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	BLOCK START INTERLOCK	*BSL	YC13	YD53	YE93	YFD3

[Function]

This signal prohibits start of the next block in automatic operation (memory, MDI or tape).

[Operation]

While the "Block start interlock" (*BSL) signal is OFF, execution of the next block may not be started in automatic operation. When the signal is given during execution of a block, the execution of the block continues until it is completed. Since the signal does not cause stop or suspension of automatic operation, execution of program starts when the "Block start interlock" (*BSL) signal turns ON.

(Note 1) This signal is valid to all blocks including blocks internally generated in controller by fixed cycle, etc.

(Note 2) The signal (*BSL) is ON when the power is turned ON. When the signal is not used, programming on the PLC is not required for this signal.

[Related signals]

(1) Cutting block start interlock (*CSL: YC14)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	CUTTING BLOCK START INTERLOCK	*CSL	YC14	YD54	YE94	YFD4

[Function]

This signal prohibits start of an axis motion command block other than that for positioning in automatic operation (memory, MDI, tape).

[Operation]

While the "Cutting block start interlock" (*CSL) signal is OFF, execution of an axis motion command block other than that for positioning may not be started in automatic operation. When the signal is given during execution of a block, the execution of the block continues until it is completed.

Since the signal does not cause stop or suspension of automatic operation, execution of program starts when the "Cutting block start interlock" (*CSL) signal is turned ON.

(Note 1) This signal is valid to all blocks including blocks internally generated by fixed cycle, etc.

(Note 2) The signal (*CSL) is ON when the power is turned ON. When the signal is not used, programming on the PLC is not required for this signal.

[Related signals]

(1) Block start interlock (*BSL: YC13)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DRY RUN	DRN	YC15	YD55	YE95	YFD5

[Function]

Feedrate in automatic operation is specified by manually set value instead of program command value (F value).

[Operation]

(1) DRY RUN signal given during cutting feed
- When "Rapid traverse" (RT) signal is ON, the cutting feedrate is equal to the maximum cutting feedrate.In this case, "cutting feedrate override" and "rapid traverse override" are ignored.
- When "Rapid traverse" (RT) signal is OFF, the set manual feedrate (*JV1 to 16) will apply. Cutting feed override will also be valid if the "Manual override method selection" (OVSL) signal is ON.

(2) Dry run signal given during rapid traverse
- The parameter must be turned ON to validate dry run for rapid traverse (G0, G27, G28, G29, G30).
- When "Rapid traverse" (RT) signal is ON, the "Dry run" signal is ignored.
- When "Rapid traverse" (RT) signal is OFF, the speed is equal to manually set speed.

(Note 1) Dry run is not applicable to manual operation.

(Note 2) Dry run is valid even during G84 or G74 operation.

[Related signals]

(1) Manual feedrate code m (*JV1 to 16: YC70)

(2) Rapid traverse (RT: YC26)

(3) Manual override method selection (OVSL: YC59)

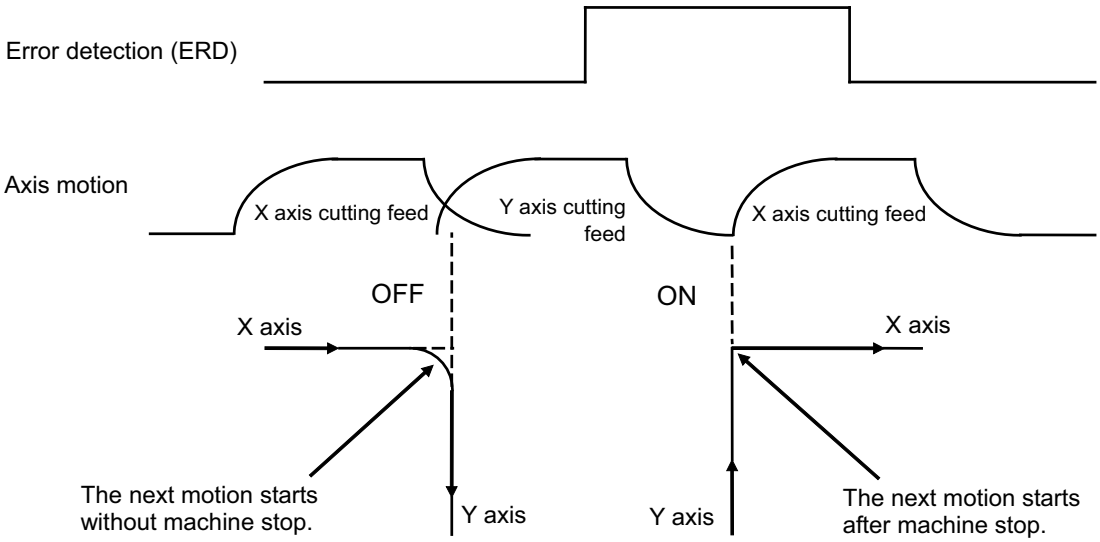
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ERROR DETECTION	ERD	YC17	YD57	YE97	YFD7

[Function]

Machine motion is stopped momentarily in transition from a cutting feed block to other block during automatic operation to provide time for determination whether in-position check is made or not before start of the next block.
Block-to-block transition may cause rounding in cutting because of delay caused by acceleration or deceleration, and servo response delay. Rounding can be eliminated by stopping the machine motion between the blocks by turning the "Error detection" signal (ERD) ON.

[Operation]

When this "Error detection" signal (ERD) is ON in block-to-block transition during cutting in automatic operation, in-position check is accomplished. If the signal is OFF, the next block starts after completion of the preceding block without stop.



(Note 1) In general practice, the signal (ERD) is turned ON and OFF using an appropriate miscellaneous function (M code, etc.) so that command program can determine whether machine motion should be stopped or not. When the signal is ON, the status is same as the case where G09 is specified by the command program. Consequently, it is recommended to use G function unless otherwise required especially.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC RESET 1	NRST1	YC18	YD58	YE98	YFD8

[Function]

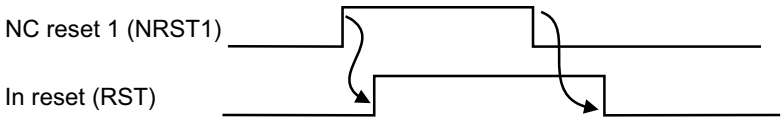
This signal is used to reset the control unit.

[Operation]

When this signal (NRST1) is turned ON, the control unit can be reset.

Generally, the signal for the reset button of the NC operation board is set to "NC reset 1" (NRST1). At this time, the control unit will take the following actions.

(1) The G command modal will be held.
(2) The tool compensation data will be held.
(3) The memory will be indexed.
(4) The error/alarm will be reset.
(5) The MST code output will be held.
(6) The M code independent output (M00, M01, M02, M30) will turn OFF.
(7) The axis movement will stop.
(8) The "In reset" signal (RST) will be output.



[Related signals]

(1) NC reset 2 (NRST2: YC19)
(2) Reset & rewind (RRW: YC1A)
(3) In "reset" (RST: XC15)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NC RESET 2	NRST2	YC19	YD59	YE99	YFD9

[Function]

This signal is used to reset the control unit.

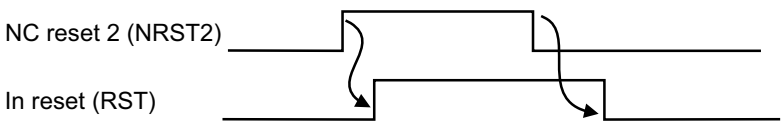
[Operation]

When this signal (NRST2) is turned ON, the control unit can be reset.

Generally, this is turned ON when the miscellaneous function M02 or M30 is executed. In some cases, the "Reset & Rewind" (RRW) explained later is used.

At this time, the control unit will take the following actions.

(1) The G command modal will be initialized.
(2) The tool compensation data will be canceled. (Will not be applied.)
(3) The memory will not be indexed.
(4) The error/alarm will be reset.
(5) The MST code output will be held.
(6) The M code independent output (M00, M01, M02, M30) will turn OFF.
(7) The axis movement will stop.
(8) The "In reset" signal (RST) will be output.



[Related signals]

(1) NC reset 1 (NRST1: YC18)
(2) Reset & rewind (RRW: YC1A)
(3) In "reset" (RST: XC15)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	RESET & REWIND	RRW	YC1A	YD5A	YE9A	YFDA

[Function]

This signal resets the controller.

During memory operation, the head of the machining program currently being run can be called out.

The reset key in the communication terminal is also set to YC1A by the sequence program.

[Operation]

When this signal (RRW) turns ON:

(1) Ongoing axis motion is decelerated and stopped.

(2) CNC is reset after axis motion stops. In about 0.5 second after CNC is reset, "In reset" signal (status signal RST) turns ON.

(3) At the same time as CNC is reset, "In rewind" (RWD) signal turns ON.
- In memory operation mode, the head of program in execution is read (memory index).

(4) While the signal (RRW) is ON, automatic operation and manual operation are impossible.

(5) G command modal is initialized.

(6) Tool compensation (offset) data are canceled (no motion).

(7) Error/alarm is reset.

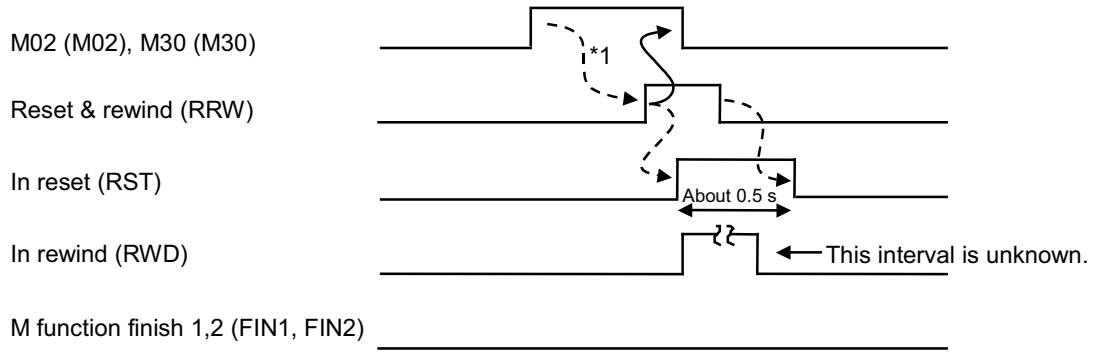
(8) M, S, T code outputs are held. (Strobe signal turns OFF.)

(9) M code independent output (M00, M01, M02 and M30) is turned OFF.

<Operation example>

The process when M02 or M30 are commanded in the program is shown below.

Generally, when M02 (or M30) is executed by the program, this signal (RRW) will be returned when the designated operation is completed. M function finish 1 (FIN1) and M function finish 2 (FIN2) will not be returned.(Refer to *1 in the following drawing.)



[Related signals]

(1) In reset (RST: XC15)

(2) In rewind (RWD: XC17)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	CHAMFERING	*CDZ	YC1B	YD5B	YE9B	YFDB

[Function]

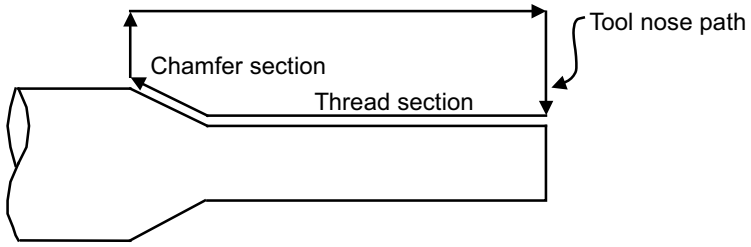
In thread cutting cycle, chamfering can be ignored.

[Operation]

Status of this signal is determined at start of thread cutting cycle.

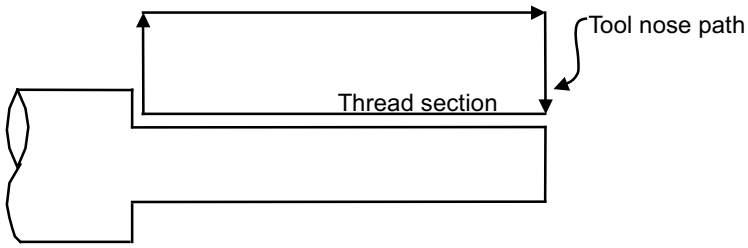
- CHAMFERING (*CDZ) is OFF.

Chamfering (at end of thread cutting) is accomplished.



- CHAMFERING (*CDZ) is ON.

Chamfering is not accomplished (signal is ignored).



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	AUTOMATIC RESTART	ARST	YC1C	YD5C	YE9C	YFDC

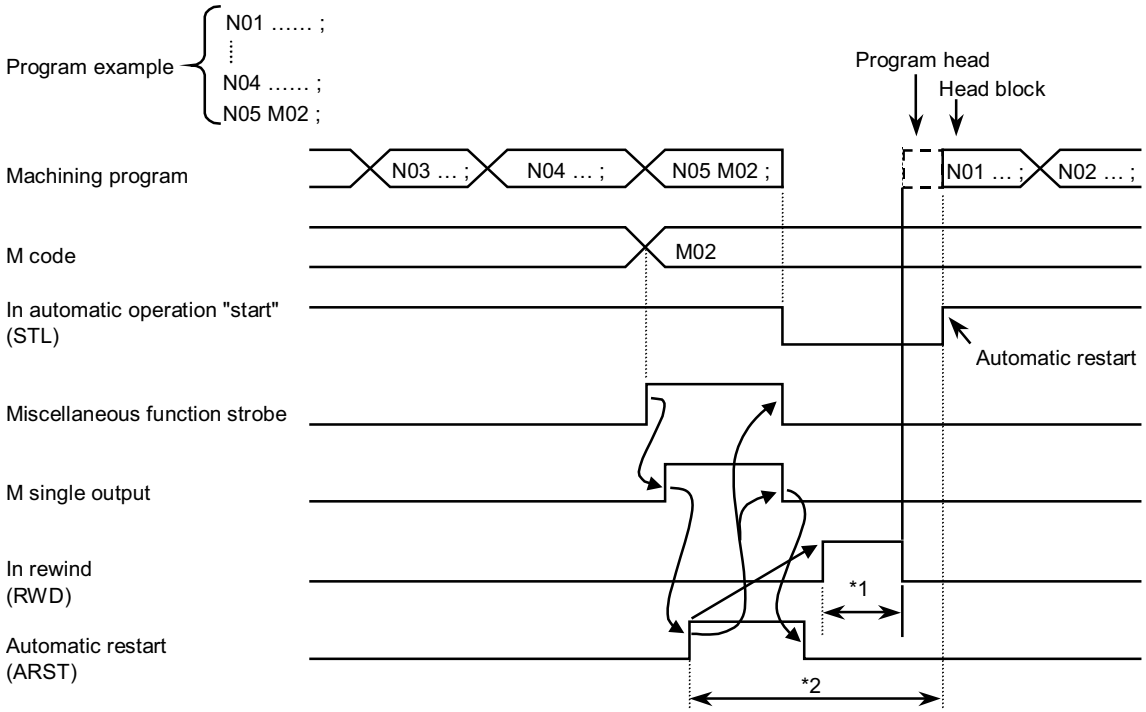
[Function]

If this signal is turned ON after the end of the machining program execution, the same machining program will be restarted.

[Operation]

The same machining program will restart if this signal is turned ON during automatic start.

[Timing chart]



*1:Rewind time During memory operation …approx. 0.1 [s] + α (α is the PC cycle time)
During tape operation …according to length of tape
*2:Refer to Note 8.

(Note 1) The modal is initialized with this signal.
(Note 2) This signal is valid only during automatic start.
(Note 3) This signal is valid during the memory and MDI automatic operation modes.
(Note 4) Normally, "M code independent output" signal for M02 or M30 is input into this signal, but in this case, do not input the M02 or M30 completion signal (FIN1, FIN2).
(Note 5) If the "Automatic operation "pause" command" (*SP) signal is valid, the "Automatic restart" signal will be invalid.
(Note 6) This signal is invalid during single block stop.
(Note 7) Note that if an M command other than M02 or M30 is input into this signal, the program will return to the start point without completing the program, and the program will be restarted.
(Note 8) If "Reset & rewind" (RRW) are applied during the automatic restart process (*2 section in time chart above), the modal will be initialized and the tape will be rewound, but the "Automatic restart" signal will be invalid.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M FUNCTION FINISH 1	FIN1	YC1E	YD5E	YE9E	YFDE

[Function]

This status signal informs the controller that specified miscellaneous (M) function, spindle (S) function, tool (T) function or 2nd miscellaneous function (A, B or C) is accomplished on the PLC side.

[Operation]

If the M, S, T or 2nd M function command is executed during automatic operation, the code and each function strobe (MF1 to 4, SF1 to 4, TF1 to 4, BF1 to 4) will turn ON.

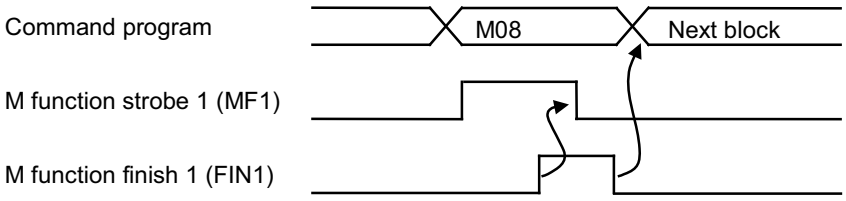
When the PLC verifies that one or more M, S, T and/or B function has been specified, it performs that function(s) and, after completion of the function(s), "M function finish 1" (FIN1) signal turns ON.

When the controller verifies that signal FIN1 turns ON, it turns OFF strobe signal of corresponding function.

The PLC checks that each strobe signal turns OFF, then turns OFF FIN1.

With the signal FIN1 turned OFF, the controller proceeds to the next block.

An example of timing chart, where M function is specified, is as follows:



There are two "M function finish" signals, namely, "M function finish 1" and "M function finish 2" (refer to the next page). The only difference is if the next block is proceeded to at the falling edge or at the rising edge. These can be used separately per operation in one PLC.

(Note 1) "M function finish 1" (FIN1) signal is common to M, S, T and B functions.

(Note 2) The "M function finish 1" signal is also the signal for upgrading the spindle speed output (S command data, etc.) during S function execution.

(Note 3) If signal FIN1 has been ON before M, S, T or B function is specified, data pertinent to M, S, T or B function are not output. To output, the signal FIN1 should be turned OFF once.

(Note 4) When "Reset & rewind" (RRW) signal is sent to the controller by M02 or M30, "M function finish 1 or 2" signal should not be sent back. If the "M function finish 1 (2)" signal is return with the M02 command at the end of the machining program, the NC alarm program error (P36) will occur.

[Related signals]

(1) M function finish 2 (FIN2: YC1F)
(2) M function strobe 1 to 4 (MF1 to 4: XC60)
(3) S function strobe 1 to 4 (SF1 to 4: XC64)
(4) T function strobe 1 to 4 (TF1 to 4: XC68)
(5) 2nd M function strobe 1 to 4 (BF1 to 4: XC6C)
(6) M, S, T, B function data (output to file register R: R504 and later)
(7) Reset & rewind (RRW: YC1A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M FUNCTION FINISH 2	FIN2	YC1F	YD5F	YE9F	YFDF

[Function]

This status signal informs the controller that specified miscellaneous (M) function, spindle (S) function, tool (T) function or 2nd miscellaneous function (A, B or C) is accomplished on the PLC side. When too much signals FIN1 must be used, this signal can be used instead of signal FIN1 to save time.

[Operation]

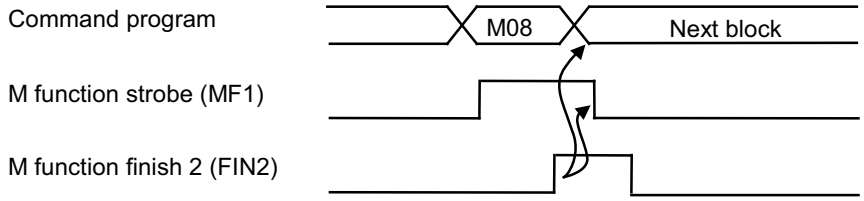
If the M, S, T or 2nd M function command is executed during automatic operation, the code and each function strobe (MF1 to MF4, SF1 to 4, TF1 to 4, BF1 to BF4) will turn ON.

When the PLC verifies that one or more M, S, T and/or 2nd M function has been specified, it performs that function(s) and, after completion of the function(s), "M function finish 2 (FIN2)" signal turns ON.

When the controller verifies that signal FIN2 turns ON, it turns OFF strobe signal of corresponding function.

When each strobe signal turns OFF, the PLC turns OFF signal FIN2. With the signal FIN2 turned OFF, the controller proceeds to the next block.

An example of timing chart, where M function is specified, is as follows:



There are two types of M function finish signals, namely, "M function finish 1" (refer to the previous page) and "M function finish 2". The only difference is if the next block is proceeded to at the falling edge or at the rising edge. These can be used separately per operation in one PLC.

(Note 1) "M function finish 2 (FIN2)" signal is common to M, S, T and B functions.

(Note 2) The M function finish 2 signal is also the signal for upgrading the spindle speed output (S analog data, etc.) during S function execution.

(Note 3) If signal FIN2 has been ON before M, S, T or B function is specified, data pertinent to M, S, T or B function are not output.

(Note 4) When "Reset & rewind" signal (RRW) is sent to the controller by M02 or M30, "M function finish" 2 or 1 signal should not be sent back. If the "M function finish 2 (1)" signal is return with the M02 command at the end of the machining program, the NC alarm program error (P36) will occur.

[Related signals]

(1) M function finish 1 (FIN1: YC1E)
(2) M function strobe 1 to 4 (MF1 to 4: XC60)
(3) S function strobe 1 to 4 (SF1 to 4: XC64)
(4) T function strobe 1 to 4 (TF1 to 4: XC68)
(5) 2nd M function strobe 1 to 4 (BF1 to 4: XC6C)
(6) M, S, T, B function data (output to file register R: R504 and later)
(7) Reset & rewind (RRW: YC1A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LENGTH MEASUREMENT 1	TLM	YC20	YD60	YEA0	YFE0

[Function]

"Tool length manual measurement 1" is selected by this signal.

For M system, "Tool length manual measurement 1 and 2" functions are used by this signal.

[Operation]

When the signal (TLM) is turned ON (1), amount of tool length to be corrected is calculated automatically in the controller.

[Caution]

(1) This signal is invalid if the tool length screen is not selected.

(2) The calculation result is read when INPUT key is pressed.

(3) Turn this signal OFF before executing a program with manual speed command.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LENGTH MEASUREMENT 2	TLMS	YC21	YD61	YEA1	YFE1

[Function]

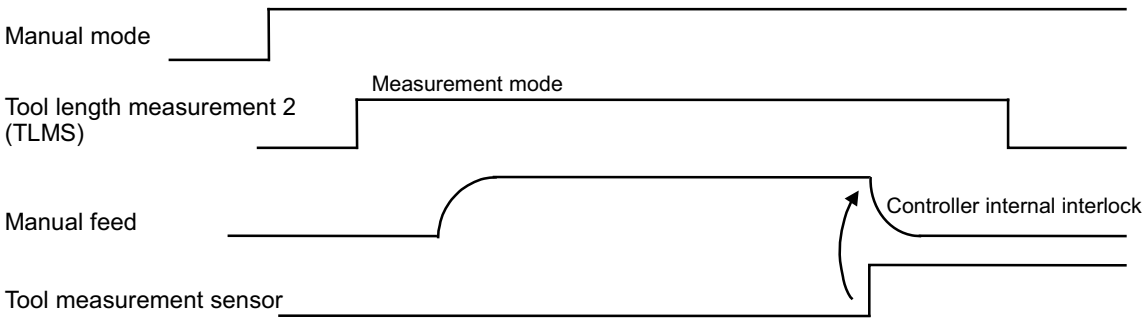
"Tool length measurement 2" is selected by this signal.

[Operation]

When the signal (TLMS) is turned ON, calculation of tool length compensation amount is automatically started in the controller.

When skip signal is input during tool length measurement, amount of tool length to be corrected is calculated.

[Timing chart]



[Caution]

(1) To use the tool length measurement 2 function, select manual operation mode.
Otherwise, tool length measurement mode cannot be established.

(2) "Tool length measurement 2" can be used with a machine equipped with tool measurement sensor.
The sensor for tool length measurement is connected to the connector "SENSOR" No. 2 pin ON the controller unit.

(3) The calculation result is read automatically inside the controller.

(4) With tool length measurement 2, multiple part systems cannot be measured simultaneously.

[Related signals]

(1) Tool length measurement 2 Tool No. (R2618)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SYNCHRONIZATION CORRECTION MODE	SYCM	YC22	YD62	YEA2	YFE2

[Function]

When the "M01 OPERATION ERROR 0051" (Synchronization error too large) occurs, the occurring error is corrected without changing the operation method with this mode.

[Operation]

In the correction mode, the operation is as follows.

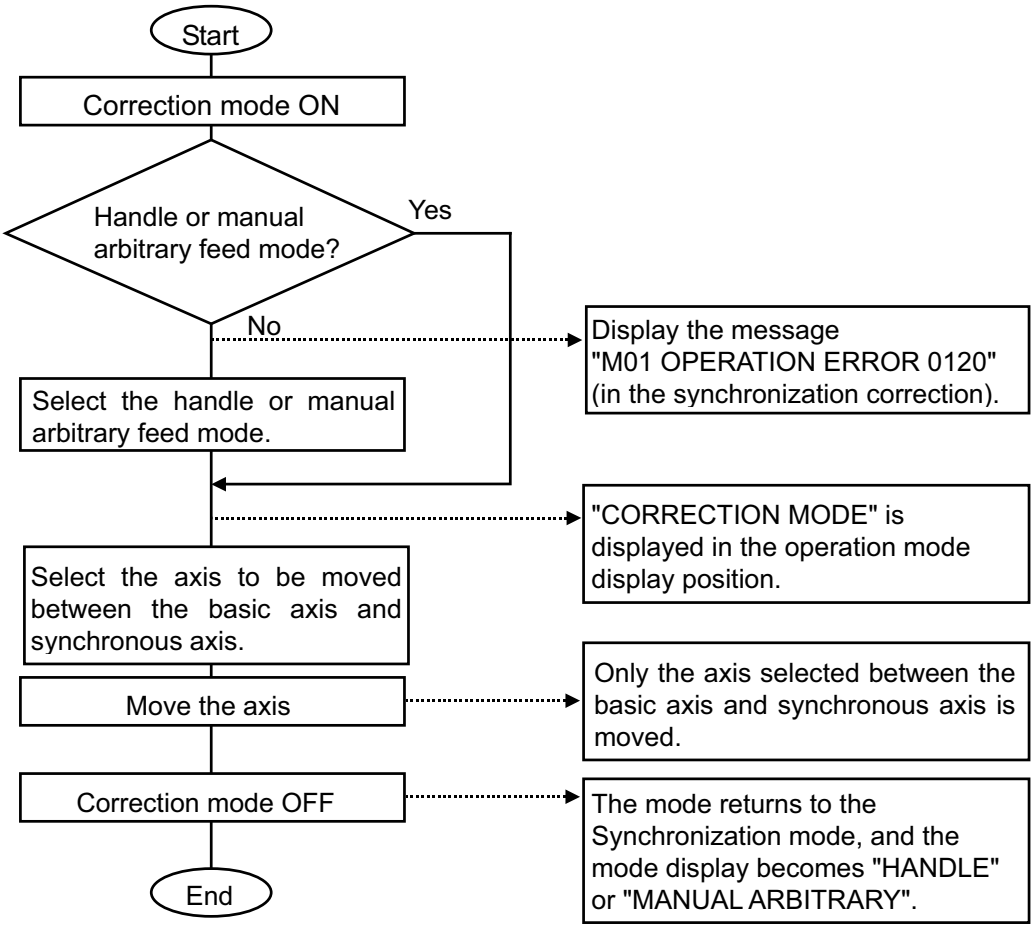
(1) The synchronous control is not carried out even in the synchronous axis, and the basic axis and synchronous axis are handled as independent two axes in the each control part. Thus, the basic axis and synchronous axis can be moved individually.

(2) If the zero point has established, the synchronization error check is carried out.

(3) If the correction mode switch is turned ON during selecting the mode except the handle or manual arbitrary feed mode, the "M01 OPERATION ERROR 0120" (Synchronization correction mode ON) will occur.

In the handle or manual arbitrary feed mode, if the correction mode switch is turned ON, the correction mode can be set and "CORRECTION MODE" will be displayed in the operation mode display position.

The operation procedure is shown below.



[Related signals]

(1) Synchronous control operation method (R2589)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PROGRAM RESTART	PRST	YC23	YD63	YEA3	YFE3

[Function]

With the program restart function, when the axis is returned to the restart position with the manual mode after the restart search is performed, the direction can be checked, or the axis can be stopped at the restart position.

[Operation]

If the "Program restart" signal (PRST) is turned ON after the restart search is performed and the axis is moved to the restart position direction with the manual mode, the axis is stopped at the restart position automatically. The [RESTART-R] values on the program restart screen are set to zero and "RP" appears by the side of the [RESTART-P] values. If the axis is moved in the opposite direction to the restart position, an OPERATION ERROR will occur.

[RESTART – (G54)]		[RESTART – R]	
X	- 130.000RP	X	0.000
Y	-10.000RP	Y	0.000
Z	0.000RP	Z	0.000

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PLAYBACK	PB	YC24	YD64	YEA4	YFE4

[Function]

This signal is used to convert amount of axis motion into controller command data for generation of operation program.

[Operation]

When the "Playback" (PB) signal turns ON, the playback display mode appears on the communication terminal. By moving and stopping axis motion components (tool or table) with JOG feed, rapid traverse or handle feed, the displayed coordinate value is read and converted into NC data in accordance with the operation program format. By repeating data read, an operation program can be created.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MACRO INTERRUPT	UIT	YC25	YD65	YEA5	YFE5

[Function]

When the controller is ready for user macro interrupt, the program being in execution can be interrupted, or other program can be executed after the former program has been executed, by turning ON "Macro interrupt" (UIT) signal.

[Operation]

When "Macro interrupt" (UIT) signal turns ON within time interval starting with M96 command(Note 1) and ending with M97 command or reset, the program being in execution can be interrupted for execution of other program.

"Macro interrupt" (UIT) signal becomes valid when:

(1) Memory, tape or MDI is selected.
(2) Automatic operation is selected (signal STL is ON).
(3) Other user macro is not being executed.

"Macro interrupt" (UIT) signal is accepted in "status trigger" method or "edge trigger" method, either one of which can be selected by parameter #1112.

(1) Status trigger method

While "Macro interrupt" (UIT) signal is ON, the signal can be accepted.

When M96 is used to make acceptable user macro interrupt, the inserted program is executed when the signal (UIT) turns ON.

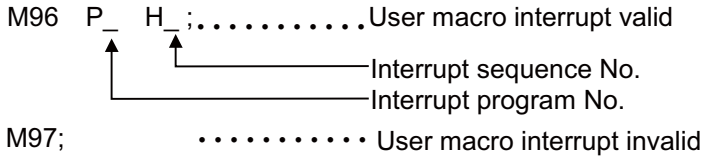
With the signal (UIT) kept turned ON, inserted program can be executed repeatedly.

(2) Edge trigger method

The signal (UIT) is accepted when its status changes from "OFF" to "ON" (i.e., with rise edge of signal).

This method is advantageous when inserted program is executed only once.

<Command format>



Refer to the relevant Programming Manual for details on the user macro interrupt function such as interrupt method and call method for when the "Macro interrupt" (UIT) signal is ON.

(Note 1) M96 and M97 can be changed to other M code by using a parameter.

(Note 2) User macro interrupt control M code is processed internally and not output to an external source (PLC).

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	RAPID TRAVERSE	RT	YC26	YD66	YEA6	YFE6

[Function]

Speed or feedrate of axis motion in "JOG" mode, "incremental feed" mode or "reference position return" mode can be changed to rapid traverse speed.

[Operation]

When the signal (RT) is turned ON:

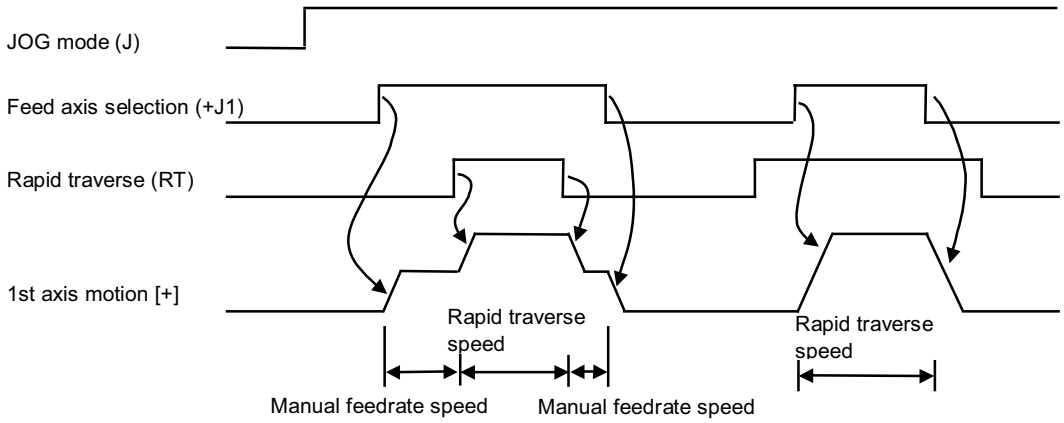
(1) The jog and incremental feedrate will be the rapid traverse feedrate set with parameters.

(2) The speed until the near-point detection dog signal is detected during dog-type reference position return will be the reference position return rapid traverse feedrate set with parameters.

(3) Speed or feedrate is changed at the same time as the signal is turned ON.When the signal (RT) is turned OFF, rapid traverse speed changes to the previous speed or feedrate. "Feed axis selection" signal (±J1 to 8) may be kept turned ON.

(4) The speed will be the rapid traverse feedrate until the near point dog signal is detected during jog, incremental feed or reference position return. The rapid traverse override will also be valid.

(5) The "Rapid traverse override code 1,2" (ROV1, ROV2) will be validated when the "Rapid traverse" signal is ON.



(Note 1) "Rapid traverse" (RT) signal does not act as mode signal, but serves as interrupt signal for "JOG" mode, "INCREMENTAL FEED" mode, etc.

(Note 2) This signal can be used likewise during machine lock.

(Note 3) For handling of "Rapid traverse" (RT) signal during dry run, refer to the description about dry run signal (DRN).

[Related signals]

(1) Rapid traverse override code 1,2 (ROV1, ROV2: YC68, YC69)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	REVERSE RUN	VRV	YC27	YACA	YAD2	YADA

[Function]

This signal is used to select reverse/forward run in the arbitrary reverse run.

[Operation]

Forward run is executed when this signal is OFF.

Reverse run is executed when this signal is ON.

This signal is available only in the reverse run control mode.

[Related signals]

(1) Reverse run from block start (RVSP: YD08)

(2) Macro interrupt priority (RVIT: YD09)

(3) Reverse run control mode (RVMD: YD0A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ABSOLUTE	ABS	YC28	YD68	YEA8	YFE8

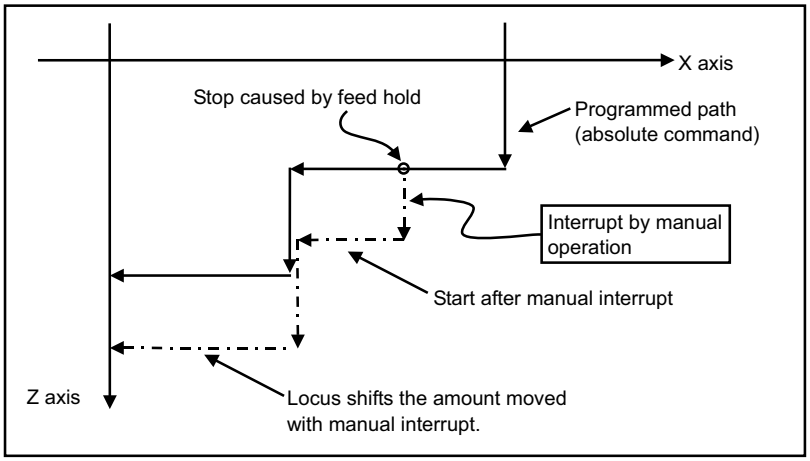
[Function]

This signal selects whether to update the program coordinate system the amount moved with manual operation (jog, handle, etc.).

[Operation]

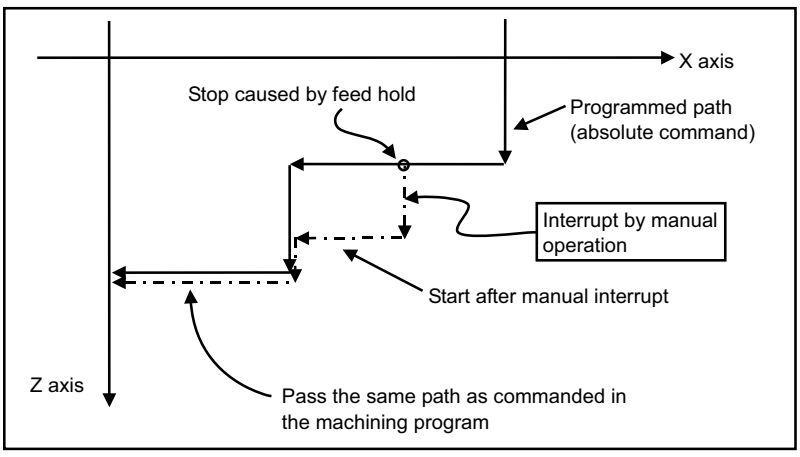
(1) When "Manual absolute" signal (ABS) is OFF:

The amount moved with manual operation is not added to the absolute position register in the controller. Thus, if manual is used during automatic operation, the axis will move in parallel the amount moved manually at the end point of the block and the end point of the following blocks. (The axis will move in parallel regardless of the absolute/ incremental command in the machining program.)



(2) When "Manual absolute" signal (ABS) is ON:

The amount moved by manual operation is added to the absolute position register in the controller, and the coordinate system is not changed. Thus, if manual operation is used during automatic operation by absolute command, the axis will return to the position commanded at the end of the inserted block and following blocks. However, if the manual interrupt is an incremental command, the axis will move in parallel the amount moved manually. (The axis will move in parallel regardless of the absolute/incremental command at the end of the inserted block.)



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DISPLAY LOCK	DLK	YC29	YD69	YEA9	YFE9

[Function]

By using this signal, the current position displayed on the display unit is not updated even if the machine is moved with automatic operation or manual operation.

[Operation]

When the display lock signal (DLK) is ON, the machine movement and program coordinate system are updated in the normal state, but the current position displayed on the display unit is locked.

(Note 1) This signal (DLK) is valid at all times, and can be turned ON and OFF immediately.

(Note 2) This signal is valid during machine lock operation.

[Related signals]

(1) In display lock (DLKN: XC29)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	F1-DIGIT SPEED CHANGE VALID	F1D	YC2A	YD6A	YEAA	YFEA

[Function]

When this signal is ON and F1-digit feed is commanded, the feedrate registered in the parameters can be increased or decreased by turning the manual handle.

[Operation]

When the program feedrate is commanded with an F1-digit, the feedrate can be increased or decreased by turning the manual handle.

(1) Speed fluctuation amount using manual handle

The speed fluctuation amount DF is expressed with the following expression.

$\Delta F = \Delta P \times (FM/K)$

ΔP: Handle pulse (±)

FM : Upper limit value for F1-F5 (parameter setting value #1506)

K : Speed fluctuation constant (parameter setting value #1507)

(Example) To increase/decrease by 10mm/min per handle feed scale

When FM 3600mm/min is set,

K =360 based on the following expression: $\Delta F = 10 = 1 \times (3600/K)$

(2) Validity conditions

(a) Automatic operation must be active.

(b) Automatic operation must be started.

(c) The operation must be in cutting feed, and the F1-digit feedrate must be designated.

(d) The F1-digit valid parameter must be ON.

(e) The F1-digit speed change valid signal must be ON.Machine lock must not be active.Dry run must not be active.

[Related signals]

(1) F1-digit commanded (F1DN: XC2A)

(2) F1-digit No. code (F11 to F18: XC30 to XC33)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	RECALCULATION REQUEST	CRQ	YC2B	YD6B	YEAB	YFEB

[Function]

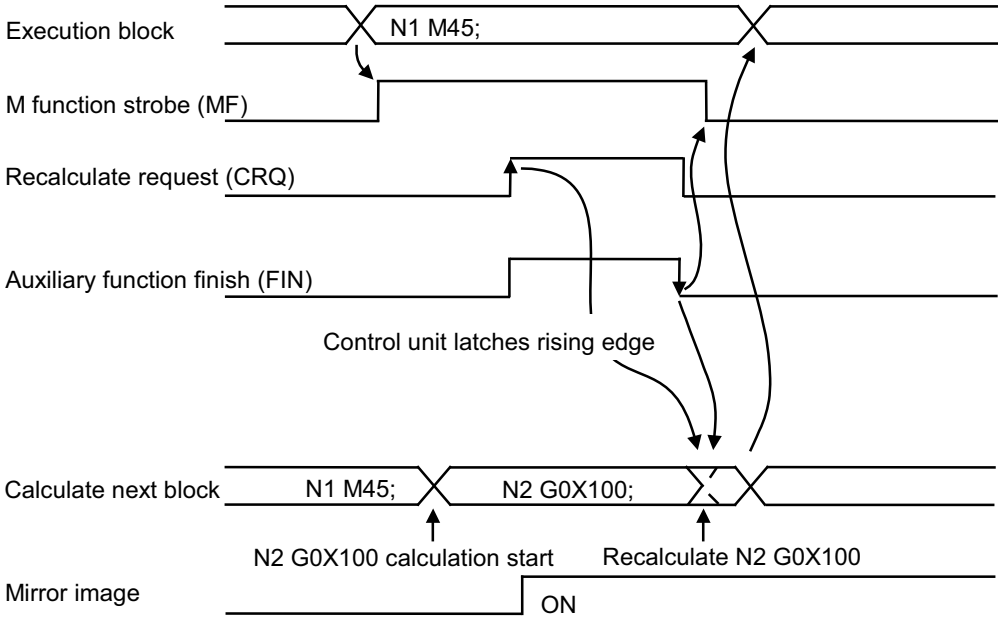
This signal is turned ON if a calculated block (next block) is recalculated during operation of the machining program.

[Operation]

For example, to operate mirror image, etc., with the miscellaneous (M) command in the program.

:
N1 M45; To apply mirror image with this M command
N2 G0X100;
:

When the N1 block is reached in the above program example, the "Recalculate request" signal will turn ON before FIN is output or simultaneously with FIN. This will validate the mirror image from the N2 block.



[Caution]

The "Recalculation request" (CRQ) signal latches the rising edge in the controller. Thus, even if the "Recalculation request" (CRQ) signal is ON (1), the "recalculation" will not take place unless at the rising edge.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PLC EMERGENCY STOP	QEMG	YC2C	YD6C	YEAC	YFEC

[Function]

The controller can be set to emergency stop condition, like the case where emergency stop signal is given by user PLC.

[Operation]

Emergency stop occurs in the controller when the signal (QEMG) is turned ON. In this case, "Servo ready completion (SA)" is turned OFF.

(Note) Since this signal is processed in software, response is somewhat slower, as compared with external emergency stop signal. Approximate response is equal to 1 scan by user PLC plus 100ms.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION RETRACT	RTN	YC2D	YD6D	YEAD	YFED

[Function]

This function returns immediately to a set reference position when the return signal is input. This function is used to return to a set position for changing the tool.

[Operation]

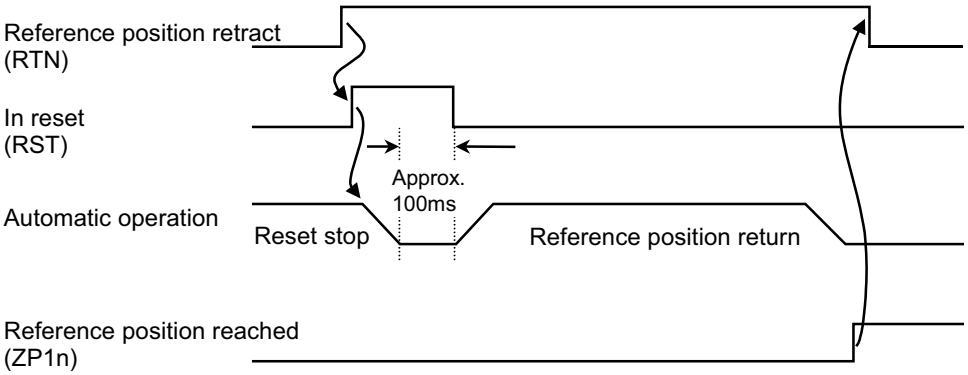
Reference position return is executed when this signal is turned ON. At the rising edge of the signal, the program is automatically reset (reset & rewind) and then reference position return is executed.

During the automatic or MDI operation, the operation is interrupted and stopped by the reset, and reference position return is executed.

If this signal is input during execution of a tap cycle in the automatic or MDI operation modes, the "Tap retract possible" signal will be output by the reset interruption, and the return operation will be the tap retract operation. The tap retract is completed at the initial point, and after that the reference position return will be carried out.

(1) If there are two or more axes, set the return order with parameter "#2019 revnum".
(2) When the reference position is reached, the corresponding "Reference position reached" signal will be output.
(3) This signal must be held until the "Reference position reached" signal is output. If it is turned OFF midway, the return operation will be interrupted and stop. If the signal is input again, the operation will restart from execution of resetting.
(4) The reference position return speed is handled in the same manner as the normal reference position return speed.
(5) The reference position returned to during reference position retract depends on the YC90 and YC91 reference position selection code 1,2.
(6) Even if the return signal is input during the thread cutting cycle, it will be invalid. However, if the return signal is executed in a block other than the thread cutting block, the return operation will be executed.
(7) The return signal is invalid if the coordinate system is not established. An alarm "M01 Ref point retract invalid" will occur when the return signal is input.

[Timing chart]



[Related signals]

(1) Tap retract possible (TRVE: XCA5)
(2) Tap retract (TRV: YC5C)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PLC INTERRUPT	PIT	YC2E	YD6E	YEAE	YFEE

[Function]

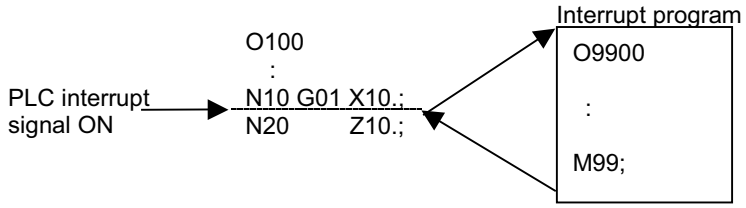
Interruption is executed with the interrupt program set with the R register when a signal is issued from the PLC during single block stop in automatic operation, or not in the automatic operation.

[Operation]

PLC interrupt categorized as "start during the automatic operation" and "start with other mode" and some operations differ. If it is in automatic operation is determine by whether the "In automatic operation" signal (OP) is output.

(1) Operation when the interrupt starts during the automatic operation
Following operation is performed when this signal is turned ON at a single block stop during the automatic operation.

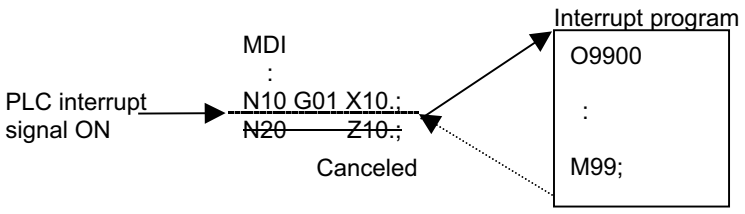
<Operation example>
(Example 1) When program is interrupted during memory operation single block stop



After the O100 N10 block ends, the designated interrupt program (O9900) is called when this signal turns ON. The PLC interrupt ends at the M99 block, and the block will stop. (When the block stops, it is possible to turn this signal ON and then execute the PLC interruption again.)O100 N20 is executed from the next automatic start.

(Note 1) The PLC interruption is not executed if this signal is turned ON while the automatic operation is activated. The alarm "M01 PLC interruption impossible 0129" will occur. Cancel the alarm by turning OFF or reset the PLC interruption signal.

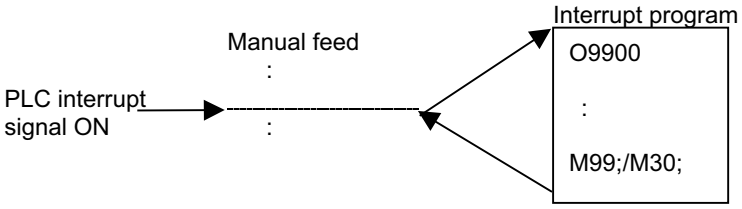
(Example 2) When program is interrupted during MDI operation single block stop



After the MDI N10 block ends, the designated interrupt program (O9900) is called when this signal is turned ON. The PLC interrupt ends at the M99 block, and the block will stop. The next and subsequent blocks of the MDI program are canceled so operation cannot be continued.

(2) Operation when the interruption starts during other than automatic operation
Following operation is performed if this signal is turned ON when the machine is in manual mode such as jog mode or handle mode etc. or when the machine is not in program operation even it is in the memory mode.

<Operation example> When program is interrupted during manual mode



During manual feed, the designated interrupt program (O9900) is called when this signal turns ON. The PLC interruption will be reset and finished at the M99 block, and the machine enters into the manual mode.

(Note 1) To turn this signal ON during the manual mode, use the manual/automatic simultaneous function concurrently.
(Note 2) Interrupt program is finished at M99 and reset 1 is input automatically.

[Caution]

(1) Single block operation and automatic operation pause are valid even when the interrupt program is executed. To invalidate single block during the interrupt program execution, set system variable #3003. To invalidate automatic operation pause, set system variable #3004.
(2) Other PLC interrupt and MDI interrupt cannot be commanded during execution of the interrupt program.
(3) To disable the display of the interrupt program being executed on the Monitor screen, set the basic specification parameter "#1122 pglk_c" to 1 or 2.
(4) The PLC interrupt signal is ignored even if it is turned ON during automatic operation start or automatic operation pause.
(5) "In automatic start" signal (OP) is output while the interrupt program is executed regardless of the operation mode which is active before the interruption.
(6) PLC interrupt is valid for each part system.
(7) If PLC interrupt is executed when there is no interrupt program or when program search has not been executed, a program error (P232) will occur when M99 is commanded.
(8) If the interrupt program No. set in the R register is not within the setting range, a program error (P232) will occur.
(9) Cancel the program error (P232) with reset.
(10) This function is an option. If the option is not provided, the PLC interrupt signal will be ignored even if it is commanded.
(11) The interruption is not executed in the part system where the PLC interrupt signal is OFF.
(12) "In automatic operation "run"" signal (OP) and "In automatic operation "start"" signal (STL) are output during the PLC interrupt program execution.
Likewise, they are output during the PLC interrupt program execution in other than automatic operation.

[Related signals]

(1) PLC interrupt program No. (R2518)
(2) In PLC interrupt (PCINO: XC35)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING	CHPS	YC30	YD70	YEB0	YFF0

[Function]

This signal validates the chopping function.

[Operation]

The chopping mode is entered at the rising edge of this signal.

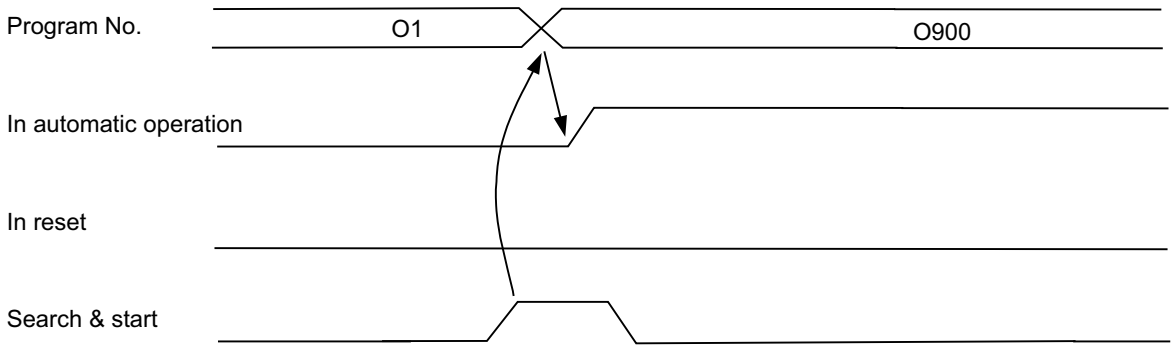
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SEARCH & START	RSST	YC31	YD71	YEB1	YFF1

[Function]

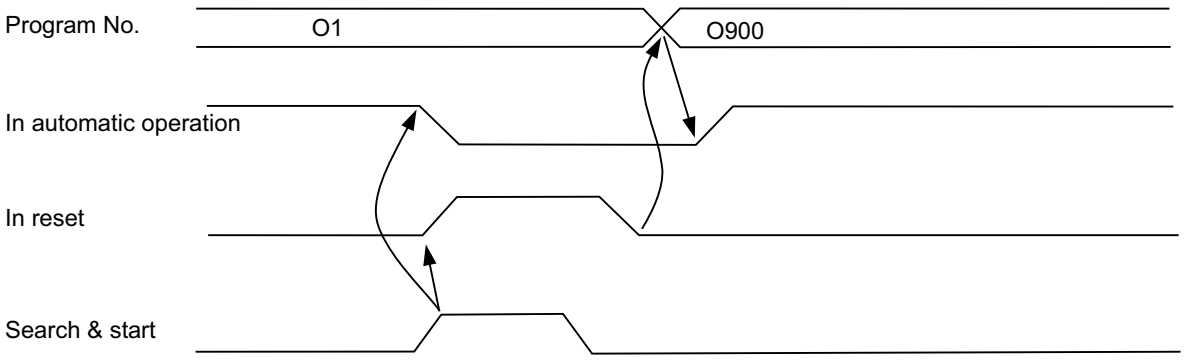
This signal is input into the controller when executing operation search in the memory mode and carrying out automatic start up.

[Operation]

If this signal is input when the memory operation mode is selected, an operation search of the machining program with the designated No. (R2562, R2563) will be carried out. After the search, the program will be automatically started.
If this signal is input during automatic operation, the program will be reset before the search. After the resetting is completed, the search and automatic start operations will be executed.
(Example1) Search & start is executed by designating O900 machining program from the reset state.



(Example2) When O900 machining program is designated during operation of the O1 machining program, and search & start is executed.



[Caution]

(1) This signal is valid only when the memory mode is selected.
(2) An error signal will be output if the machining program No. is not designated or if the designated program No. is illegal (0 or exceeding 99999999).
(3) This signal is valid at the rising edge.
(4) If this signal is input during resetting, the search & start will not be executed.
(5) When the multi-part system program management is valid, the search is executed for all part systems in batch with the signal for $1. Only the programs with "0" No. are searched.

[Related signals]

(1) Search & start program No. (R2562, R2563)
(2) Search & start error (SSE: XC8A)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CHOPPING PARAMETER VALID		YC34	YD74	YEB4	YFF4

[Function]

This signal validates the chopping control data assigned to R register.

[Operation]

(1) The chopping control data is validated at the rising edge of this signal.

(2) This signal must be turned OFF after confirming the chopping start ready completion signal is turned ON. Chopping start ready completion signal is included in the control status within the chopping control data.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	INCLINED AXIS CONTROL VALID		YC35	YD75	YEB5	YFF5

[Function]

This signal validates the inclined axis control.

[Operation]

When this signal is turned ON, the inclined axis control is executed following the set parameter.

If this signal is turned OFF from ON, the inclined axis control will be invalid.

[Caution]

Even if this signal is changed over during the axis movement or the automatic operation, this signal will not be valid.

If this signal is changed over during the axis movement, this signal will be valid after the axis movement is stopped.

If this signal is changed over during the automatic operation, the block stop will occur.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	INCLINED AXIS CONTROL NO Z AXIS COMPENSATION		YC36	YD76	YEB6	YFF6

[Function]

Select whether the movement for the inclined axis in the manual operation is affected to the corresponding basic axis or not.

[Operation]

When this signal is turned ON and the manual operation for the inclined axis is executed, the corresponding basic axis is not moved.

When this signal is turned OFF and the manual operation for the inclined axis is executed, the compensation operation attending the movement of the inclined axis is executed to the corresponding basic axis.

[Caution]

Even if this signal is changed over during the axis movement, this signal will not be valid.

If this signal is changed over during the axis movement, this signal will be valid after the axis movement is stopped.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	OPTIONAL BLOCK SKIP m	BDT1 to 9	YC37 to F	YD77 to F	YEB7 to F	YFF7 to F

[Function]

Block accompanying "/n (n: 1 to 9)" (slash) can be skipped.

By creating a machining program with a "/" code inserted, a different part can be machined with one program.

[Operation]

(1) When a program having a block with "/n" (slash code) placed at the head of block is executed with "Optional block skip" signal turned ON, the block is skipped. The block with the "/n" code in the middle instead of at the head will be executed.

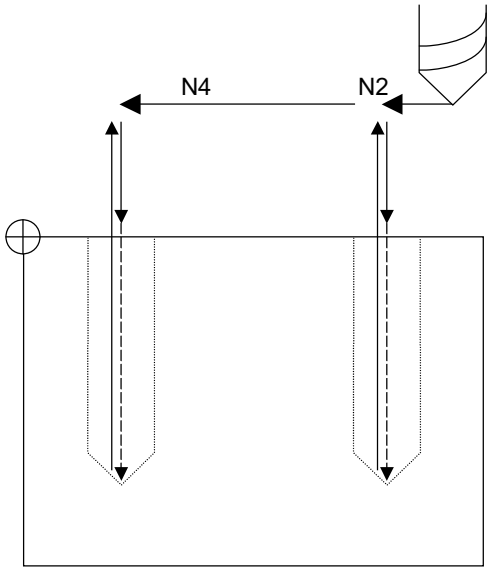
When the signal is OFF, block with "/n" is executed.

(Example) If machining the two parts as illustrated below, create the following program. When machining with the "Optional block skip" signal ON, part 1 will be provided. With the signal OFF, part 2 will be provided.

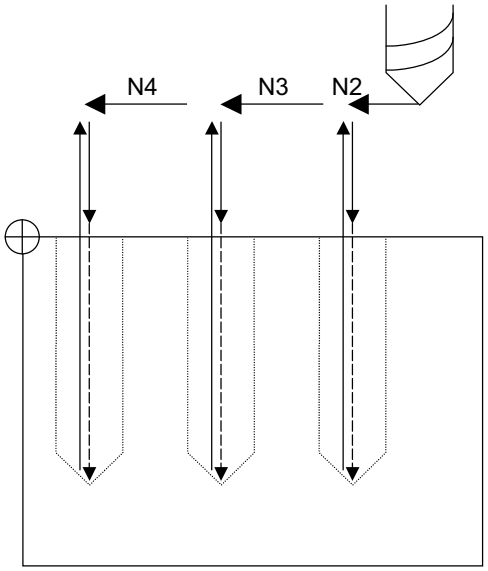
<Program>

```
N1 G54;
N2 G90G81X50. Z-20. R3. F100;
/1N3 X30.;
N4 X10.;
N5 G80;
M02;
```

Part 1
Optional block skip ON



Part 2
Optional block skip OFF



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	1ST HANDLE AXIS SELECTION CODE m	HS11 to 116	YC40 to 4	YD80 to 4	YEC0 to 4	Y1000 to 4

[Function]

In HANDLE mode (handwheel is operated), axis component to be moved is selected.

In the case of 2-axis or 3-axis handle specification (two or three handles are required), axis is selected for the 1st handle.

[Operation]

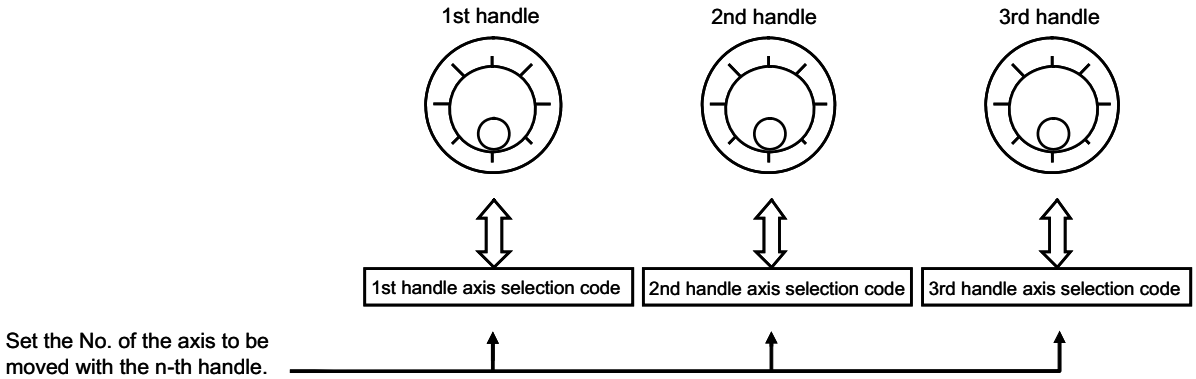
For axis motion in HANDLE mode:

(1) Select HANDLE mode.
(2) Specify axis No. for 1st handle axis selection code
(3) Turn ON "1st handle valid" (HS1S) signal (later described).
(4) Turn the handle (handwheel) ... motion will start.

The relationship between "handle axis No." and "motion axis" is as follows:

Handle axis No. / Motion axis	HS 1S	—	—	HS 116	HS 18	HS 14	HS 12	HS 11
X axis (1st axis) selected	1	—	—	0	0	0	0	1
Y axis (2nd axis) selected	1	—	—	0	0	0	1	0
Z axis (3rd axis) selected	1	—	—	0	0	0	1	1
#4 axis (4th axis) selected	1	—	—	0	0	1	0	0
#5 axis (5th axis) selected	1	—	—	0	0	1	0	1
#6 axis (6th axis) selected	1	—	—	0	0	1	1	0
#7 axis (7th axis) selected	1	—	—	0	0	1	1	1
#8 axis (8th axis) selected	1	—	—	0	1	0	0	0

"1st handle valid" signal



[Caution]

Unit configuration decides handle Nos.

<M700VW Series>..."ENC": Connector on control unit "MPG": Connector on operation panel I/O unit

Operation panel I/O unit (FCU7-DX67x/ DX77x)	1st handle	2nd handle	3rd handle
Used	"MPG" 1ch	"MPG" 2ch	"MPG" 3ch
Not used	"ENC" 1ch	"ENC" 2ch	-

<M700VS/M70V Series>..."ENC": Connector on control unit "MPG": Connector on operation panel I/O unit

Operation panel I/O unit (FCU7-DX71x/ DX72x/ DX73x)	1st handle	2nd handle	3rd handle
Used	"MPG" 1ch	"MPG" 2ch	"ENC" 1ch (Note)
Not used	"ENC" 1ch	"ENC" の 2ch	-

(Note) If one handle is only connected to "MPG", the handle connected to "ENC" 1ch will still be treated as the 3rd handle. "ENC" 2ch is not employed when an operation panel I/O unit is used.

[Related signals]

(1) 2nd handle axis selection code m (HS21 to 216: YC48 to YC4C)
(2) 2nd handle valid (HS2S: YC4F)
(3) 3rd handle axis selection code m (HS31 to 316: YC50 to YC54)
(4) 3rd handle valid (HS3S: YC57)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	1ST HANDLE VALID	HS1S	YC47	YD87	YEC7	Y1007

[Function]

In HANDLE mode, axis No. of axis motion component to be moved is set for 1st handle axis selection code (HS11 to HS116). To make valid the specified handle axis No., this signal is used.

[Operation]

Axis motion does not start when the 1st handle (handwheel) is rotated after HANDLE mode is selected and the desired axis No. is set for the 1st handle axis selection code if this signal (HS1S) is not given. Although either the "1st handle axis selection code" signal or the "1st handle valid" signal can be given first, these two signals are to be given when manual axis motion is started.

[Related signals]

(1) 1st handle axis selection code m (HS11 to 116: YC40 to 4)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND HANDLE AXIS SELECTION CODE m	HS21 to 216	YC48 to C	YD88 to C	YEC8 to C	Y1008 to C

[Function]

This signal selects which handle to move with the 2nd handle when using the 2-axis or 3-axis handle specifications (two or three handles are required).

[Operation]

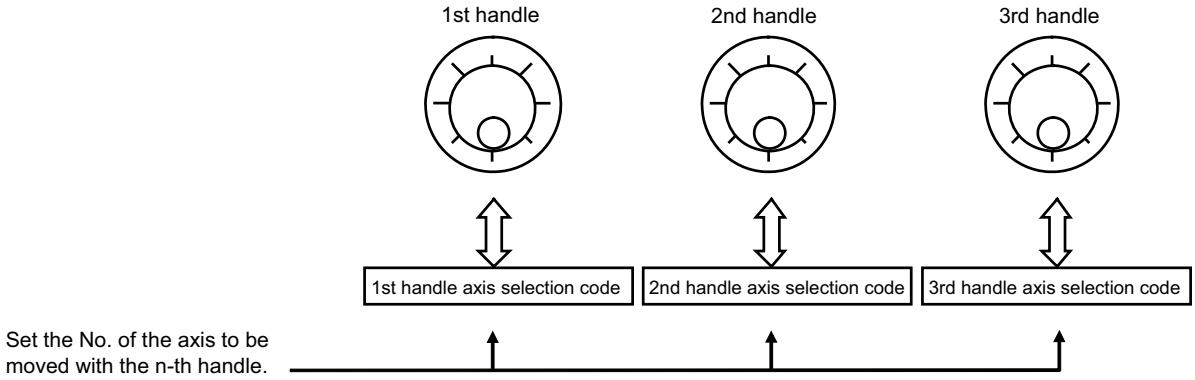
For axis motion controlled by the 2nd handle:

(1) Select HANDLE mode.
(2) Specify axis No. for 2nd handle axis selection code
(3) Turn ON "2nd handle valid" signal (HS2S).
(4) Turn the handle (handwheel) ... motion will start.

The relationship between "handle axis No." and "motion axis" is as follows:

Handle axis No. / Motion axis	HS 2S	—	—	HS 216	HS 28	HS 24	HS 22	HS 21
X axis (1st axis) selected	1	—	—	0	0	0	0	1
Y axis (2nd axis) selected	1	—	—	0	0	0	1	0
Z axis (3rd axis) selected	1	—	—	0	0	0	1	1
#4 axis (4th axis) selected	1	—	—	0	0	1	0	0
#5 axis (5th axis) selected	1	—	—	0	0	1	0	1
#6 axis (6th axis) selected	1	—	—	0	0	1	1	0
#7 axis (7th axis) selected	1	—	—	0	0	1	1	1
#8 axis (8th axis) selected	1	—	—	0	1	0	0	0

"2nd handle valid" signal



[Related signals]

(1) 1st handle axis selection code m (HS11 to 116: YC40 to 4)
(2) 1st handle valid (HS1S: YC47)
(3) 3rd handle axis selection code m (HS31 to 316: YC50 to 4)
(4) 3rd handle valid (HS3S: YC57)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND HANDLE VALID	HS2S	YC4F	YD8F	YECF	Y100F

[Function][Operation]

This signal is the same as "1st handle valid" signal in function and operation, except that it is applicable only to 2-axis handle specification (two handles are required).

Refer to the above table for the relation with the "2nd handle axis selection code" (HS21 to 216).

[Related signals]

(1) 2nd handle axis selection code m (HS21 to 216: YC48 to C)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	3RD HANDLE AXIS SELECTION CODE m	HS31 to 316	YC50 to 4	YD90 to 4	YED0 to 4	Y1010 to 4

[Function]

This signal selects which handle to move with the 3rd handle when using the 3-axis handle specifications (three handle is required).

[Operation]

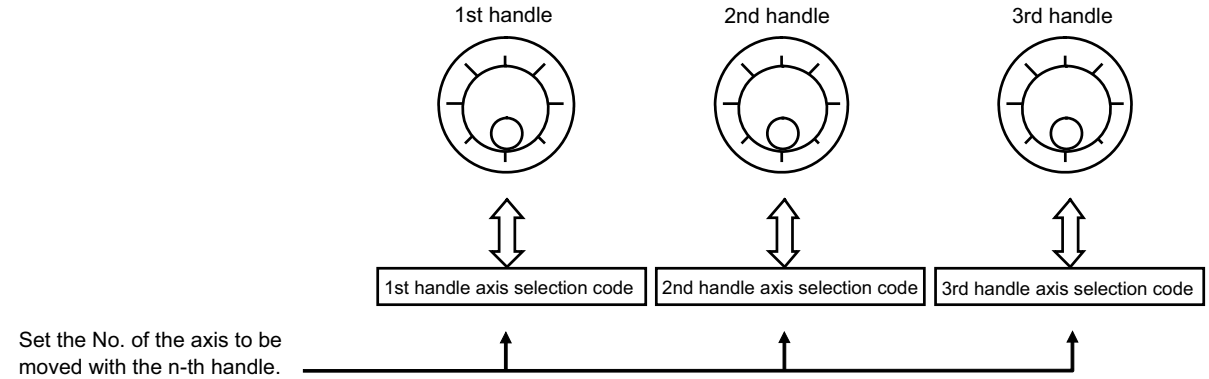
For axis motion in HANDLE mode:

(1) Select HANDLE mode.
(2) Specify axis No. for 3rd handle axis selection code
(3) Turn ON "3rd handle valid" (HS3S) signal (later described).
(4) Turn the handle (handwheel) ... motion will start.

The relationship between "handle axis No." and "motion axis" is as follows:

Handle axis No. / Motion axis	HS 3S	—	—	HS 316	HS 38	HS 34	HS 32	HS 31
X axis (1st axis) selected	1	—	—	0	0	0	0	1
Y axis (2nd axis) selected	1	—	—	0	0	0	1	0
Z axis (3rd axis) selected	1	—	—	0	0	0	1	1
#4 axis (4th axis) selected	1	—	—	0	0	1	0	0
#5 axis (5th axis) selected	1	—	—	0	0	1	0	1
#6 axis (6th axis) selected	1	—	—	0	0	1	1	0
#7 axis (7th axis) selected	1	—	—	0	0	1	1	1
#8 axis (8th axis) selected	1	—	—	0	1	0	0	0

"3rd handle valid" signal



[Related signals]

(1) 1st handle axis selection code m (HS11 to 116: YC40 to 4)
(2) 1st handle valid (HS1S: YC47)
(3) 2nd handle axis selection code m (HS21 to 216: YC48 to C)
(4) 2nd handle valid (HS2S: YC4F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	3RD HANDLE VALID	HS3S	YC57	YD97	YED7	Y1017

[Function][Operation]

This signal is the same as "1st handle valid" signal in function and operation, except that it is applicable only to 3-axis handle specification (three handles are required).

Refer to the above table for the relation with the "3rd handle axis selection code" (HS31 to HS316).

[Related signals]

(1) 3rd handle axis selection code m (HS31 to HS316: YC50 to YC4)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	OVERRIDE CANCEL	OVC	YC58	YD98	YED8	Y1018

[Function]

With this signal, override to cutting feedrate input to the controller during automatic operation is ignored.

[Operation]

When the signal (OVC) turns ON ...

(1) Cutting feedrate override code (*FV1 to 16) is ignored and feedrate specified by F command is selected.

(2) When cutting feedrate override is set at "0%", the signal (OVC) is not valid (feedrate is zero and no motion occurs).

(3) The signal does not affect to "Manual feedrate override" and "Rapid traverse override".

[Related signals]

(1) Cutting feedrate override code m (*FV1 to 16: YC60)

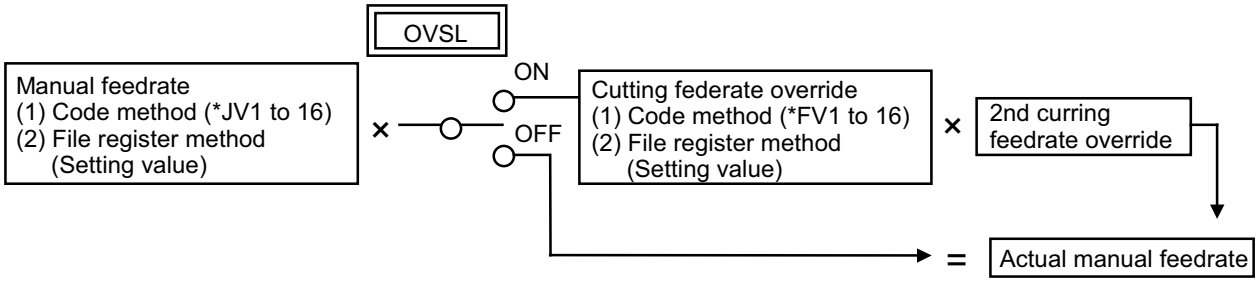
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL OVERRIDE METHOD SELECTION	OVSL	YC59	YD99	YED9	Y1019

[Function]

Override can be exerted on "manual feedrate" (feedrate in JOG feed, incremental feed, etc. during manual operation).

[Operation]

When this signal (OVSL) is turned ON when manual feedrate has been set, the previously set cutting feedrate override (%) is applied to that feedrate.



(Note) For details of "manual feedrate", "cutting feedrate override" and "2nd cutting feedrate override", refer to the relevant descriptions.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MISCELLANEOUS FUNCTION LOCK	AFL	YC5A	YD9A	YEDA	Y101A

[Function]

Strobe signal for miscellaneous function (M, S, T and B) specified during automatic operation cannot be output when this signal is used. The signal (AFL) can be used to check machining program, for example.

[Operation]

When the signal (AFL) turns ON:

(1) Miscellaneous function (M, S, T and B) specified in automatic operation cannot be executed, i.e. output of code data and function strobe signal (MF1 to 4, SF1 to 4, TF1 to 4, BF1 to 4) are withheld.

(2) If the signal turns ON after code data is output, that output is accepted and the corresponding function can be completed (FIN1 or FIN2 is received and strobe signal is set to "0").

(3) Miscellaneous function M00, M01, M02 or M30 is, however, accepted and realized even when the signal (AFL) is ON and the decode signals, code data and "M function strobe" signal are output.

(4) Miscellaneous function which is executed within the controller and does not output its code data and "M function strobe" signal, such as M98 and M99, is executed even when the signal is ON.

(Note) As for S command data (output), the value before "Miscellaneous function lock" signal (AFL) is turned ON will be retained even when this signal is ON. When the signal is ON at NC power ON, S command data will be 0V.

[Related signals]

(1) M function strobe (MFn: XC60)
(2) M code data (R504)
(3) S function strobe (SFn: XC64)
(4) S code data (R512)
(5) T function strobe 1 (TF1: XC68)
(6) T code data (R536)
(7) 2nd M function strobe 1 (BF1: XC6C)
(8) 2nd M function data (R544)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TAP RETRACT	TRV	YC5C	YD9C	YEDC	Y101C

[Function]

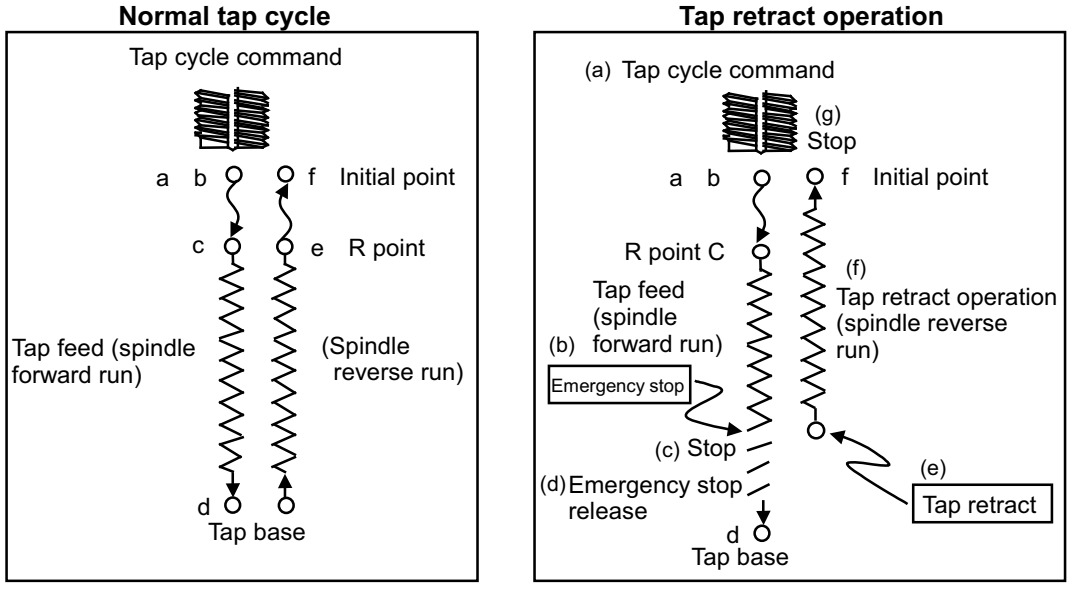
This function is used to remove the tap from the workpiece when tap cycle has been stopped due to emergency stop, etc.

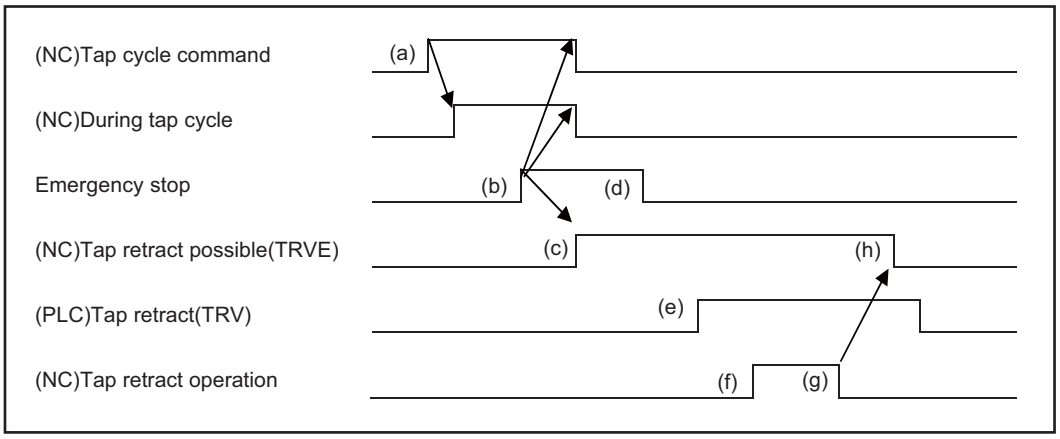
[Operation]

If the "Tap retract" signal (TRV) is turned ON while the "Tap retract possible" signal (TRVE) is ON due to an interruption in the tap cycle, the tap retract operation can be started.

(1) The following items are conditions for tap retract. (The "Tap retract possible" signal will turn ON at this time.)
- Emergency stop during tap cycle
- Reset during tap cycle
- Power OFF during tap cycle (Only for absolute position detection system)

(2) Tap retract is executed as follows:
- Execute the synchronous tap cycle command. → (a)
- Stop the tap cycle with emergency stop. → (b)
- The "Tap retract possible" signal (TRVE) turns ON. → (c)
- Release the emergency stop. (The "Servo ready completion" signal (SA) turns ON.) → (d)
- Turn ON the "Tap retract" signal (TRV). → (e)
- The spindle will rotate in reverse, and the tap axis will move toward the tap cycle's initial point.The feedrate is the tap cycle feedrate. → (f)
- When the tap axis reaches the tap cycle initial point, the spindle and tap axis will stop, and tap retract will be completed. → (g)
- The "Tap retract possible" signal (TRVE) will turn OFF.





Tap retract operation

(Note 1) The area between "c" and "e" in the figure above is the tap cycle. The "Tap retract possible" signal will not be output if the operation is not stopped in this area.
(Note 2) This signal is valid only during rising edge of the signal.
(Note 3) When this signal turns ON, emergency stop and reset will not function.
(Note 4) When the parameter "#1234 set06/bit3" is set to "0", the tap retract operation is not carried out even this signal is turned ON during the operation error "0057".

[Related signals]

(1) Tap retract possible (TRVE: XCA5)
(2) Tap retract possible state cancel (TRVEC:YCD6)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL HANDLE FEED MODE		YC5E	YD9E	YEDE	Y101E

[Function]

When this signal is turned ON, tool handle feed mode will be activated.
In the tool handle feed mode, axis can be moved with the manual pulse generator in tool axis direction, tool radius direction X and Y within the hypothetical coordinate system over the tool axis.

[Operation]

When the tool handle feed mode is selected, axis moves with the manual pulse generator in tool axis direction, tool radius direction X and Y.
Operate in the following procedure.

(1) Select handle mode at the mode selection
(2) Turn ON the signal (YC5E)
(3) Move in tool axis direction, tool radius direction X and Y.

Handle feed magnification is shown as below.

Handle feed magnification	YC82	YC81	YC80
1-fold	0/1	0	0
10-fold	0/1	0	1
100-fold	0/1	1	0
1000-fold	0/1	1	1

(Note1) When the signal (YC5E) is "0", it is considered as normal handle mode.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	CUTTING FEEDRATE OVERRIDE CODE m	*FV1 to 16	YC60 to 4	YDA0 to 4	YEE0 to 4	Y1020 to 4

[Function]

Override (multiplication) can be exerted to cutting feedrate (F feedrate) during automatic operation with this signal.

[Operation]

When the signal is valid, true feedrate is the product obtained by multiplying referenced speed by override ratio (%) specified by the signal.

Override is 100%, even when the signal is given, in the following cases:

(1) When "Override cancel" (OVC) signal is ON.
(2) During tapping mode.
(3) During thread cutting.

These signals (*FV1 to 16) are set with the code method. The relation is shown below.

*FV16	*FV8	*FV4	*FV2	*FV1	Cutting feedrate override	
1	1	1	1	1	0%	
1	1	1	1	0	10%	
1	1	1	0	1	20%	
1	1	1	0	0	30%	
1	1	0	1	1	40%	
1	1	0	1	0	50%	
1	1	0	0	1	60%	
1	1	0	0	0	70%	
1	0	1	1	1	80%	
1	0	1	1	0	90%	Generally, the rotary switch (5-step, 21-notch, compliment binary code output) is connected to the operation board, and used between 0 and 200%.
1	0	1	0	1	100%	
1	0	1	0	0	110%	
1	0	0	1	1	120%	
1	0	0	1	0	130%	
1	0	0	0	1	140%	
1	0	0	0	0	150%	
0	1	1	1	1	160%	
0	1	1	1	0	170%	
0	1	1	0	1	180%	If *FV1 to *FV16 are all OFF, the previous value will be maintained. The value will change to 0% when the power is turned OFF.
0	1	1	0	0	190%	
0	1	0	1	1	200%	
0	1	0	1	0	210%	
0	1	0	0	1	220%	
0	1	0	0	0	230%	
0	0	1	1	1	240%	
0	0	1	1	0	250%	
0	0	1	0	1	260%	
0	0	1	0	0	270%	
0	0	0	1	1	280%	
0	0	0	1	0	290%	
0	0	0	0	1	300%	

[Related signals]

(1) Override cancel (OVC: YC58)
(2) 2nd cutting feedrate override valid (FV2E: YC66)
(3) Cutting feedrate override method selection (FVS: YC67)

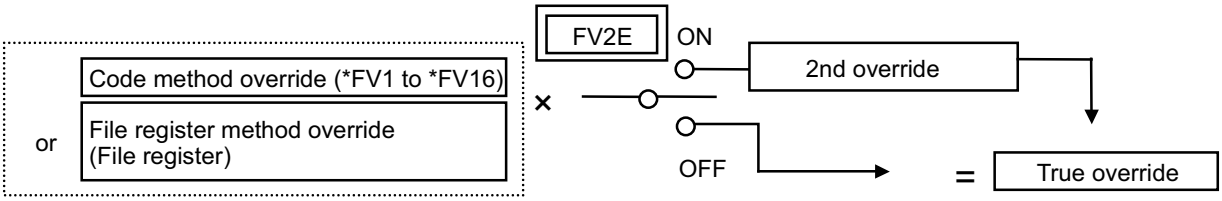
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND CUTTING FEEDRATE OVERRIDE VALID	FV2E	YC66	YDA6	YEE6	Y1026

[Function]

Override normally exerted on cutting feedrate in automatic operation is within a range from 0% to 300%. When this signal is used, another override (ranging from 0% to 327.67%) can be exerted on overridden feedrate.

[Operation]

When the signal (FV2E) is ON, override can be exerted on feedrate previously overridden in code method (*FV1 to 16), or file register method (by setting numerals manually). Applicable range of the 2nd override is 0% to 327.6% (0.01% increment). Value (override ratio) is set to file register in binary code.



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CUTTING FEEDRATE OVERRIDE METHOD SELECTION	FVS	YC67	YDA7	YEE7	Y1027

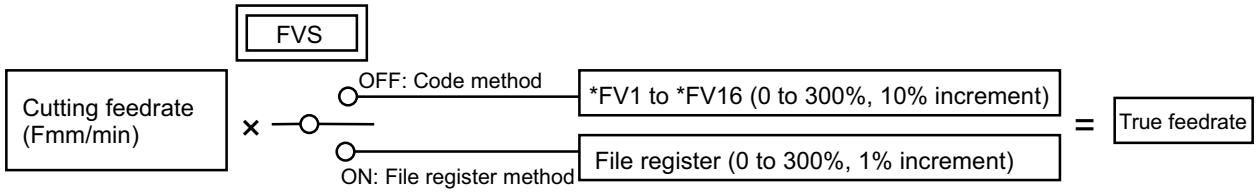
[Function]

When override is exerted on cutting feedrate in automatic operation, override method can be selected between "code method" and "file register method".

[Operation]

When the signal (FVS) is OFF, code method (*FV1 to 16) is selected.

When the signal (FVS) is ON, file register method (value is specified by manual setting) is selected.



(Note) For details of code method and file register method, refer to the relevant descriptions.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	RAPID TRAVERSE OVERRIDE CODE 1,2	ROV1,2	YC68,9	YDA8,9	YEE8,9	Y1028,9

[Function]

This signal is used to exert override on rapid traverse speed set by parameter (for rapid traverse) in automatic operation (memory, MDI or tape) or manual operation.

[Operation]

The true rapid traverse speed is that obtained by multiplying rapid traverse speed (set by parameter) by override ratio specified by this signal.

This signal is invalid if the "Rapid traverse" signal (RT) is OFF during cutting feed during automatic operation or during manual operation.

These signals (ROV1, 2) are set with the code method. The relation is shown below.

ROV2	ROV1	Rapid traverse override
0	0	100%
0	1	50%
1	0	25%
1	1	1%

[Related signals]

(1) Rapid traverse override method selection (ROVS: YC6F)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	RAPID TRAVERSE OVERRIDE METHOD SELECTION	ROVS	YC6F	YDAF	YEEF	Y102F

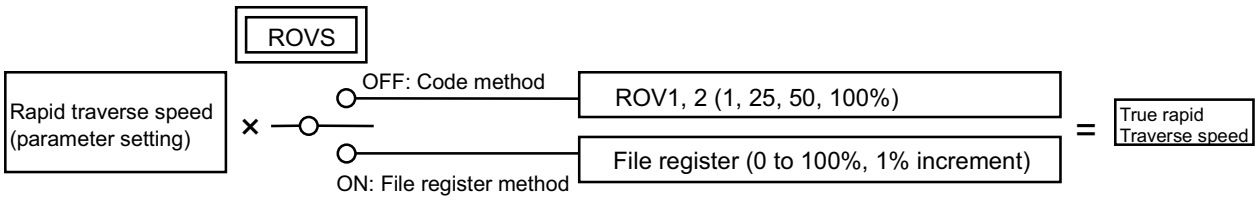
[Function]

When speed override is exerted on rapid traverse speed specified in automatic operation or manual operation, override method is selected between code method and file register method (manually set).

[Operation]

When the signal (ROVS) is OFF, code method (ROV1, 2) is used.

When the signal (ROVS) is ON, file register method is used.



(Note) For details of "code method override" and "file register method", refer to the respective description.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	MANUAL FEEDRATE CODE m	*JV1 to 16	YC70 to 4	YDB0 to 4	YEF0 to 4	Y1030 to 4

[Function]

Feedrate in manual operation (JOG mode, incremental feed mode, etc.) or in dry run of automatic operation (memory, MDI, tape) is selected.

[Operation]

This signal is valid in the following cases, but will be invalid when the "Rapid traverse" signal (RT) is ON.

(1) Jog mode, incremental mode or reference position return mode is ON.
(2) During cutting feed in automatic operation and "Dry run" signal (DRN) is ON.
(3) Dry run signal is ON during rapid traverse in the automatic operation. Note that parameter "#1085 G00 dry run" must be ON.

These signals (*JV1 to 16) are set with the code method. The relation is shown below.

*JV16	*JV8	*JV4	*JV2	*JV1	Manual feedrate			
					Machine parameter set in meters		Machine parameter set in inches	
					Metric mode (mm/min)	Inch mode (inch/min)	Metric mode (mm/min)	Inch mode (inch/min)
1	1	1	1	1	0.00	0.000	0.00	0.000
1	1	1	1	0	1.00	0.040	0.51	0.020
1	1	1	0	1	1.40	0.054	0.71	0.028
1	1	1	0	0	2.00	0.079	1.02	0.040
1	1	0	1	1	2.70	0.106	1.37	0.054
1	1	0	1	0	3.70	0.146	1.88	0.074
1	1	0	0	1	5.20	0.205	2.64	0.104
1	1	0	0	0	7.20	0.283	3.66	0.144
1	0	1	1	1	10.00	0.394	5.08	0.200
1	0	1	1	0	14.00	0.551	7.11	0.280
1	0	1	0	1	20.00	0.787	10.16	0.400
1	0	1	0	0	27.00	1.060	13.72	0.540
1	0	0	1	1	37.00	1.460	18.80	0.740
1	0	0	1	0	52.00	2.050	26.42	1.040
1	0	0	0	1	72.00	2.830	36.58	1.440
1	0	0	0	0	100.00	3.940	50.80	2.000
0	1	1	1	1	140.00	5.510	71.12	2.800
0	1	1	1	0	200.00	7.870	101.60	4.000
0	1	1	0	1	270.00	10.600	137.16	5.400
0	1	1	0	0	370.00	14.600	187.96	7.400
0	1	0	1	1	520.00	20.500	264.16	10.400
0	1	0	1	0	720.00	28.300	365.76	14.400
0	1	0	0	1	1000.00	39.400	508.00	20.000
0	1	0	0	0	1400.00	55.100	711.20	28.000
0	0	1	1	1	2000.00	78.700	990.60	39.000
0	0	1	1	0	2700.00	106.000	1371.60	54.000
0	0	1	0	1	3700.00	146.000	1879.60	74.000
0	0	1	0	0	5200.00	205.000	2641.60	104.000
0	0	0	1	1	7200.00	283.000	3657.60	144.000
0	0	0	1	0	10000.00	394.000	5080.00	200.000
0	0	0	0	1	14000.00	551.000	7112.00	280.000

*JV 1 to *JV16 are all OFF, the previous value will be maintained. The value will be set to 0 when the power is turned OFF.

(Note 1) In JOG mode, true feedrate changes if this signal changes during feed motion.

(Note 2) In incremental feed mode, true feedrate does not change if this signal changes during feed motion.

[Related signals]

(1) Manual feedrate method selection (JVS:YC77)

(2) Manual override method selection (OVSL:YC59)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL FEEDRATE METHOD SELECTION	JVS	YC77	YDB7	YEF7	Y1037

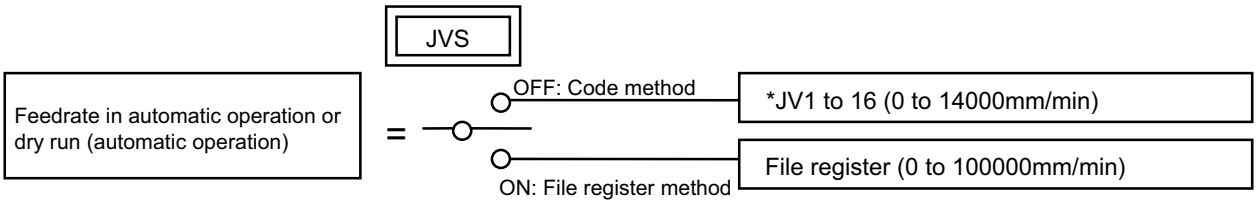
[Function]

When feedrate is specified in manual operation (JOG mode, incremental feed mode, etc.) or dry run (automatic operation), feedrate command method is selected between code method and file register method.

[Operation]

When the signal (JVS) is OFF, code method (*JV1 to *JV16) is selected.

When the signal (JVS) is ON, file register method is selected.



(Note) For details of "code method feedrate" and "file register method feedrate", refer to the relevant description.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	FEEDRATE LEAST INCREMENT CODE 1,2	PCF1,2	YC78,9	YDB8,9	YEF8,9	Y1038,9

[Function]

When manual feedrate is specified in file register method (JVS: "ON") or in arbitrary manual feed mode, file registers R (R2504 and R2505) are used. In this case, least increment of feedrate entered into file registers R2504 and R2505 is specified by this signal.

[Operation]

The relationship between PCF1/PCF2 and least feed increment is as follows:

PCF2	PCF1	Least increment (mm/min or inch/min)	Operation
0	0	10	10mm/min (inch/min) when "1" is set in file registers.
0	1	1	1mm/min (inch/min) when "1" is set in file registers.
1	0	0.1	0.1mm/min (inch/min) when "1" is set in file registers.
1	1	0.01	0.01mm/min (inch/min) when "1" is set in file registers.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	JOG HANDLE SYNCHRONOUS	JHAN	YC7B	YDBB	YEFB	Y103B

[Function]

Jog feed and handle feed can be carried out without changing the operation mode.

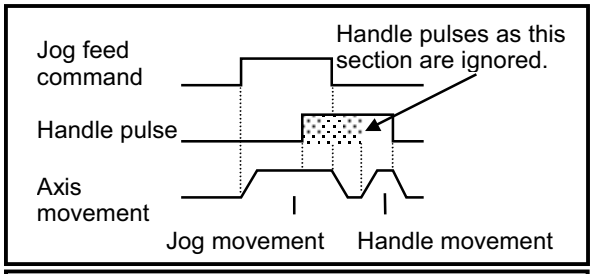
[Operation]

If the "Jog mode" (J) signal and this signal are input simultaneously, the "jog/handle synchronous mode" will be entered. If the "Rapid traverse" (RT) signal is turned ON during the "jog/handle synchronous mode", the jog feed will be carried out at the rapid traverse feedrate. When the "Rapid traverse" turns OFF, the jog feed will be carried out at the manual feedrate.

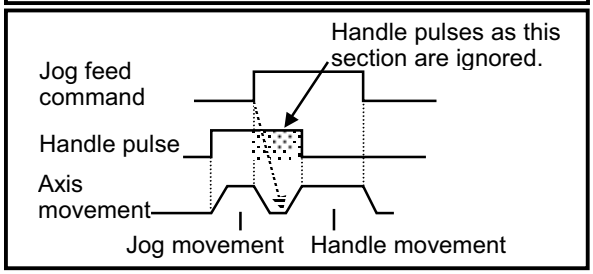
Operation mode	Jog handle synchronous signal (YC7B)	Rapid traverse signal (YC26)	Operation during jog feed	Handle feed
Jog feed	On	On	Rapid traverse feedrate	Possible
		Off	Manual feedrate	Possible
	Off	On	Rapid traverse feedrate	Impossible
		Off	Manual feedrate	Impossible

(1) During "jog/handle synchronous mode", jog feed and handle feed can be carried out randomly. However, jog feed and handle feed cannot be carried out simultaneously on the same axis. If carried out simultaneously, the jog feed will have a priority. The changeover between jog feed and handle feed on the same axis is carried out when the relevant axis has stopped.

- If handle feed is carried out on an axis that is being jog fed, the jog feed will have a priority, so after movement with jog feed has completed (the axis has stopped), handle feed movement will start.



- If jog feed is carried out on an axis that is being handle fed, the handle feed movement will stop at the rising edge of the jog feed command. After the axis stops, the jog feed movement will start.



(Note) If only the "Jog handle synchronous" signal is output, "M01 OPERATION ERROR 0101" will occur. If the "Jog handle synchronous" signal is input simultaneously with an operation mode signal other than the jog mode, the "Jog handle synchronous" signal will be ignored.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	EACH AXIS MANUAL FEEDRATE B VALID		YC7C	YDBC	YEFC	Y103C

[Function]

This signal validates manual feed using each axis manual feedrate B.

[Operation]

(1) If this signal and the manual feedrate B valid signal for the corresponding axis are validated when carrying out manual feed in the jog mode, the axis will move at the speed commanded by each axis manual feedrate B which is commanded separately from the manual feedrate or manual feedrate B.

(2) This signal is common for all axes.

[Related signals]

(1) Manual feedrate B valid (FBEn: Y940 to Y947)

(2) Each axis manual feedrate B (R5764 to R5779)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL FEEDRATE B SURFACE SPEED CONTROL VALID		YC7D	YDBD	YEFD	Y103D

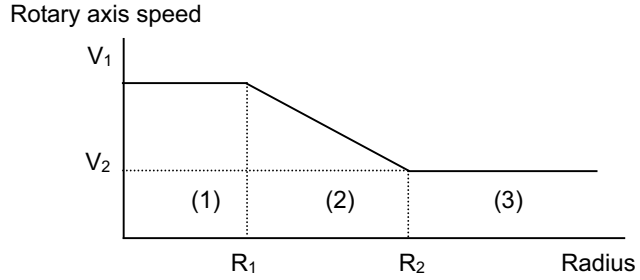
[Function]

This signal validates manual federate B surface speed control.

[Operation]

It validates the manual feedrate B surface speed control for a rotary axis selected by the manual feedrate B valid signal. If "0" is set, it will be invalid.
This signal is common for all axes.

When machining by moving the orthogonal axis while rotating the rotary table with the manual feedrate B surface speed control function, the tool nose and workpiece's relative speed will drop as the tool nears the rotation center if the table rotation speed remains under the set conditions.
The table rotation speed can be controlled according to the distance from the rotation center by validating the manual feedrate B surface speed control.
As shown below, the distances (radiuses) from the rotation center to two points (R1 and R2) and the rotary axis speed at the two points (R1 and R2) are set as parameters. When the "manual feedrate B surface speed control valid" signal (YC7D) is turned ON, the rotary axis speed is calculated automatically in accordance with a current radius.



(1) If R ≦ R1, then V1will be applied.
(2) If R<R2, the speed V is calculated with the following

$$V=\frac{(V_2 - V_1)}{(R_2 - R_1)} *(R - R_1)+V_1$$

expression. (3) If R2≤R, then V2 will be applied.

Override can be applied in the range of 0 to 200% in respect to the rotary axis speed.

[Caution]

(1) For a linear axis, the manual feedrate B surface speed control is not valid; however, the manual feedrate B override is valid.
(2) When the power is turned ON, validate the manual feedrate B surface speed control after returning the orthogonal axis to the reference position, establishing the coordinate system. If the surface speed control is applied to the rotary axis without establishing the coordinate system, the rotary axis moves at unexpected speed.

[Related signals]

(1) Manual feedrate B valid (FBEn: Y940 to Y947)
(2) Manual feedrate B override (R2524)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE VALID		YC7E	YDBE	YEFE	Y103E

[Function]

This signal is used to execute JOG or handle feed for the X and Y axes on the specified coordinate ("linear-linear" or "circular-linear").

[Operation]

After this signal turns ON in the JOG or handle mode, the X and Y axes move on the specified hypothetical coordinate. (The coordinate and so on are specified with the R registers explained below.)

[Caution]

(1) This signal does not effect on the operation of the axes other than X and Y axes, nor the PLC axis.
(2) This signal does not turn ON in the following conditions.
  (a) Either X axis or Y axis is in machine lock.
    (In this case, even machine lock is not performed.)
  (b) Either X axis or Y axis is not completed the reference position return.
  (c) Either X axis or Y axis is in servo OFF.
  (d) When the NC is in one of the following states.
    - Automatic operation (OP)
    - Emergency stop
    - Reset
  (e) The current position is outside of the specified movable range.
  (f) The setting value which is specified with R register is illegal.

[Related signals]

(1) In circular feed in manual mode (XC4F)
(2) Circular feed in manual mode operation mode data (R2636,7)
(3) Circular feed in manual mode basic point X data (R2644,5)
(4) Circular feed in manual mode basic point Y data (R2648,9)
(5) Circular feed in manual mode gradient/arc center X data (R2668,9)
(6) Circular feed in manual mode gradient/arc center Y data (R2672,3)
(7) Circular feed in manual mode travel range X+ data (R2652,3)
(8) Circular feed in manual mode travel range X- data (R2656,7)
(9) Circular feed in manual mode travel range Y+ data (R2660,1)
(10) Circular feed in manual mode travel range Y- data (R2664,5)
(11) Circular feed in manual mode current position X (R636,7)
(12) Circular feed in manual mode current position Y (R640,1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	HANDLE/INCREMENTAL FEED MAGNIFICATION CODE m	MP1 to 4	YC80 to 2	YDC0 to 2	YF00 to 2	Y1040 to 2

[Function]

This signal is used to specify the magnification factor per pulse at the handle in HANDLE feed mode, or the amount of feed motion per shot in incremental feed mode (±J1 to 8: "ON").

When the "handle/incremental feed magnification method selection" signal (MPS) is OFF, this magnification is applied for the hand pulse from handy terminal.

[Operation]

This signal (MP1 to 4) is set with the code method.

The amount of feed motion (per pulse feed in handle feed mode, and per ON/OFF of ±Jn value in incremental feed mode) is obtained by multiplying the original feed amount by MP1, MP2, MP4.

When parameter "#1003 iunit" is either "B" or "C", only a value 1000 or smaller can be set regardless of MP4's ON/OFF status.

The relationship between multiplier code (MP1 to 4) and multiplication in each feed mode is as follows.

MP4	MP2	MP1	Amount of motion per handle/ incremental feed	
			#1003 iunit: Other than B or C	#1003 iunit: B,C
0	0	0	1	1
0	0	1	10	10
0	1	0	100	100
0	1	1	1000	1000
1	0	0	1	5000
1	0	1	10	10000
1	1	0	100	50000
1	1	1	1000	100000

[Related signals]

(1) Handle mode (H: YC01)

(2) Incremental mode (S: YC02)

(3) Handle/incremental feed magnification method selection (MPS: YC87)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MAGNIFICATION VALID FOR EACH HANDLE	MPP	YC86	YDC6	YF06	Y1046

[Function] [Operation]

This signal sets magnification per each handle when setting magnification of feed arbitrarily.

(1) When the signal is ON

When setting magnification of feed with an arbitrary value, magnification can be set per each handle.

When selecting magnification with code method, a common magnification of feed will be applied for all handles.

Handle	Magnification of feed	
	File register method	Code method
1st handle	R2508,2509	YC80 to YC82
2nd handle	R2510,2511	
3rd handle	R2512,2513	

(2) When the signal is OFF

When setting magnification of feed with an arbitrary value, magnification of 1st handle/incremental feed (R2508,9) will be applied for all handles.

When selecting magnification with code method, a common magnification of feed will be applied for all handles.

[Related signals]

(1) Handle/incremental feed magnification method selection (MPS: YC87)

(2) Handle/incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)

(3) 1st handle/incremental feed magnification (R2508, R2509)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	HANDLE/INCREMENTAL FEED MAGNIFICATION METHOD SELECTION	MPS	YC87	YDC7	YF07	Y1047

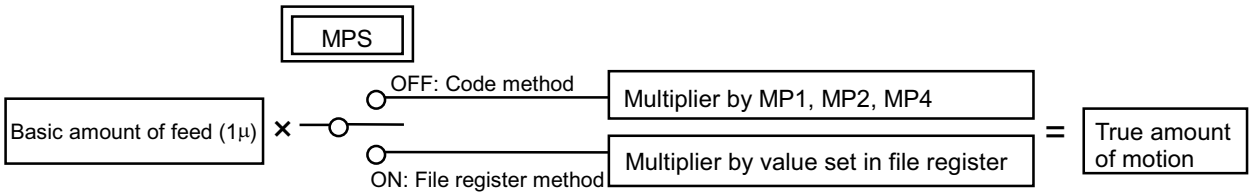
[Function]

Feed magnification method in handle feed or incremental feed is selected between "code method" and "file register method" by this signal.

[Operation]

When the signal (MPS) is OFF, "code feed magnification method" is selected.

When the signal (MPS) is ON, "file register magnification method" is selected.



(Note)For details of the motion corresponding to the code method or file register method, refer to the relevant descriptions.

[Related signals]

(1) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)

(2) 1st Handle/Incremental feed magnification (R2508, R2509)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL ALARM 1	TAL1	YC88	YDC8	YF08	Y1048

[Function]

This signal sets the tool data status during tool life management to status 3 (Tool alarm 1/Tool skip).

[Operation]

By turning ON the signal in the tool life management specification, status of tool data can be changed to "3".

This signal is validated when tool life management input signal (YC8B) is ON.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL ALARM 2	TAL2	YC89	YDC9	YF09	Y1049

[Function]

This signal sets the tool data status during tool life management to status 4 (Tool alarm 2).

[Operation]

By turning ON the signal in the tool life management specification, status of tool data can be changed to "4".

This signal is validated when tool life management input signal (YC8B) is ON.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	USAGE DATA COUNT VALID	TCEF	YC8A	YDCA	YF0A	Y104A

[Function]

This signal validates tool life count during the tool life management.

[Operation]

The tool life count (usage time or usage count corresponding to tool) is validated in the tool life management specification.

This signal is validated when tool life management input signal (YC8B) is ON.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL LIFE MANAGEMENT INPUT	TLF1	YC8B	YDCB	YF0B	Y104B

[Function]

This signal validates the tool life management.

[Operation]

By turning ON the signal in the tool life management specification, the tool life management process is executed.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL CHANGE RESET	TRST	YC8C	YDCC	YF0C	Y104C

[Function]

This signal is used to clear all tool usage data in a group with the tool life management II.

[Operation]

Select with the tool group No. designation (file register R2590, 2591) whether all groups that have exceeded their lifetimes or specific group to be cleared.

After this signal is input, the first tool of the group will be selected at the next group selection.

(Note) When the tool change reset or the tool skip is performed on the group currently selected, usage data count will be carried out on the tool used at the time of signal input until the next tool selection. Therefore, if a tool selected needs to be changed along with the signal input, select a group again. However, a tool may not be selected due to a preceding process if there is no movement command up to the next group selection after the signal input. In this case, contents of the preceding process can be invalidated by turning ON the "recalculation request" (CRQ) signal before selecting the group.

[Related signals]

(1) Recalculation request (CRQ: YC2B)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL ESCAPE AND RETURN TRANSIT POINT DESIGNATION		YC8D	YDCD	YF0D	Y104D

[Function]

With the tool escape and return function, a transit point can be designated by pressing the transit point switch when tool escapes. The tool returns to the machining halted point, passing through the transit point designated.

This signal turns ON when the transit point switch is pressed and turns OFF when recognition of the transit point is completed.

[Operation]

Refer to the section on "In tool escape and return mode signal" (XC4A).

[Related signals]

(1) In tool escape and return mode (XC4A)

(2) Tool escape and return transit point recognition finish (XC87)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION SELECTION CODE 1,2	ZSL1,2	YC90,1	YDD0,1	YF10,1	Y1050,1

[Function]

It is also possible to return to the nth reference position in the manual reference position return mode. This signal is used to select the number of the reference position (n) to return to. Normally both the "Reference position selection code 1, 2" (ZSL1n, ZSL2n) signals are turned OFF, and 1st point reference position return is performed.

[Operation]

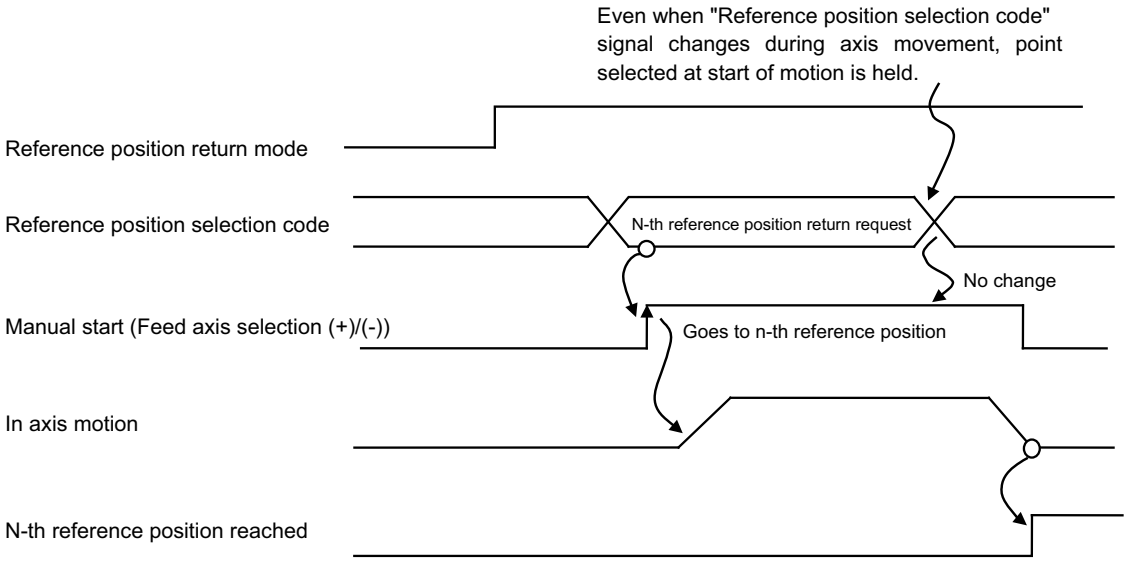
"Reference position selection code 1, 2" (ZSL1n, ZSL2n) signals are valid when:

(1) Reference position return mode is ON ("1").

(2) Manual start condition is held.

Reference position selection code 2	Reference position selection code 1	Return position
0	0	1st reference position
0	1	2nd reference position
1	0	3rd reference position
1	1	4th reference position

(Note 1) Returning to the first reference position must be performed before returning to the second, third or forth reference position.



[Related signals]

(1) Reference position return mode (ZRN: YC04)

(2) Feed axis selection (+Jn: Y1D8, -Jn: Y900)

(3) N-th reference position reached (ZP11 to 48: X800 to X867)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LENGTH COMPENSATION ALONG THE TOOL AXIS COMPENSATION AMOUNT CHANGE MODE		YC92	YDD2	YF12	Y1052

[Function]

This signal controls the tool length compensation along the tool axis compensation amount change mode.

[Operation]

(1) When the signal is ON:
When the handle is operated, only compensation amount of tool length compensation along the tool axis will be changed. Handle interrupt function will be invalid.

(2) When the signal is OFF:
Compensation amount of tool length compensation along the tool axis cannot be changed by the manual handle even during the tool length compensation along the tool axis mode.

[Related signals]

(1) Mechanical axis specifications 1st rotary axis angle / 2nd rotary axis angle (R2628,R2629 / R2630,R2631)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION SELECTION METHOD	M	YC97	YDD7	YF17	Y1057

[Function]

This signal selects whether the reference position selection is common for all axes or independent for each axis.

[Operation]

When this signal is OFF, the reference position selection is common for all axes, and ZSL1 and ZSL2 are valid.
When this signal is ON, the reference position selection is independent for each axis, and "Each axis reference position selection" is valid.

[Related signals]

(1) Reference position selection code 1,2 (ZSL1, 2: YC90, YC91)
(2) Each axis reference position selection (R2584)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MANUAL SPEED COMMAND VALID		YC9D	YDDD	YF1D	Y105D

[Function]

This signal is used to run the machining program with handle feedrate or JOG feedrate (manual feedrate).

[Operation]

After this signal is ON, manual speed (handle or manual feedrate) is applied to the axis feedrate in the whole automatic operation: the speed commanded in the program is not used.

If the program has not started, the automatic operation start is executed with handle or manual feedrate.

The manual operation mode decides whether the manual feedrate or handle feedrate is used.

- In handle mode

  The program under operation is executed at the feedrate of the 1st handle, 1st axis.

  During the reset, block stop or pause in the automatic operation mode, the automatic operation starts at the time when the handle feedrate has been commanded.

  When the reverse run is valid, a command in the (+) direction makes the movement as in the program, while a command in (-) direction reverses the movement against the program. The reversed movement, however, is available only within the current block.

- In JOG mode

  The program under operation is executed at the manual feedrate as long as the JOG mode signal is ON for the 1st axis.

  During the reset, block stop or pause in the automatic operation mode, the automatic operation starts at the time when the JOG mode has been turned ON.

  When the reverse run is valid, a command in the (+) direction makes the movement as in the program, while a command in (-) direction reverses the movement against the program. The reversed movement, however, is available only within the current block.

  When the "Rapid traverse" signal is ON, the axis moves at the rapid traverse feedrate.

[Caution]

(1) Turning ON this signal in the automatic operation leads the automatic operation pause.

(2) While this signal is ON, the "Automatic operation "start" command" signal is not valid.

(3) When the automatic operation is carried out with the manual speed command, the "In automatic operation "pause"" signal is output regardless of the axis movement.

(4) The manual speed command makes the movement follow the command on the 1st axis, even though the other axis is commanded in the program. Any commands to the other axes lead "M01 OPERATION ERROR 0005" (Internal interlock axis exists).

(5) The following G commands or modal make the movement different from that in the normal automatic operation.

G00: The manual feedrate is applied, not the rapid traverse feedrate.

G28: The manual feedrate is applied, not the reference position return feedrate.

G31: The manual feedrate is applied, not the skip feedrate. The movement when the skip signal is input, however, is the same as in the normal operation.

G33, G34 to 36 (L system): The thread cutting (G33), the variable lead thread cutting (G34: L system only), and the arc thread cutting (G35/36: L system only) operate the same as the dry run. The manual feedrate is applied. (When the parameter "#1247 set19/bit1" is set to "1", it operates according to the program command.)

G95: The feed per rotation operates the same as the dry run.

F1-digit feed: The manual feedrate is applied, not the F1-digit feedrate. The "F1-digit commanded" signal is not output, either.

(6) Only the 1st handle is used. The other handles are ignored.

(7) When this signal is valid, the feedrate is not changed by the Inch/Metric changeover command (G20/G21), nor by the rotary axis command speed tenfold.

(8) The manual interruption and the thread cutting cycle retract are available when this signal is ON. The automatic handle interruption, as well as the manual operation in the manual/auto simultaneous mode, cannot be used on the 1st axis because the axis applies the manual input upon this signal.

[Related signals]

(1) Manual speed command sign reversed (YC9E)
(2) Manual speed command reverse run valid (YC9F)
(3) In automatic operation "pause" (SPL: XC14)
(4) In manual speed command valid (XC48)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MANUAL SPEED COMMAND SIGN REVERSED		YC9E	YDDE	YF1E	Y105E

[Function]

When the manual speed is commanded, this signal reverses the direction that has been commanded with the handle feed or JOG feed.

[Operation]

When this signal is ON, a speed command in the (+) direction reverses the movement against the program. (Note that this operation is not available unless the reverse run is valid.) A command in the (-) direction makes the movement as commanded in the program.

Manual speed command Reverse run valid	Manual speed command Sign reversed	Movement direction	
		by (+) operation	by (-) operation
OFF	(Invalid)	+	+
ON	OFF	+	-
ON	ON	-	+
In the modals that do not allow the reverse run (thread cutting and synchronous tapping)		+	The operation is ignored

[Caution]

This signal is not valid when the "Manual speed command Reverse run valid" signal is OFF.

[Related signals]

(1) Manual speed command valid (YC9D)
(2) Manual speed command reverse run valid (YC9F)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MANUAL SPEED COMMAND REVERSE RUN VALID		YC9F	YDDF	YF1F	Y105F

[Function]

This signal allows the manual speed command in the (-) direction to reverse the movement against the program.

[Operation]

When this signal turns ON during the manual speed is commanded, a speed command in the (-) direction in handle or JOG mode reverses the movement against the program.

When this signal is OFF, a command in the (-) direction makes the same movement as commanded in the (+) direction: the movement follows the program.

[Caution]

(1) The reverse run is available within the block in execution. The reversed axis movement stops at the start point of the block in execution.

(2) Unless all the axes stop, this signal cannot be changed ON/OFF. The ON/OFF change of this signal during the axis movement is realized after all the axes have stopped.

(3) The reverse run is not allowed in the following operations. The axis stays stopped if a speed command is given in the (-) direction.

(a) In the reference position return (G28, G29). When G28 is commanded, however, the reverse run is available from the start point and to the intermediate point. When G29 is commanded, the reverse run is available from the intermediate point to the end point.

(b) In cutting cycle in the synchronous or asynchronous tap.

(c) In shift amount operation in a fixed cycle.

(d) In tool center point control.

(e) In normal line control.

(f) In milling interpolation, pole coordinate rotation or cylindrical interpolation.

(g) When the thread cutting command (G33) is given.

(h) In exponential interpolation.

(i) In spline interpolation.

(j) In NURBS interpolation.

(k) In tool change position return or 2nd/3rd/4th reference position return (from the intermediate point to the block end).

[Related signals]

(1) Manual speed command valid (YC9D)

(2) Manual speed command sign reversed (YC9E)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 1ST AXIS SELECTION CODE m	CX11 to 116	YCA0 to 4	YDE0 to 4	YF20 to 4	Y1060 to 4

[Function]

This signal specifies a number of the axis component to move in manual arbitrary feed mode.
Components of up to three axes can be moved simultaneously in manual arbitrary feed mode. This signal is used to specify one of them.

[Operation]

(1) The "Manual arbitrary feed 1st axis selection code m" (CX11 to CX116) must be set before strobe signal CXS8 is turned ON. An attempt to set it during motion shall fail.

(2) Besides this signal (CX11 to CX116), there are two signals to specify a "Manual arbitrary feed 2nd axis selection code m" (CX21 to CX216) and a "Manual arbitrary feed 3rd axis selection code m" (CX31 to CX316). The axis numbers need not be specified in ascending order.

(3) The "Manual arbitrary feed 1st axis selection code m" is validated by turning ON the "Manual arbitrary feed 1st axis valid" (CX1S) signal explained later. Similarly, the "specific validity" signals (CX2S and CX3S) are also provided for the 2nd and 3rd axis number signals.

(4) Axis numbers can be specified as follows:

n: 1 to 3

Signal / Axis specification	CXnS	—	—	CXn16	CXn8	CXn4	CXn2	CXn1
1st axis	1	—	—	0	0	0	0	1
2nd axis	1	—	—	0	0	0	1	0
3rd axis	1	—	—	0	0	0	1	1
4th axis	1	—	—	0	0	1	0	0

Validity signal　　Axis number

(5) Motion of the specified axis component is as follows:

(a) The motion of the axis component specified by the "Manual arbitrary feed 1st axis selection code m" signal corresponds to the contents of "Manual arbitrary feed 1st axis travel amount" (R2544 and R2545).

(b) The motion of the axis component specified by the "Manual arbitrary feed 2nd axis selection code m" signal corresponds to the contents of "Manual arbitrary feed 2nd axis travel amount" (R2548 and R2549).

(c) The motion of the axis component specified by the "Manual arbitrary feed 3rd axis selection code m" signal corresponds to the contents of "Manual arbitrary feed 3rd axis travel amount" (R2552 and R2553).

[Related signals]

For related signals, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 1ST AXIS VALID	CX1S	YCA7	YDE7	YF27	Y1067

[Function]

This signal is used to validate the axis specified by the "Manual arbitrary feed 1st axis selection code m" signal so that the axis component can move in manual arbitrary feed mode.

[Operation]

(1) The specification of the axis by the "Manual arbitrary feed 1st axis selection code m" signal explained earlier is validated only when the "CX1S" signal is turned ON.

[Related signals]

For related signal, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 2ND AXIS SELECTION CODE m	CX21 to 216	YCA8 to C	YDE8 to C	YF28 to C	Y1068 to C

[Function][Operation]

See the descriptions on the "Manual arbitrary feed 1st axis selection code m" signal (CX11 to CX116: YCA0 to 4) explained above.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 2ND AXIS VALID	CX2S	YCAF	YDEF	YF2F	Y106F

[Function][Operation]

See the descriptions on the "Manual arbitrary feed 1st axis valid" signal (CX1S: YCA7).

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 3RD AXIS SELECTION CODE m	CX31 to 316	YCB0 to 4	YDF0 to 4	YF30 to 4	Y1070 to 4

[Function][Operation]

See the descriptions on the "Manual arbitrary feed 1st axis selection code m" signal (CX11 to CX116: YCA0 to 4) explained above.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 3RD AXIS VALID	CX3S	YCB7	YDF7	YF37	Y1077

[Function][Operation]

See the descriptions on the "Manual arbitrary feed 1st axis valid" signal (CX1S: YCA7).

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED SMOOTHING OFF	CXS1	YCB8	YDF8	YF38	Y1078

[Function]

This signal is used to move an axis component under the condition where the acceleration/ deceleration time constant is 0 in manual arbitrary feed mode.

[Operation]

With the "Manual arbitrary feed smoothing off" (CXS1) signal set ON, axis motion in manual arbitrary feed mode is performed under the same conditions as when the acceleration/deceleration time constant is set to 0.

(Note 1) When using this signal to move an axis component under the condition where the acceleration/deceleration time constant is 0, move it at a slow speed. Otherwise, a servo alarm (excess error) may occur.

[Related signals]

For related signal, see the section "Manual arbitrary feed mode" (PTP: YC03) mode.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED AXIS INDEPENDENT	CXS2	YCB9	YDF9	YF39	Y1079

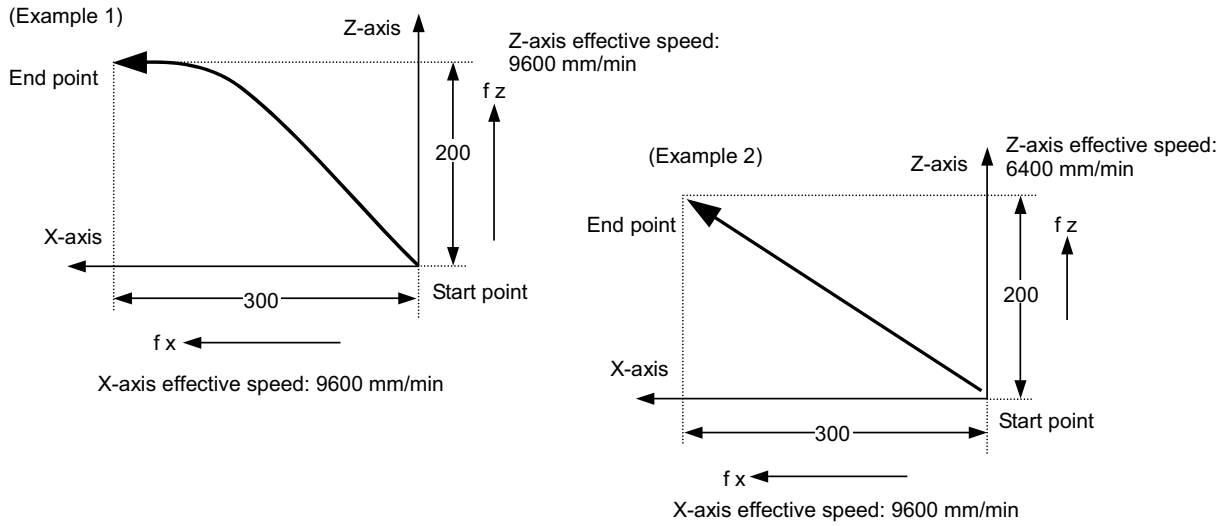
[Function]

When moving two or more axis components simultaneously in "manual arbitrary feed" mode, this signal can be used to position each axis independently without performing interpolation.

[Operation]

When a manual arbitrary feed is executed for two or more axes at the same time with CXS2 ON, each axis is positioned independently without being subjected to interpolation.The "CXS2" signal is generally used when the "Manual arbitrary feed G0/G1" signal (CXS4) explained later is OFF (G0 selected).

The following is an example where the rapid traverse speeds of X-axis and Z-axis are both set to 9,600 mm/min, and the amounts of movement of X-axis and Z-axis are set to 300mm and 200mm respectively.



[Related signals]

For related signal, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED EX. F/MODAL. F	CXS3	YCBA	YDFA	YF3A	Y107A

[Function]

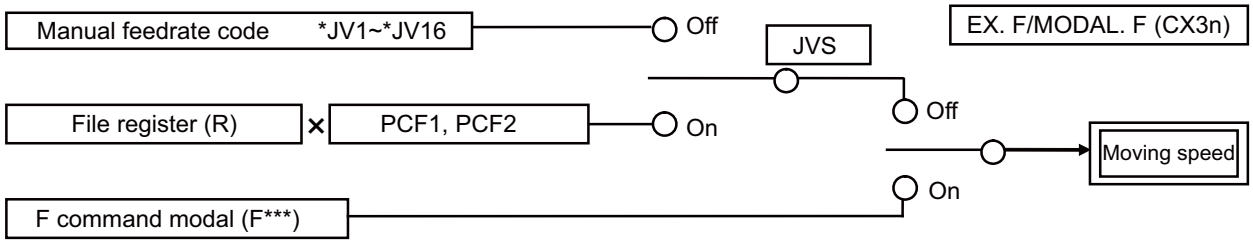
This signal selects whether a manual arbitrary feed in G1 mode is done at manual feed rate or at modal speed in automatic operation.

[Operation]

When the "Manual arbitrary feed G0/G1" (CXS4) signal explained later is ON n, the "CXS3" signal works as follows:

(1) When Manual arbitrary feed EX.F/MODAL.F (CXS3) is OFF:
When the "Manual feedrate method selection (JVS)" signal is OFF, the speed selected by the manual feedrate code (*JV1 to 16) applies.When the "Manual feedrate method selection (JVS)" signal is ON, the applicable speed is determined by the relation between the contents of the corresponding file register (R) and the "Feedrate least increment code 1,2" signal (PCF1 or PCF2).

(2) When Manual arbitrary feed EX.F/MODAL.F (CXS3) is ON:
Manual arbitrary feed is done at a modal speed (F***) set in automatic operation. However, manual arbitrary feed will not be done, if no F command has been executed before.



[Related signals]

For related signal, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED G0/G1	CXS4	YCBB	YDFB	YF3B	Y107B

[Function]

This signal selects a manual feed speed or rapid traverse speed in manual arbitrary feed mode.

[Operation]

This signal operates as shown below depending on the status of the "Manual arbitrary feed G0/G1" (CXS4) signal.

(1) When the "Manual arbitrary feed G0/G1" signal is OFF:
The rapid traverse speed originally set to the corresponding axis applies. Rapid traverse override is also valid. The rapid traverse speed applicable when moving two or more axis components at the same time varies with the status of the "Manual arbitrary feed axis independent (CXS2)" signal. See the descriptions on the "Manual arbitrary feed axis independent (CXS2)" signal.

(2) When the "Manual arbitrary feed G0/G1" signal is ON:
The manual feed speed or the speed specified by the F command in automatic operation apply. For details, see the description on the Manual arbitrary feed EX.F/MODAL.F (CXS3).

[Related signals]

For related signal, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED MC/WK	CXS5	YCBC	YDFC	YF3C	Y107C

[Function]

This signal selects a machine coordinate system or a modal workpiece coordinate system on which positioning is done in manual arbitrary feed mode.

[Operation]

The "Manual arbitrary feed MC/WK (CXS5)" signal becomes valid when the "Manual arbitrary feed ABS/INC (CXS6)" signal explained later is OFF in manual arbitrary feed mode.

(1) When the "Manual arbitrary feed MC/WK" signal is OFF:
"Manual arbitrary feed n-th axis travel amount" set in a file register (R) is used for positioning on the machine coordinate system.

Amount of motion =

Manual arbitrary feed n-th travel amount - Coordinate value on machine coordinate system

(2) When the "Manual arbitrary feed MC/WK" signal is ON:
"Manual arbitrary feed n-th axis travel amount" set in a file register (R) is used for positioning on the modal workpiece coordinate system.

Amount of motion =

Manual arbitrary feed n-th travel amount - Coordinate value on modal workpiece coordinate system

[Related signals]

For related signal, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED ABS/INC	CXS6	YCBD	YDFD	YF3D	Y107D

[Function]

This signal selects whether travel amount is given in an absolute value or incremental value for manual arbitrary feed.

[Operation]

(1) When the "Manual arbitrary feed ABS/INC" (CXS6) signal is OFF:
"Manual arbitrary feed n-th axis travel amount" set in a file register (R) is handled as an absolute value. For details, see the descriptions on the "Manual arbitrary feed MC/WK (CXS5)" signal explained before.

(2) When the "Manual arbitrary feed ABS/INC" signal is ON:
"Manual arbitrary feed n-th axis travel amount" set in a file register (R) is handled as a real movement value.

[Related signals]

For related signal, see the section "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	MANUAL ARBITRARY FEED STOP	*CXS7	YCBE	YDFE	YF3E	Y107E

[Function]

This signal stops an ongoing axis component halfway in manual arbitrary feed mode.

The function of this signal is equivalent to those of the "Manual interlock+ n-th axis" (*+MITn) and "Manual interlock- n-th axis" (*-MITn) signals.

[Operation]

Turning the "Manual arbitrary feed stop" signal (*CXS7) OFF (0) causes the following:

(1) Motion of axis in manual arbitrary feed mode is decelerated and stopped.

(2) The axis component which is going to move in manual arbitrary feed mode remains stopped.
When the "Manual arbitrary feed stop" (*CXS7) signal is turned ON (1) while an axis component is in the stop state, it immediately restarts the operation.

(Note 1) When the power is turned ON, the "Manual arbitrary feed stop" (*CXS7) signal is automatically set to "1". If the "Manual arbitrary feed stop" signal is not to be used, there is no need to make a sequence program for it.

[Related signals]

For related signal, see the "Manual arbitrary feed mode (PTP: YC03)."

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED STROBE	CXS8	YCBF	YDFF	YF3F	Y107F

[Function]

This signal is a trigger signal for moving an axis component in manual arbitrary feed mode. The axis component starts moving at the rising edge of this signal.

[Operation]

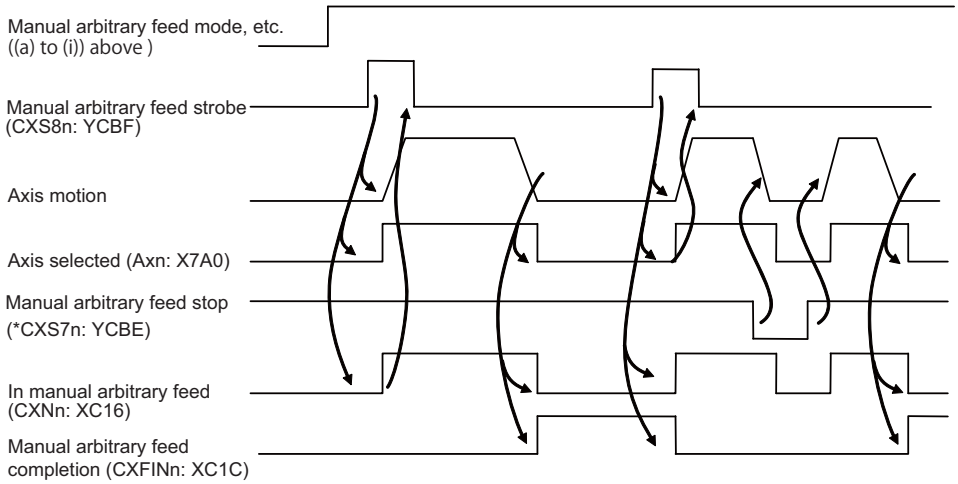
The "Manual arbitrary feed strobe" signal (CXS8) should be turned ON after all signal values necessary for manual arbitrary feed are set appropriately.

(1) The following signals must be appropriately set before turning ON the "Manual arbitrary feed strobe" signal:
- (a) Manual arbitrary feed mode (PTP)
- (b) Manual arbitrary feed n-th axis selection code (CXn1 to CXn16) and manual arbitrary feed n-th axis valid (CXnS)
- (c) Manual arbitrary feed n-th axis travel amount (file registers R2544 to R2553)
- (d) Manual arbitrary feed smoothing OFF (CXS1)
- (e) Manual arbitrary feed axis independent (CXS2)
- (f) Manual arbitrary feed EX.F/MODAL.F (CXS3)
- (g) Manual arbitrary feed G0/G1 (CXS4)
- (h) Manual arbitrary feed MC/WK (CXS5)
- (i) Manual arbitrary feed ABS/INC (CXS6)

(2) The following signals can be changed even after the "Manual arbitrary feed strobe" signal is turned ON:
- (j) Manual feed speed code m
- (k) Rapid traverse override for a rapid traverse speed when the "Manual arbitrary feed G0/G1" signal (CXS4) is OFF.
- (l) Manual arbitrary feed stop (*CXS7)

(Note 1) The "Manual arbitrary feed strobe" signal can be accepted even when the "Manual arbitrary feed stop" signal (*CXS7) is OFF (0).

Example of operation timing chart



(Note 2) The "Manual arbitrary feed strobe" signal (CXS8) must be ON for at least 100ms.

[Related signals]

Signals listed in (a) to (l) above

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CURRENT LIMIT MODE 1	ILM1	YCC0	YE00	YF40	Y1080
A	CURRENT LIMIT MODE 2	ILM2	YCC1	YE01	YF41	Y1081

[Function]

This signal selects process of current limit reached.

[Operation]

When the current reaches its limit during current control, the "current limit reached" signal will be output, and the following mode will be selected and performed.

Current limit mode 2	Current limit mode 1	Mode
0	0	Normal
0	1	Interlock
1	0	Normal
1	1	Normal

(1) Normal mode

Movement command is executed in the current state.

In automatic operation, the movement command is executed to the end and moves to the next block with droops accumulated.

(2) Interlock mode

Movement command is blocked (internal interlock).

In automatic operation, the operation stops at the corresponding block and does not move to the next block.

In manual operation, the subsequent commands to the same direction will be ignored.

[Related signals]

(1) In current limit n-th axis (ILI1 to 8: X900 to X907)
(2) Current limit reached n-th axis (ILA1 to 8: X920 to X927)
(3) Current limit changeover n-th axis (ILC1 to 8: Y9A0 to Y9A7)
(4) Droop release request n-th axis (DOR1 to 8: Y9C0 to Y9C7)
(5) Current limit changeover (R2593)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR EXECUTION	LDWT	YCC3	YE03	YF43	Y1083

[Function]

Teaching and monitoring is executed.

[Operation]

The teaching or monitor mode is valid from the point that this signal turns ON during automatic operation.

Whether to carry out teaching or monitoring follows the teaching mode and monitor mode input signal.

The teaching and monitor mode is invalidated at the point this signal turns OFF.

[Caution]

(1) Select the teaching mode or monitor mode before turning this signal ON.

This signal will not be validated if the teaching mode or monitor mode is not selected.

(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC4 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR TEACHING MODE		YCC4	YE04	YF44	Y1084

[Function]

The teaching mode is selected.

[Operation]

Turn this signal ON to select the teaching mode.

The teaching mode is actually validated when this signal turns ON and then the teaching/monitor valid signal turns ON.

[Caution]

(1) Do not turn the monitor mode input signal ON when turning this signal ON.

(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)

(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)

(3) Load monitor Execution, Monitor mode, Alarm reset, Warning reset (YCC3, YCC5 to YCC7)

(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)

(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR MONITOR MODE		YCC5	YE05	YF45	Y1085

[Function]

The monitor mode is selected.

[Operation]

Turn this signal ON to select the monitor mode.

The monitor mode is actually validated when this signal turns ON and then the teaching/monitor valid signal turns ON.

[Caution]

(1) Do not turn the teaching mode input signal ON when turning this signal ON.

(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)

(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)

(3) Load monitor Execution, Teaching mode, Alarm reset, Warning reset (YCC3, YCC4, YCC6, YCC7)

(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)

(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR ALARM RESET		YCC6	YE06	YF46	Y1086

[Function]

This signal resets the alarm signal.

[Operation]

If this signal is turned ON when the alarm axis and data alarm information bit are ON, each alarm bit will turn OFF.

The warning information is reset simultaneously.

[Caution]

(1) This signal is used to clear the alarm information and does not affect the other operations.

(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)

(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)

(3) Load monitor Execution, Teaching mode, Monitor mode, Warning reset (YCC3 to YCC5, YCC7)

(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)

(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR WARNING RESET		YCC7	YE07	YF47	Y1087

[Function]

The warning signal is reset.

[Operation]

If this signal is turned ON when the warning axis information bit is ON, each warning bit will turn OFF.

[Caution]

(1) This signal does not clear the alarm information.

(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)

(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)

(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset (YCC3 to YCC6)

(4) Load monitor Teaching axis selection, Load change rate detection axis, Teaching data sub-No. (R2580 to R2582)

(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
B	2ND REFERENCE POSITION RETURN INTERLOCK	*ZRIT	YCC8	YE08	YF48	Y1088

[Function]

The axis is interlocked at a designated position during manual 2nd reference position return.

[Operation]

During 2nd reference point return while this signal is valid (base specification parameter "#1505 ckref2" is "1"), if this signal turns OFF, movement of axes that have reached the designated position will stop, and an interlock will be applied. Axes that have not reached the designated position will be interlocked after reaching the designated position.

When this signal is ON, the axis movement will not stop, and the 2nd reference position return will continue.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ADAPTIVE CONTROL EXECUTION		YCC9	YE09	YF49	Y1089

[Function]

This signal is input to execute adaptive control.

[Operation]

Adaptive control will start if this signal is turned ON during load monitor execution.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Adaptive control in execution (XCA3)

(2) Adaptive control override (R571)

(3) Adaptive control basic axis selection (R2583)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Small diameter deep hole drilling cycle		YCCA	YE0A	YF4A	Y108A

[Function]

The cutting operation of the samll diameter deep hole drililng cycle is skipped.

[Operation]

The remaining cutting command is skipped and move on to the next operation by turning ON this signal during the cutting operation of the small diameter deep hole drilling cycle.

[Caution]

The cutting opearation is skipped when this signal is turned ON.

[Related signals]

(1) In small diameter deep hole cycle (XCC1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	HIGH-SPEED RETRACT FUNCTION VALID		YCCC	YE0C	YF4C	Y108C

[Function]

When executing a fixed cycle, the axis will be retracted at a high-speed from the bottom of the hole.

[Operation]

If the fixed cycle program (G81/G82/G83/G73) is executed while this signal is ON, the axis will be retracted at a high-speed from the bottom of the hole.

[Caution]

(1) High-speed retract will not be executed even if this signal is turned ON during the fixed cycle. Always turn the signal ON before the fixed cycle command, and hold the state until the fixed cycle command is completed.

(2) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) High-speed retract function valid state (XCC2)

(2) In high-speed retract function operation (XCC3)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	WAITING IGNORE		YCD0	YE10	YF50	Y1090

[Function]

This signal is used to designate whether to execute the waiting between part systems by M code or not.

[Operation]

1:The waiting by M code is not executed. The M code to execute waiting commanded during the machining program is ignored.

0:The waiting by M code is executed. If the M code to execute waiting is commanded in one part system, the execution of the next block starts after the same M code is commanded in the other part system.

(Note 1) With the M code for waiting, the code signal and strobe signal are not output differently from the other M code.

(Note 2) The M code during the machining program can be ignored with the "Waiting ignore" signal. The operation is possible only in the single part system without deleting the M code during the machining program.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SPINDLE-SPINDLE POLYGON CANCEL		YCD1	YE11	YF51	Y1091

[Function]

Spindle-spindle polygon machining is canceled.

[Operation]

If this signal is input during spindle-spindle polygon, the spindle-spindle polygon machining mode will be canceled.

[Related signals]

(1) In spindle-spindle polygon mode (XCB2)

(2) Spindle-spindle polygon synchronization completion (XCB3)

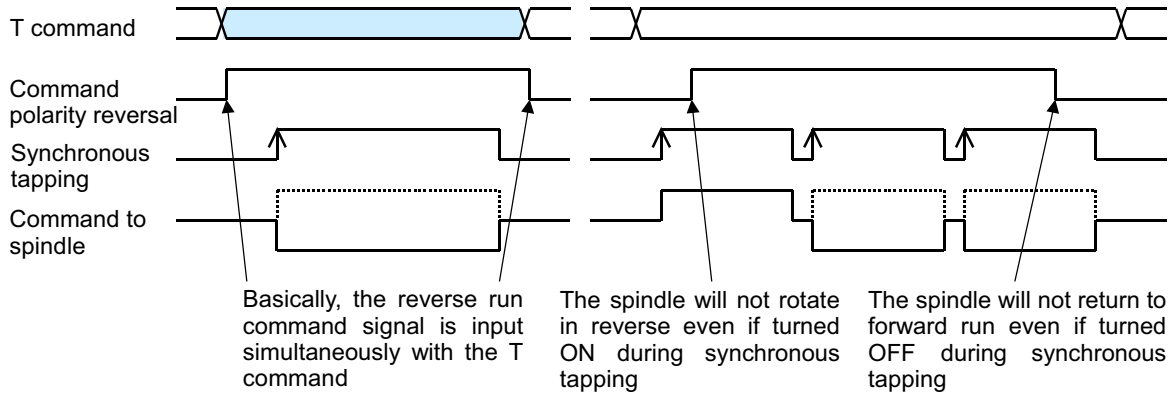
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SYNCHRONOUS TAPPING COMMAND POLARITY REVERSAL		YCD2	YE12	YF52	Y1092

[Function]

Designate whether to rotate the spindle in reverse during synchronous tapping.

[Operation]

When the "Synchronous tapping command polarity reversal" signal is ON, the spindle will rotate in reverse during synchronous tapping.



Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SPINDLE OFF MODE		YCD3	YE13	YF53	Y1093

[Function]

This function is used to check the program by moving the machine without rotating the spindle.

[Operation]

(1) Synchronized tapping mode

When the spindle OFF mode is turned ON, the spindle will not rotate even if the servo is turned ON.

During the synchronized tapping mode, the operation up to when the synchronized tapping mode turns OFF will not change even if the spindle OFF mode is changed.

This signal should be ON from the start of operation.

(2) Asynchronous tapping mode

(a) During synchronous (per revolution) feed

In addition to M03, M04 processing and dry run signal, turn the spindle OFF mode ON.The program will advance when the signal is turned ON.

(b) During asynchronous feed (per minute) feed

The program will advance even if the spindle OFF mode is not turned ON.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TAP RETRACT POSSIBLE STATE CANCEL	TRVEC	YCD6	YE16	YF56	Y1096

[Function]

Turning ON this signal allows to move the axis, both automatically and manually, without tap retract.

This signal is used when the spindle rotation with tap retract may cause danger; when the tap is damaged, for example.

[Operation]

Turning this signal ON turns OFF the "Tap retract possible" (TRVE) signal.

[Related signals]

(1) Tap retract (TRV: YC5C)

(2) Tap retract possible (TRVE: XCA5)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING COMPENSATION UPDATE PREVENTION RE-QUEST	CHPRCR	YCD7	YE17	YF57	Y1097

[Function] [Operation]

This signal prevents the chopping compensation amount from being updated.

[Related signals]

(1) Chopping compensation update prevented (CHPRCC)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	BARRIER VALID (LEFT)		YCD8	YE18	YF58	Y1098
A	BARRIER VALID (RIGHT)		YCD9	YE19	YF59	Y1099

[Function]

This signal is used to validate the left (right) barrier range for the chuck/tailstock barrier function.

[Operation]

The chuck/tailstock barrier function's barrier range is validated when this signal turns ON. If the tool nose attempts to enter the range, an error will occur.

Note that to validate the barrier function, this signal must be ON, and the parameter "#8310 Barrier ON" must be set to "1", and "#8315 BARRIER TYPE (L)" ("#8316 BARRIER TYPE (R)") must not be set to "0" on the BARRIER screen. (Excluding when using a special display unit.)

The barrier range validity can also be changed with the G22/G23 command instead of this signal input. In this case, the left and right settings will change simultaneously. (There are some systems with which G22/G23 cannot be commanded because of the selected G code system.)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL PRESETTER SUB-SIDE VALID		YCDA	YE1A	YF5A	Y109A

[Function]

Select whether to measure the tool compensation amount on the main spindle side or sub-spindle side.

[Operation]

OFF:The tool compensation No. is acquired from the main spindle side R registers used for the setting of compensation No.

ON:The tool compensation No. is acquired from the sub spindle side R registers used for the setting of compensation No.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DOOR OPEN II	DOOR2	YCE1	YE21	YF61	Y10A1

[Function]

This signal stops all axes, and cuts OFF contactor power.

[Operation]

The NC carries out the following operations when the "Door open II" signal turns ON.

(1) A deceleration stop is carried out for all axes (servo axes and spindles). (Axis interlock)

(2) After all axes stop, the contactor power of each drive unit is cut OFF. The "Servo ready completion" signal (SA) does not turn OFF.

(3) The "Door open enable" signal turns ON.

The NC carries out the following operations when the "Door open II" signal turns OFF.

(1) A ready ON and servo ON state occurs for all axes.

(2) The "Door open enable" signal turns OFF.

[Caution]

(1) Handling of the PLC axis

Set so a "Door open" signal is output to the NC after the PLC axis is stopped by the PLC.

If a "Door open" signal is input without stopping the PLC axis, the axis will stop with a dynamic brake method due to the ready OFF state.

The remaining distance will be held in the R register being used in the PLC axis control.

(2) Handling of the analog spindle

When an analog spindle is connected, it is not possible to confirm that the spindle has completely stopped with the NC. Thus, confirm that the spindle has completely stopped using the PLC, before opening the door.

Because the spindle may start rotating again immediately after the door is closed, for safety turn the forward run and reverse run signals OFF when the door is open.

(3) Opening the door during ATC operation

When opening the door during ATC operation, apply an interlock with the user PLC.

[Related signals]

(1) Door open enable (DROPNS: XCD8)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DOOR OPEN SIGNAL INPUT (spindle speed monitor)		YCE2	YE22	YF62	Y10A2

[Function]

This signal informs the door open or close state to the spindle drive unit with the spindle speed monitor function.

[Operation]

"1" is entered in the door open state.

The compatibility check of this signal and the door close signal connected with the spindle drive unit is performed in the spindle drive unit.

If those signals are not compatible for continuous 3 seconds, the servo alarm (5D) will occur.

[Related signals]

(1) Door open enable (DROPNS: XCD8)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DOOR INTERLOCK SPINDLE SPEED CLAMP		YCE3	YE23	YF63	Y10A3

[Function]

This signal is used to change the spindle's clamp speed.

[Operation]

When the "Door interlock spindle speed clamp" signal is turned ON, the spindle rotation speed will be limited by the set clamp speed value.

The relation of the "Door interlock spindle speed clamp" signal and the clamp speed parameter in each operation is shown below.

Spindle operation	Clamp speed parameter (spindle parameter)	
	Door interlock spindle speed clamp OFF	Door interlock spindle speed clamp ON
Orientation (multi-point orientation)	#3205 SP005	#3315 SP115
Turret indexing	#3312 SP112	#3211 SP011
Synchronized tapping (zero point return)	#3414 SP214	#3315 SP115
Spindle C axis (C axis zero point return)	#3349 SP149	#3315 SP115

[Caution]

(1) This signal is valid only when the door interlock spindle clamp speed valid parameter "#1239 set11 BIT5" is set to "1".

(2) The clamp speed parameter setting value validated when the "Door interlock spindle speed clamp" signal is ON must always be set smaller than the original clamp speed setting value (clamp speed valid when signal is OFF). The clamp speed will change when the signal turns ON regardless of the size of the parameter setting values.

(3) Do not change the state of the "Door interlock spindle speed clamp" signal during multi-point indexing. The clamp speed will change if the signal state is changed during operation.

(4) Even if the "Door interlock spindle speed clamp" signal is changed during orientation, during zero point return at synchronized tapping, or during reference position return after changing from the spindle mode to the C axis mode under the spindle/C-axis control function, the clamp speed will not change. The rotation speed is clamped by the clamp speed set with the signal state before each operation is executed.

(5) The target for changing the clamp speed with the "Door interlock spindle speed clamp" signal differs according to the "#1154 pdoor" setting and system configuration. The combinations are shown below.

#1154 pdoor setting value	No. of part systems	Door interlock spindle speed clamp
0	1	YCE3
0	2	YCE3
1	1	YCE3
1	2	YCE3

(6) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	BARRIER CHECK INVALID	BCHK	YCF4	YE34	YF74	Y10B4

[Function]

This signal invalidates barriers of chuck barrier and tail stock barrier (G22).

[Operation]

When the signal is ON, it invalidates chuck barrier and tail stock barrier regardless of chuck barrier and tail stock barrier command (G22/G23) ON/OFF in machining program.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	DRY RUN INVALID	DRNC	YCFA	YE3A	YF7A	Y10BA

[Function]

This signal invalidates dry run in dry run operation.

[Operation]

When the "dry run invalid (DRNC)" signal is ON, NC operates at designated speed, ignoring the dry run function (DRN).

[Related signals]

Dry run (DRN: YC15)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REVERSE RUN FROM BLOCK START	RVSP	YD08	YE48	YF88	Y10C8

[Function]

This signal is used to designate where a reverse run starts in the arbitrary reverse run.

[Operation]

When this signal is OFF, a reverse run starts from the block stop point.

When this signal is ON, a reverse run starts from the start point of the block where the movement stopped.

Return to the start point for the reverse run from block start, turn this signal ON, and then start an automatic operation.

Keep this signal ON until the "In auto operation "start"" signal (STL) turns ON.

This signal is available only in the reverse run control mode.

[Related signals]

(1) Macro interrupt priority (RVIT: YD09)

(2) Reverse run control mode (RVMD: YD0A)

(3) Reverse run (VRV: YC27)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MACRO INTERRUPT PRIORITY	RVIT	YD09	YE49	YF89	Y10C9

[Function]

In the arbitrary reverse run, turning ON the "Macro interrupt" (UIT) signal executes a block stop during the reverse run. Then this signal is used to select the operation when an automatic operation is started while the "Reverse run" (VRV) signal is OFF.

[Operation]

When this signal is OFF, a forward run is executed with the fall of the "Automatic operation "start" command" signal.

When this signal is ON, a macro interrupt program is executed with the fall of the "Automatic operation "start" command" signal.

This signal is available only in the reverse run control mode.

[Related signals]

(1) Reverse run from block start (RVSP: YD08)

(2) Reverse run control mode (RVMD: YD0A)

(3) Reverse run (VRV: YC27)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	REVERSE RUN CONTROL MODE	RVMD	YD0A	YE4A	YF8A	Y10CA

[Function]

This signal is used to save the reverse run information used for the reverse run control in the arbitrary reverse run.

[Operation]

When this signal is ON, the reverse run information is saved.

Turn this signal ON at the start of the block where the reverse run control is executed. Turn it OFF when resetting.

Turn ON the "Recalculation request" signal (CRQ) when turning ON this signal.

Unless the recalculation is requested, the reverse run information does not include the block that has been created by pre-reading.

[Related signals]

(1) Reverse run from block start (RVSP: YD08)
(2) Macro interrupt priority (RVIT: YD09)
(3) Reverse run (VRV: YC27)
(4) Recalculation request (CRQ: YC2B)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (JOG,INC) in tool axis coordinate system	MJCT	YD18	YE58	YF98	Y10D8
A	Manual feed for 5-axis machining (JOG,INC) in table coordinate system	MJCB	YD19	YE59	YFB9	Y10D9
A	Manual feed for 5-axis machining (JOG,INC) in feature coordinate system	MJCF	YD1A	YE5A	YFBA	Y10DA

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out by jog feed or incremental feed.

[Related signals]

(1) Jog mode (J:YC00)
(2) Incremental mode (S:YC02)
(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (1st handle) in tool axis coordi-nate system	MH1CT	YD1B	YE5B	YFBB	Y10DB
A	Manual feed for 5-axis machining (1st handle) in table coordinate system	MH1CB	YD1C	YE5C	YFBC	Y10DC
A	Manual feed for 5-axis machining (1st handle) in feature coordinate system	MH1CF	YD1D	YE5D	YFBD	Y10DD

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out on the 1st handle axis.

[Related signals]

(1) 1st handle axis selection code (HS11 to HS116:YC40 to 4)

(2) 1st handle valid (HS1S:YC47)

(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (2nd handle) in tool axis coordi-nate system	MH2CT	YD1E	YE5E	YFBE	Y10DE
A	Manual feed for 5-axis machining (2nd handle) in table coordinate system	MH2CB	YD1F	YE5F	YFBF	Y10DF
A	Manual feed for 5-axis machining (2nd handle) in feature coordinate system	MH2CF	YD20	YE60	YFA0	Y10E0

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out on the 2nd handle axis.

[Related signals]

(1) 2nd handle axis selection code (HS21 to HS216:YC48 to C)

(2) 2nd handle valid (HS2S:YC4F)

(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (3rd handle) in tool axis coordi-nate system	MH3CT	YD21	YE61	YFA1	Y10E1
A	Manual feed for 5-axis machining (3rd handle) in table coordinate system	MH3CB	YD22	YE62	YFA2	Y10E2
A	Manual feed for 5-axis machining (3rd handle) in feature coordinate system	MH3CF	YD23	YE63	YFA3	Y10E3

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out on the 3rd handle axis.

[Related signals]

(1) 3rd handle axis selection code (HS31 to HS316:YC50 to 4)

(2) 3rd handle valid (HS3S:YC57)

(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool center point rotation	TCPRC	YD27	YE67	YFA7	Y10E7

[Function]

This signal informs the operation of the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle).

[Operation]

It operates with keeping the positional relationship of tool center point looking from the workpiece, when the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle) is operated.

<table>
<tr><th colspan="5">Input</th><th colspan="2">output</th></tr>
<tr><th rowspan="2">#7912
NO_MANUAL</th><th colspan="3">Hypothetical coordinate system selection signal</th><th>Tool center point rotation signal</th><th rowspan="2">Selection coordinate system</th><th rowspan="2">Tool center point rotary valid/invalid</th></tr>
<tr><th>YD18</th><th>YD19</th><th>YD1A</th><th>YD27</th></tr>
<tr><td rowspan="5">Valid</td><td colspan="3" rowspan="2">All 0</td><td>0</td><td rowspan="2">Machine coordinate system selection</td><td>Invalid</td></tr>
<tr><td>1</td><td>Valid</td></tr>
<tr><td colspan="3" rowspan="2">Only any one of them is 1</td><td>0</td><td rowspan="2">In accordance with the hypothetical coordinate system selection signal</td><td>Invalid</td></tr>
<tr><td>1</td><td>Valid</td></tr>
<tr><td colspan="3">Other than above</td><td>0 / 1</td><td colspan="2">The operation error "M01 Manual feed for 5-axis machining/Selecting coordinate system illegal 0231"</td></tr>
<tr><td>Invalid</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0 / 1</td><td>Machine coordinate system selection</td><td>Invalid</td></tr>
</table>

[Related signals]

(1) Manual feed for 5-axis machining (JOG, INC) in tool axis coordinate system
(2) Manual feed for 5-axis machining (JOG, INC) in table coordinate system
(3) Manual feed for 5-axis machining (JOG, INC) in feature coordinate system
(4) Manual feed for 5-axis machining (1st handle) in tool axis coordinate system
(5) Manual feed for 5-axis machining (1st handle) in table coordinate system
(6) Manual feed for 5-axis machining (1st handle) in feature coordinate system
(7) Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system
(8) Manual feed for 5-axis machining (2nd handle) in table coordinate system
(9) Manual feed for 5-axis machining (2nd handle) in feature coordinate system
(10) Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system
(11) Manual feed for 5-axis machining (3rd handle) in table coordinate system
(12) Manual feed for 5-axis machining (3rd handle) in feature coordinate system

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	EDIT/SEARCH		Y1878

[Function]

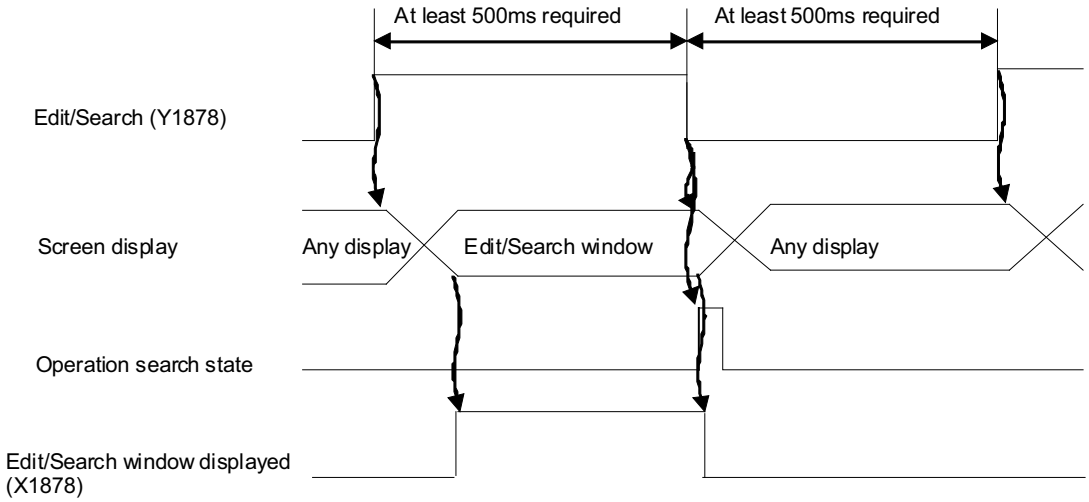
This signal indicates that the edit/search state has been entered.

[Operation]

Turning this signal ON identifies the edit/search state, displaying the Edit/Search window on the Monitor screen when the basic specification parameter "#11031 Cursor pos search" is set to "2". Moving the cursor at a position in the Edit/Search window and turning this signal OFF will start an operation search of the cursor position.

Allow at least 500ms between turning the "Edit/Search" signal ON and OFF.

[Timing chart]



[Related signals]

(1) Edit/Search window displayed (X1878)

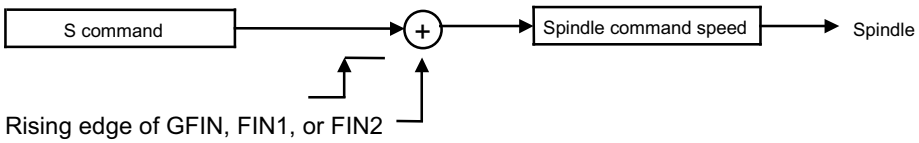
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	GEAR SHIFT COMPLETION	GFIN	Y1885	Y18E5	Y1945	Y19A5	Y1A05	Y1A65

[Function]

This signal changes the spindle speed to the speed (S command) specified in the machining program.
This signal is used to smoothly perform the spindle speed (S command, etc.) control.

[Operation]

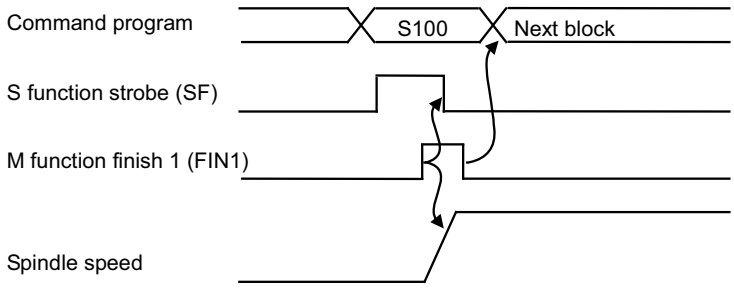
To change the spindle speed to the speed specified by the S command during automatic operation (memory, MDI, or tape), it is needed to turn ON the "Gear shift completion" (GFIN), or "M function finish 1 (FIN1, FIN2)" signal.



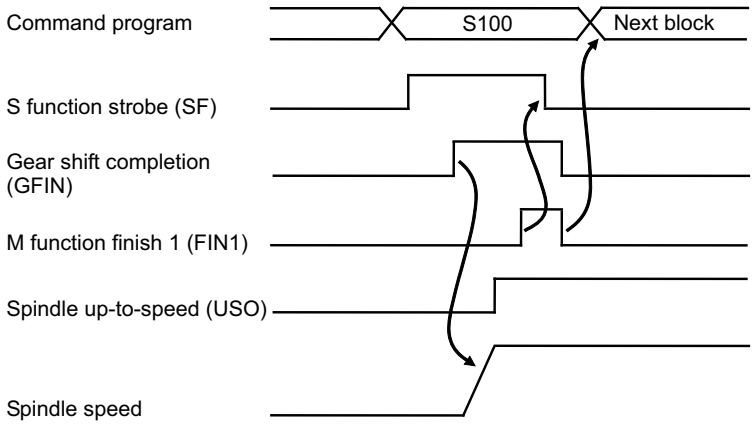
When using the "Gear shift completion" signal, the following two conditions should be considered:

- Whether gear shift (gear change) is applicable (whether there are two or more states of gear shift).
- Whether "Spindle up-to-speed" signal output from the spindle controller is used for verification of spindle speed.

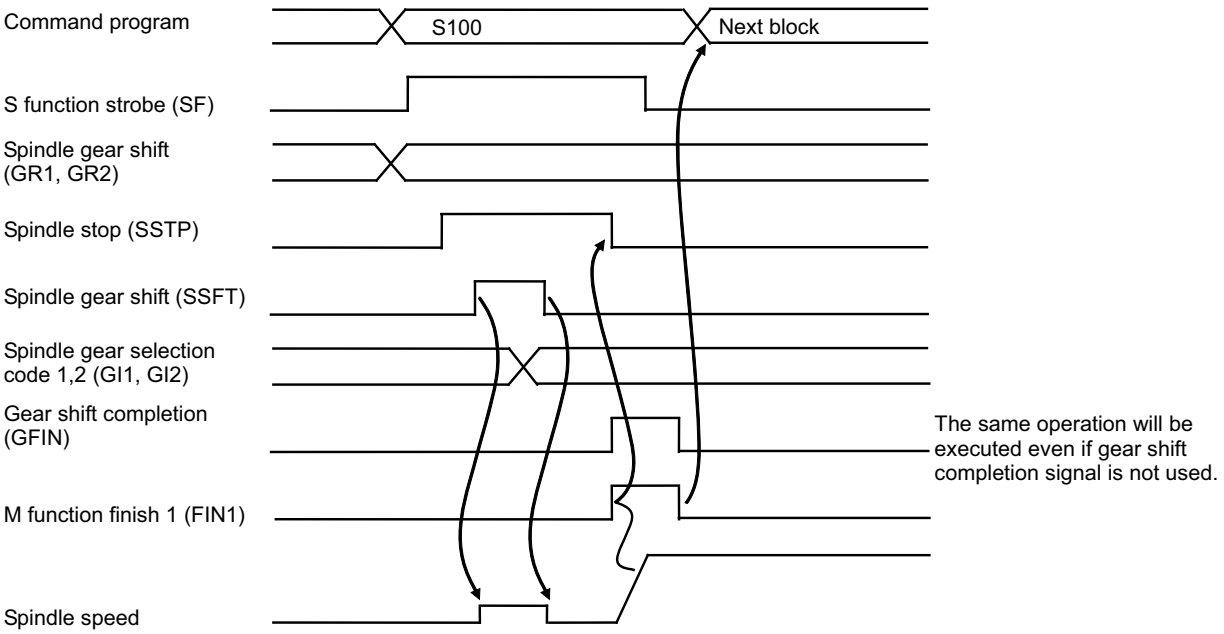
(Operation example 1) There is no gear shift and the "Spindle up-to-speed" signal is not used.



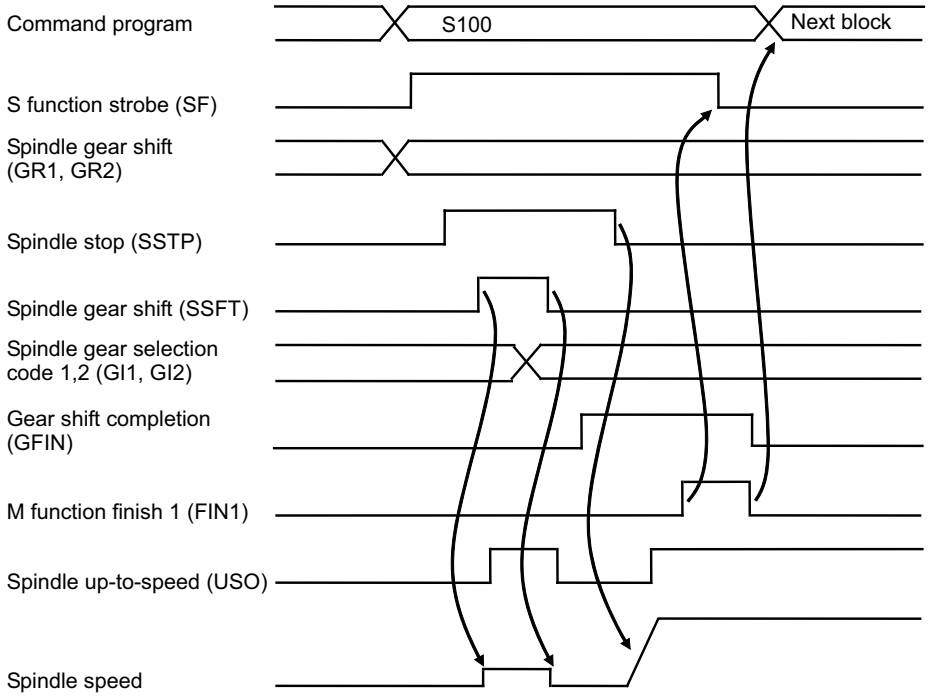
(Operation example 2) There is no gear shift, but the "Spindle up-to-speed" signal is used.



(Operation example 3) There is gear shift, but the "Spindle up-to-speed" signal is not used.



(Operation example 4) There is gear shift and "Spindle up-to-speed" signal are used.



[Related signals]

(1) S function strobe (SFn: XC64)
(2) Spindle gear shift (GR1, GR2: X1885, X1886)
(3) M function finish (FIN1, FIN2: YC1E, YC1F)
(4) Spindle gear selection code 1,2 (GI1, GI2: Y1890, Y1891)
(5) Spindle stop (SSTP: Y1894), Spindle gear shift (SSFT: Y1895)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SPEED OVERRIDE CODE m	SP1 to 4	Y1888 to A	Y18E8 to A	Y1948 to A	Y19A8 to A	Y1A08 to A	Y1A68 to A

[Function]

This signal applies override (multiplication) on the S command issued in the automatic operation (memory, MDI, tape).

[Operation]

When "Spindle override method selection" (SPS) signal is OFF, this signal is valid.

By selecting "Spindle speed override code m" (SP1 to 4) signal, override ratio can be selected within range from 50% to 120% (increment: 10%).

Override cannot be set when:

(1) "Spindle stop" signal is ON.

(2) TAP mode is selected.

(3) Thread cutting mode is selected.

This signal (SP1 to 4) is set with the code method. The relation is shown below.

SP4	SP2	SP1	Spindle override
1	1	1	50%
0	1	1	60%
0	1	0	70%
1	1	0	80%
1	0	0	90%
0	0	0	100%
0	0	1	110%
1	0	1	120%

[Related signals]

(1) Spindle override method selection (SPS: Y188F)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE OVERRIDE METHOD SELECTION	SPS	Y188F	Y18EF	Y194F	Y19AF	Y1A0F	Y1A6F

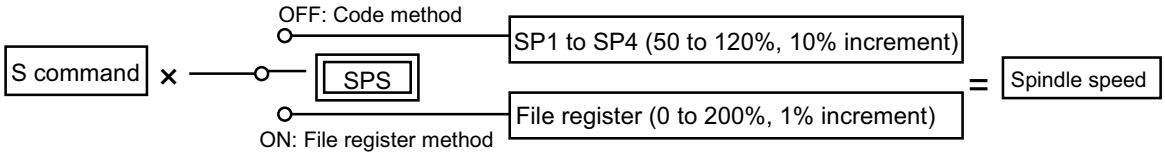
[Function]

When override is applied on the S command issued in automatic operation (memory, MDI or tape), "code method" or "file register method" is selected for override method.

[Operation]

When the "Spindle override method selection" (SPS) is OFF, code method override (signal SP1 to 4 is applicable) is selected.

When the "Spindle override method selection" (SPS) is ON, register method override (value set in file register is applicable) is selected.



(Note 1) For details of "code method override" and "file register method override", refer to the respective description.

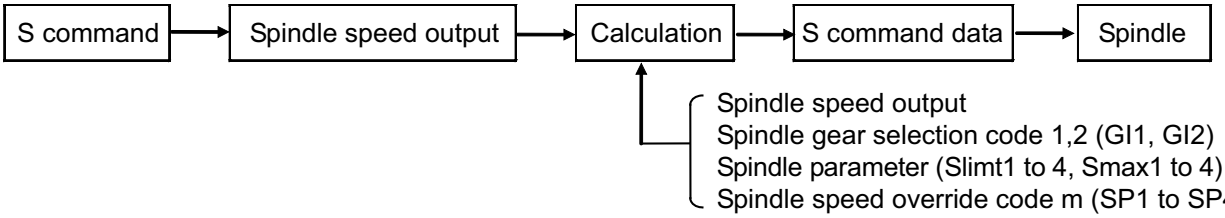
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE GEAR SELECTION CODE 1,2	GI1,2	Y1890,1	Y18F0,1	Y1950,1	Y19B0,1	Y1A10,1	Y1A70,1

[Function]

This signal informs the controller which spindle gear has been selected on the machine side.

[Operation]

This signal is set according to the machine's spindle gear stage. The controller calculates the S command data (data is transferred when the spindle controller is the high-speed serial connection specification) based on this signal.
The flow after the S command is executed and output to the spindle is shown below.



The relation of the gear stage, spindle gear selection code signal and spindle limit speed is as shown below.

Gear stage	Spindle gear selection code signal		Spindle speed limit
	GI2	GI1	
1	0	0	Slimt1
2	0	1	Slimt2
3	1	0	Slimt3
4	1	1	Slimt4

(1) Slimt1 to 4 are set with parameters. The spindle speed for when the S command data is the max. (the motor is run at the max. speed) is set.
This setting is used for each gear unit, and is determined by the deceleration ratio (gear ratio) of the motor and spindle.
For example, if the max. motor speed is 6000 r/min, and the 1st gear stage is decelerated to half, "3000" will be set in parameter Slimt1.

(2) The controller calculates the spindle speed output data as shown below.
For example, if S command is issued, gear selection input is the 2nd stage (GI1=ON, GI2=OFF), spindle override value (%) is SOVR, and S command data's max. value is "10":

$$\text{S command data} = \frac{\text{S command}}{\text{Slimt2}} \times \frac{\text{SOVR}}{100} \times 10$$

(3) If S1300 is executed when using S command output (max. 10V), Slimt2 = "2000", and spindle override "100%":

$$\text{S command output} = \frac{1300}{2000} \times \frac{100}{100} \times 10\ (\text{V}) = 6.5\ (\text{V})$$

(4) The S command is clamped with the Smaxn (n=1 to 4).
If Smax2="1000" in the above state, the S command output will be:

$$\text{S command output} = \frac{1000}{2000} \times \frac{100}{100} \times 10\ (\text{V}) = 5.0\ (\text{V})$$

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE HOLDING FORCE UP	EXOBS	Y1893	Y18F3	Y1953	Y19B3	Y1A13	Y1A73

[Function]

This signal is used to validate the disturbance observer of the spindle drive unit to increase the spindle torque up.

[Operation]

(1) Confirm the spindle is stopped and turn this signal ON.
(2) Turning ON this signal validates the disturbance observer.
(3) When the spindle holding force gets high enough to execute the cutting, NC outputs the "In spindle holding force up" (EXOFN) signal.
(4) To cancel the spindle holding force up, confirm the spindle is stopped and then turn this signal OFF.

[Related signals]

(1) In spindle holding force up (EXOFN: X18B5)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE STOP	SSTP	Y1894	Y18F4	Y1954	Y19B4	Y1A14	Y1A74

[Function]

In spindle control, S command data (spindle speed) can be set to "0" by using this signal (SSTP). Usually, the signal is not used alone, but combined with "Spindle gear shift" signal (SSFT) explained later.

[Operation]

When the signal (SSTP) is turned ON, S command data is set to "0". Analog data is restored when the signal is turned OFF.

When "Spindle gear shift" (SSFT) signal turns ON while the signal is ON, S command data which corresponds to speed set by the spindle speed parameter is output.

"Spindle speed override code m" (SP1 to 4) is ignored while the signal is ON.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE GEAR SHIFT	SSFT	Y1895	Y18F5	Y1955	Y19B5	Y1A15	Y1A75

[Function]

This signal is used to run the spindle motor at low speed, when spindle gear is shifted, so that spindle gear can be engaged smoothly.

[Operation]

When the signal (SSFTn) turns ON, the S command data equivalent to the low speed previously set by parameter is output.

If gears are not engaged properly, the signal is turned ON. It should be noted that "Spindle stop" (SSTPn) signal should be ON beforehand to use the signal (SSFTn).

Together with this signal (SSFTn), the forward run signal or the reverse run signal needs to be turned ON.

Spindle gear shift speed is selected by "Spindle gear selection code m" (GImn).The relation is as follows:

Gearstage	Spindle gearselection codesignal		Spindle speed atgear shift	Spindle speedlimit
	GI2n	GI1n		
1	0	0	Ssift1	Slimt1
2	0	1	Ssift2	Slimt2
3	1	0	Ssift3	Slimt3
4	1	1	Ssift4	Slimt4

S command data (spindle speed data) while "Spindle gear shift" (SSFTn) signal is ON can be determined from the formula shown below.

For example, if the "Spindle gear selection code m" (GImn) is the 1st stage (GI1n=OFF, GI2n=OFF), the spindle rotation speed data is as follows:

$$\text{Spindle rotation speed (Motor rotation speed)} = \frac{\text{Ssift1}}{\text{Slimt1}} \times \text{Maximum motor rotation speed}$$

Actual value is as follows:

Spindle command final data (SBINn) = Ssift1 / Slimt1 * 4095

When the spindle command final data (SBINn) is "4095", the rotation speed of the motor becomes maximum.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE ORIENTATION	SORC	Y1896	Y18F6	Y1956	Y19B6	Y1A16	Y1A76

[Function]

This signal is used to run the spindle motor at low speed when executing mechanical orientation (Note) during spindle control.

<Supplement>

Since most spindle drive/control units recently marketed are equipped with spindle orientation function, and therefore this signal is rarely used for mechanical orientation. The signal (SORCn) is used for application such as rotating the spindle by constant rotation speed.

(Note) The mechanical orientation assumes to operate the orientation by performing as follows.

(1) Rotate the spindle at low speed.

(2) It detects when the spindle has reached the area where such as proximity switch is used and then stops the spindle. The spindle stops after the speed is slowed to some extent.

(3) The position (the orientation position) is decided by hitting the pin against the spindle under the status of (2).

[Operation]

When the signal (SORCn) turns ON, spindle speed is changed to the low speed previously set by parameter.
It should be noted that "Spindle stop" (SSTPn) signal must be ON to use the signal (SORCn). Together with this signal (SORCn), the forward run signal or the reverse run signal is required.

The table below shows the relationship between the oriented spindle speed and the "Spindle gear selection code m" (GImn) signal.

Gearstage	Spindle gearselection codesignal		Orientantion spindle speed	Spindle speedlimit
	GI2n	GI1n		
1	0	0	SORI	Slimt1
2	0	1		Slimt2
3	1	0		Slimt3
4	1	1		Slimt4

Spindle speed data while "Spindle orientation" (SORCn) signal is ON can be determined from the formula shown below. When "Spindle gear selection code m" (GImn)" signal combination is GI2n=0 and GI1n=1, the spindle rotation speed data is as follows:

$$\text{Orientation spindle speed data (Motor rotation speed)} = \frac{\text{SORI}}{\text{Slimt2}} \times \text{Maximum motor rotation speed}$$

Actual spindle rotation speed is as follows:

Spindle command final data (SBINn) = SORI / Slimt2 * 4095

When the spindle command final data (SBINn) is "4095", the motor becomes the maximum rotation speed.

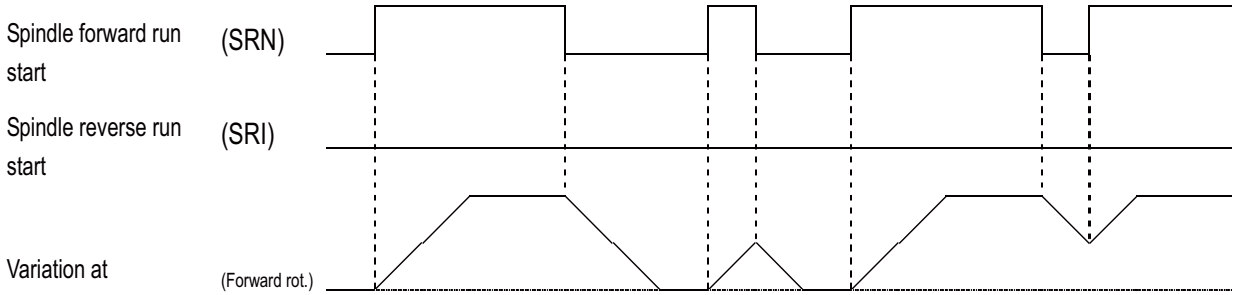
Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE FORWARD RUN START	SRN	Y1898	Y18F8	Y1958	Y19B8	Y1A18	Y1A78

[Function]

This signal is issued to the high speed serial connection specification spindle controller (spindle drive). When the signal turns ON, the spindle motor starts rotating in normal direction (CCW as viewed from the shaft side).

[Operation]

Spindle starts running at speed specified by S command (S command data) when the signal (SRN) is turned ON.
When the signal is turned OFF, spindle motion decelerates and stops.
When the "Spindle forward run start" signal (SRN) is turned OFF during acceleration of spindle forward rotation, the acceleration will be interrupted and the spindle will decelerate to stop immediately.
When the "Spindle forward run start" signal (SRN) is turned OFF during deceleration to stop of spindle forward rotation, the spindle deceleration will be interrupted and the acceleration will start immediately.



(1) Spindle decelerates to stop if "Spindle forward run start" signal (SRN) and "Spindle reverse run start" signal (SRI) are turned ON at the same time. To resume forward run, both signals OFF once and then turn the "Spindle forward run start" signal ON.
(2) The operation may stop during forward run due to emergency stop, spindle alarm or resetting. Turn the forward run signal OFF and ON once after the "Servo ready completion" signal (SA) turns ON.
(3) The motor will not run if the S command data is 0. The motor will run at the corresponding rotation speed when the S command data changes.
(4) When "Spindle orientation command" signal (ORC) is turned ON at the same as "Spindle forward run start" signal (SRN) is turned ON, priority is given to the former signal.
(5) Servo ON command (SRV) of the spindle control input signal has to controlled at the NC side so that it will turn ON when starting the spindle rotation and OFF when decelerating to stop.

[Related signals]

(1) Spindle reverse run start (SRI: Y1899)
(2) Spindle orientation command (ORC: Y189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE REVERSE RUN START	SRI	Y1899	Y18F9	Y1959	Y19B9	Y1A19	Y1A79

[Function]

This signal is issued to the high speed serial connection specification spindle controller (spindle drive). When the signal turns ON, the spindle motor starts rotating in inverse direction (CW as viewed from the shaft side).

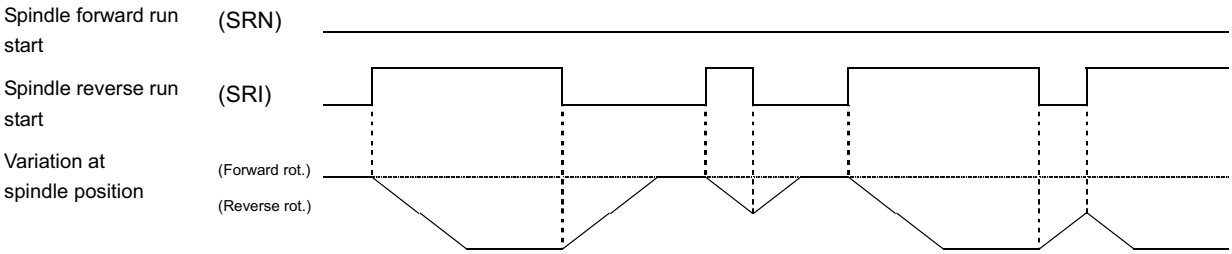
[Operation]

Spindle starts running at speed specified by S command (S command data) when the signal (SRI) is turned ON. (The operation with "Spindle reverse run start" (SRI) signal is the same as one with "Spindle forward run start" (SRN) except for its rotation direction.)

When the signal is turned OFF, spindle motion decelerates and stops.

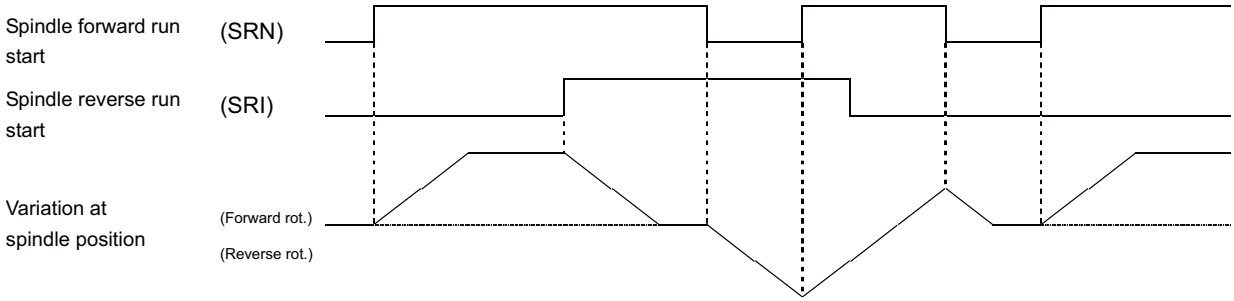
When the "Spindle reverse run" signal (SRI) is turned OFF during acceleration of spindle reverse rotation, the acceleration will be interrupted and the spindle will decelerate to stop immediately.

When the "Spindle reverse run" signal (SRI) is turned OFF during deceleration to stop of spindle reverse rotation, the spindle deceleration will be interrupted and the acceleration will start immediately.



(1) Spindle decelerates to stop if "Spindle reverse run start" signal (SRI) and "Spindle forward run start" signal (SRN) turn ON at the same time. To resume reverse run, both signals OFF once and then turn the "Spindle reverse run start" signal ON.

(2) The operation may stop during reverse run due to emergency stop, spindle alarm or resetting. Turn the reverse run signal OFF and ON once after the "Servo ready completion" signal (SA) turns ON.



(3) The motor will not run if the S command data is 0. The motor will run at the corresponding rotation speed when the S command data changes.

(4) When "Spindle orientation command" signal (ORC) is turned ON at the same time "Spindle reverse run start" signal (SRI) is turned ON, priority is given to the former signal.

(5) Servo ON command (SRV) of the spindle control input signal has to controlled at the NC side so that it will turn ON when starting the spindle rotation and OFF when decelerating to stop.

[Related signals]

(1) Spindle forward run start (SRN: Y1898)

(2) Spindle orientation command (ORC: Y189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE TORQUE LIMIT 1	TL1	Y189A	Y18FA	Y195A	Y19BA	Y1A1A	Y1A7A
A	SPINDLE TORQUE LIMIT 2	TL2	Y189B	Y18FB	Y195B	Y19BB	Y1A1B	Y1A7B

[Function]

This signal is issued to the high-speed serial connection specification spindle controller (spindle drive). When the signal turns ON, spindle motor torque is reduced temporarily.

The signal is used in mechanical oriented spindle stop, or gear shift.

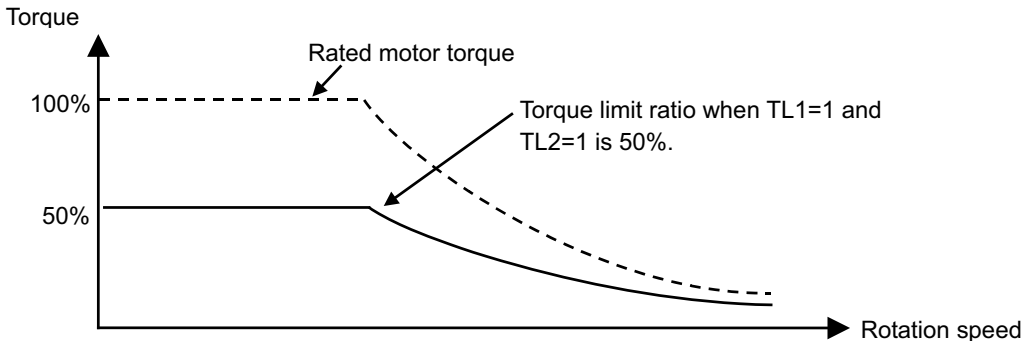
[Operation]

There are spindle torque limit 1 (TL1) and spindle torque limit 2 (TL2) signals.

Torque limit ratio is determined depending on the combination of spindle torque limit 1 (TL1) and 2 (TL2), and the output torque will drop accordingly.

Signal Selection		Spindle torque limit (TL1)	Spindle torque limit (TL2)	Note
Torque limit invalid		0	0	
Torque limit	001	1	0	Limits with value of the spindle parameter SP065
	002	0	1	Limits with value of the spindle parameter SP066
	003	1	1	Limits with value of the spindle parameter SP067

(Example) When TL1=1,TL2=1 and SP067=50



(Note 1) This signal is valid only for systems that are connected with the spindle controller via high-speed serial interface.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE FORWARD RUN INDEX	WRN	Y189C	Y18FC	Y195C	Y19BC	Y1A1C	Y1A7C

[Function]

This signal is used for the spindle forward run index in multi-point indexing.

[Operation]

(1) Multi-point indexing

(a) This signal turns ON after the "Spindle in-position (ORAO)" signal is output.

(b) Continuous indexing can be carried out by turning this signal ON and OFF while the "Spindle orientation command" (ORC) signal is ON.

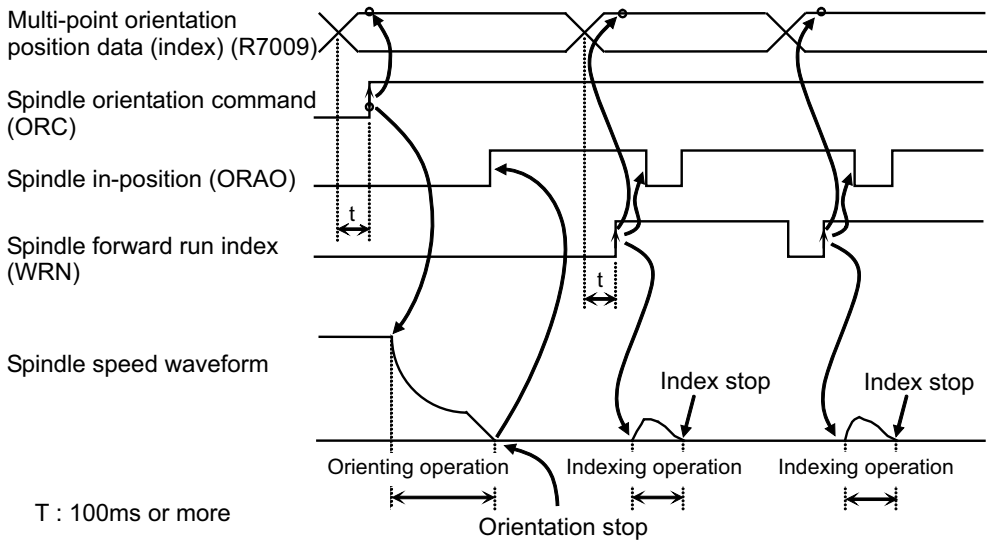
(c) If this signal is turned ON before the "Spindle orientation command" (ORC) signal is turned ON and the "Spindle in-position" (ORAO) signal is output, first the "Spindle orientation command" (ORC) signal will turn ON, and the orientation will be completed at the multi-point orientation position data (R7009) read in. Then, the spindle will be indexed to the position command value read in when this signal is turned ON. If the position command value is the same when the "Spindle orientation command" (ORC) turns ON and this signal turns ON, the indexing operation will not be carried out.

(d) The index position command value is read in at the rising edge of this signal. Thus, even if the index position command value is changed after this signal is input, the stop position will not change.

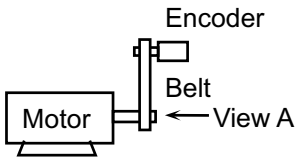
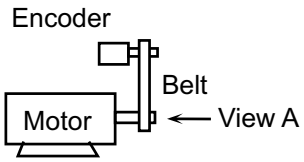
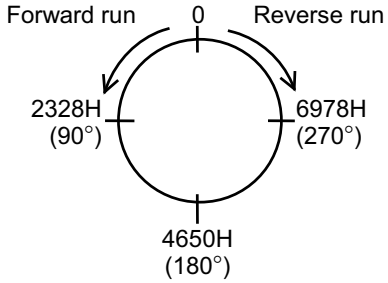
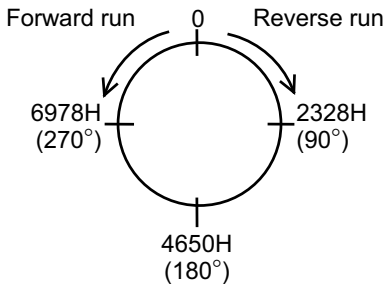
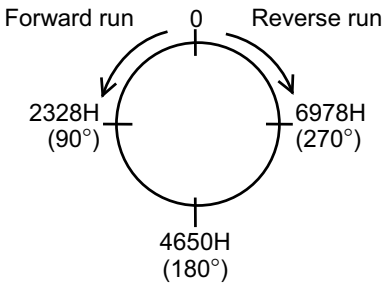
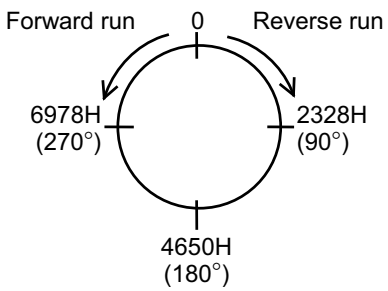
(e) Even if this signal is turned OFF while the "Spindle orientation command" (ORC) is ON, the spindle will continue to stop at the position before this signal was turned OFF. Even if this signal is turned OFF during the indexing operation, the spindle will stop at the position command value read at the rising edge of this signal.

(f) If the stop point and index position command value are close (within the in-position range), the "Spindle in-position" (ORAO) signal may not turn OFF and the indexing may be carried out.

(g) If the "Spindle orientation command" (ORC) signal is turned OFF during indexing or when stopped, the servo lock will turn OFF and the motor will coast. Orientation must be carried out again when executing indexing again.



[Indexing operation according to encoder installation direction]

	Case 1	Case 2
Installation method		
Indexing		
Orienting		

(Note) Case 1 above applies when using the motor built-in encoder with Z-phase.

[Related signals]

(1) Multi-point orientation position data (R7009)
(2) Spindle in-position (ORAO: X188E)
(3) Spindle orientation command (ORC: Y189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE REVERSE RUN INDEX	WRI	Y189D	Y18FD	Y195D	Y19BD	Y1A1D	Y1A7D

[Function]

This signal is used for the spindle reverse run index in multi-point indexing.

[Operation]

The operation is the same as forward run indexing, except that the direction is different. Refer to the section on "Spindle forward run index".

[Related signals]

(1) Spindle forward run index (WRN: Y189C)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE ORIENTATION COMMAND	ORC	Y189E	Y18FE	Y195E	Y19BE	Y1A1E	Y1A7E

[Function]

This signal is issued to the high-speed serial connection specification spindle controller (spindle drive). When the signal is turned ON, the spindle is indexed in position.

[Operation]

If the "Spindle orientation command" signal (ORC) turns ON during spindle rotation or when stopped, the spindle will start orientation (stopping at set position). When positioning at the set position is completed, the "Spindle in-position" signal (ORAO) will be output, and orientation will stop.

During oriented spindle stop, the control system is under "servo lock" condition. Servo lock is released when the signal (ORC) is turned OFF. When servo lock must be maintained, the signal, therefore, should be kept turned ON.

The encoder or magnetic sensor method can be used for orientation.

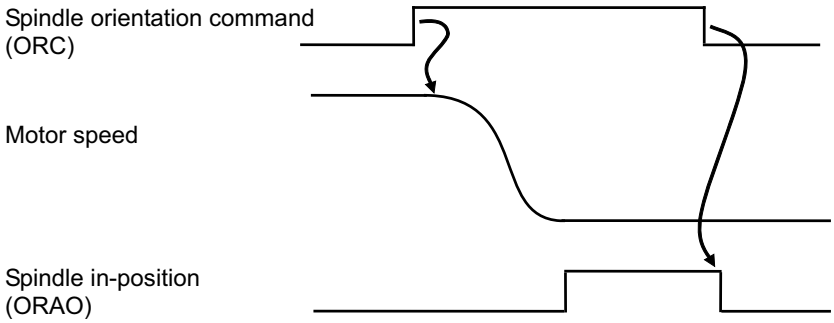
The orientation rotation direction is determined with the parameters.

The orientation stop position is determined by the Z-phase for the encoder method, and by the sensor installation position for the magnetic sensor method. The stopping position can be changed with the following items when using the encoder method.

(1) By parameters (position shift amount)

(2) By multi-point orientation position data (data specification by R7009) value
The multi-point orientation position data by the parameter and R7009 is added.

The timing chart for basic orientation is shown below.



(Note 1) The "Spindle orientation command" (ORC) takes precedence over the forward run (SRN) and reverse run (SRI) commands.

(Note 2) This signal is valid only for systems that are high-speed serial connected with the spindle controller.

[Related signals]

(1) Multi-point orientation position data (R7009)

(2) Spindle in-position (ORAO: X188E)

(3) Spindle 2nd in-position (ORA2O:X1888)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	L COIL SELECTION	LRSL	Y189F	Y18FF	Y195F	Y19BF	Y1A1F	Y1A7F

[Function]

This signal is used to select the low-speed coil in the spindle coil changeover function.

[Operation]

The high-speed coil and low-speed coil are changed over only with the "L coil selection" (LRSL) in the 2-step coil changeover specification. The high-speed coil, middle- speed coil and low-speed coil are changed over with the combination of the "L coil selection" (LRSL) and "M coil selection" (LRSM) in the 3-step coil changeover specification.

(Note) The coil is not changed over during the position loop control mode even if this signal is changed. The coil selected immediately before the position loop control mode is entered is retained.

(1) 2-step coil changeover

Selected coil	L coil selection (LRSL)	In L coil selection (LCSA)
High-speed (H)	OFF	OFF
Low-speed (L)	ON	ON

(2) 3-step coil changeover

Selected coil	L coil selection (LRSL)	M coil selection (LRSM)	In L coil selection (LCSA)	In M coil selection (MCSA)
High-speed (H)	OFF	OFF	OFF	OFF
Middle-speed (M)	OFF	ON	OFF	ON
Low-speed (L)	ON	OFF	ON	OFF
	ON	ON	ON	ON

[Related signals]

(1) M coil selection (LRSM: Y18A6)

(2) In L coil selection (LCSA: X188F)

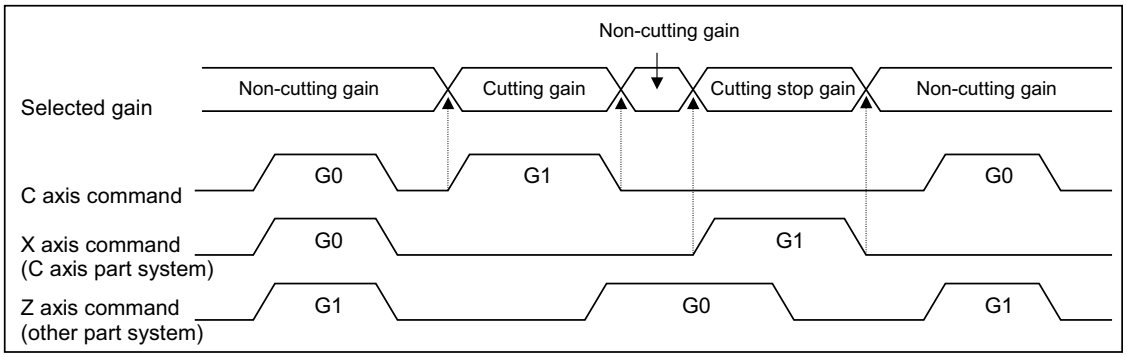
(3) In M coil selection (MCSA: X189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE POSITION CONTROL (C AXIS) CUTTING GAIN L,H		Y18A2,3	Y1902,3	Y1962,3	Y19C2,3	Y1A22,3	Y1A82,3

[Function]

This signal selects whether to change the C axis gain (select optimum gain) according the C axis cutting state. During C axis cutting feed, cutting gain is applied. During other axis' cutting feed (C axis face turning), non-cutting stop gain is applied. Non-cutting gain is applied in all other cases.

[Operation]



(Note 1) The cutting feed of other part systems dose not affect the C axis gain selection.

(Note 2) There are 1st to 3rd cutting gains, which are selected with the ladder.

Signal Selected details	C axis gain L	C axis gain H	Remarks	
Non-cutting gain	-	-	Spindle parameter SP003 selection	Selected during rapid traverse
1st cutting gain	0	0	Spindle parameter SP130 selection	Selected during cutting feed
	1	1		
2nd cutting gain	1	0	Spindle parameter SP131 selection	
3rd cutting gain	0	1	Spindle parameter SP132 selection	
Cutting stop gain	-	-	Spindle parameter SP133 selection	

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	M COIL SELECTION	LRSM	Y18A6	Y1906	Y1966	Y19C6	Y1A26	Y1A86

[Function]

This signal is used to select the middle-speed coil in the 3-step coil changeover specification of the spindle coil changeover function.

[Operation]

The coil is selected depending on the combination of this signal and the "L coil selection" (LRSL).

(Note) The coil is not changed over during the position loop control mode even if this signal is changed. The coil selected immediately before the position loop control mode is entered is retained.

Selected coil	L coil selection (LRSL)	M coil selection (LRSM)	In L coil selection (LCSA)	In M coil selection (MCSA)
High-speed (H)	OFF	OFF	OFF	OFF
Middle-speed (M)	OFF	ON	OFF	ON
Low-speed (L)	ON	OFF	ON	OFF
	ON	ON	ON	ON

[Related signals]

(1) L coil selection (LRSL: Y189F)
(2) In L coil selection (LCSA: X188F)
(3) In M coil selection (MCSA: X189E)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SELECTION	SWS	Y18A8	Y1908	Y1968	Y19C8	Y1A28	Y1A88

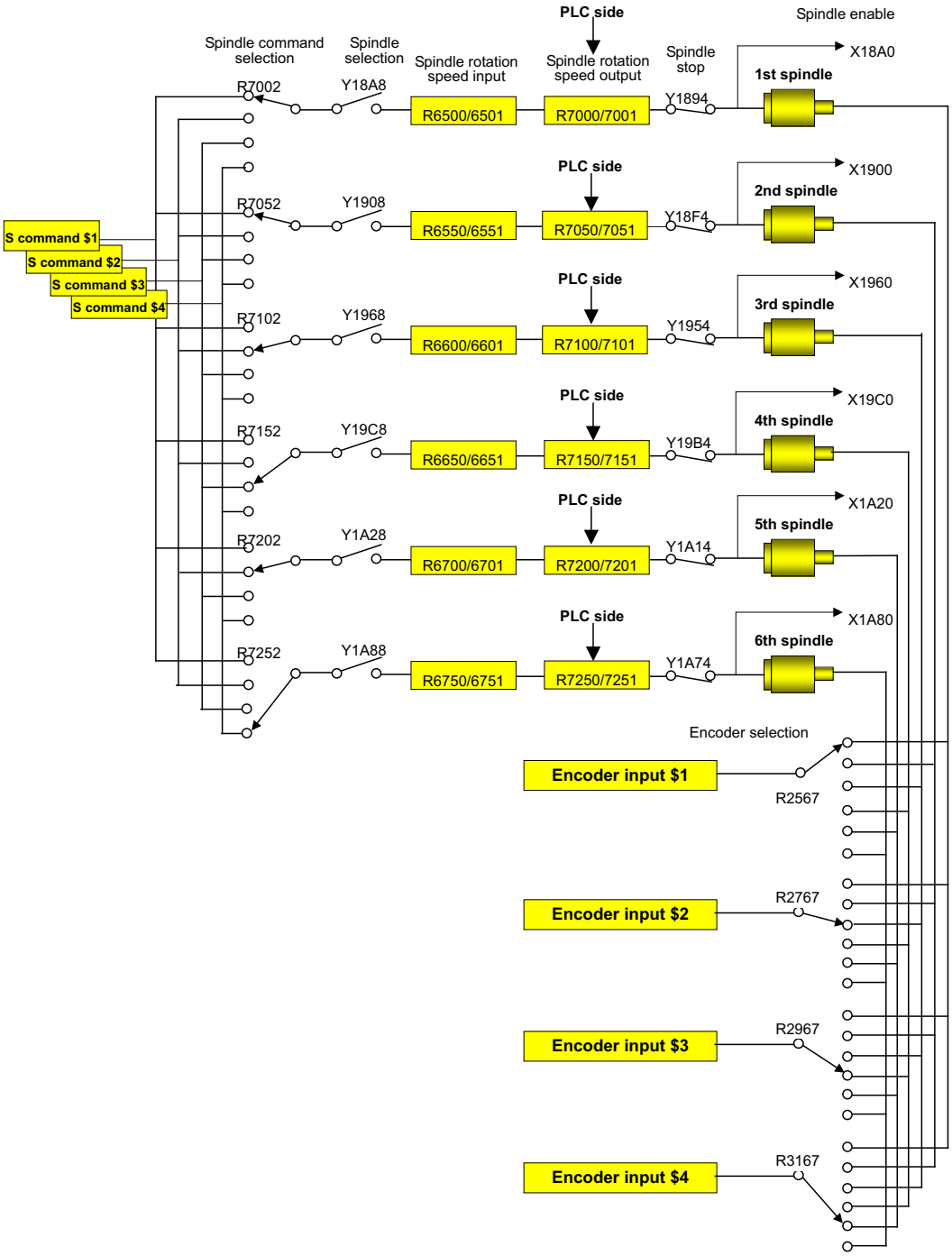
[Function]

The spindle to which the S command for the spindle is output is selected when the multi-spindle control II is valid.

0: Not select

1: Select

[Operation]



The S command for a spindle is output as the rotation speed command to the spindle which has been selected by the "Spindle selection" signal (SWS) ON from the PLC. The selected spindle rotates at the rotation speed which was output. The spindles which were deselected by the "Spindle selection" signal (SWS) OFF continue to rotate at the same rotation speed as the speed immediately before their de-selection. This allows each spindle to be rotated simultaneously at a different rotation speed. The "Spindle command selection" signal is used to select which of the spindles is to receive the S command from which part system.

[Related signals]

(1) Spindle command selection (SLSP: R7002)
(2) Spindle stop (SSTP: Y1894)
(3) Spindle enable (ENB: X18A0)
(4) Encoder selection (R2567)
(5) Spindle forward run start (SRN: Y1898)
(6) Spindle reverse run start (SRI: Y1899)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	PLC COIL CHANGEOVER	MPCSL	Y18AF	Y190F	Y196F	Y19CF	Y1A2F	Y1A8F

[Function]

When the coil changeover is the NC internal process, the coil changeover with the PLC signal can be performed with this signal.

[Operation]

If the coil changeover is the NC internal process, the NC internal process selection is interrupted and changed to the selection with the PLC signal when this signal is turned ON.
The coil changeover in the NC internal process and the coil changeover via the PLC are changed over with the parameter #1239 set11/bit0.

0: Via PLC
1: NC internal process

(1) H/L coil changeover
- The L -> H coil changeover is changed over at the same time when the H coil selection is entered.
- The H -> L coil changeover is not changed over during the "Speed detection" signal (VRO) OFF even if the L coil selection is entered.
  The coil changeover is changed over after the "Speed detection" signal (SD) is turned ON.

(2) H/M/L coil changeover
- The L -> M coil changeover is changed over at the same time when the M coil selection is entered.
- The L -> H coil changeover is changed over at the same time when the H coil selection is entered.
- The M -> H coil changeover is changed over at the same time when the M coil selection is entered.
- he H -> M coil changeover is not changed over during the "Speed detection 2" signal (SD2) OFF even if the M coil selection is entered.The coil changeover is changed over after the "Speed detection 2" signal (SD2) is turned ON.
- The H -> L coil changeover is not changed over during the "Speed detection" signal (VRO) OFF even if the L coil selection is entered.The coil changeover is changed over after the "Speed detection" signal (VRO) is turned ON.
- The M -> L coil changeover is not changed over during the "Speed detection" signal (VRO) OFF even if the L coil selection is entered.The coil changeover is changed over after the "Speed detection" signal (VRO) is turned ON.

(Note) This signal must be turned ON after the "L coil selection" (LRSL)/ "M coil selection" (LRSM) signal has been decided. The NC internal changeover process is entered when this signal is turned OFF, so note the spindle rotation speed.

[Related signals]

(1) L coil selection (LRSL: Y189F)
(2) M coil selection (LRSM: Y18A6)
(3) In L coil selection (LCSA: X188F)
(4) In M coil selection (MCSA: X189E)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE SYNCHRONIZATION	SPSY	Y18B0

[Function]

The spindle synchronous control mode is entered by turning this signal ON.

[Operation]

The spindle synchronous control mode is entered by inputting the "Spindle synchronous control" signal (SPSY). During the spindle synchronous control mode, the synchronous spindle is controlled in synchronization with the rotation speed commanded for the basic spindle.

Set the basic spindle, synchronous spindle and rotation direction beforehand.

Device No.	Signal name	Abbrev	Explanation
R7016	Spindle synchronous control Basic spindle selection	-	Select a serially connected spindle to be controlled as the basic spindle. (0: 1st spindle), 1: 1st spindle, 2: 2nd spindle, 3: 3rd spindle, 4: 4th spindle, 5: 5th spindle, 6: 6th spindle (Note 1)Spindle synchronization control will not take place if a spindle not connected in serial is selected. (Note 2)If "0" is designated, the 1st spindle will be controlled as the basic spindle.
R7017	Spindle synchronous control Synchronous spindle selection	-	Select a serially connected spindle to be controlled as the synchronous spindle. (0: 2nd spindle), 1: 1st spindle, 2: 2nd spindle, 3: 3rd spindle, 4: 4th spindle, 5: 5th spindle, 6: 6th spindle (Note 3)Spindle synchronization control will not take place if a spindle not connected in serial is selected or if the same spindle as the basic spindle is selected. (Note 4)If "0" is designated, the 2nd spindle will be controlled as the synchronous spindle.
Y18B2	Spindle synchronous rotation direction	-	Designate the basic spindle and synchronous spindle rotation directions for spindle synchronization control. 0:The synchronous spindle rotates in the same direction as the basic spindle. 1:The synchronous spindle rotates in the reverse direction of the basic spindle.

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle synchronous rotation direction (SPSDR: Y18B2)
(4) Spindle phase synchronization (SPPHS: Y18B1)
(5) Spindle phase synchronization completion (FSPPH: X18AA)
(6) Spindle synchronous control Basic spindle selection (R7016)
(7) Spindle synchronous control Synchronous spindle selection (R7017)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE PHASE SYNCHRONIZATION	SPPHS	Y18B1

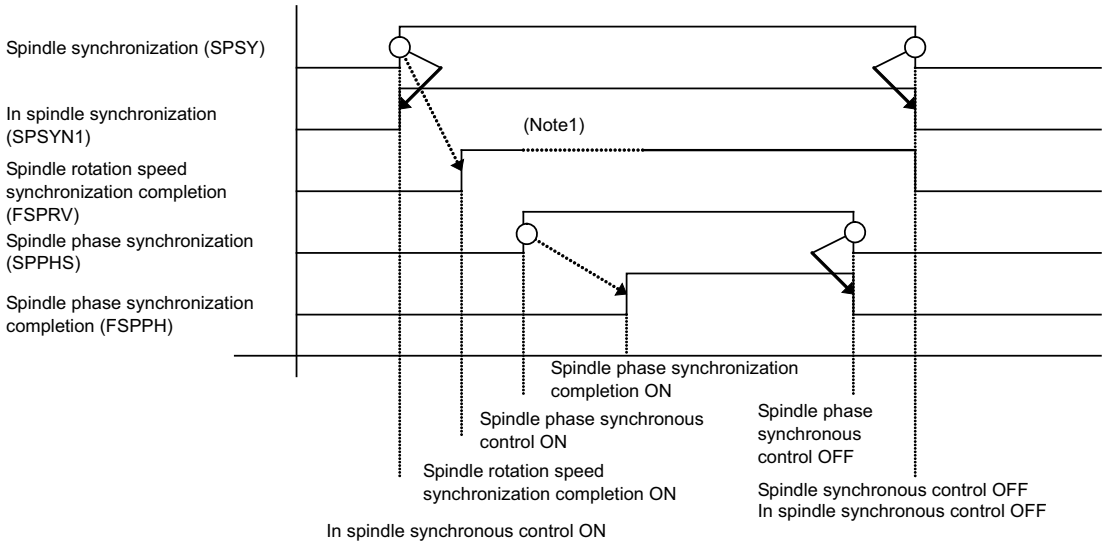
[Function]

Spindle phase synchronization starts this signal is turned ON during the spindle synchronous control mode.

[Operation]

Spindle phase synchronization starts when the "Spindle phase synchronous control" signal (SPPHS) is input during the spindle synchronous control mode. The "Spindle phase synchronization completion" signal is output when the spindle phase synchronization attainment level setting value (#3051 spplv) is reached.

(Note) This signal will be ignored even if it is turned ON during a mode other than the spindle synchronous control mode.



(Note 1) This is turned OFF once to change the rotation speed during phase synchronization.

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle synchronization (SPSY: Y18B0)
(4) Spindle synchronous rotation direction (SPSDR: Y18B2)
(5) Spindle phase synchronization completion (FSPPH: X18AA)
(6) Spindle synchronization phase shift amount (R7018)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE SYNCHRONOUS ROTATION DIRECTION	SPSDR	Y18B2

[Function]

The synchronous spindle's rotation direction is designated with this signal. Select whether the direction is the same as or the reverse of the basic spindle.

[Operation]

Designate the rotation direction for the basic spindle and synchronous spindle during spindle synchronous control.

0: Synchronous spindle rotates in same direction as basic spindle.

1: Synchronous spindle rotates in reverse direction of basic spindle.

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle synchronization (SPSY: Y18B0)
(4) Spindle phase synchronization (SPPHS: Y18B1)
(5) Spindle phase synchronization completion (FSPPH: X18AA)
(6) Spindle synchronization phase shift amount (R7018)

Con-tact	Signal name	Signal abbreviation	1stSP
A	PHASE SHIFT CALCULATION REQUEST	SSPHM	Y18B3

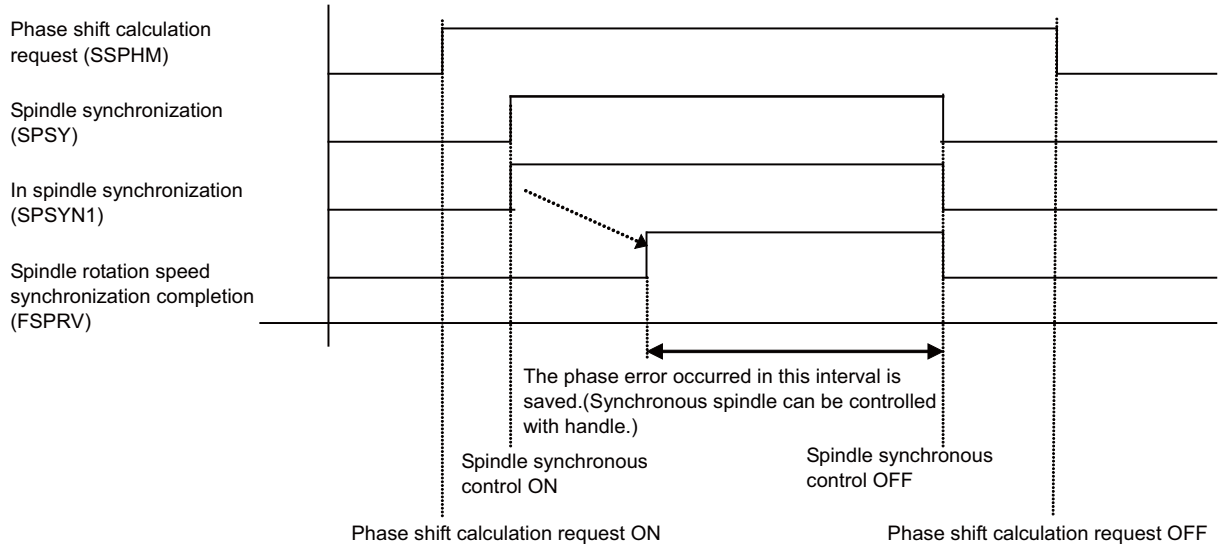
[Function]

This signal calculates the phase error of the basic spindle during rotation synchronization, and requests that it be saved in the NC memory.

[Operation]

The phase error of the basic spindle and synchronous spindle is saved in the NC memory when this signal is ON and the rotation synchronization command's (with no R address command) spindle synchronization is completed (when "Spindle rotation speed synchronization completion" signal is ON).

This signal turns ON when the spindle rotation is stopped before the rotation synchronization command.



(Note 1) The phase cannot be aligned when calculating the phase shift.

(Note 2) If the handle mode is selected as the manual operation mode, the synchronous spindle cannot be rotated with the handle.

[Related signals]

(1) Phase offset request (SSPHF: Y18B4)

(2) Spindle synchronization phase error/Hob axis delay angle (R6516)

(3) Spindle synchronization Phase offset data (R6518)

Con-tact	Signal name	Signal abbreviation	1stSP
A	PHASE OFFSET REQUEST	SSPHF	Y18B4

[Function]

This signal requests that the phase be aligned to the value obtained by adding the value commanded with the phase synchronization command's R address to the phase error of the basic spindle and synchronous spindle saved with the "Phase shift calculation request" signal (SSPHM).

[Operation]

If phase synchronization is commanded (with R address command) while this signal is ON, the basic spindle and synchronous spindle phases will be aligned to attain the phase error obtained by adding the value commanded with the R address command to the phase error of the basic spindle and synchronous spindle saved in the NC memory.

[Related signals]

(1) Phase shift calculation request (SSPHM: Y18B3)

(2) Spindle synchronization phase error/Hob axis delay angle (R6516)

(3) Spindle synchronization Phase offset data (R6518)

Con-tact	Signal name	Signal abbreviation	1stSP
A	ERROR TEMPORARY CANCEL	SPDRPO	Y18B5

[Function]

This signal cancels the error caused by the speed fluctuation when the chuck is closed.
When the chuck is closed, the speed will fluctuate due to external causes. An error will occur between the basic spindle's position and the synchronous spindle's position due to this speed fluctuation. This signal is used to cancel this error. (If spindle synchronization is attempted when closing the chuck without canceling this error, torsion could occur.)

[Operation]

The error between the basic spindle's position and synchronous spindle's position is saved when this signal changes from OFF to ON. The saved error is canceled and the spindle is synchronized while this signal is ON. (Even if the chuck close signal is OFF, the error will be canceled while the "Error temporary cancel" signal is ON.)

(Note 1) Turn this signal ON after the chucks on both the basic spindle side and synchronous spindle side have closed and grasped the chuck.

(Note 2) Turn this signal OFF when the either the basic spindle side or synchronous spindle side chuck is open.

(Example)

(1) Close the basic spindle side chuck.
(2) Start spindle synchronization (G114.1).
(3) Close the synchronous spindle side chuck.
(The speed will fluctuate due to external causes at this time, and an error will occur.)
(4) Using the "Chuck close confirmation" (SPCMP) signal, check that the chucks are closed.
(5) Turn the "Error temporary cancel" (SPDRPO) signal ON, and cancel the error.
(6) Execute machining with spindle synchronous control.
(7) Open the chuck on the synchronous spindle side.
(8) Using the "Chuck close confirmation" (SPCMP) signal, check that the chuck is opened.
(9) Turn the "Error temporary cancel" (SPDRPO) signal OFF, and stop the error cancellation.

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle phase synchronization completion (FSPPH: X18AA)
(4) Chuck close confirmation (SPCMP: X18AC)
(5) Chuck close (SPCMPC: Y18B9)

Con-tact	Signal name	Signal abbreviation	1stSP
A	SPINDLE SYNCHRONIZATION/ SUPERIMPOSITION CANCEL	SPSYC	Y18B8

[Function]

This signal is used to cancel the spindle synchronous control and spindle superimposition with the G114.n command.
The spindle synchronous control with the "Spindle synchronization" (Y18B0) is not canceled.

[Operation]

The spindle synchronous control mode and spindle superimposition can be canceled by turning this signal ON.

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle phase synchronization completion (FSPPH: X18AA)
(4) Spindle phase synchronization (SPPHS: Y18B1)
(5) Spindle synchronization phase error 1 (R6522)
(6) Spindle synchronization phase error 2 (R6523)

Con-tact	Signal name	Signal abbreviation	1stSP
A	CHUCK CLOSE	SPCMPC	Y18B9

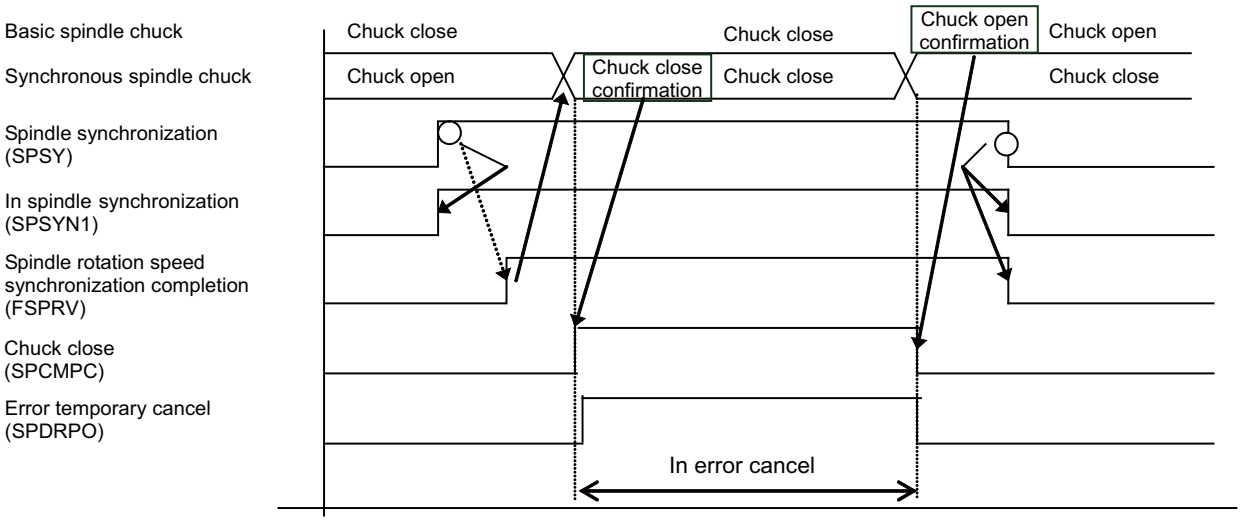
[Function]

This signal is turned ON while the basic spindle and synchronous spindle clamp the same work.

[Operation]

The "Spindle chuck close confirmation" signal is turned ON when the "Chuck close" signal is ON.

The "Spindle chuck close confirmation" signal is turned OFF when the "Chuck close" signal is OFF.



(Note) Use the "Error temporary cancel" only when the rotation error between the basic spindle and synchronous spindle occurs because of the "Chuck close" signal.

[Related signals]

(1) "Chuck close confirmation" signal (SPCMP: X18AC)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	POSITION SWITCH n INTERLOCK		Y1D00 to 17	Y1D20 to 37	Y1D40 to 57	Y1D60 to 77

[Function]

An interlock is applied on the axis when outside the position switch range, and movement of the axis targeted by the position switch is prohibited.

[Operation]

When this signal turns ON and the axis targeted for the corresponding position switch is outside the range, an interlock will be applied on the axis, and movement will be prohibited. Movement is possible within the set range.

- Movement in interlock range

[For linear axis]

The axis can move only in the direction toward the position switch range.If a command is issued in the direction that moves away from the position switch range, "M01 OPERATION ERROR 0004 *" (* is axis name) will occur.

[For rotary axis]

If axis movement is commanded in the interlock state, "M01 OPERATION ERROR 0004 *" (* is axis name) will occur. To move the axis, turn the "Position switch interlock" signal input OFF and cancel the interlock state. Note that even if the axis is moved away from the position switch range in this state, the interlock will not be applied.

- Coasting distance

The coasting distance when outside the position switch range by axis movement depends on the commanded speed and parameter setting.

[Coasting distance for position switch interlock]

Pcheck	<check>	Coasting distance
0	0	The acceleration/deceleration delay is added to the movement distance within the commanded speed × 0.060 [s] or less.
0	1	Same as the above distance. (When Pcheck is 0, the <check> setting is invalid.)
1	0	Within commanded speed × 0.015 [s] or less (During manual mode, commanded speed × 0.030 [s] or less)
1	1	Acceleration/deceleration delay or position loop gain delay is added to above distance.

[Caution]

(1) When moving from the set range to outside the range, the coasting distance up to when the axis stops will differ according to the position switch method.

(2) The position switch interlock is invalid for a reference position return incomplete axis (incremental specifications) absolute position initialization incomplete axis and an axis for which absolute position initialization is being carried out.

(3) The position switch range is judged with the machine coordinate system. Thus, the inclined axis is judged with the oblique (actual axis).

If the basic axis moves with a command issued for the inclined axis, the axis interlock will not be applied even if the basic axis moves out of the position switch range. (The interlock is valid only for the commanded axis.)

[Related signals]

(1) Position switch (PSW1 to 24: X1D00 to X1D17)

6.4 PLC Output Signals (Data Type: R***)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	ANALOG OUTPUT m	AOn	R200 to 7

[Function]

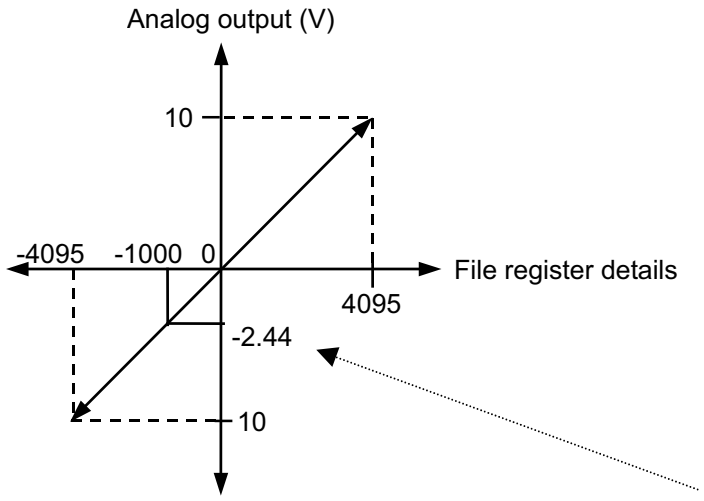
An analog voltage can be output from the designated connector pins (see below) on the remote I/O unit DX120/DX121 by setting designated data in the file registers.

[Operation]

"Analog voltage" signal (for speed control) can be output by setting signed binary data to the corresponding file register. The analog output interface is explained below.

Channel	File register (R)	Remote I/O unit DX120/DX121 output destination
A01	R200	Channel setting switch is set to 1st card B04, A04 (Common)
A02	R201	Channel setting switch is set to 3rd card B04, A04 (Common)
A03	R202	Channel setting switch is set to 5th card B04, A04 (Common)
A04	R203	Channel setting switch is set to 7th card B04, A04 (Common)
A05		
A06		
A07		
A08		

<Relation of file register details and analog output voltage>



Output voltage : -10V to +10V (±5%)
Resolution : 2^{12} (1/4095) x Fullscal
Load conditions : 10kohm resistance load (standard)
Output impedance: 220ohm

Output voltage = $\frac{-1000}{4095}$ x 10V = -2.44V

<Relation of file register details and output voltage>

The output voltage is

Rn								n = 100 to 103							
2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
1	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0

When -1000
(FC18 with hexadecimal)

The data is input as binary coded data.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	DISPLAYED SCREEN NO.		R210

[Function][Operation]

The No. of the screen displayed by the screen change key is registered.

The following table shows the screen change keys and the corresponding Nos. to be registered.

Screen change key		Displayed screen No. to be set in the R register
MONITOR (MONITOR)	Monitor	1
SET UP (SETUP)	Setup	2
EDIT (EDIT)	Edit	3
DIAGN (DIAGN)	Diagnosis	4
MAINTE (MAINTE)	Maintenance	5
SFP		9
F0		10
	Window display	13
?	Window selection	14

[Caution]

(1) This register is not retained after the power OFF. The data is initialized to "0" at the power ON.

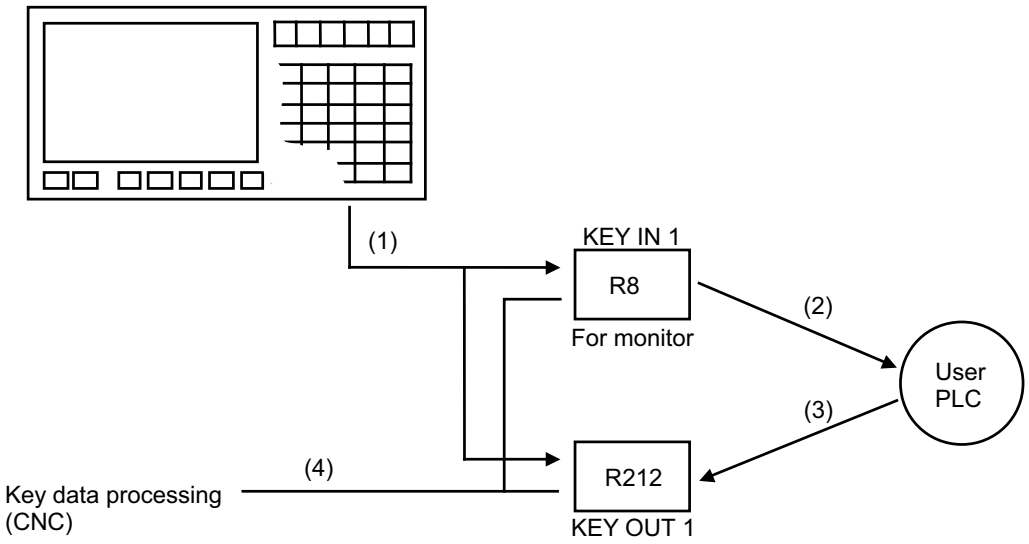
(2) The displayed screen No. is not set in this register when the PLC onboard or the custom application (EXE) is closed without the screen change keys (with [ ], [Close] buttons and so on). When the standard screen is displayed in the forefront after the application has been closed, the displayed screen No. on the standard screen is set in this register.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	KEY OUT 1		R212

[Function]

When this signal is used, key data can be entered on the user PLC side instead of the CNC keyboard.

[Operation]



(1) Key data is set to file registers R8 and R212 at the head of user PLC main program.
(2) The user PLC refers to the key data, and performs required processing.
(3) The user PLC sets the key data which meets the keyboard currently in use to register R212.
(4) The controller processes the effective key data after the main program of user PLC has been processed, referring to the settings of R8 and R212.

[Related signals]

(1) KEY IN 1 (R8)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	POWER OFF INDICATION Y DEVICE NO.		R215

[Function][Operation]

This signal sets the Y device to notify the control unit's power OFF.
The setting range is 0 to 5FF(HEX).
Set the Y device No. taking the hardware configuration into consideration.
Designate binary data for Y device No.
When a Y device No. outside the setting range is set, this signal will not be output to the Y device.
Refer to the "Automatic power OFF request" signal (Y75D) for details.

[Related signals]

(1) Power OFF processing (X707)
(2) Automatic power OFF request (Y75D)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	USER SEQUENCE PROGRAM VERSION CODE		R224 to 7

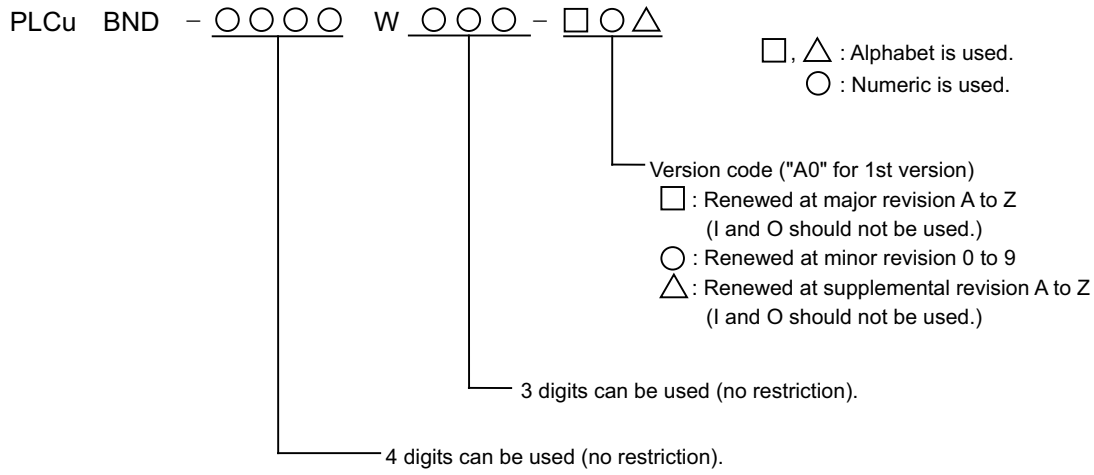
[Function]

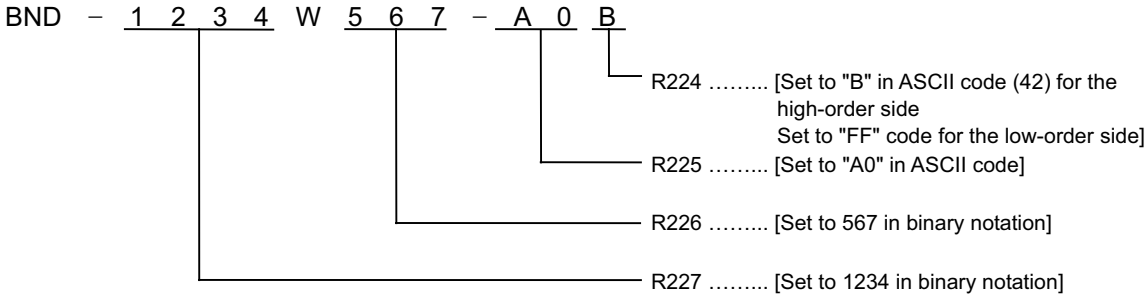
The user sequence program version can be displayed with the software version that controls the other controller on the setting and display unit (communication terminal) DIAGNOSIS screen.

[Operation]

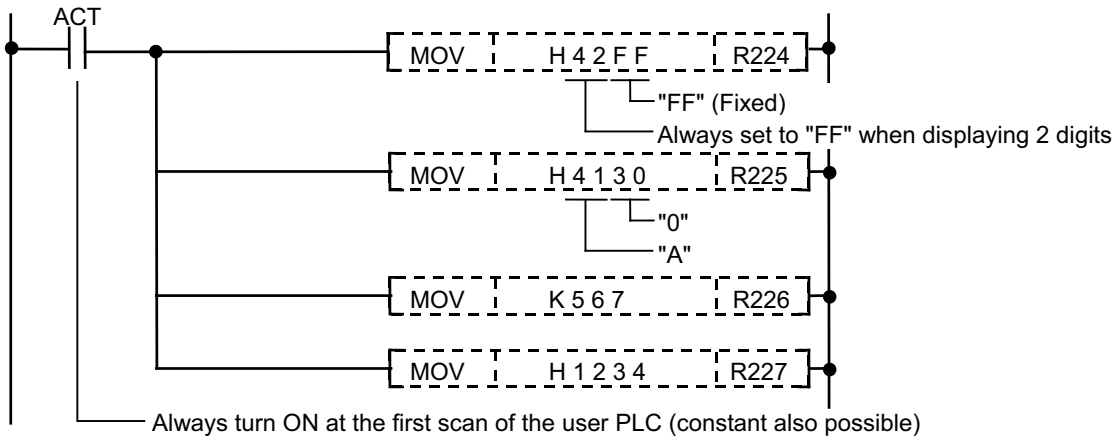
Characters to be displayed are placed in ASCII code.

<Display format>





(Program example)



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	USER SEQUENCE PROGRAM VERSION CODE 2		R232 to 9

[Function]

This signal enables the user sequence program version to be displayed, together with the software version controlling another control unit, in the DIAGNOSIS screen of the setting display unit (communication terminal).

[Operation]

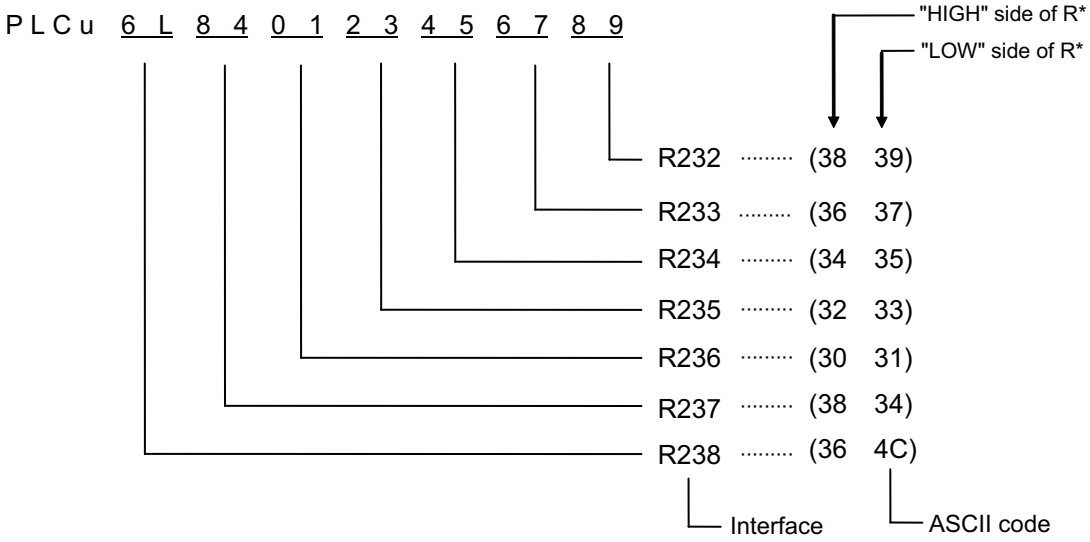
The ASCII code that corresponds to the character to be displayed in the version display interface is set.

<Display format and usage example>

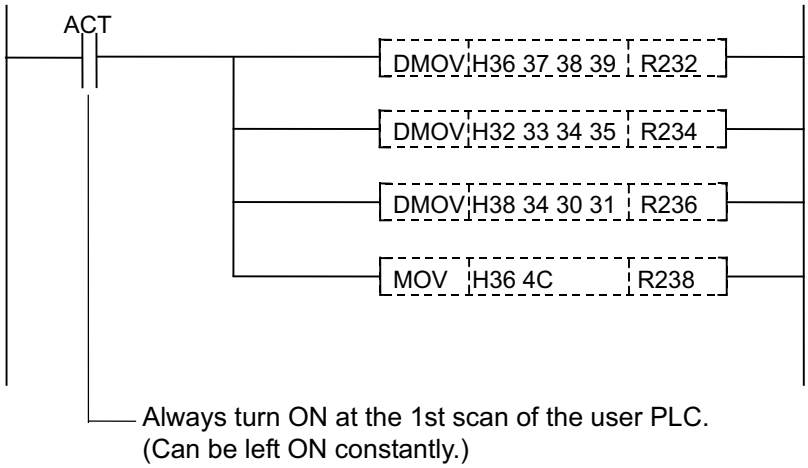
PLCu □□□□□□□□□□□□□□

Total of 14 characters

□ : Random alphanumeric characters are used.



(Program example)



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	APLC VERSION		R240 to 3

[Function]

This signal indicates APLC software version.

[Operation]

File register R240 to R243 is as the following data.

R240 to R243 is as the following data.

(Example) BND-1003W400-A0B
(1) (2) (3)

Item		File register	Type	Example
(1)	Model function No.	R240	Binary	1003=03EBH
(2)	Serial No.	R241	Binary	400=0190H
(3)	Version	Bits 7 to 0 of R242	ASCII code	A=41H
		Bits F to 8 of R242	ASCII code (Note1)	0=30H
		Bits 7 to 0 of R243	ASCII code (Note1)	B=42H
-	-	Bits F to 8 of R243	Always FFH (Note2)	FFH

(Note1) If the version is 1-digit No., set the version in bits 7 to 0 of R242, and set "00H" in bits F to 8 of R242 and bits 7 to 0 of R243.

(Note2) Always set "FFH" in bits F to 8 of R243. If not, it will not be displayed correctly.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	OT IGNORED		R248,9

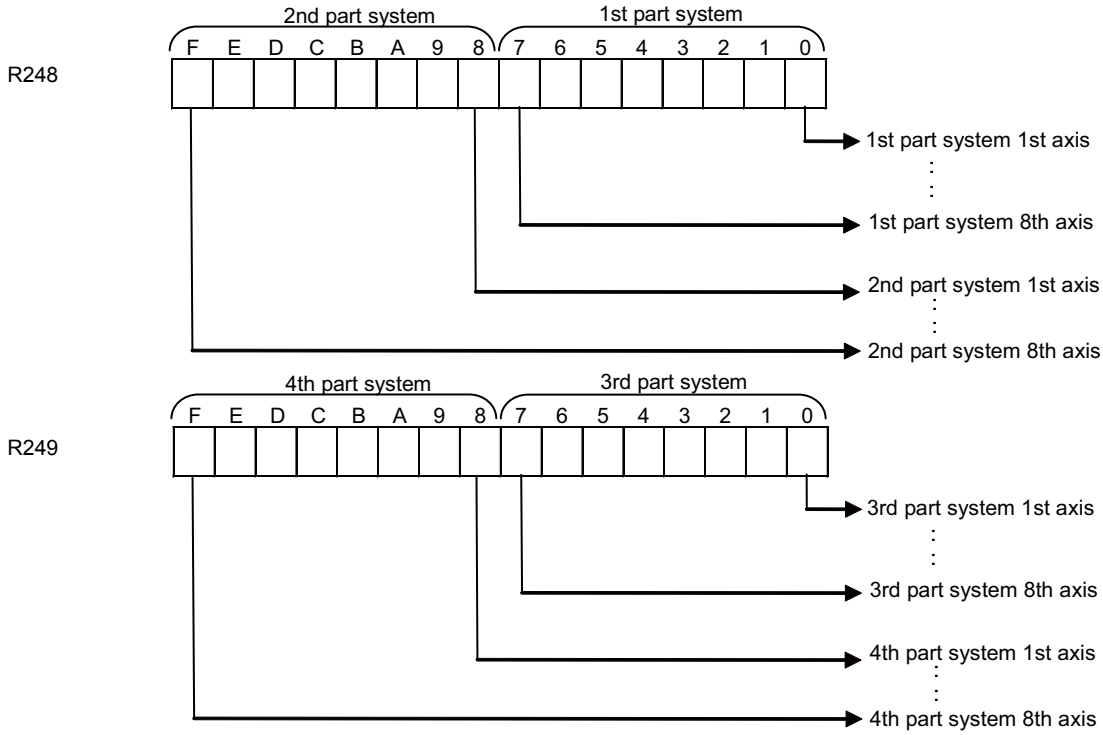
[Function]

When this signal is used, "stroke end error" can be avoided without eternal wiring for stroke end signal (remote I/O connector pin No. fixed signal) provided for each axis. "Stroke end" signal on axis for which the "OT ignored" signal is set can be used for other purpose.

[Operation]

"Stroke end error" signal associated with a specific axis motion can be ignored.

The interface for this signal is as follows:



(Note 1) The signal is applicable to (+) and (-) motion at the same time (ignored when "ON").

(Note 2) "OT" is abbreviation of "Over Travel".

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS OT IGNORED		R255

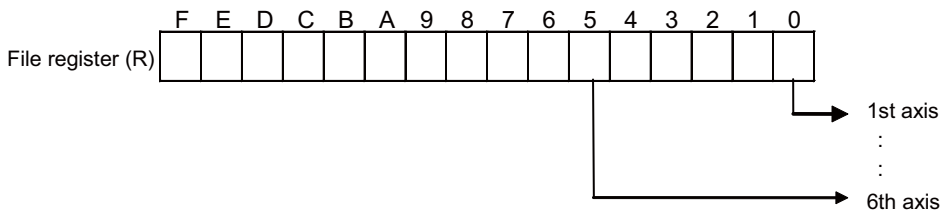
[Function]

When this signal is used, "stroke end error" can be avoided without eternal wiring for stroke end signal (remote I/O connector pin No. fixed signal) provided for each axis. "Stroke end" signal on axis for which the "PLC axis OT ignored" signal is set can be used for other purpose.

[Operation]

"Stroke end error" signal associated with a specific axis motion can be ignored.

The interface for this signal is as follows:



(Note 1) The signal is applicable to (+) and (-) motion at the same time (ignored when "ON").

(Note 2) "OT" is abbreviation of "Over Travel".

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	NEAR-POINT DOG IGNORED		R272,3

[Function]

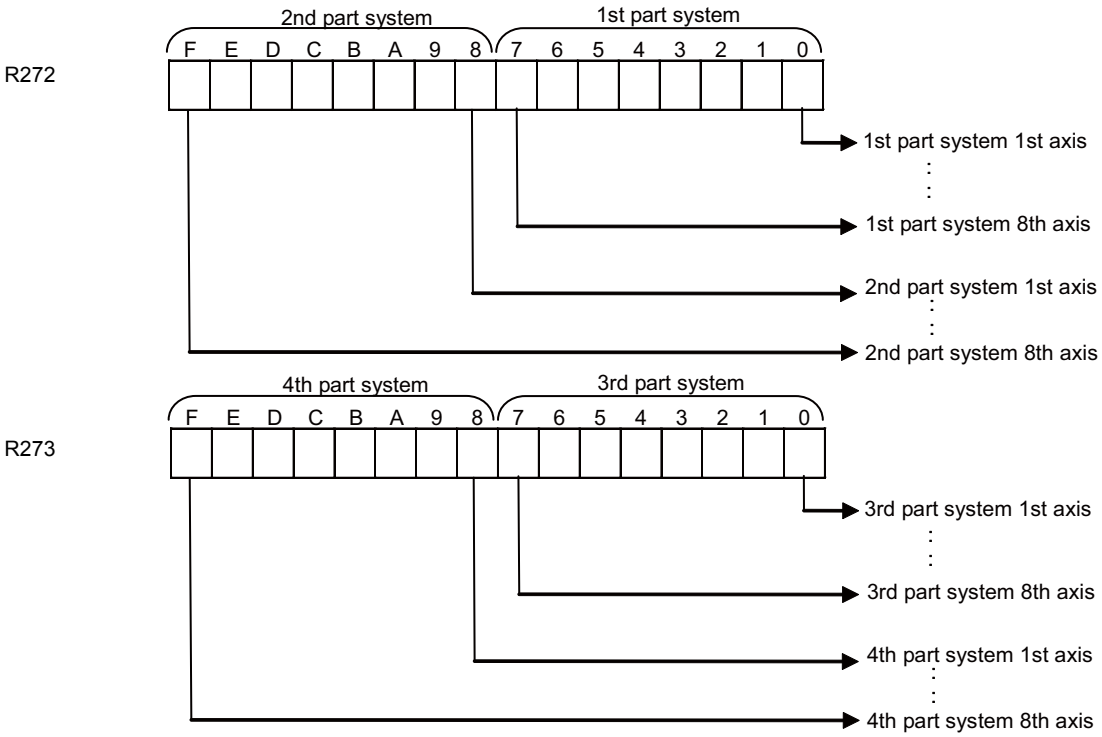
When this signal is used, "Near point detection" signal (remote I/O connector pin No. fixed signal) which is used for dog type reference position return can be ignored (dog not-passed state).

Furthermore, the "Near point detection" signal for an axis to which the "Near-point ignored" signal is set can be used for other applications.

[Operation]

When the signal is turned ON, "Near point detection" signal for the corresponding control axis can be ignored.

The interface is shown below:



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS NEAR-POINT DOG IGNORED		R279

[Function]

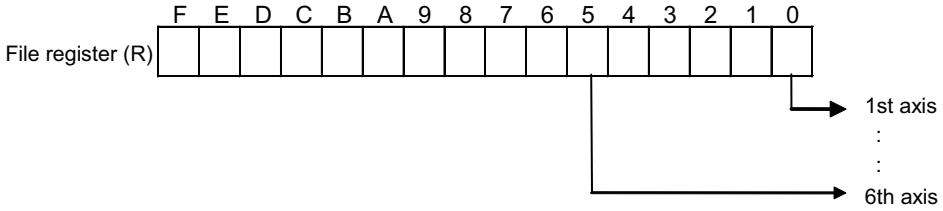
When this signal is used, "Near point detection" signal (remote I/O connector pin No. fixed signal) which is used for dog type reference position return can be ignored (dog not-passed state).

Furthermore, the "Near point detection" signal for an axis to which the "PLC axis near-point ignored" signal is set can be used for other applications.

[Operation]

When the signal is turned ON, "Near point detection" signal for the corresponding control axis can be ignored.

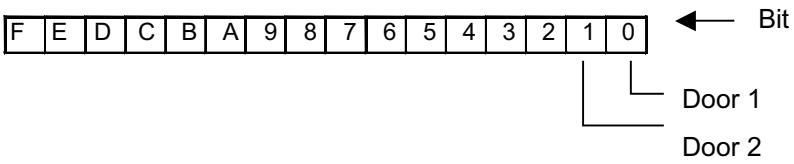
The interface is shown below:



Con-tact	Signal name	Signal abbreviation	Common for part systems
A	SPEED MONITOR MODE	SOMD	R296

[Function]

This signal executes speed monitor function for the control axis for which a valid door No. is selected with parameter "#2118 SscDrSel" and the spindle for which a valid door No. is selected with parameter "#3071 SscDrSelSp".
The door No. corresponds to the following bits.



[Operation]

NC performs as follows by turning the speed monitor signal ON.

(1) Checks compatibility of speed monitor parameter
(2) Checks if NC's speed monitor parameter matches with the speed monitor parameter sent to servo drive unit and spindle drive unit.
(3) Notifies speed monitor command to the drive unit
(4) Executes the speed monitor function on NC
(5) Turns ON speed monitor door open possible signal when NC receives the in speed monitor mode signal from the drive unit

The followings are performed while the speed monitor function is executed.

Item	Details
Monitoring command speed	When a command speed NC outputs to the drive unit exceeds a safety speed set with parameter, an emergency stop occurs.
Monitoring feed back speed	When a motor rotation speed sent to NC from the drive unit exceeds a safety rotation speed set with parameter, an emergency stop occurs.
Monitoring feed back position	When a difference between feedback position sent to NC from the drive unit and a position commanded by NC is large, an emergency stop occurs.

[Caution]

(1) Be sure to turn ON the speed monitor mode signal (SOMD) after confirming deceleration of all axes. If the speed monitor mode signal (SOMD) is turned ON without deceleration, and the motor rotation speed exceeds the set speed, a speed monitor alarm will occur, resulting in an emergency stop state. Then, power of the drive section will be shut off.
(2) Turn OFF the speed monitor mode signal after confirming the door lock is OFF.
(3) Even if the speed monitor mode signal (SOMD) is turned ON while parameter error is output, speed monitoring is not initiated. Set the parameter with appropriate value, and then turn ON the speed monitor mode signal (SOMD).
(4) While the axis is being removed, it will be taken off from the watch list even if the parameters "#2313 SV113/bit F (safety observation function)" and "#13229 SP229/bit F" are ON.
However, removing all axes in the group which the door state signal is turned ON with "#2282 SV082/bit F-C (dis Digital signal input selection)" and "#13227 SP227/bit F-C (dis Digital signal input selection)" causes the emergency stop.
Do not remove the axis which the door state signal is to be input.

[Related signals]

(1) Speed monitor door open possible (SMDOEN: R96)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	HANDY TERMINAL DATA AREA TOP ADDRESS		R297

[Function]

Set the top address of the area in which data to be transmitted/received to/from the handy terminal is stored.

[Operation]

Set the CNC side R register top address corresponding to the handy terminal side D0 to "Handy terminal Data area top address (R297)", and set the number of registers to communicate into "Handy terminal Data valid number of registers (R298)".

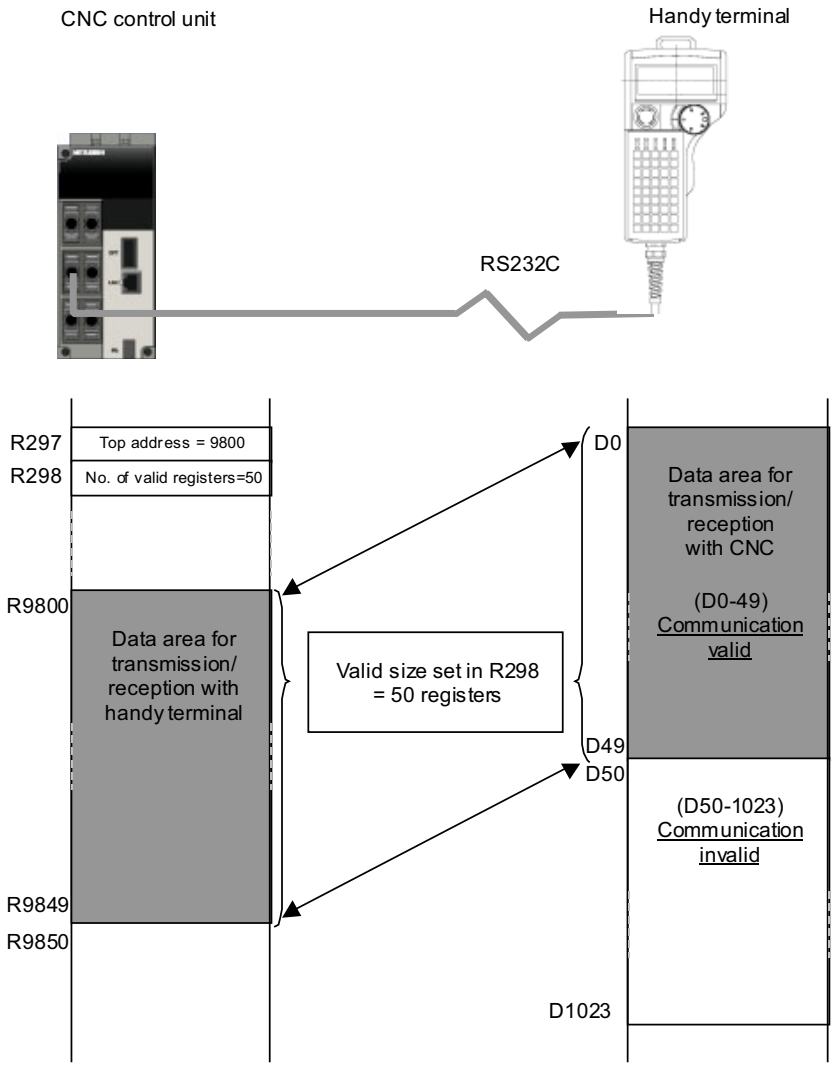
<Setting example>

The following is the setting value used for allocating the data from R9800 to R9849, the CNC side user area, by using 50 registers from D0 to D49 in the handy terminal side.

"9800 (0x2648) for "Handy terminal Data area top address (R297)"

"50 (0x32) for "Handy terminal Data valid number of registers (R298)"

Image drawing of internal register



[Related signals]

(1) Handy terminal key 1 to 45 (X1CD0 to X1CFC)
(2) Handle pulse encoder communication connector priority (Y70D)
(3) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)
(4) Handle/incremental feed magnification method selection (MPS: YC87)
(5) Handy terminal Data valid number of registers (R298)
(6) Handy terminal Cause of communication error (R299)
(7) 1st handle/incremental feed magnification (R2508, R2509)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	HANDY TERMINAL DATA VALID NUMBER OF REGISTERS		R298

[Function][Operation]

Set the number of valid registers from D0 within the handy terminal transmission/reception area (D0 to 1023).
With CNC, the range of handy terminal transmission/reception area is the number of registers set starting from "Handy terminal Data area top address (R297)".
Refer to the section on "Handy terminal Data top address" for details.

[Related signals]

(1) Handy terminal key 1 to 45 (X1CD0 to X1CFC)
(2) Handle pulse encoder communication connector priority (Y70D)
(3) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)
(4) Handle/incremental feed magnification method selection (MPS: YC87)
(5) Handy terminal Data area top address (R297)
(6) Handy terminal Cause of communication error (R299)
(7) 1st handle/incremental feed magnification (R2508,R2509)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	HANDY TERMINAL CAUSE OF COMMUNICATION ERROR		R299

[Function][Operation]

For details on communication error, refer to the table below.

Hexadecimal (HEX)	Decimal (DEC)	Details
0000	0	No error
FFFE	-2	Serial port in use
FFFC	-4	Timeout terminated
FFF9	-7	Serial driver forcibly terminated
FFF6	-10	Serial driver not ready (SIO cable is disconnected)
FFF1	-15	Parity error
FFEF	-17	Number of received characters over
FFEC	-20	Flaming error, H/W error
FC18	-1000	Handy terminal data area illegal (Out of user area)

[Related signals]

(1) Handy terminal key 1 to 45 (X1CD0 to X1CFC)
(2) Handle pulse encoder communication connector priority (Y70D)
(3) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)
(4) Handle/incremental feed magnification method selection (MPS: YC87)
(5) Handy terminal Data valid number of registers (R298)
(6) Handy terminal Cause of communication error (R299)
(7) 1st handle/incremental feed magnification (R2508, R2509)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL I/D R/W POT NO. DESIGNATION		R336

[Function]

Designate the number of the pot containing the tool No. of the information communicated with the tool ID controller.

[Operation]

(1) Designate the pot No. to store the tool information tool No. read in from the tool ID controller.
(2) Designate the pot No. containing the tool No. to write the tool information to the tool ID controller.
(3) Designate the pot No. containing the tool No. of which tool information is to be erased.

[Caution]

(1) Do not change the pot No. while communicating with the tool ID.
(2) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	LARGE DIAMETER TOOL INFORMATION		R337

[Function]

Information indicating whether the tool mounted on the spindle and standby tool are large diameter tools or not is set. (H: Spindle, L: Standby tool)

[Operation]

When the tool mounted on the spindle or standby tool is changed, "1" is set if the tool is a large diameter tool, and "0" is set if it is a normal tool, respectively.

If there is no tool mounted on the spindle or standby tool, H: spindle and L: standby tool will be cleared to "0".

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL WEIGHT (Spindle tool)		R338

[Function]

Weight of the tool mounted on the spindle is set.

[Operation]

When the tool mounted on the spindle is changed, the weight of the newly-mounted tool will be set.

If no tool is mounted on the spindle, this setting will be cleared to "0".

[Caution]

(1) Incremental unit for the weight is 0.1 kg.
(2) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TOOL WEIGHT (Standby tool)		R339

[Function]

Weight of the standby tool is set.

[Operation]

When the standby tool is changed, the weight of newly-set standby tool will be set.

If there is no standby tool, this setting will be cleared to "0".

[Caution]

(1) Incremental unit for the weight is 0.1 kg.
(2) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	UNSET TOOL INFORMATION		R340

[Function]

Information indicating whether the tool mounted on the spindle and standby tool are unset tools (Note 1) or not is set. (H: Spindle, L: Standby tool)

[Operation]

When the tool mounted on the spindle or standby tool is changed, "1" is set if the tool is an unset tool, and "0" is set if the tool is set, respectively.

If there is no tool or standby tool mounted on the spindle, H: spindle and L: standby tool will be cleared to "0".

(Note 1) When changing the tool numbers in the ID label (when writing new tool information in the ID label), the tool must be set as an unset tool.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	REMOTE PROGRAM INPUT NO.		R352,3

[Function][Operation]

Refer to the section on "Remote program input start signal" (RPN) for the function and operation.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) In remote program input (X724)
(2) Remote program input completion (X725)
(3) Remote program input error (X726)
(4) Remote program input error information (R30)
(5) Remote program input start (RPN: Y76C)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	MACHINE MANUFACTURER MACRO PASSWORD NO		R354,5

[Function]

This function uses a password No. to prohibit editing and input/output of the user PLCs to prevent these user PLCs prepared by the machine manufacturer from being incorrect overwritten by the end user.

This function is an option.

[Operation]

The machine manufacturer's original password No. is registered in R354[L]/R355[H] with the user PLCs.

Set the password No. in the range of "2" to "99999999". "0" and "1" cannot be set. Note that if the R354/R355 value is "0" or "1", "5963" (default value) will be used as the password No.

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	DIRECT SCREEN SELECTION		R356 to 9

[Function]

This signal allows an automatic transition to the alarm display screen when an alarm occurs.

[Operation]

The following shows the descriptions of the registers R356 to R359.

Register No.	Description		Setting value
R356	Selection requirement/completion data		0: Initial state 1: Screen selection requirement 4: Screen selection completion 8: There is no application for the screen selection requirement
R357	Selection requirement	Function No.	Set "4" to transit to the alarm message display screen.
R358		Main menu No.	Set "6" to transit to the alarm message display screen.
R359		Sub menu No.	Set "1" to transit to the NC alarm display screen, "2" to the PLC alarm display screen.

(1) Confirm the initial state ("0") is set to R356, the selection requirement/completion data.

(2) Set the function No. (to R357), main menu No. (to R358) and sub menu No. (to R359). Then enter "1" to R356, the selection requirement/completion data.

(3) NC confirms the screen selection requirement and then sets the screen selection completion ("4") to the selection requirement/completion data (R356) to execute the screen transition.

(4) After the screen transition, user PLC confirms the screen selection completion ("4") in R356 and then initializes the data (to "0").

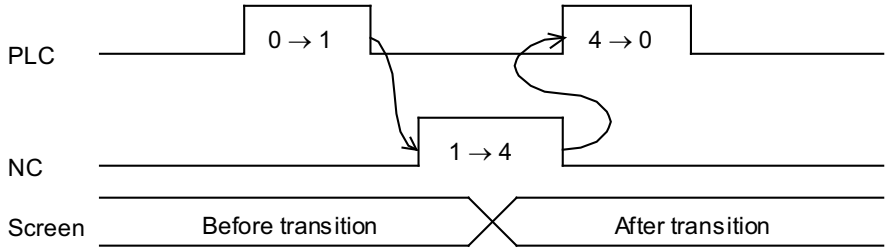
(Note 1) Setting the function No. is necessary. Without this No., the screen transition is not executed.

(Note 2) If the main menu No. has not been set (stays "0"), the function No. designates the screen transition. The screen transition is as same as when each function key has been pressed.

(Note 3) When the sub menu No. has been set, the main menu No. has also to be set. Unless the main menu is set, the transition is as same as when only the function No. is set.

(Note 4) When either the function No., main menu No. or sub menu No. is out of range, the screen transition is not executed. Then the selection requirement/completion data (R356) remains "1".

The timing chart of the selection requirement/completion data is shown below.



[Caution]

(1) This signal is used only for the transition to the alarm message display screen (NC/PLC message display screen) on the diagnosis screen. No other screen transition is executed by setting the screen selection data.

(2) The direct screen selection is not available with the display unit FCU7-DA201-xx or FCU7-DA211-xx.

(3) A failure of the screen transition does not display or set any error data, except for "8" in R356, which informs that no application software is found to make the direct screen selection requirement.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	LOAD METER NAME DESIGNA-TION		R377

[Function] [Operation]

This signal switches the name of the load meter.

Refer to the section on "Load meter display" in the "PLC Programming Manual" for details.

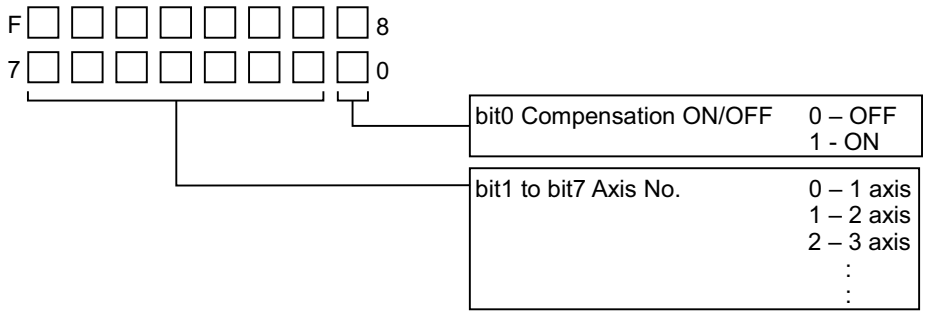
Con-tact	Signal name	Signal abbreviation	1stAX	2ndAX	3rdAX	4thAX
A	BALL SCREW THERMAL DISPLACEMENT COMPENSATION OFFSET AMOUNT n-TH AXIS		R400	R403	R406	R409
A	BALL SCREW THERMAL DISPLACEMENT COMPENSATION MAX. COMPENSATION AMOUNT n-TH AXIS		R401	R404	R407	R410
A	BALL SCREW THERMAL DISPLACEMENT COMPENSATION PART-SYSTEM, AXIS NO. n-TH AXIS		R402	R405	R408	R411

[Function]

These signals use R register as interface for PLC and NC. Up to 4 sets of axis can be set in R register, including axis No., offset amount, and max. compensation amount in one set.

[Operation]

(1) Part-system, axis No.(raxno): R402



(2) Offset amount (offset): R400
Set compensation amount for the farthest negative side (mdvno position) in the compensation range by using ladder, etc.

(3) Max. compensation amount (maxcmp): R401
Set compensation amount for the farthest positive side (pdvno position) in the compensation range by using ladder, etc. This compensation amount is a value using offset position as a criterion.

(4) Compensation amount (legcmp): R72
This is compensation amount for the current machine position set by NC.
Refer to the section on "Ball screw thermal displacement compensation Compensation amount" (R72) for details.

(Note 1) Raxno, offset, and maxcmp cannot be set from the program or NC screen. Set them in R register by using ladder, etc.

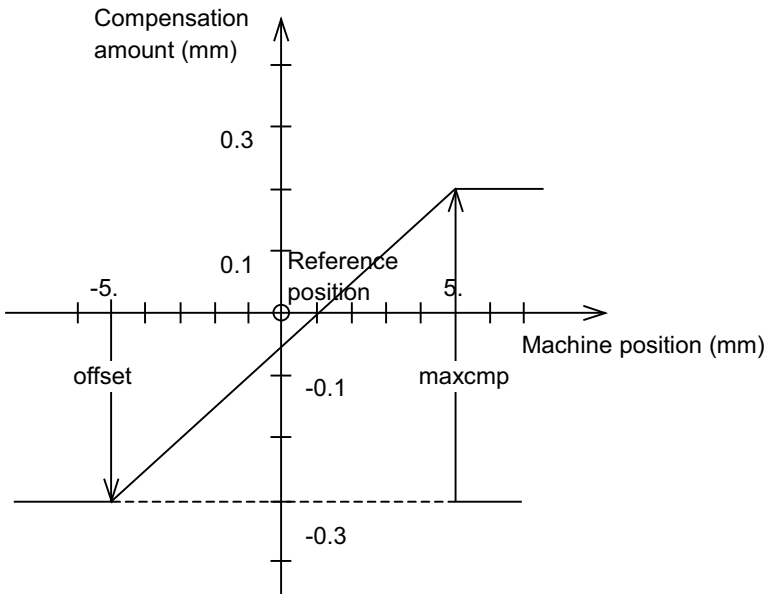
(Note 2) Unit for (2) to (4) above follows the setting of "#1006 Machine error compensation unit".
Parameters (backlash and pitch error compensation, etc.) regarding machine error compensation and external machine coordinate system compensation also follow this unit.

[Setting example]
When only the ball screw thermal displacement compensation is valid:

(Example 1)

Compensation range
cmpax X
drcax X
rdvno 4105
mdvno 4101
pdvno 4110
spcdv 1000

Compensation amount
offset -600
maxcmp 1000
raxno 1



When the ball screw thermal displacement compensation is used with the machine error compensation:

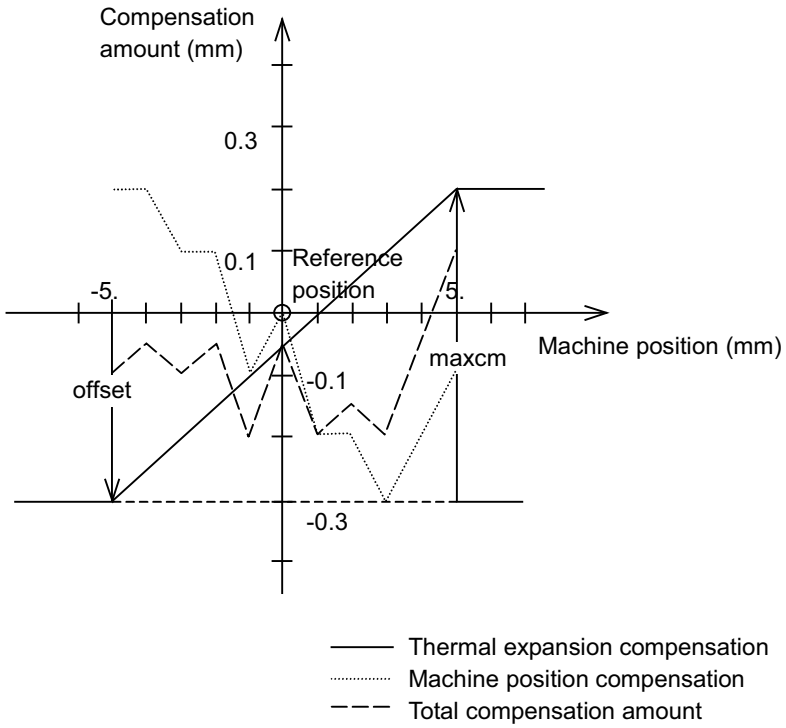
(Example 2)

Compensation range
cmpax X
drcax X
rdvno 4105
mdvno 4101
pdvno 4110
spcdv 1000

(Absolute value method)

Division No.	Compensation amount
1	200
2	200
3	100
4	100
5	-100
6	-200
7	-200
8	-300
9	-200
10	-100

Compensation amount
offset -600
maxcmp 1000
raxno 1



[Related signals]

(1) Ball screw thermal displacement compensation offset amount n-th axis (R400)
(2) Ball screw thermal displacement compensation Max. compensation amount n-th axis (R401)
(3) Ball screw thermal displacement compensation part-system, axis No. n-th axis (R402)
(4) Thermal expansion compensation amount (R72)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS CONTROL INFORMATION ADDRESS n-TH AXIS		R440 to 7

[Function]

The PLC axis control information address stores control information head R register for each PLC axis.

[Operation]

PLC axis control information address is designated by the following devices.

Device No.	Signal name
R440	PLC axis control information address 1st axis
R441	PLC axis control information address 2st axis
R442	PLC axis control information address 3st axis
R443	PLC axis control information address 4st axis
R444	PLC axis control information address 5st axis
R445	PLC axis control information address 6st axis
R446	PLC axis control information address 7st axis
R447	PLC axis control information address 8st axis

(Note) The following R registers can be used.
R8300 to R9799 (Battery backup area)
R9800 to R9899 (Non battery backup area)
R18300 to R19799 (Battery backup area)
R19800 to R19899 (Non battery backup area)
R28300 to R29799 (Battery backup area)
R29800 to R29899 (Non battery backup area)

[Related signals]

(1) PLC axis control buffering mode valid (PABMI:Y723)
(2) PLC axis control valid (PLCAEn:Y770 to Y777)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	PLC AXIS CONTROL BUFFERING MODE INFORMATION ADDRESS		R448

[Function][Operation]

The PLC axis control buffering mode information address stores PLC axis control buffering mode information.

[Related signals]

(1) PLC axis control buffering mode valid (PABMI:Y723)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	ENCODER 1 ARBITRARY PULSE 1		R456
A	ENCODER 1 ARBITRARY PULSE 2		R457
A	ENCODER 2 ARBITRARY PULSE 1		R458
A	ENCODER 2 ARBITRARY PULSE 2		R459

[Function]

Encoder pulse input used to be fixed to 1024 pulse input on the conventional analogue I/F. With this function, arbitrary pulse can be input by parameters set in R register. The maximum number of input pulse is 76800.

[Operation]

In order to input encoder arbitrary pulse, set the number of pulses necessary in R register. Switch encoder to be used by ON/OFF on the PLC device, and turn ON the arbitrary pulse input valid signal.

Turn OFF the arbitrary pulse input valid signal when using the conventional 1024 pulse encoder.

Device No.	Signal name	Details	
R456	Encoder 1 arbitrary pulse 1	This signal is selected when the encoder 1 arbitrary pulse selection (Y764) is OFF.	Input 1/2 of the number of pulses necessary for arbitrary pulse input with the encoder input 1. This number of pulses must be in hexadecimal but not in quad edge evaluation. The setting range is 0x200(512) to 0x9600(38400).
R457	Encoder 1 arbitrary pulse 2	This signal is selected when the encoder 1 arbitrary pulse selection (Y764) is ON.	
R458	Encoder 2 arbitrary pulse 1	This signal is selected when the encoder 2 arbitrary pulse selection (Y765) is OFF.	Input 1/2 of the number of pulses necessary for arbitrary pulse input with the encoder input 2. This number of pulses must be in hexadecimal but not in quad edge evaluation. The setting range is 0x200(512) to 0x9600(38400).
R459	Encoder 2 arbitrary pulse 2	This signal is selected when the encoder 2 arbitrary pulse selection (Y765) is ON.	

[Caution]

(1) Arbitrary pulse cannot be input from a bus-connected encoder.

(2) Input 1/2 of the number of pulses actually used with the encoder 1 arbitrary pulse 1 and 2 (R456 to 457), and the encoder 2 arbitrary pulse 1 and 2 (R458 to 459) in hexadecimal. If a different number of pulses is input, the speed at feed per rotation changes.

(3) When 0 to 0x1FF are set in R456 to R459, the encoder input pulse will be 1024 pulse input. When a value exceeding 0x9600 is set, it will be 76800 pulse input.

[Related signals]

(1) Encoder 1 arbitrary pulse selection (Y764)

(2) Encoder 2 arbitrary pulse selection (Y765)

(3) Encoder 1 arbitrary pulse valid (Y766)

(4) Encoder 2 arbitrary pulse valid (Y767)

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus BLOCK 1 TRANSFER POSITION		R470

[Function]

This signal sets the head position for the transfer block 1 between the Modbus device and the file register.

[Operation]

Transfer from Modbus device to the file register is executed in the transfer block 1 every time the PLC scans.
The head position for the transfer is set with word unit.
The setting range is 0 to 199. Transfer is not executed if the value other than the setting range is set.
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus BLOCK 1 NUMBER OF TRANSFERS		R471

[Function]

This signal sets the number of words for the transfer block 1 to transfer between Modbus device and file register

[Operation]

Transfer from Modbus device to the file register is executed in the transfer block 1 every time the PLC scans.
Set the number of words to transfer.
The setting range is 0 to 200. If the value other than the setting range is set, it will be handled as "0".
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus BLOCK 2 TRANSFER POSITION		R472

[Function]

This signal sets the head position for the transfer block 2 between the Modbus device and the file register.

[Operation]

Transfer from Modbus device to the file register is executed at a constant frequency in the transfer block 2.
The head position for the transfer is set with word unit.
The setting range is 0 to 199. Transfer is not executed if the value other than the setting range is set.
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus BLOCK 2 NUMBER OF TRANSFERS		R473

[Function]

This signal sets the number of words for the transfer block 2 to transfer between Modbus device and file register

[Operation]

Transfer from Modbus device to the file register is executed at a constant frequency in the transfer block 2.
Set the number of words to transfer.
The setting range is 0 to 200. If the value other than the setting range is set, it will be handled as "0".
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus BLOCK 3 TRANSFER POSITION		R474

[Function]

This signal sets the head position for the transfer block 3 between the Modbus device and the file register.

[Operation]

Transfer from the file register to Modbus device is executed in the transfer block 3 every time the PLC scans.
The head position for the transfer is set with word unit.
The setting range is 0 to 199. Transfer is not executed if the value other than the setting range is set.
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus BLOCK 3 NUMBER OF TRANSFERS		R475

[Function]

This signal sets the number of words for the transfer block 3 to transfer between Modbus device and file register

[Operation]

Transfer from the file register to Modbus device is executed in the transfer block 3 every time the PLC scans.
Set the number of words to transfer.
The setting range is 0 to 200. If the value other than the setting range is set, it will be handled as "0".
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus BLOCK 4 TRANSFER POSITION		R476

[Function]

This signal sets the head position for the transfer block 4 between the Modbus device and the file register.

[Operation]

Transfer from the file register to Modbus device is executed at a constant frequency in the transfer block 4.
The head position for the transfer is set with word unit.
The setting range is 0 to 199. Transfer is not executed if the value other than the setting range is set.
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus BLOCK 4 NUMBER OF TRANSFERS		R477

[Function]

This signal sets the number of words for the transfer block 4 to transfer between Modbus device and file register.

[Operation]

Transfer from the file register to Modbus device is executed at a constant frequency in the transfer block 4.
Set the number of words to transfer.
The setting range is 0 to 200. If the value other than the setting range is set, it will be handled as "0".
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Contact	Signal name	Signal abbreviation	Common for part systems
A	Modbus TRANSFER CYCLE		R478

[Function]

This signal sets the transfer cycle between the transfer block 2 and the transfer block 4.

[Operation]

The table below shows the constant cycle to execute the transfer with the setting value.
This setting is common for the transfer block 2 and the transfer block 4.
If the value other than the setting range is set, it will be handled as "0".
It is initialized to "0" when the power is turned ON. Set the value at the first scan of the sequence.
If the value is changed, it will take effect immediately.

Setting value	Transfer cycle
0	A transfer is executed every time the PLC scans.
1	A transfer is executed every two PLC scans.
2	Transfer is executed every three PLC scans.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal ab-breviation	Common for part systems
A	Modbus TIME-OUT PERIOD 1		R479

[Function]

This signal sets the time-out period to detect the Modbus/TCP communication is aborted.

[Operation]

The setting range is 0 to 65535 and the setting unit is 0.1 [sec.].

If "0" is set, the time-out detection is disabled.

This setting time is valid for Modbus/TCP communication only. The time-out period of the I0 parameter is used for Modbus/RTU communication.

It is initialized to "0" when the power is turned ON.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	1ST CUTTING FEEDRATE OVERRIDE		R2500	R2700	R2900	R3100

[Function]

When "Cutting feedrate override method selection" (FVS) is set to "file register method", override (0 to 300%, 1% increment) can be exerted on the cutting feedrate. Desired value is set to file register (R) in binary code.

[Operation]

When override is exerted to the preset feedrate, the true feedrate is the product obtained by multiplying the preset feedrate by the specified override ratio (provided that "2nd cutting feedrate override" is not valid).

The override ratio is fixed to 100%, irrespective of "1st feedrate override" setting, under the following condition:

(1) "Override cancel" (OVC) signal is ON.
(2) During tapping in fixed cycle.
(3) During TAPPING mode.
(4) During thread cutting.

(Note) Only when override setting is 0%, override is exerted even on rapid traverse speed in automatic operation. That is, cutting feed as well as rapid traverse stop if the 1st feedrate override is set to 0% during automatic operation. When override setting is 0%, "M01 OPERATION ERROR" appears in the alarm display section of setting and display unit, and "M01 OPERATION ERROR 0102" in the ALARM DIAGNOSIS display.

[Related signals]

(1) Cutting feedrate override code m (*FV1 to 16: YC60)
(2) Cutting feedrate override method selection (FVS: YC67)
(3) 2nd cutting feedrate override valid (FV2E: YC66)
(4) 2nd cutting feedrate override (R2501)

(Note) For relationship among these signals, refer to the description the cutting feedrate override.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND CUTTING FEEDRATE OVERRIDE		R2501	R2701	R2901	R3101

[Function]

When the "2nd cutting feedrate override valid" function (FV2E) is used, another override can be exerted on "Cutting feedrate override code" (*FV1 to 16), or "1st cutting feedrate override" when the "Cutting feedrate override method selection" (FVS) is set to file register method. The 2nd feedrate override can be set within range from 0% to 327.67% with 0.01% increment. The value is set in the file register (R) in binary.

[Operation]

When this override function is used, the true feedrate is the product obtained by multiplying commanded feedrate (F) by "1st cutting feedrate override" ratio and "2nd cutting feedrate override" ratio.

Since the least increment of 2nd feedrate override is 0.01%, override setting "10000" corresponds to 100%.

The override ratio is fixed to 100%, irrespective of "1st cutting feedrate override" or "2nd cutting feedrate override" setting, under the following condition:

(1) "Override cancel" (OVC) signal is ON.
(2) During tapping in fixed cycle.
(3) During TAPPING mode.
(4) During thread cutting.

(Note) Only when the 1st cutting feedrate override or 2nd cutting feedrate override is 0% or both of them are 0%, override is exerted even on rapid traverse speed in automatic operation. That is, cutting feed as well as rapid traverse stop if the 1st override feedrate is set to 0% during automatic operation. When override setting is 0%, "M01 OPERATION ERROR" appears in the alarm display section of setting and display unit, and "M01 OPERATION ERROR 0102" in the ALARM DIAGNOSIS display.

[Related signals]

(1) Cutting feedrate override code m (*FV1 to 16: YC60)
(2) Cutting feedrate override method selection (FVS: YC67)
(3) 2nd cutting feedrate override valid (FV2E: YC66)
(4) 1st cutting feedrate override (R2500)

(Note) For relationship among these signals, refer to the description about the cutting feedrate override.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	RAPID TRAVERSE OVERRIDE		R2502	R2702	R2902	R3102

[Function]

When "Rapid traverse override method selection" signal (ROVS) is set to "file register method", override can be exerted, besides the code method override (ROV1, ROV2), by setting within the range of 0% to 100% by 1% increments. The value is set in the file register (R) in binary.

[Operation]

During rapid traverse in the automatic or manual operation, the actual feedrate will be the result of multiplying the rapid traverse speed set in a parameter by this override ratio.

(Note 1) The override will be clamped at 100%.
(Note 2) The "M01 Rapid traverse override zero 0125" will occur if the override value is 0%.

[Related signals]

(1) Rapid traverse override code 1,2 (ROV1, ROV2: YC68, YC69)
(2) Rapid traverse override method selection (ROVS: YC6F)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING OVERRIDE	CHPOV	R2503	R2703	R2903	R3103

[Function]

The chopping override can be set in the range between 0 and 100% .

The value is set directly in the R register for chopping override. (The code method setting is not available.)

The data is set in R2503.

[Operation]

(1) Only the chopping override is valid for the chopping operation.When rapid traverse override valid is commanded from the PLC window, the rapid traverse override can be validated for the rapid traverse between the basic position and upper dead center point.The rapid traverse override can be set with either the code method (1, 25, 50, 100%) or the file register (value setting) method (0 to 100%, 1% increment).

(2) The chopping override is set between 0 and 100%.Select either "1 %" or "0.01%" by the control data for the setting unit.If a value outside the range from 0 to 100% is set, the override will be clamped at 100%.

(3) Set the data with one command.

(4) If the "Chopping override" signal is set to "0", "M01 OPERATION ERROR 0150" will occur.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL FEEDRATE		R2504,5	R2704,5	R2904,5	R3104,5

[Function]

When "Manual feedrate method selection" signal (JVS) is set to "file register method", feedrate can be specified, besides code method (*JV1 to 16) setting, by setting desired feedrate ratio manually. The value is set in the file register (R) in binary.

[Operation]

This mode of feedrate setting can be used in JOG feed, incremental feed, reference position return feed and manual arbitrary feed mode. For JOG, incremental and reference position return mode, "Rapid traverse speed" (RT) signal should be OFF. For manual arbitrary feed mode, "Manual arbitrary feed EX.F/MODAL.F" signal (CXS3) should be OFF. Feedrate specified in this mode can be applied to feed motion in dry run (automatic operation).

The use of this signal is conditioned as follows:

(1) When "Manual override method selection" signal (OVSL) is OFF, the originally set feedrate is applied.

(2) When "Manual override method selection" signal (OVSL) is ON, the actual feedrate can be obtained by multiplying the feedrate specified by the 1st/2nd cutting feed override value.

(3) Manual feedrate is set to file registers Rn and Rn+1. The feedrate depends on "Feedrate least increment code 1,2" (PCF1, PCF2) as listed below.

PCF2	PCF1	Least increment (mm/min or inch/min)	Operation
0	0	10	10mm/min (inch/min) when "1" is set in file registers.
0	1	1	1mm/min (inch/min) when "1" is set in file registers.
1	0	0.1	0.1mm/min (inch/min) when "1" is set in file registers.
1	1	0.01	0.01mm/min (inch/min) when "1" is set in file registers.

(4) Feedrate clamp (max. feedrate) depends on setting of axis parameter (cutting feedrate clamp) when "Rapid traverse" signal (RT) is OFF.

(Note 1) During incremental feed mode, the true feedrate does not change even when the manual feedrate setting is changed while feed motion is going on.

(Note 2) As for file registers (Rn and Rn+1), Rn is of low order.
Of the file registers Rn and Rn+1 to designate the feedrate, if the value is 2-bytes (one word), the high-order side does not need to do anything.

[Related signals]

(1) Manual feedrate code m (*JV1 to *JV16: YC70 to YC74)

(2) Manual feedrate method selection (JVS: YC77)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL FEEDRATE B		R2506,7	R2706,7	R2906,7	R3106,7

[Function][Operation]

Designate the manual feedrate for the axis selected with the manual feedrate B valid signal.

[Caution]

(1) The speed designated with this register is valid for the manual feedrate of an axis for which the manual feedrate B valid signal is valid.

(2) Cutting override and manual override are invalid for this register's speed.

(3) This register is not related to the dry run speed.

(4) A binary value is directly set for this register. The setting unit is 0.01mm/min (°/min).

(5) This signal is a register common for all axes.

[Related signals]

(1) Manual feedrate B valid (FBEn:Y940 to 947)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	1ST HANDLE/INCREMENTAL FEED MAGNIFICATION		R2508,9	R2708,9	R2908,9	R3108,9

[Function]

By selecting the handle/incremental feed magnification method (MPS), an arbitrary magnification can be designated separately from magnification set by regular code method. Magnification value (multiplier) is set in file register (R) in binary.

When the "handle/incremental feed magnification method selection" signal (MPS) is ON, this magnification factor is applied for the hand pulse from handy terminal.

[Operation]

Magnification is applied to amount of feed per pulse in handle feed mode (output from manual pulse generator), or to amount of feed per signal in incremental feed mode (+J1, -J1, etc.).

When multiplier is "500" and one pulse is given in handle feed mode, for example, 500 μ m of feed motion occurs. When multiplier is "30000" and one feed command signal is given in incremental feed mode, 30mm of feed motion occurs (time constant for feed motion is equal to time constant for rapid traverse or step).

(Note 1) Change of magnification setting during feed motion is ignored.

(Note 2) Since considerably large magnification can be used, the signal should be used carefully.

[Related signals]

(1) Handle/Incremental feed magnification code m (MP1, MP2, MP4: YC80, YC81, YC82)

(2) Handle/Incremental feed magnification method selection (MPS: YC87)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	2ND HANDLE FEED MAGNIFICATION		R2510,1	R2710,1	R2910,1	R3110,1
A	3RD HANDLE FEED MAGNIFICATION		R2512,3	R2712,3	R2912,3	R3112,3

[Function]

By selecting the handle/incremental feed magnification method, an arbitrary magnification can be designated separately from magnification set by regular code method. Magnification value (multiplier) is set in file register (R) in binary.

Arbitrary magnification, when using 2nd and 3rd handles, is designated here.

[Operation]

When 1 pulse is sent by 2nd or 3rd handle, its feed amount conforms to this feed magnification.

For example, when 1 pulse is sent in handle mode with magnification set at "500", its feed amount will be 500 μ m.

(Note 1) Changing magnification during feed motion is invalid.

(Note 2) Considerably large magnification can be set in the handle/incremental feed magnification method. Pay extra attention when setting magnification.

[Related signals]

(1) Handle/incremental feed magnification code m (MP1,MP2,MP4:YC80,C81,C82)

(2) 1st handle/incremental feed magnification (R2508)

(3) Handle/incremental feed magnification method selection (MPS:YC87)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	PLC INTERRUPT PROGRAM NO.		R2518,9	R2718,9	R2918,9	R3118,9

[Function]

Set the program No. to execute the PLC interrupt.

[Operation][Caution]

Refer to "PLC interrupt (PIT)" for details of PLC interrupt operation.

[Related signals]

(1) PLC interrupt (PIT:YC2E)

(2) In PLC interrupt (PCINO:XC35)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD METER DISPLAY INTERFACE 1,2		R2520 to 3	R2720 to 3	R2920 to 3	R3120 to 3

[Function][Operation]

The load meter can be displayed on the coordinate value screen by just setting a value in the corresponding file register.
Refer to the section on "Load meter display" in the "PLC Programming Manual" for details.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL FEEDRATE B OVERRIDE		R2524	R2724	R2924	R3124

[Function]

Override for manual feedrate B valid axis is set.

[Operation]

The override set with this register will be valid for the axis selected with the manual feedrate B valid signal.
This register can be set within the range of 0 to 200% in 0.01% increment.
If a value larger than 200%(setting value=20000) is set, the value is regarded as 200% when operating.
This register is common for axes.

[Caution]

(1) When the manual feedrate B override commanded by the user PLC is "0"%, even if the feed axis selection signal for the axis selected by the manual feedrate B valid signal is turned ON, an error occurs and the axis will not move.
(2) For a linear axis, the manual feedrate B surface speed control is not valid. However, the manual feedrate B override is valid.
(3) In order to use manual feedrate B override, the manual feedrate B surface speed control option is required.

[Related signals]

(1) Manual feedrate B valid (FBEn:Y940 to Y947)
(2) Manual feedrate B surface speed control valid (YC7D)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 1ST AXIS TRAVEL AMOUNT		R2544,5	R2744,5	R2944,5	R3144,5

[Function]

This data specifies the travel amount or positioning point in manual arbitrary feed mode.

[Operation]

"Manual arbitrary feed 1st axis travel amount" is for the axis whose number is specified by "Manual arbitrary feed 1st axis selection code m" (CX11 to 116: YCA0 to YCA4).

"Manual arbitrary feed 1st axis travel amount" means differently depending on the statuses of the "Manual arbitrary feed MC/WK (CXS5)" and "Manual arbitrary feed ABS/INC (CXS6)" signals.

(1) When the Manual arbitrary feed ABS/INC (CXS6) signal is ON:
"Manual arbitrary feed 1st axis travel amount" specifies travel amount (increment).

(2) When the "Manual arbitrary feed ABS/INC (CXS6)" signal is OFF, it depends on the status of the "Manual arbitrary feed MC/WK (CXS5)" signal as follows:

(a) When the "Manual arbitrary feed MC/WK (CXS5)" signal is OFF:
"Manual arbitrary feed 1st axis travel amount" specifies a coordinate position (positioning point) of the machine coordinate system.

(b) When the "Manual arbitrary feed MC/WK (CXS5)" signal is ON:
"Manual arbitrary feed 1st axis travel amount" specifies a coordinate position (positioning point) of the modal workpiece coordinate system.

"Manual arbitrary feed 1st axis travel amount" is written in binary notation with a sign. The unit of the specified value matches that of data entered.

(Ex.)When (R2545, R2544)=1 is specified in micrometer system, axis motion is 1 μ m (at incremental specification).

[Caution]

"Manual arbitrary feed 1st axis travel amount" forms a data item by R2544 and R2545 or R2744 and R2745. Handle negative data carefully.

[Related signals]

For related signals, see the descriptions on "Manual arbitrary feed mode (PTP: YC03)".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 2ND AXIS TRAVEL AMOUNT		R2548,9	R2748,9	R2948,9	R3148,9

[Function][Operation]

"Manual arbitrary feed 2nd axis travel amount" is for the axis whose number is specified by "Manual arbitrary feed 2nd axis selection code m (CX21 to CX216)".

The other conditions are the same as for "Manual arbitrary feed 1st axis travel amount" explained in the previous section.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MANUAL ARBITRARY FEED 3RD AXIS TRAVEL AMOUNT		R2552,3	R2752,3	R2952,3	R3152,3

[Function][Operation]

"Manual arbitrary feed 3rd axis travel amount" is for the axis whose number is specified by "Manual arbitrary feed 3rd axis selection code m (CX31 to CX316)."

The other conditions are the same as for "Manual arbitrary feed 1st axis travel amount" explained in the previous section.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ALARM MESSAGE I/F 1 to 4		R2556 to 9	R2756 to 9	R2956 to 9	R3156 to 9

[Function]

Desired alarm messages prepared using PLC development tool (personal computer) can be displayed in ALARM DIAGNOSIS screen of the setting and display unit by setting values (binary code) to alarm interface file registers (Rn, Rn+1, Rn+2, Rn+3).

[Operation]

If table No. of previously prepared alarm message table has been set to alarm interface file registers, alarm message, if alarm occurs, can be displayed in ALARM DIAGNOSIS screen.Maximum 4 alarm messages can be displayed at the same time.

Alarm message can be cleared by setting "0" to alarm interface file registers.

For details of alarm message display, refer to the "PLC Programming Manual".

[Caution]

(1) Set machine parameter PLC "#6450 bit 0" to 1 to display the alarm messages.

(2) For alarm message interface, file register (R method) or temporary storage (F method) can be used. The selection is made with machine parameter PLC "#6450 bit 1".

(3) In both R method (file register) and F method (temporary storage), alarm does extend to the controller.When it is desirous to stop controller operation according to alarm type, signals such as "Automatic operation "pause" command" (*SP) signal, "Single block" (SBK) signal and "Interlock" signal should be processed on the PLC side.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	OPERATOR MESSAGE I/F		R2560	R2760	R2960	R3160

[Function]

Desired operator message prepared using PLC development tool (personal computer) can be displayed by setting value (binary code) to operator message interface file register (Rn). Operator message appears in ALARM DIAGNOSIS screen of the setting and display unit.

[Operation]

If table No. of previously prepared operator message table has been set to operator message interface file register, operator message can be displayed in ALARM DIAGNOSIS screen.Operator message can be cleared by setting "0" to operator message interface file register.

For details of operator messages, refer to the "PLC Programming Manual".

[Caution]

(1) Set machine parameter PLC "#6450 bit 2" to 1 to display the operator messages.

(2) Display of operator message does not cause alarm on the controller side. When it is desirous to stop controller operation according to operator message, signals such as "Automatic operation "pause" command" (*SP) signal, "Single block" (SBK) signal and "Interlock" signal should be processed on the PLC side.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SEARCH & START PROGRAM NO.		R2562,3	R2762,3	R2962,3	R3162,3

[Function]

The No. of the program to be searched with search & start is designated.

[Operation]

Set the No. of the program to be searched with search & start with a binary value.

(Note 1) The program No. must be set before the "Search & start" signal is input.

(Note 2) If a machining program No. is not designated or if an illegal No. is designated, and error signal will be output when the search operation is executed.

[Related signals]

(1) Search & start (RSST: YC31)

(2) Search & start Error (SEE: XC8A)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ENCODER SELECTION		R2567	R2767	R2967	R3167

[Function]

Using a binary setting, select which spindle's encoder feedback to use.

0: 1st spindle1: 2nd spindle2: 3rd spindle3: 4th spindle4: 5th spindle5: 6th spindle

(Note) If a setting exceeds the number of connected spindles, it will be interpreted that a selection has not been made.

[Related signals]

(1) Spindle selection (SWS: X18A8)
(2) Spindle command selection (SLSP: R7002)
(3) Spindle stop (SSTP: Y1894)
(4) Spindle enable (ENB: X18A0)
(5) Spindle forward run start (SRN: Y1898)
(6) Spindle reverse run start (SRI: Y1899)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	C AXIS SELECTION		R2568	R2768	R2968	R3168

[Function]

The "C axis selection" signal is used to issue the commands with the axis name command address to the axis selected from the Spindle/C-axis having the same axis name in the part system.

[Operation]

Using the axis number, set which spindle or C axis to output the commands to.

0: First C axis, 1: 1st axis, 2: 2nd axis, 3: 3rd axis, 4: 4th axis, ... 8: 8th axis

The setting is made with the axis number used in the part system.

(Note 1) This signal must always be input simultaneously with the "Recalculation request" signal (CRQ).
(Note 2) This signal is valid even when the multi-spindle function is invalid.
(Note 3) If an axis name (#1013 axname) is different from the initial C axis name, "M01 OPERATION ERROR 1031" will occur.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR TEACHING AXIS SELECTION		R2580	R2780	R2980	R3180

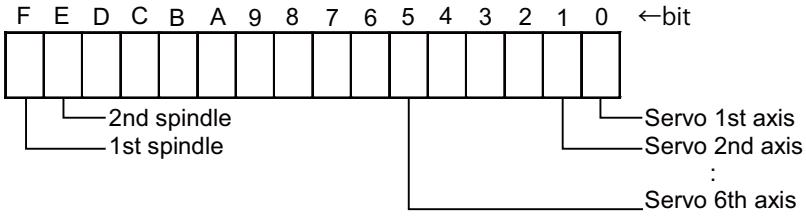
[Function]

The axis for teaching and monitor operations is designated.

[Operation]

The axis for teaching and monitor operations is designated with bit correspondence.

Teaching and monitor operations are carried out to all axes designated with this signal.



[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC3 to YCC7)
(4) Load monitor Load change rate detection axis, Teaching data sub-No. (R2581, R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR LOAD CHANGE RATE DETECTION AXIS		R2581	R2781	R2981	R3181

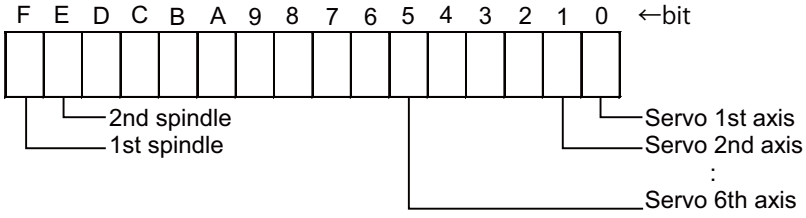
[Function]

The axis targeted for the change rate detection is designated.

[Operation]

With bit correspondence, designate the axis for detecting the change rate when judging the start of actual cutting during teaching and monitor operation.

If a change rate is detected for even one of the axes designated with this signal, it will be judged that actual cutting has started.



[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Teaching data sub-No. (R2580, R2582)
(5) Load monitor status (R596 to R605)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	LOAD MONITOR TEACHING DATA SUB-NO.		R2582	R2782	R2982	R3182

[Function]

The sub-No. for teaching and monitor operation is designated.

[Operation]

Designate the sub-No. of the data registered with teaching operation, and the sub-No. of data used for the monitor operation.

[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Load monitor In execution, Teaching mode valid, Monitor mode valid (XCA0 to XCA2)
(2) Load monitor Warning axis, Alarm axis, Data alarm information (R564 to R566)
(3) Load monitor Execution, Teaching mode, Monitor mode, Alarm reset, Warning reset (YCC3 to YCC7)
(4) Load monitor Teaching axis selection, Load change rate detection axis (R2580, R2581)
(5) Load monitor status (R596 to R605)

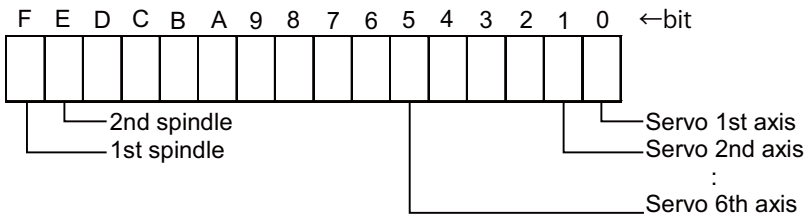
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	ADAPTIVE CONTROL BASIC AXIS SELECTION		R2583	R2783	R2983	R3183

[Function]

The basic axis for adaptive control is designated.

[Operation]

Designate which of the actual load's detection axes is targeted for adaptive control.
Only one of the monitor target axes is designated.



[Caution]

(1) This signal is prepared for a specific machine tool builder.

[Related signals]

(1) Adaptive control in execution (XCA3)
(2) Adaptive control execution (YCC9)
(3) Adaptive control override (R571)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	EACH AXIS REFERENCE POSITION SELECTION		R2584	R2784	R2984	R3184

[Function]

Select the each axis reference position return position for manual reference position return.

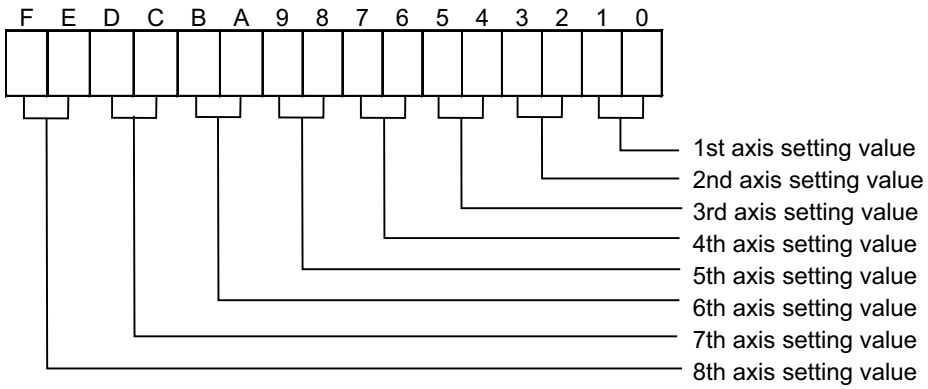
[Operation]

(1) This signal is valid when the reference position select method is ON.

(2) Two bits are used for each axis to select the reference position.

(a) R register and corresponding axis

Each axis reference position selection



(b) Setting value and reference position No.

High-order bit	Low-order bit	Return position
0	0	1st reference position
0	1	2nd reference position
1	0	3rd reference position
1	1	4th reference position

[Related signals]

(1) Reference position selection method (M:YC97)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CHOPPING CONTROL DATA ADDRESS		R2587	R2787	R2987	R3187

[Function][Operation]

This signal designates the chopping control data head No. (R register No.) assigned to R register.

R register area that can be used for assigning the chopping control data is as shown below.

R8300 to R9768 (Backup area)

R9800 to R9886 (Non back up area)

[Caution]

(1) Setting error occurs if an odd number is set.

(2) When the backup area is used, set the area ahead of the compensation amount record area (#1324 chop_R).

(3) Error occurs if the chopping control data overlaps with the other part system or the compensation amount record area.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE MANAGEMENT DATA SORT		R2588	R2788	R2988	R3188

[Function][Operation]

This signal is a flag for tool life data sort necessary/unnecessary.

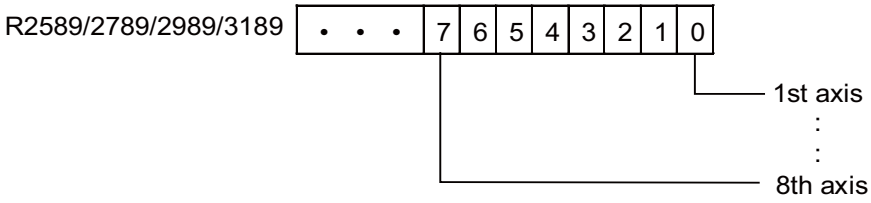
Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SYNCHRONOUS CONTROL OPERATION METHOD		R2589	R2789	R2989	R3189

[Function][Operation]

(1) Synchronous control

Synchronous control for the 1st part system is designated with the R2589 register, and for the 2nd part system with the R2789 register.

Synchronous control can be turned ON and OFF by setting the bits corresponding to each axis in the R2589/2789/2989/3189 registers. The CNC changes the operation when all axes reach the in-position state.



(a) Designating the synchronous operation method

Turn ON both bits corresponding to the axis related to the basic axis and synchronous axis with the base specification parameter "#1068 slavno".

(Example) To operate the 2nd axis (basic axis) and 3rd axis (synchronous axis) in synchronization

	7 6 5 4 3 2 1 0 HEX
R2589	o o o o o o o o 0 0 o o o o o 1 1 o 0 6

(b) Designating the independent operation method

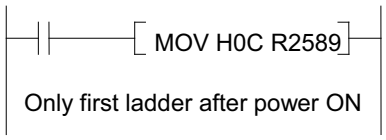
Turn ON only the bit corresponding to only one of the axes to be moved with the basic axis command.

(Example) To move only the 3rd axis (synchronous axis)

	7 6 5 4 3 2 1 0 HEX
R2589	o o o o o o o o 0 0 o o o o o 1 o o 0 4

If, due to the machine structure, the synchronous state must always be entered immediately after the power is turned ON, set the R2589 register with the first ladder after the power is turned ON.

Example of ladder creation



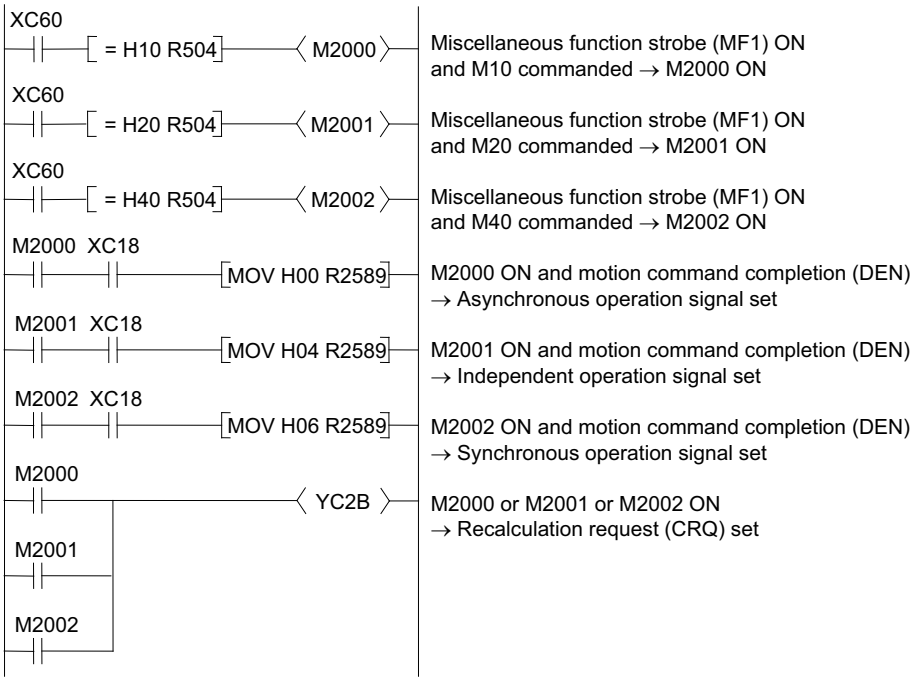
(Note) The registers R2789 and later are used for the 2nd to 4th part system.

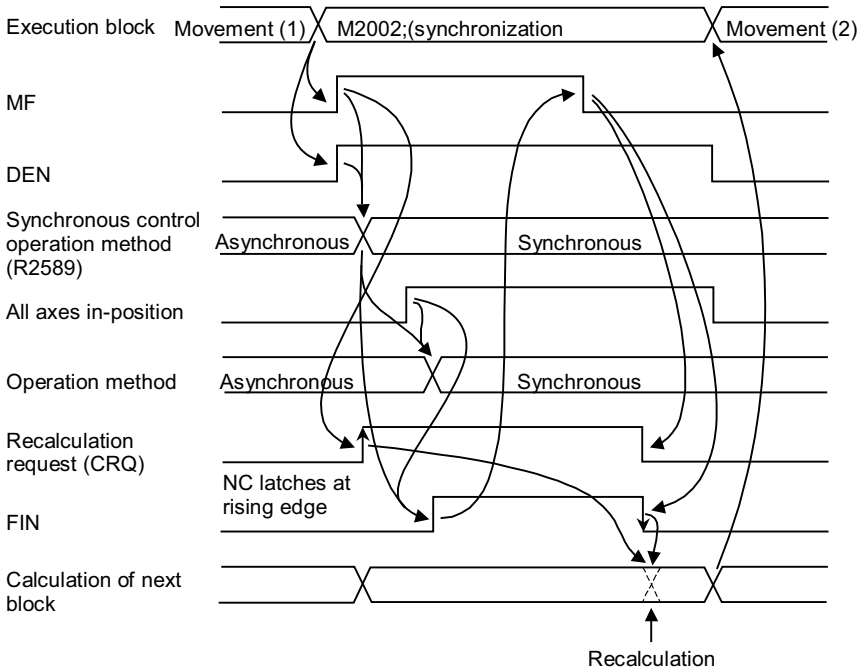
When changing the operation with the R2589/2789/2989/3189 register during automatic operation, calculate the coordinates again.

After synchronous axis independent operation is carried out, the end point coordinates of the synchronous axis are substituted in the program end point coordinates for the basic axis. Thus, if the coordinates are not recalculated, the basic axis' movement command will not be created properly.

Request recalculation immediately after the R2589/2789/2989/3189 register is changed.

<Example of ladder creation>
Basic axis: 2nd axisSynchronous axis: 3rd axis
When M code is assigned to each:
M10: Asynchronous operation
M20: Independent operation
M40: Synchronous operation





[Caution]

(1) During synchronous operation or independent operation, the basic axis signals are valid for the "Interlock" and "Machine lock" signals, etc.

(2) The synchronous axis will return to the reference position in synchronization with the basic axis if G27, G28 or G30 is commanded during synchronous operation. If the synchronous axis is at the reference position when the basic axis completes reference position return, the reference position return will be completed. If the synchronous axis is not at the reference position when the basic axis completes reference position return, the "Reference position reached" signal for the basic axis will not be output.

(3) The position switches are processed independently for the basic axis and synchronous axis.

(4) Input the same OT signal for the basic axis and synchronous axis.
Set the same soft limit value for the basic axis and synchronous axis.
If the above settings cannot be made because of the machine specifications, observe the following points.
- If OT or soft limit occurs during the manual operation mode, an alarm will occur only for the synchronous axis, and the basic axis will not stop.Thus, make sure that the basic axis alarm turns ON before the synchronous axis.
- OT during the manual operation mode will cause the synchronous axis to stop when the OT signal for only the basic axis turns ON. The basic axis is stopped by the position controller, and the synchronous axis is stopped by the NC control unit.Thus, there may be a difference in the stop positions. If an excessive error alarm occurs because of OT, enter the correction mode, and cancel the alarm.

(5) The basic axis independent operation is handled as asynchronous, so the PLC input/output signal is not reflected on the synchronous axis.

(6) When the parameter "#1281 ext17/bit6" is ON, changing the "Synchronization control operation method" immediately changes the compensation amount of the synchronous axis in the external machine coordinate system compensation or the ball screw thermal expansion compensation:
- When the synchronous operation is changed to the independent operation; the basic axis compensation amount changes to the synchronous axis compensation amount.
- When the independent operation is changed to the synchronous operation; the synchronous axis compensation amount changes to the basic axis compensation amount.

(7) When the synchronous operation is set by the "Synchronization control operation method" while the parameter "#1281 ext17/bit6" is ON, the ball screw thermal expansion compensation is executed for the synchronous axis with the base axis compensation amount. R72 to R75, however, indicate each axis compensation amount.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL GROUP NO. DESIGNA-TION		R2590,1	R2790,1	R2990,1	R3190,1

[Function]

The group No. is designated when clearing usage data of a group that has exceeded lifetime with the tool life management II or when forcibly changing tools currently in use.

[Operation]

The group designation range is as follows.

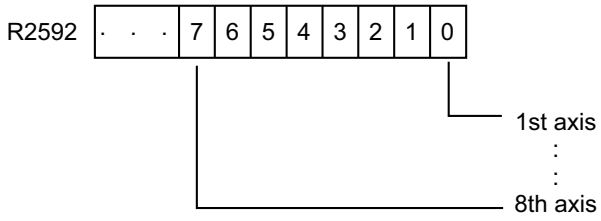
For group designation: 1 to 9999 of group No.

For all groups: 65535(all 1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	REFERENCE POSITION ADJUSTMENT COMPLETION		R2592	R2792	R2992	R3192

[Function][Operation]

Upon the completion of the reference position adjustment to determine the reference position in the dog-type reference position return, input the bit, which corresponds to the master axis in the part system, from PLC.
Then, turn OFF this signal after the corresponding bit of "Reference position adjustment value parameter setting completed" signal is turned ON.
When the axis is outside the position switch range, execute an interlock on the axis and prohibit the movement of the axis targeted at by the position switch.



(Example)If the 2nd axis is the master axis, set the bits as follows after the completion of the reference position adjustment for the slave axis.

	7 6 5 4 3 2 1 0 HEX
R2592	o o o o o o o o 0 0 o o o o o o 1 o 0 2

[Caution]

A change of the reference position adjustment value requires another reference position return. If the automatic operation stars without the reference position return, an alarm occurs to inform the uncompleted return.

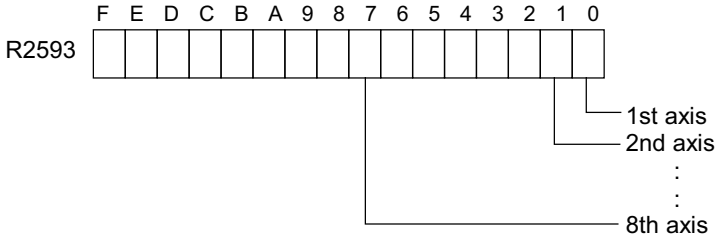
[Related signals]

(1) Reference position adjustment value parameter setting completed (R576)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CURRENT LIMIT CHANGEOVER		R2593	R2793	R2993	R3193

[Function][Operation]

Droop will be released when the corresponding bit for the droop release request signal is OFF.



[Related signals]

(1) In current limit n-th axis (ILI1 to 8: X900 to 7)
(2) Current limit reached n-th axis (ILA1 to 8: X920 to 7)
(3) Current limit changeover n-th axis (ILC1 to 8: Y9A0 to 7)
(4) Droop release request n-th axis (DOR1 to 8: Y9C0 to 7)
(5) Current limit mode 1 and 2 (ILM1,2: YCC0,1)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	WEAR COMPENSATION NO. (Tool presetter)		R2594	R2794	R2994	R3194

[Function]

To clear the wear compensation amount after measuring the tool compensation amount with manual tool length measurement, set the wear compensation No. in a BCD code.

[Operation]

When the sensor is touched by the tool, wear data of the compensation No. automatically specified will be cleared to 0. If 0 or a non-existing compensation No. is set, the wear data will not be cleared.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	WORKPIECE COORDINATE OFFSET MEASUREMENT TOOL COMPENSATION NO./ SELECTED COMPENSATION TOOL NO.		R2600,1	R2800,1	R3000,1	R3200,1

[Function]

(1) External workpiece coordinate offset measurement function
Set the tool No. (R2602, 2603) and the tool compensation No. (R2600, 2601) used for workpiece coordinate offset measurement in a BCD code.

(2) Chuck barrier check
Set the tool No. (R2602, 2603) and the compensation No. (R2600, 2601) selected for the chuck barrier check.

[Operation]

(1) External workpiece coordinate offset measurement function
Set the tool No. and the tool compensation No. used for workpiece coordinate offset measurement in a BCD code. This is set with the user PLC.This tool No. (R2602, 2603) is interpreted as the tool offset No. by the CNC.

(2) Chuck barrier check
The file register used differs according to the parameter (#1097 Tlno.)

#1097 Tlno.	R2600,2601/R2800,2801	R2602,2603/R2802,2803
0	Tool length, tool nose wear offset No.	Tool No.
1	Tool nose wear offset No.	Tool No., tool length compensation No.

If the tool length compensation No. is not designated (if the contents are 0), the tool length and tool nose wear offset will both follow the T command modal.
The T command modal will also be followed if the designated offset No. is not within the specified range.
If the T command modal value is 0, the compensation amount will be interpreted as 0.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	WORKPIECE COORDINATE OFFSET MEASUREMENT TOOL NO.(Main)/ /SELECTED TOOL NO.		R2602,3	R2802,3	R3002,3	R3202,3

[Function][Operation]

Refer to the explanation for R2600 and R2601 for details.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SELECTION TOOL COMPENSATION NO. (Sub)		R2604,5	R2804,5	R3004,5	R3204,5

[Function]

(1) Workpiece coordinate offset measurement function
Set the tool compensation No. used in the sub spindle side for external workpiece coordinate offset measurement in a BCD code.

(2) Chuck barrier check
Designate the tool No. and compensation No. selected on the sub-spindle side for chuck barrier check.

[Operation]

(1) Workpiece coordinate offset measurement function
Set the tool compensation No. used in the sub spindle side for external workpiece coordinate offset measurement in a BCD code.

(2) Chuck barrier check
The file register used differs according to the parameter (#1097 Tlno.)

#1097 Tlno.	R2604,2605/R2804,2805	R2606,2607/R2806,2807
0	Tool length, tool nose wear offset No.	Tool No.
1	Tool nose wear offset No.	Tool No., tool length compensation No.

If the tool length compensation No. is not designated (if the contents are 0), both the tool length and tool nose wear offset follow the details designated for the main spindle. The details for the main spindle will also be set if the designated offset No. is not within the specified range.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SELECTION TOOL WEAR NO. (Sub)		R2606,7	R2806,7	R3006,7	R3206,7

[Function][Operation]

Refer to the section for the "Selection tool compensation No. (sub) (R2604, 5)".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL MOUNTING INFORMATION m		R2608,9	R2808,9	R3008,9	R3208,9

[Function]

Designate the presence of a tool mounted on the tool post (tool compensation amount validity).

[Operation]

When the tool designated for tool mounting is selected, the tool compensation amount will be added to the chuck barrier check.

<Bit allocation>

Tool mounting information (high order) R2609/ R2809	bitF	bitE	bitD	bitC	bitB	bitA	bit9	bit8
	Tool 32	Tool 31	Tool 30	Tool 29	Tool 28	Tool 27	Tool 26	Tool 25
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	Tool 24	Tool 23	Tool 22	Tool 21	Tool 20	Tool 19	Tool 18	Tool 17

Tool mounting information (low order) R2608/ R2808	bitF	bitE	bitD	bitC	bitB	bitA	bit9	bit8
	Tool 16	Tool 15	Tool 14	Tool 13	Tool 12	Tool 11	Tool 10	Tool 9
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	Tool 8	Tool 7	Tool 6	Tool 5	Tool 4	Tool 3	Tool 2	Tool 1

Bit OFF: Tool not mounted (tool compensation amount not added)

Bit ON: Tool mounted (tool compensation amount added)

In a machine that uses tools 1 to 12 on the main spindle's tool post and tools 17 to 28 on the sub-spindle's tool post, if the tools are mounted in either tool post, H0FFF is set for both R2608 and R2609.

When tool 28 is detached from the sub-spindle side next, R2609 will be set to H07FF.

[Remark]

This signal is initialized to HFFFF when the power is turned ON.

Thus, if this signal is not used, the tool compensation amount will always be added to the chuck barrier check.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LENGTH MEASUREMENT 2 TOOL NO.		R2618	R2818	R3018	R3218

[Function]

Set the compensation No. of the tool data for setting the measurement result during manual tool length measurement II. This is set in BCD code.

[Operation]

When the sensor is touched by the tool, compensation amount will be written into the tool data of the compensation No. automatically specified.

This tool No. is interpreted as the tool compensation No. by the CNC.

[Related signals]

(1) Wear compensation No. (R2594)

(2) Tool length measurement 2 (TLMS: YC21)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SERVO READY COMPLETION OUTPUT DESIGNATION		R2625	R2825	R3025	R3225

[Function]

"Servo ready completion" (SA) signal indicates that the servo system is ready for normal operation. The signal can be output to a Y device of remote I/O, which is designated by this register.

The direct transfer of the signal from CNC to remote I/O allows the output of the signal during PLC is stopped.

[Operation]

The first setting data since the power ON is valid.Only the first setting is valid. The value changed later is invalid.

The setting range is 1 to 5FF (HEX), except for 2C0 to 2FF.

If the first setting of Y device No. is out of range, the signal is not output to the Y device. To output the signal, turn the power ON again and then set the Y device No. again within the range.

[Caution]

(1) Setting "0" does not mean the output to Y0. This setting is invalid.

(2) If the "Servo ready completion" signal is OFF on either of the R registers (among R2625/R2825/R3025/R3225) with the overlapped setting value, the signals to be output to Y device turn OFF.

(3) Y2C0 to 2FF, which are used by the system, cannot be set as servo ready completion output designation.

(4) This register, if designated after the "Servo ready completion" signal is ON without initial ladders, turns valid from the time of the setting and the signal is output to Y device.

(5) The devices Y300 to Y5FF are available when the external PLC link such as PROFIBUS-DP and CC-Link is connected.

(6) Do not control the designated Y devices with user PLC. When the device is controlled with user PLC, the "Servo ready completion" signal is overwritten and turns invalid.

(7) If the servo ready completion output designation, which has not been set with this register, is written twice in 1 scan of user PLC, the latter setting is valid.

[Related signals]

(1) Servo ready completion (SA: XC11)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	MECHANICAL AXIS SPECIFICATIONS 1ST ROTARY AXIS ANGLE		R2628,9	R2828,9	R3028,9	R3228,9
A	MECHANICAL AXIS SPECIFICATIONS 2ND ROTARY AXIS ANGLE		R2630,1	R2830,1	R3030,1	R3230,1

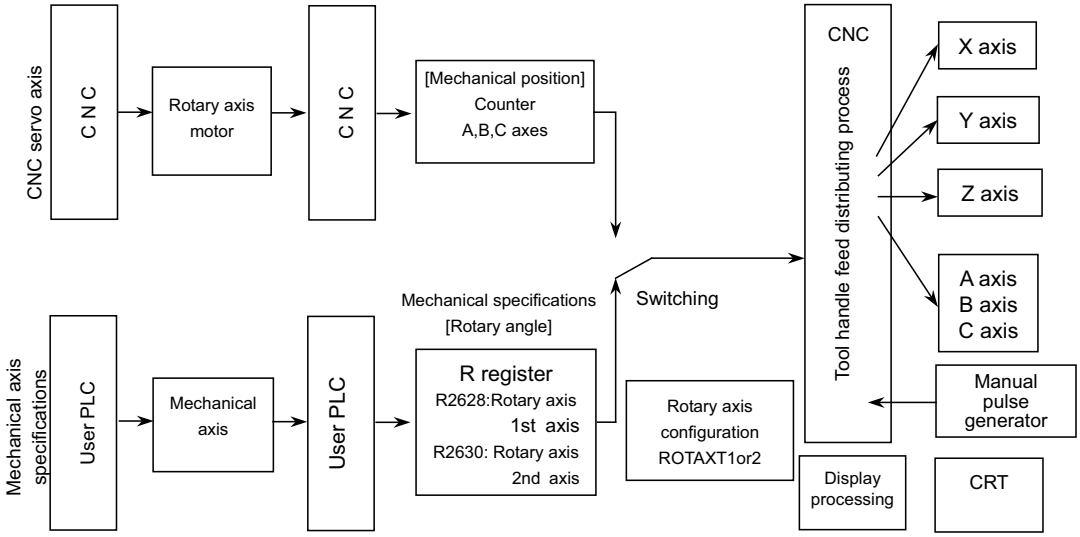
[Function]

This signal sets rotary axis angle of the mechanical axis specifications.

The setting range is 0 to ±720000(1degree/1000).

[Operation]

When handle-feeding to tool axis direction/tool radius direction in the mechanical axis specifications, the rotary axis angle can be input by writing the angle in R register with the user PLC.



R register	Details	Input range
R2628 R2629	Mechanical specifications rotary axis 1st angle R2628(low order)/R2629(high order)	0 to ± 720000 (1degree/1000)
R2630 R2631	Mechanical specifications rotary axis 2nd angle R2630(low order)/R2631(high order)	0 to ± 720000 (1degree/1000)

(Example) Writing 90 degree on A axis and 180 degree on C axis with A-C axes configuration is shown as below.

A axis: 90 angle × 1000 1/1000degree = 90000 System unit

```
 ┤ ├─[ DMOV   K90000   R2628]─
```

C axis: 180 angle × 1000 1/1000degree = 180000 System unit

```
 ┤ ├─[ DMOV   K180000   R2630]─
```

[Caution]

(1) Tool center point rotary mode cannot be used during the mechanical axis in use.

(2) Do not change the rotary axis angle of the mechanical axis during tool handle feed & interruption.

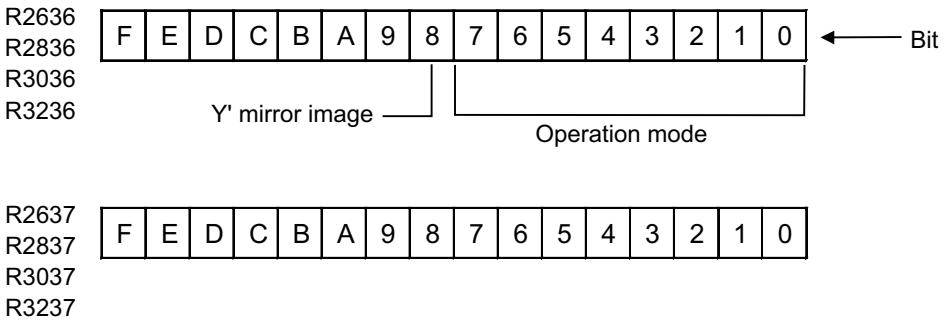
(3) When angle of the mechanical axis is written in R register, only for the tool center point value counter on the position display screen will be updated. Other counters will not be updated.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE OPERATION MODE DATA		R2636,7	R2836,7	R3036,7	R3236,7

[Function]

The operation mode for the circular feed in manual mode is designated.

[Operation]



- Operation mode: Designate the coordinate setting.

Setting value	Description
1	Linear-linear coordinate is selected.
2	Circular-linear coordinate is selected. ("+" indicates the CW direction of X'.)
3	Circular-linear coordinate is selected. ("+" indicates the CCW direction of X'.)

The setting value other than above is invalid.

- Y' mirror image: Reverse the "+" direction of Y'.

Setting value	Description
1	Y' mirror image is not valid
2	Y' mirror image is valid

[Caution]

(1) This data is valid when the "Circular feed in manual mode valid" signal is ON.

(2) The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE BASIC POINT X DATA		R2644,5	R2844,5	R3044,5	R3244,5
A	CIRCULAR FEED IN MANUAL MODE BASIC POINT Y DATA		R2648,9	R2848,9	R3048,9	R3248,9

[Function]

Designate a basic point on the hypothetical coordinate.

[Operation]

Designate a basic point on the hypothetical coordinate using the machine coordinate system.

The setting range differs in each PLC setting unit.

	PLC setting unit	
	mm	inch
(B)	± 99999.999mm	± 3937.0078inch
(C)	± 9999.9999mm	± 393.70078inch

[Caution]

(1) This data is valid when the "Circular feed in manual mode valid" signal is ON.

(2) The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.

(3) The basic point coordinate is designated with "0.5*PLC setting unit"

(4) When "1" is set to the parameter "#1040 M_inch", set the data by inch.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE X+ DATA		R2652,3	R2852,3	R3052,3	R3252,3
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE X- DATA		R2656,7	R2856,7	R3056,7	R3256,7
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE Y+ DATA		R2660,1	R2860,1	R3060,1	R3260,1
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE Y- DATA		R2664,5	R2864,5	R3064,5	R3264,5

[Function]

Designate the travel range on the hypothetical coordinate.

[Operation]

Designate the travel ranges with the value in the "+" or "-" direction on the hypothetical coordinate. Set the hypothetical coordinate value in the following state.

"Linear-linear" hypothetical coordinate	Y' axis: mirror image is not valid
"Circular-linear" hypothetical coordinate	X' axis: "+" indicates the inverse (CW) direction Y' axis: mirror image is not valid

In the "circular-linear" mode, set the travel range of X' by the angle from the basic point on the hypothetical coordinate. The setting range differs in each PLC setting unit.

	PLC setting unit		
	mm	inch	angle
(B)	± 99999.999mm	± 3937.0078inch	± 360.000°
(C)	± 9999.9999mm	± 393.70078inch	± 360.0000°

[Caution]

(1) The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.
(2) The basic point is treated as zero point on the hypothetical coordinate.
(3) The basic point coordinate is designated with "0.5*PLC setting unit"
(4) When "1" is set to the parameter "#1040 M_inch", set the data by inch.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE GRADIENT/ARC CEN-TER X DATA		R2668,9	R2868,9	R3068,9	R3268,9
A	CIRCULAR FEED IN MANUAL MODE GRADIENT/ARC CEN-TER Y DATA		R2672,3	R2872,3	R3072,3	R3272,3

[Function]

Designate the gradient on the "linear-linear" hypothetical coordinate, or the arc center on the "circular-linear" hypothetical coordinate.

[Operation]

How to designate differs in each operation mode.

Operation mode is "1"	Use the X-Y ratio to designate the gradients of X axis on the machine coordinate and X' axis on the hypothetical coordinate. Signs are available. "+" indicates the CCW direction from the X axis. If the gradient is 45°, X and Y should have the same value.
Operation mode is 2 or 3	Designate an arc center on the hypothetical coordinate using the machine coordinate system.

The setting range differs in each PLC setting unit.

	PLC setting unit	
	mm	inch
(B)	± 99999.999mm	± 3937.0078inch
(C)	± 9999.9999mm	± 393.70078inch

[Caution]

(1) This data is valid when the "Circular feed in manual mode valid" signal is ON.
(2) The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.
(3) The basic point coordinate is designated with "0.5*PLC setting unit"
(4) When "1" is set to the parameter "#1040 M_inch", set the data by inch.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	EXT. MACHINE COORDINATE SYSTEM OFFSET DATA n-TH AXIS		R5700 to 15	R5716 to 31	R5732 to 47	R5748 to 63

[Function]

This data compensates the basic machine coordinate system. The axis moves the amount equivalent to the set data (machine error compensation unit). The entire coordinate system value, including the basic machine coordinate system, will not change.

[Operation]

When the "Ext. machine coordinate system offset data" (R5700 to 15) is set, the axis will move the amount equivalent to that set value.

The entire coordinate system value, including the basic machine coordinate system, will not change.

If the changed amount of the set value exceeds the rapid traverse feedrate, the set value turns invalid: the compensation is executed with the set value unchanged.

<Data range>

80000000 (HEX) to 7FFFFFFF (HEX) (Absolute compensation amount -2147483648 to 2147483647)

Unit: Machine error compensation unit

[Related signals]

(1) Ext. machine coordinate system offset data illegal n-th axis (XA40 to XA47)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	EACH AXIS MANUAL FEEDRATE B n-TH AXIS		R5764 to R5779	R5780 to R5795	R5796 to R5811	R5812 to R5827

[Function]

When the each axis manual feedrate B valid signal is valid, designate the manual feedrate for the axis selected with the manual feedrate B valid signal.

[Operation]

(1) When the each axis manual feedrate B valid signal is valid, the each axis speed designated with this register is valid for the manual feedrate of an axis for which the manual feedrate B valid signal is valid.
(2) Cutting override and manual override are invalid for this register's speed.
(3) This register is not related to the dry run speed.
(4) A binary value is directly set for this register. The setting unit is 0.01mm/min (°/min).
(5) This signal is a register independent for each axis.

[Related signals]

(1) Manual feedrate B valid (FBEn:Y940 to Y947)
(2) Each axis manual feedrate B valid (YC7C)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO INPUT #1032 (PLC -> NC)		R6436,7	R6444,5	R6452,3	R6460,1

[Function]

This is interface function used to coordinate user PLC to user macro.

(Note) The other signals from R0 to R99 are PLC inputs, but this signal is output to the NC from PLC.

[Operation]

The data set in file registers Rn and Rn+1 with the user PLCs, can be referred to on the user macro side with the user macro system variables #1000 to #1031 or #1032.

The relationship between system variable and file register is as follows:

System variable	Points	Interface input signal	System variable	Points	Interface input signal
#1000	1	Register R6436 bit 0	#1016	1	Register R6437 bit 0
#1001	1	Register R6436 bit 1	#1017	1	Register R6437 bit 1
#1002	1	Register R6436 bit 2	#1018	1	Register R6437 bit 2
#1003	1	Register R6436 bit 3	#1019	1	Register R6437 bit 3
#1004	1	Register R6436 bit 4	#1020	1	Register R6437 bit 4
#1005	1	Register R6436 bit 5	#1021	1	Register R6437 bit 5
#1006	1	Register R6436 bit 6	#1022	1	Register R6437 bit 6
#1007	1	Register R6436 bit 7	#1023	1	Register R6437 bit 7
#1008	1	Register R6436 bit 8	#1024	1	Register R6437 bit 8
#1009	1	Register R6436 bit 9	#1025	1	Register R6437 bit 9
#1010	1	Register R6436 bit 10	#1026	1	Register R6437 bit 10
#1011	1	Register R6436 bit 11	#1027	1	Register R6437 bit 11
#1012	1	Register R6436 bit 12	#1028	1	Register R6437 bit 12
#1013	1	Register R6436 bit 13	#1029	1	Register R6437 bit 13
#1014	1	Register R6436 bit 14	#1030	1	Register R6437 bit 14
#1015	1	Register R6436 bit 15	#1031	1	Register R6437 bit 15

System variable	Points	Interface input signal
#1032	32	Register R6436, R6437
#1033	32	Register R6438, R6439
#1034	32	Register R6440, R6441
#1035	32	Register R6442, R6443

This correspondence table shows the example for file registers R6436 and R6437.

File registers R6436 and R6437 correspond to system variables #1000 to #1031, and #1032 (32-bit data).

To use the R register of the 2nd and subsequent part system, set "1" to "#1230 set02/bit7".

[Related signals]

(1) User macro input #1033, #1034, #1035 (R6436/6437,R6438/6439,R6440/6441,R6442/6443)

(2) User macro output #1132, #1133, #1134, #1135 (R6372/6373,R6374/6375,R6376/6377,R6378/6379)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO INPUT #1033 (PLC -> NC)		R6438,9	R6446,7	R6454,5	R6462,3

[Function]

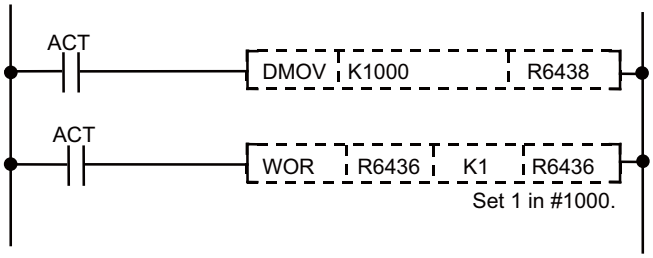
This provides interface function used to coordinate user PLC to user macro.

[Operation]

The data set in file registers Rn and Rn+1 with the user PLCs, can be referred to on the user macro side with the user macro system variables #1033.

(Example)

Sequence program



User macro program

```
IF [#1000  EQ  0]  GOTO  100
#100 = #1033
N100
```

The #1033(R6438, R6439) data is read into #100
Other than when #1000 is set to 0.

[Related signals]

(1) User macro input #1032, #1034, #1035 (R6436/6437,R6440/6441,R6442/6443)

(2) User macro output #1132, #1133, #1134, #1135 (R6372/6373,R6374/6375,R6376/6377,R6378/6379)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO INPUT #1034 (PLC -> NC)		R6440,1	R6448,9	R6456,7	R6464,5

[Function][Operation]

The function, operation, etc. are the same as those of "USER MACRO INPUT #1033".

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USER MACRO INPUT #1035 (PLC -> NC)		R6442,3	R6450,1	R6458,9	R6466,7

[Function][Operation]

The function, operation, etc. are the same as those of "USER MACRO INPUT #1033".

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE COMMAND ROTATION SPEED OUTPUT		R7000,1	R7050,1	R7100,1	R7150,1	R7200,1	R7250,1

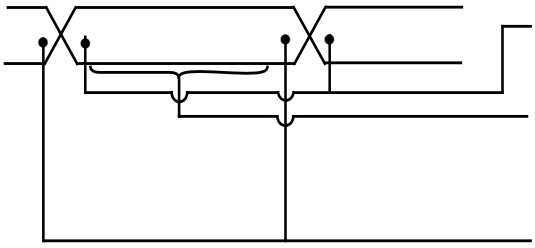
[Function]

By setting data of desired spindle speed to this signal, the spindle can be run at that speed.

[Operation]

When this signal is used, operation is same as the case where usual spindle command rotation speed input signal (R6500, 1) is given. Difference is that when data is set by user PLC, priority is given to that data over spindle (S) command data specified in automatic operation, or by manual command setting.

User PLC main (medium-speed) operation pattern



(1) "Spindle command rotation speed input data" is set to the "output data" at the head of user PLC main program (controller process).

(2) "Spindle command rotation speed output data" can be rewritten by user PLC within this interval if necessary (PLC process).

(3) "Spindle command rotation speed output data" is processed at the end of user PLC and signal is given to spindle controller (controller process).

(Note 1) "Spindle command rotation speed output data" is rewritten by user PLC for each scan (constant).

(Note 2) "Spindle speed override", "Spindle gear selection code 1,2 (GI1, GI2)", "Spindle stop (SSTP)", "Spindle gear shift (SSFT)" and "Spindle orientation (SORC)" conditions are added to "Spindle command rotation speed output data" and sent to the spindle controller.

(Note 3) For flow of spindle (S) function command data, data update timing, etc., refer to the section for normal "Spindle command rotation speed input" signal (R6500, 1).

[Related signals]

(1) Spindle command rotation speed input (R6500, R6501)

(2) Spindle command final data (R6502, R6503)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE COMMAND SELECTION	SLSP	R7002	R7052	R7102	R7152	R7202	R7252

[Function]

Set which the part system the S command is output from when the multiple-spindle control II is valid.

0: 1st part system
1: 2nd part system
2: 3rd part system
3: 4th part system

(Note) If a setting value exceeds the maximum number of part systems determined by specifications, it will be interpreted that a selection has not been made.

[Operation]

The S command for a spindle is output as the rotation speed command to the spindle which has been selected by the "Spindle selection" signal (SWS) ON from the PLC. The selected spindle rotates at the rotation speed which was output. The spindles which were de-selected by the "Spindle selection" signal (SWS) OFF continue to rotate at the same rotation speed as the speed immediately before their de-selection. This allows each spindle to be rotated simultaneously at a different rotation speed. The "Spindle command selection" signal is used to select which of the spindles is to receive the S command from which part system.

[Related signals]

(1) Spindle selection (SWS: Y18A8)
(2) Spindle stop (SSTP: Y1894)
(3) Spindle enable (ENB: X18A0)
(4) Encoder selection (R2567)
(5) Spindle forward run start (SRN: Y1898)
(6) Spindle reverse run start (SRI: Y1899)

Con-tact	Signal name	Signal ab-breviation	1st SP	2nd SP	3rd SP	4th SP
A	OPTIMUM ACCELERATION/DE-CELERATION PARAMETER GROUP SELECTION [SPINDLE] N-TH AXIS	SPESL1 to 4	R7003	R7053	R7103	R7153

[Function]

This signal selects the operation parameter group.

[Operation]

- Enter the operation parameter group from 0 to 3.
  0: Standard (standard inertial mass)
  1: Level 1 (medium inertial mass)
  2: Level 2 (big inertial mass)
  3: Level 3 (huge inertial mass)
- Select the parameter group with this register and specify the switching axis to "Optimum acceleration/deceleration parameter switching axis (axis and bit selection)" (R2617) or "Optimum acceleration/deceleration parameter switching axis (spindle and bit selection)" (R391). Then, turn "Optimum acceleration/deceleration parameter switching request [axis]" signal (YCD5) or "Optimum acceleration/deceleration parameter switch request [spindle]" signal (Y711) ON.
- If the value other than 0 to 3 is set, it will be handled as "0: Standard".

[Caution]

(1) This signal is prepared for a specific machine tool builder.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	S COMMAND OVERRIDE		R7008	R7058	R7108	R7158	R7208	R7258

[Function]

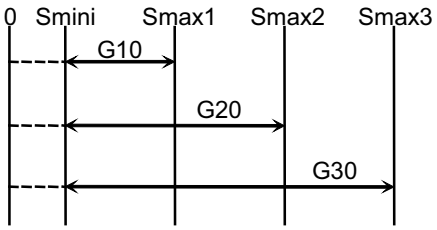
When "Spindle override method selection" signal is set to "file register method", override can be exerted on the spindle rotation speed besides the code method override (SP1 to SP4). Override can be exerted within range of 0% to 200% (1% increment). The value is set in the file register (R) in binary.

[Operation]

When this function is used, the true spindle speed is obtained by multiplying the originally set spindle speed by override ratio set with this signal.

Clamp spindle speed is the maximum or minimum speed set with parameters, which depends on "Spindle gear selection code 1,2" signal (GI1, GI2).

Even when spindle speed exceeds the maximum or minimum speed at the currently selected gear stage, due to change of override setting, "Spindle gear shift" signal (GR1, GR2) does not automatically change.



Applicable override range at gear stage 3

GR10 : Applicable override range at gear stage
GR20 : Applicable override range at gear stage
GR30 : Applicable override range at gear stage
Smini : Minimum spindle speed (parameter)
Smax1: Maximum spindle speed at gear stage 1 (parameter)
Smax2: Maximum spindle speed at gear stage 2 (parameter)
Smax3: Maximum spindle speed at gear stage 3 (parameter)

(Note) Override is not valid (100%) under the following condition:

(1) "Spindle stop" signal (SSTP) is ON.
(2) During tapping mode.
(3) During thread cutting.

[Related signals]

(1) Spindle speed override code m (SPn: Y1888)
(2) Spindle override method selection (SPS: Y188F)
(3) Spindle gear selection code 1,2 (GI1, GI2: Y1890, Y1891)
(4) Spindle stop (SSTP: Y1894)
(5) Spindle gear shift (SSFT: Y1895)
(6) Spindle orientation (SORC: Y1896)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	MULTI-POINT ORIENTATION POSITION DATA		R7009	R7059	R7109	R7159	R7209	R7259

[Function]

This signal, having the following two functions, is issued in respect to the high-speed serial connection specification spindle controller (spindle drive).

(1) Notification of orientation position to control unit (spindle controller) at orientation command.
Position data where the "Spindle orientation command" (ORC) is turned ON.

(2) During multi-point indexing, notification of indexing position during forward run indexing or reverse run indexing to control unit (spindle controller).
Position data where the "Spindle forward run index" (WRN), the "Spindle reverse run index" (WR1) is turned ON.

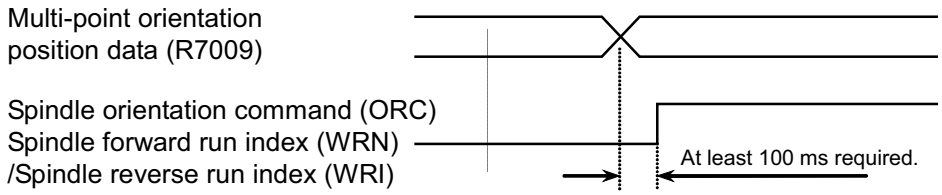
[Operation]

(1) Orientation command
The orientation position, at which the "Spindle orientation command" (ORC) turns ON, is input.
The values designated with the spindle parameter (In-position shift amount for orientation) and with "Multi-point orientation position data" signal are totaled to determine the orientation position.

(2) Multi-point indexing
Each time the "Spindle forward run index" (WRN) and "Spindle reverse run index" (WRI) turn ON, the axis rotates by the amount designated with the multi-point orientation position data.
When using MDS-D series drive unit, command value is handled as 16-bit binary data and its increment is as follows.
Command increment = 360/36000 (0.01°)

(3) Turret indexing
The turret angle is designated when the turret indexing is valid (when "#3121 tret" is set to "1").
The spindle rotation angle will be the multi-point orientation position data which is multiplied by the turret side gear ratio (in "#3122 GRC").

This signal must be validated before the "Spindle orientation command" signal turns ON (at least 100 ms before).



[Related signals]

(1) Spindle orientation command (ORC: Y189E)
(2) Spindle forward run index (WRN: Y189C)
(3) Spindle reverse run index (WRI: Y189D)

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION BASIC SPINDLE SELECTION		R7016	R7066	R7116	R7166	R7216	R7266

[Function]

Select the basic spindle to be used for synchronous control from the PLC.

[Operation]

Select the spindle to be controlled as the basic spindle from the serially connected spindles.
(0: 1st spindle), 1: 1st spindle, 2: 2nd spindle, 3: 3rd spindle, 4: 4th spindle, 5: 5th spindle, 6: 6th spindle

(Note 1) If a spindle that is not serially connected is selected, spindle synchronous control will not be executed.

(Note 2) If "0" is designated, the 1st spindle will be controlled as the basic spindle.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION SYNCHRONOUS SPINDLE SELECTION		R7017	R7067	R7117	R7167	R7217	R7267

[Function]

Select the synchronous spindle to be used for synchronous control from the PLC.

[Operation]

Select the spindle to be controlled as the synchronous spindle from the serially connected spindles.

(0: 2nd spindle), 1: 1st spindle, 2: 2nd spindle, 3: 3rd spindle, 4: 4th spindle, 5: 5th spindle, 6: 6th spindle

(Note 1) If a spindle that is not serially connected is selected or if the same spindle as the basic spindle is selected, spindle synchronous control will not be executed.

(Note 2) If "0" is designated, the 2nd spindle will be controlled as the synchronous spindle.

Con-tact	Signal name	Signal abbreviation	1stSP	2ndSP	3rdSP	4thSP	5thSP	6thSP
A	SPINDLE SYNCHRONIZATION PHASE SHIFT AMOUNT		R7018	R7068	R7118	R7168	R7218	R7268

[Function]

The synchronous spindle's phase shift amount can be designated from the PLC.

[Operation]

Designate the phase shift amount for the synchronous spindle.

Unit: 360°/4096

[Related signals]

(1) In spindle synchronization (SPSYN1: X18A8)
(2) Spindle rotation speed synchronization completion (FSPRV: X18A9)
(3) Spindle phase synchronization completion (FSPPH: X18AA)
(4) Spindle synchronization (SPSY: Y18B0)
(5) Spindle phase synchronization (SPPHS: Y18B1)
(6) Spindle synchronous rotation direction (Y18B2)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 4	AUXCM4	R8050	R8056	R8062	R8068	R8074	R8080

Con-tact	Signal name	Signal abbreviation	bit
A	Speed override 1 to 64	OV1 to OV64	AUXCM4/bit0 to 6

[Function][Operation]

This signal designates the override value added to the selected feedrate. Set a binary value for the override. Values over 100% are regarded as 100%.

Effective feedrate = (Selected speed * Speed override) / 100

Con-tact	Signal name	Signal abbreviation	bit
A	Speed override valid	OVR	AUXCM4/bit7

[Function][Operation]

This is a signal to validate the speed override. When this signal is turned OFF, the set feedrate becomes the operation speed without calculating the override.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 3	AUXCM3	R8051	R8057	R8063	R8069	R8075	R8081

Contact	Signal name	Signal abbreviation	bit
A	Station selection 1 to 256	ST1 to ST256	AUXCM3/bit0 to 8

[Function]

This signal designates an index station No. in the automatic operation mode.

[Operation]

Set an index station No. before inputting Operation start (ST) in the automatic operation mode.

Input a 9-digit binary number. An input "000000001" corresponds to station No.1.

This signal is read in at the startup of Operation start (ST). The signal changes are ignored after the startup.

When this signal is set to "000000000" and the automatic operation is started, a one station rotation special command will result. (Note that this cannot be used when the station positions are determined in non-uniform assignments.)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 2	AUXCM2	R8052	R8058	R8064	R8070	R8076	R8082

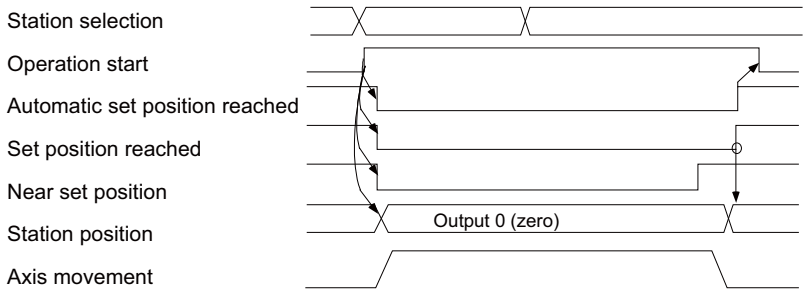
Contact	Signal name	Signal abbreviation	bit
A	Operation start	ST	AUXCM2/bit0

[Function][Operation]

When this signal is turned ON in an operation mode, the operation will start. The Operation start signal is handled as a status, so the ON status must be maintained until the operation is finished.

Operation movement in each operation mode

(1) Automatic operation mode



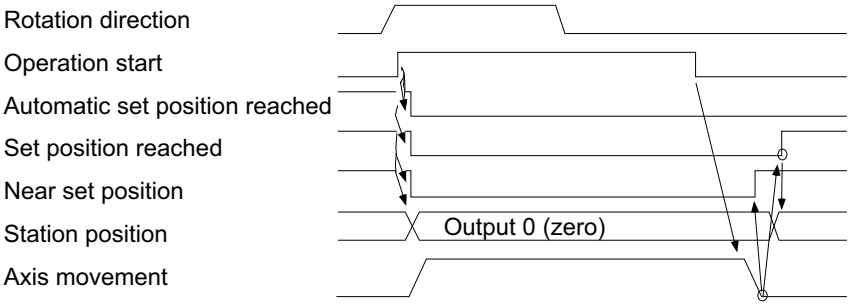
Station selection (ST1 to ST256) and Operation parameter selection (PR1, PR2) are established before inputting the Operation start signal. These two signals are read in by the startup of the Operation start signal, so they are held even if they are changed after the startup.

When the Operation start signal is input, the output signals related to the set position all turn OFF. Station position will be output as "0". When the positioning is completed, Automatic set position reached (JSTA) and Set position reached (JST) is output. Then turn the Operation start signal OFF.

When the Operation start signal is turned OFF during axis movement, the axis will stop at the nearest station. Note that for a linear axis, if there is not a nearest point in the movement direction, the commanded station becomes the nearest point.

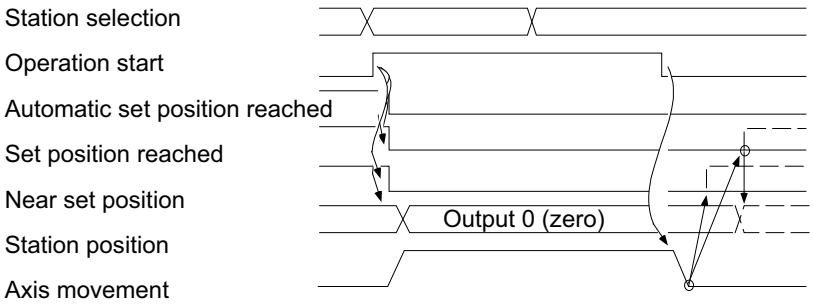
(Note) When the shortcut function is OFF for the rotating axis, the positioning direction can be designated with Rotation direction (DIR).

(2) Manual operation mode



Rotation direction (DIR) and Operation parameter selection (PR1, PR2) are established before inputting the Operation start signal. These two signals are read in by the startup of the Operation start signal, so they are held even if they are changed after the startup.
When the Operation start signal is input, the output signals related to the set position all turn OFF. Station position will be output as "0".
While the Operation start signal is ON, the rotation continues in the designated direction. When the Operation start signal is turned OFF, a positioning is carried out to the nearest station where the axis can stop in the rotation direction. Note that for a linear axis, if there is no nearest point in the movement direction, the axis will immediately decelerate to a stop.
When the positioning is completed, Set position reached (JST) is output.
(Note) Automatic set position reached (JSTA) will not be output.

(3) JOG operation mode



Rotation direction (DIR) and Operation parameter selection (PR1, PR2) are established before inputting the Operation start signal. These two signals are read in by the startup of the Operation start signal, so they are held even if they are changed after the startup.
When the Operation start signal is input, the output signals related to the set position all turn OFF. Station position will be output as "0". While the Operation start signal is ON, the rotation continues in the designated direction. When the Operation start signal is turned OFF, the axis decelerates to a stop. Set position reached (JST) and Near set position (NEAR) are output if the axis is stopped within each tolerable width from the station position.

Con-tact	Signal name	Signal ab-breviation	bit
A	Rotation direction	DIR	AUXCM2/bit1

[Function]

This signal designates the rotation direction of the operation in each operation mode.

[Operation]

Turn this signal ON to designate the rotation direction before inputting the Operation start (ST) signal.
This signal is invalid in the automatic operation mode when the shortcut control is set and selected by the parameter.
When the shortcut control is not selected, a positioning is carried out in the direction designated by this signal.
This signal is read in at the startup of Operation start (ST). The signal changes are ignored after the startup.

DIR	Axis rotation direction	Station movement direction
0	Forward run	Direction of increasing station No.
1	Reverse run	Direction of decreasing station No.

The actual motor rotation direction is reversed by changing the setting of parameter "#1018 ccw".

[Related signals]

(1) Operation start (ST: AUXCM2/bit0)

Con-tact	Signal name	Signal ab-breviation	bit
A	Arbitrary point feed command valid	STS	AUXCM2/bit2

[Function][Operation]

This signal selects the mode that executes the positioning, with the command unit specified by "#1005 plcunit", to the arbitrary position (coordinate) transferred from the NC. Automatic operation mode (AUT) must be turned ON simultaneously with Arbitrary point feed command valid.

[Related signals]

(1) Automatic operation mode (AUT: AUXCM1/bit8)

Con-tact	Signal name	Signal ab-breviation	bit
A	Incremental feed magnification 1, 2	MP1,MP2	AUXCM2/bit4,5

[Function][Operation]

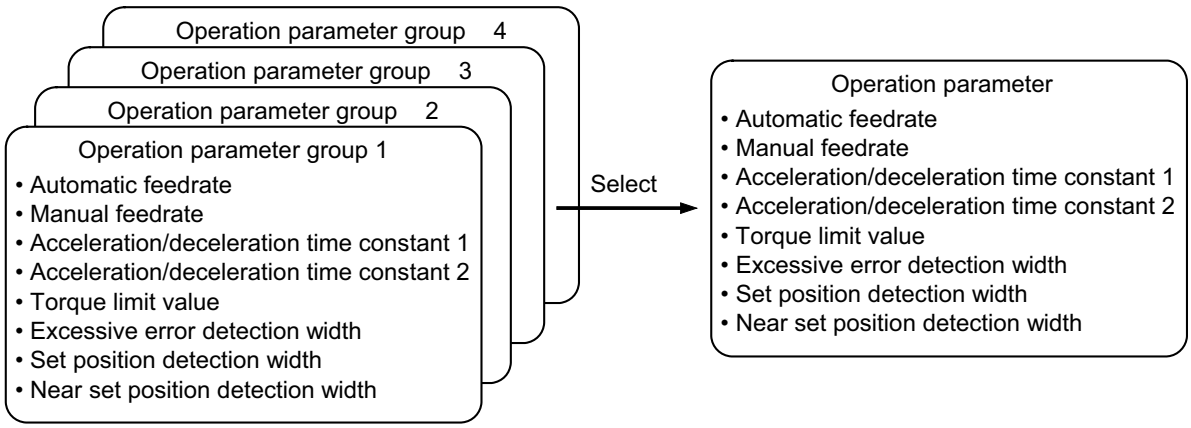
This signal selects the incremental feed amount and the handle feed magnification. In the handle feed, the movement amount per handle pulse is selected.

MP2	MP1	Feed amount
0	0	0.001°
0	1	0.01°
1	0	0.1°
1	1	1°

Con-tact	Signal name	Signal ab-breviation	bit
A	Operation parameter selection 1, 2	PR1,PR2	AUXCM2/bit6,7

[Function][Operation]

This signal selects one parameter group to be actually used from four parameter groups that designate the axis feed operation. The parameter group cannot be changed while Operation start (ST) is ON. (The group is held in NC.)
If Smoothing zero is confirmed for the target axis, the operation parameter group can be changed with the Operation start. Changing the parameter setting values of the time constant, torque limit value and excessive error detection width, however, is not possible unless Smoothing zero is confirmed for all the NC axes. The parameter values, if changed during the NC axis movement, are valid after the smoothing zero is confirmed.



PR2	PR1	Selected operation parameter group
0	0	1
0	1	2
1	0	3
1	1	4

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 1	AUXCM1	R8053	R8059	R8065	R8071	R8077	R8083

Contact	Signal name	Signal abbreviation	bit
B	Servo OFF	*SVF	AUXCM1/bit0

[Function][Operation]

When the Servo OFF signal is set to "0" (B contact), the control axis enters the servo OFF status. No matter which operation mode the servo is in and turned OFF, the axis movement will stop, and the servo will turn OFF. The axis movement restarts when the servo is turned ON again.

If the axis moves for any reason while the servo is OFF, it can be selected whether to compensate that movement amount when the servo turns ON the next time. Select with parameter "#1064 svof".

(1) When carrying out movement amount compensation (#1064 svof = 1)
When the servo is OFF, the coordinates are always updated by the amount the axis has moved. When the servo is OFF, the coordinates show the machine position.

(2) When not carrying out movement amount compensation (#1064 svof = 0)
When the servo is OFF, the coordinates are not updated even when the axis moves. When the servo is OFF, the coordinates show the machine position when the servo is OFF.
When the servo is turned ON, the axis is moved to the position where the servo was turned OFF.
When the servo is OFF and the axis movement exceeds the excessive error width (designated with parameter "#2226 SV026"), a servo alarm occurs.

[Caution]

(1) The actual servo OFF operation is validated after In-position (INP) is completed. When using a mechanical clamp, carry out the clamp operation after confirming the in-position status.

(2) When the power is turned ON, the Servo OFF signal turns OFF ("0") and the servo OFF function becomes valid. It is necessary before operation to turn the Servo OFF signal ON ("1") in the PLC program to release the servo OFF.

Contact	Signal name	Signal abbreviation	bit
A	Master reset	MRST	AUXCM1/bit3

[Function]

This signal resets the PLC indexing axis.

[Operation]

When this signal is ON, the following reset operations are carried out.

(1) The axis movement decelerates to a stop.
(2) Alarms that can be released by the reset are released.
(3) The In reset (RST) signal is output.
(4) The operation alarm is released while resetting.

[Related signals]

(1) In reset (RST: AUXST1/bit9)

Contact	Signal name	Signal abbreviation	bit
A	Interlock+	*IT+	AUXCM1/bit4

[Function][Operation]

When the control axis is moving in the (+) direction, this signal decelerates and stops the axis movement immediately. When this signal is OFF from before movement, the motion is stopped in the same manner as without starting. In any case the movement is started or restarted by turning this signal ON.

Contact	Signal name	Signal abbreviation	bit
A	Interlock-	*IT-	AUXCM1/bit5

[Function][Operation]

This is the same as the Interlock + (IT+) signal, the only difference being the direction.

Con-tact	Signal name	Signal ab-breviation	bit
A	Ready OFF	RDF	AUXCM1/bit6

[Function]

This is a signal to turn OFF the READY status.

[Operation]

When put into a READY OFF status, the power supply to the servomotor is shut off, and the contactor control output is simultaneously turned OFF. If the motor is in operation, it will stop by a dynamic brake stop or a deceleration control stop. Servo ready completion (SA) and Servo ready (RDY) are also turned OFF, but an alarm does not occur. When this signal is turned OFF, the machine immediately returns to the original state.

[Related signals]

(1) Servo ready completion (SA: AUXST1/bitC)
(2) Servo ready (RDY: AUXST1/bit0)

Con-tact	Signal name	Signal ab-breviation	bit
A	Handle feed operation mode	H	AUXCM1/bit7

[Function]

This signal selects the handle feed operation mode.

[Operation]

The axis will move for the amount determined by input pulse multiplied by feed magnification after this signal is turned ON, each signal [Operation parameter selection (PR1, PR2) and Incremental feed magnification (MP1, MP2)] is determined, and the handle pulse is input.

[Caution]

(1) Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".
(2) The handle mode acceleration/deceleration time is the acceleration/deceleration time constant 2 linear acceleration/deceleration of the selected operation parameter group.

[Related signals]

(1) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)
(2) Incremental feed magnification 1, 2 (MP1, MP2: AUXCM2/bit4,5)

Con-tact	Signal name	Signal ab-breviation	bit
A	Automatic operation mode	AUT	AUXCM1/bit8

[Function]

This signal selects the automatic operation mode.

[Operation]

Turn this signal ON, set Station selection 1 to 256 (ST1 to ST256) and then turn Operation start (ST) ON to move the axis to the designated station. The shortcut control or the rotation direction can be selected with parameters.

[Caution]

Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

[Related signals]

(1) Rotation direction (DIR: AUXCM2/bit1)
(2) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)
(3) Station selection 1 to 256 (ST1 to ST256: AUXCM3/bit0 to 8)

Con-tact	Signal name	Signal ab-breviation	bit
A	Manual operation mode	MAN	AUXCM1/bit9

[Function]

This signal selects the manual operation mode.

[Operation]

When the rotation direction is designated and Operation start (ST) is turned ON, the axis will begin moving, and the rotation will continue in the designated direction until Operation start is turned OFF. When Operation start turns OFF, the axis will be positioned to the nearest station.

[Caution]

Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

[Related signals]

(1) Rotation direction (DIR: AUXCM2/bit1)

(2) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Con-tact	Signal name	Signal ab-breviation	bit
A	JOG operation mode	J	AUXCM1/bitA

[Function]

This signal selects the JOG operation mode.

[Operation]

When the rotation direction is designated and Operation start (ST) is turned ON, the axis will begin moving, and the rotation will continue in the designated direction until Operation start is turned OFF. Unlike the manual operation mode, when Operation start is turned OFF, the axis immediately decelerate to a stop.

[Caution]

Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

[Related signals]

(1) Rotation direction (DIR: AUXCM2/bit1)

(2) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Con-tact	Signal name	Signal ab-breviation	bit
A	Reference position return mode	ZRN	AUXCM1/bitB

[Function]

This signal selects the reference position return mode.

[Operation]

When this signal (ZRN) is turned ON, the reference position return mode is designated. To start the reference position return, turn this signal ON, select the operation parameter group, then turn ON the Operation start (ST) signal.

When the absolute position coordinate system has been established in the absolute position specifications, the high-speed return will be applied in every operation.

[Related signals]

(1) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Con-tact	Signal name	Signal ab-breviation	bit
A	Basic point initialization setting mode	AZS	AUXCM1/bitD

[Function]

This signal selects the mode that initializes the basic point for the absolute position detection system.

[Operation]

When this signal is turned ON, the basic point initialization setting mode is held until the NC power is turned OFF. (Cannot be canceled)

When the stopper method is selected by setting "1" to "#2049 type", the torque limit value and the excessive error detection width in the operation parameter group 4 are automatically selected.

Con-tact	Signal name	Signal ab-breviation	bit
A	Basic point setting	ZST	AUXCM1/bitE

[Function]

This signal turns ON when designating the basic point with the basic point initialization in the absolute position detection system.

[Operation]

When this signal is turned ON in the basic point initialization setting mode, the designated position is set as the absolute position basic point.

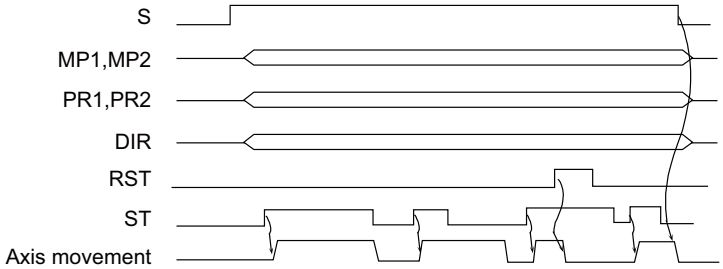
Con-tact	Signal name	Signal ab-breviation	bit
A	Incremental mode	S	AUXCM1/bitF

[Function]

This signal selects the incremental mode.

[Operation]

After turning ON this signal, designate the operation parameter group (with PR1 and PR2), the incremental feed magnification (with MP1 and MP2) and the rotation direction (with DIR). Then turn ON the Operation start (ST) signal to move the axis.



[Caution]

(1) Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101".

(2) In the incremental mode, the axis travel will be maintained at a constant amount, even if the Operation start signal is OFF.

[Related signals]

(1) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

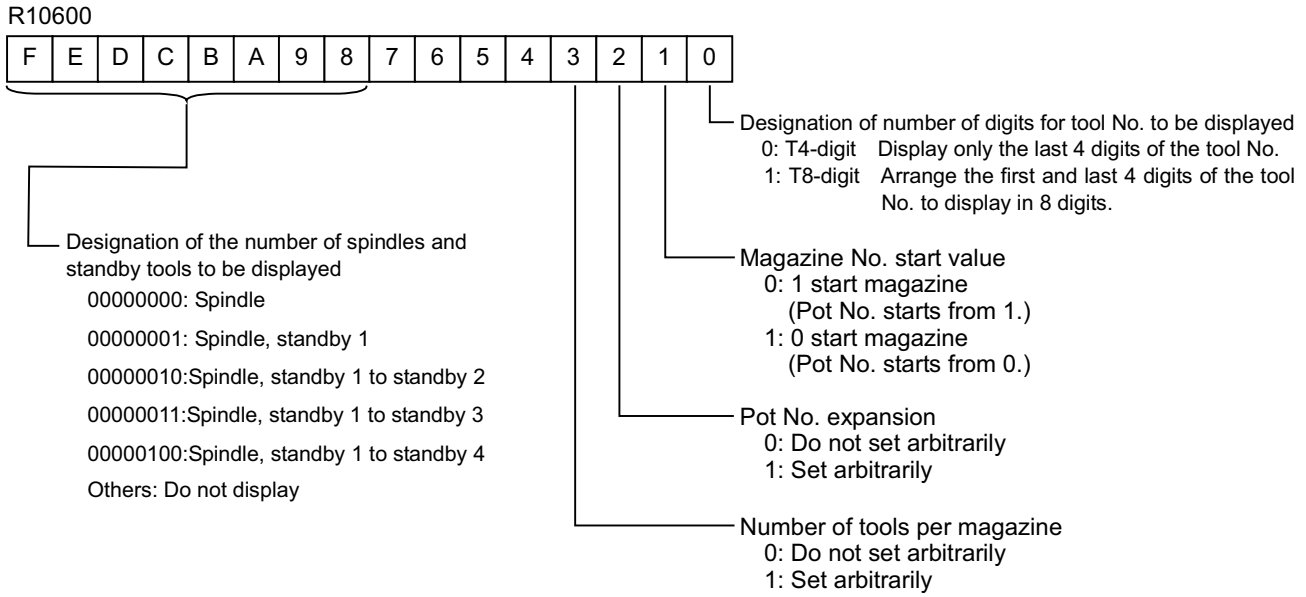
Con-tact	Signal name	Signal abbreviation	Common for part systems
A	ATC CONTROL PARAMETER		R10600

[Function]

Combination of the number of digits for tool No. to be displayed, magazine No. start value, and spindle and standby tool to be displayed are designated.

[Operation]

(1) Control parameter details



(2) Pot No. expansion

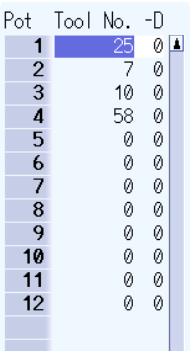
This function allows pot head No. for each magazine to be set arbitrarily.

(a) Do not set arbitrarily

The head No. for each magazine is 1 or 0, depending on the setting of ATC control parameter "magazine No. start value (R10600 bit1)".

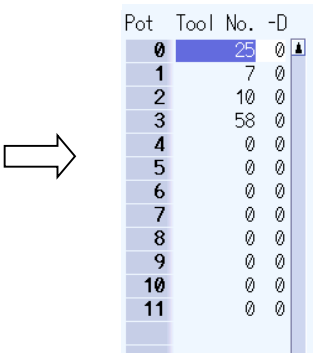
(Example 1) 1 start magazine

Set the following R registers.
R10600 : 0x0000
→ Number of digits for tool No. to be displayed : T4-digit
→ Magazine No. start value: 1 start magazine
→ Pot No. expansion : No arbitrary setting
→ Number of tools per magazine : No arbitrary setting
R10610 : 0x000C
→ Number of tools for magazine 1 : 12



(Example 2) 0 start magazine

Set the following R registers.
R10600 : 0x0002
→ Number of digits for tool No. to be displayed : T4-digit
→ Magazine No. start value: 0 start magazine
→ Pot No. expansion : No arbitrary setting
→ Number of tools per magazine : No arbitrary setting
R10610 : 0x000C
→ Number of tools for magazine 1 : 12



Pot	Tool No.	-D
0	25	0
1	7	0
2	10	0
3	58	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0

(b) To set arbitrarily

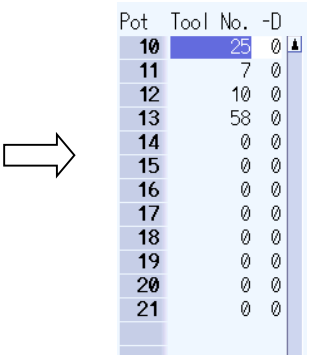
Set pot head No. for each magazine in the "each magazine pot head No. designation" register.
1st magazine pot head No. (R10695) 2nd magazine pot head No. (R10696)
3rd magazine pot head No. (R10697) 4th magazine pot head No. (R10698)
5th magazine pot head No. (R10699)

(Note 1) The head No. for each magazine is the value set in the register for "pot head No. for each magazine(R10695 to R10699)" regardless of the ATC control parameter "magazine No. start value (R10600 bit1)"

(Note 2) Numerical value 0 to 8999 can be set in the register for "pot head No. for each magazine (R10695 to R10699)". When a value outside the range is set, pot head No. is displayed from 1 or 0, depending on the setting of "magazine No. start value (R10600 bit1)".

(Example 1) Pot head No. for each magazine: 10; number of magazines: 12

Set the following R registers.
R10600 : 0x0004
→ Number of digits for tool No. to be displayed: T4-digit
→ Magazine No. start value: 1 start magazine
→ Pot No. expansion : Arbitrary setting
→ Number of tools per magazine : No arbitrary setting
R10610 : 0x000C
→ Number of tools for magazine 1 : 12
R10695 : 0x000A
→ Pot head No. for magazine 1: 10

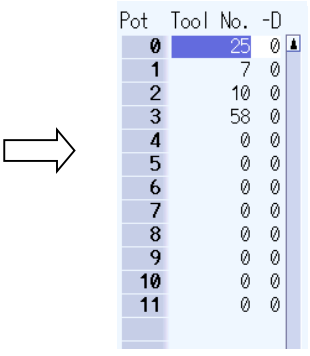


Pot	Tool No.	-D
10	25	0
11	7	0
12	10	0
13	58	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0

If the pot head No. for each magazine is outside the range of 0 to 8999, follow the setting for "magazine No. start value".

(Example 2) Pot head No. for each magazine: 9000; number of magazines: 12; magazine No. start value: 0

Set the following R registers.
R10600 : 0x0006
→ Number of digits for tool No. to be displayed : T4-digit
→ Magazine No. start value : 0 start magazine
→ Pot No. expansion : Arbitrary setting
→ Number of tools per magazine : No arbitrary setting
R10610 : 0x000C
→ Number of tools for magazine 1 : 12
R10695 : 0x2328
→ Pot head No. for magazine 1: 9000



Pot	Tool No.	-D
0	25	0
1	7	0
2	10	0
3	58	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0

(3) Number of tools per magazine

This function allows the number of tools per magazine to be set arbitrarily.

(a) Do not set arbitrarily

There is a maximum of three rows of magazine, and the total number of tools that can be registered per magazine is 120.

Magazine tool data assignment is fixed.

(b) To set arbitrarily

There is a maximum of five rows of magazine, and the total number of tools that can be registered for all the magazines is 360.

Set the number of tools per magazine in the "number of magazine designation" register.

(If there are any magazines not being used, set the designation register to 0.)

"Number of magazine designation" register

No.1 magazine ... R10610 No.2 magazine ... R10611

No.3 magazine ... R10612 No.4 magazine ... R10613

No.5 magazine ... R10614

The magazine tool data is assigned for the number of tools set in order from No.1 magazine.

(4) ATC file register

The file registers used with ATC are as shown below.

		Corresponding file (R) register										Remarks (Data type)
Magazine		No.1 magazine		No.2 magazine		No.3 magazine		No.4 magazine		No.5 magazine		
T4-digit/T8-digit specifications		T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	
ATC control parameter		R10600	←	←	←	←	←	←	←	←	←	
AUX data		R10604	←	←	←	←	←	←	←	←	←	Binary (0 to 99)
Number of magazines designation		R10610	←	R10611	←	R10612	←	R10613	←	R10614	←	Binary
Pointer designation		R10615	←	R10616	←	R10617	←	R10618	←	R10619	←	Binary
Spindle tool		R10620	R10620 R10621	R10630	R10630 R10631	R10640	R10640 R10641	R10650	R10650 R10651	R10660	R10660 R10661	BCD
Standby 1 tool		R10621	R10622 R10623	R10631	R10632 R10633	R10641	R10642 R10643	R10651	R10652 R10653	R10661	R10662 R10663	BCD
Standby 2 tool		R10622	R10624 R10625	R10632	R10634 R10635	R10642	R10644 R10645	R10652	R10654 R10655	R10662	R10664 R10665	BCD
Standby 3 tool		R10623	R10626 R10627	R10633	R10636 R10637	R10643	R10646 R10647	R10653	R10656 R10657	R10663	R10666 R10667	BCD
Standby 4 tool		R10624	R10628 R10629	R10634	R10638 R10639	R10644	R10648 R10649	R10654	R10658 R10659	R10664	R10668 R10669	BCD
Spindle tool D		R10670	←	R10675	←	R10680	←	R10685	←	R10690	←	Binary
Standby 1 tool D		R10671	←	R10676	←	R10681	←	R10686	←	R10691	←	Binary
Standby 2 tool D		R10672	←	R10677	←	R10682	←	R10687	←	R10692	←	Binary
Standby 3 tool D		R10673	←	R10678	←	R10683	←	R10688	←	R10693	←	Binary
Standby 4 tool D		R10674	←	R10679	←	R10684	←	R10689	←	R10694	←	Binary
Pot head No. for each magazine		R10695	←	R10696	←	R10697	←	R10698	←	R10699	←	Binary
Magazine tool data	Pot 1 (MG1):	- Do not set arbitrarily There is a maximum of three magazines, and the maximum number of tools per magazine is 120. Magazine tool data assignment is fixed. Refer to "(4)-(a) Example of tool data assignment when not setting arbitrarily" for details. - To set arbitrarily There is a maximum of five magazines, and the total number of tools for all the magazines is 360. The tool data assignment varies between R10700 and R11779.Refer to "(4)-(b) Example of tool data assignment when setting arbitrarily" for details on assignment method.										
Magazine tool data (Aux. D)	Pot 1:											

(a) Example of tool data assignment when not setting arbitrarily
There is a maximum of three magazines, and the maximum number of tools per magazine is 120.
The tool data assignment is fixed between R10700 and R11779 as shown below.

Magazine		Corresponding file (R) register										Remarks (Data type)
		No.1 magazine		No.2 magazine		No.3 magazine		No.4 magazine		No.5 magazine		
T4-digit/T8-digit specifications		T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	
Magazine tool data	Pot 1 (MG1)	R10700	R10700 R10701	R11060	R11060 R11061	R11420	R11420 R11421	—	—	—	—	BCD
	Pot 2 (MG2)	R10701	R10702 R10703	R11061	R11062 R11063	R11421	R11422 R11423	—	—	—	—	BCD
	Pot 3 (MG3)	R10702	R10704 R10705	R11062	R11064 R11065	R11422	R11424 R11425	—	—	—	—	BCD
	Pot 119 (MG119)	R10818	R10936 R10937	R11178	R11296 R11297	R11538	R11656 R11657	—	—	—	—	BCD
	Pot 120 (MG120)	R10819	R10938 R10939	R11179	R11298 R11299	R11539	R11658 R11659	—	—	—	—	BCD
Magazine tool data (Aux. D)	Pot 1	R10940	←	R11300	←	R11660	←	—	—	—	—	Binary
	Pot 2	R10941	←	R11301	←	R11661	←	—	—	—	—	Binary
	Pot 3	R10942	←	R11302	←	R11662	←	—	—	—	—	Binary
	Pot 119	R11058	←	R11418	←	R11778	←	—	—	—	—	Binary
	Pot 120	R11059	←	R11419	←	R11779	←	—	—	—	—	Binary

(b) Example of tool data assignment when setting arbitrarily

There is a maximum of five magazines, and the total number of tools for all the magazines is 360.
The tool data assignment varies between R10700 and R11779.
The magazine tool data is assigned for the number of tools set in order from No.1 magazine.
(Example) Number of magazines: 5 magazines
Number of tools: No.1 magazine [100 tools], No.2 to No.5 magazines [50 tools each]

		Corresponding file (R) register										Remarks (Data type)
Magazine		No.1 magazine		No.2 magazine		No.3 magazine		No.4 magazine		No.5 magazine		
T4-digit/T8-digit specifications		T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	T4-digit	T8-digit	
Magazine tool data	Pot 1 (MG1)	R10700	R10700 R10701	R11000	R11000 R11001	R11150	R11150 R11151	R11300	R11300 R11301	R11450	R11450 R11451	BCD
	Pot 2 (MG2)	R10701	R10702 R10703	R11001	R11002 R11003	R11151	R11152 R11153	R11301	R11302 R11303	R11451	R11452 R11453	BCD
	Pot 3 (MG3)	R10702	R10704 R10705	R11002	R11004 R11005	R11152	R11154 R11155	R11302	R11304 R11305	R11452	R11454 R11455	BCD
	Pot 49 (MG49)	R10748	R10796 R10797	R11048	R11096 R11097	R11198	R11246 R11247	R11348	R11396 R11397	R11498	R11546 R11547	BCD
	Pot 50 (MG50)	R10749	R10798 R10799	R11049	R11098 R11099	R11199	R11248 R11249	R11349	R11398 R11399	R11499	R11548 R11549	BCD
	Pot 99 (MG99)	R10798	R10896 R10897	—	—	—	—	—	—	—	—	BCD
	Pot 100 (MG100)	R10799	R10898 R10899	—	—	—	—	—	—	—	—	BCD
Magazine tool data (Aux. D)	Pot 1	R10900	←	R11100	←	R11250	←	R11400	←	R11550	←	Binary
	Pot 2	R10901	←	R11101	←	R11251	←	R11401	←	R11551	←	Binary
	Pot 3	R10902	←	R11102	←	R11252	←	R11402	←	R11552	←	Binary
	Pot 49	R10948	←	R11148	←	R11298	←	R11448	←	R11598	←	Binary
	Pot 50	R10949	←	R11149	←	R11299	←	R11449	←	R11599	←	Binary
	Pot 99	R10998	←	—	—	—	—	—	—	—	—	Binary
	Pot 100	R10999	←	—	—	—	—	—	—	—	—	Binary

[Related signals]

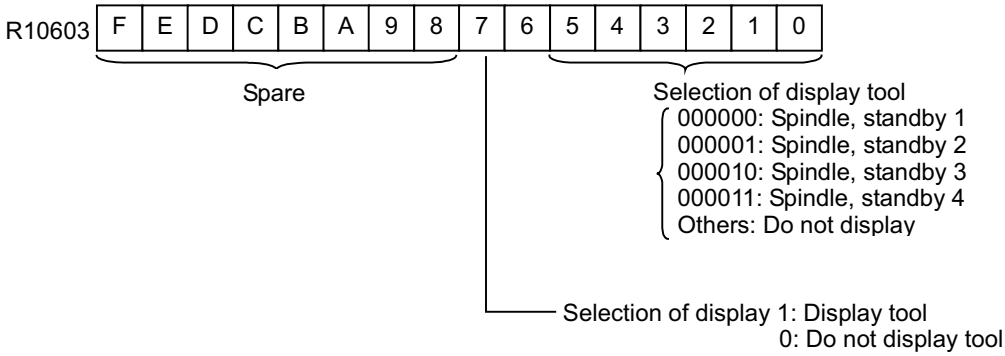
Display tool selection parameter (R10603)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	DISPLAY TOOL SELECTION PARAMETER		R10603

[Function]

Whether or not to display spindle standby is designated.

[Operation]



[Related signals]

ATC control parameter (R10600)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	SPINDLE TOOL NO.		R12200, 1	R12210, 1	R12220, 1	R12230, 1

[Function][Operation]

This signal indicates spindle No. in use.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	STANDBY TOOL NO.		R12202, 3	R12212, 3	R12222, 3	R12232, 3

[Function][Operation]

This signal indicates standby tool No.

6.5 Explanation of Special Relays (SM***)

Con-tact	Signal name	Signal abbreviation	Common for part systems
A	TEMPERATURE RISE		SM16

[Function][Operation]

If the alarm is displayed when an overheat alarm is detected in the control unit or communication terminal, the overheat signal will be output simultaneously. If the machine is in automatic operation, the operation will be continued, but restarting will not be possible after resetting or stopping with M02/M30. (Starting will be possible after block stop or feed hold.)

For details on the operation, etc., refer to "Temperature warning cause".

⚠ CAUTION

1. If the temperature rise detection function is invalidated with the parameters, the control could be disabled when the temperature is excessive. This could result in machine damage or personal injuries due to runaway axis, and could damage the device. Enable the detection function for normal use.

[Related signals]

(1) Temperature warning cause (R57)

(2) Control unit temperature (R60)

6.6 Explanations for Each Application

6.6.1 IO Link

This function makes it possible to send and receive various data between multiple NCs with packet communication using the HDLC function.
This function uses a communication channel separate from that for the conventional communication between the NC and operation board.
Data can be exchanged between one master NC and up to four slave NC stations.
The master and slaves are set with the rotary switch (NCN0) on the expansion card (HR531/HR532/HR534/HR535).

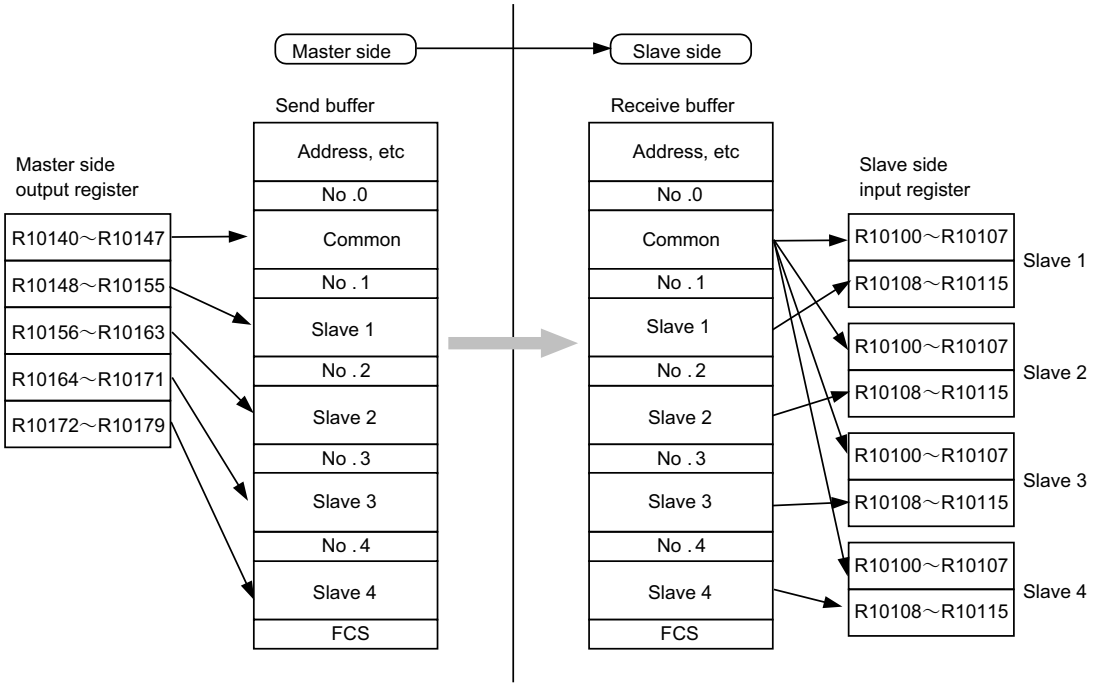
Rotary switch settings

Setting position	Function explanation
0	Master station for normal use or IO link
1	Slave station 1 for IO link
2	Slave station 2 for IO link
3	Slave station 3 for IO link
4	Slave station 4 for IO link

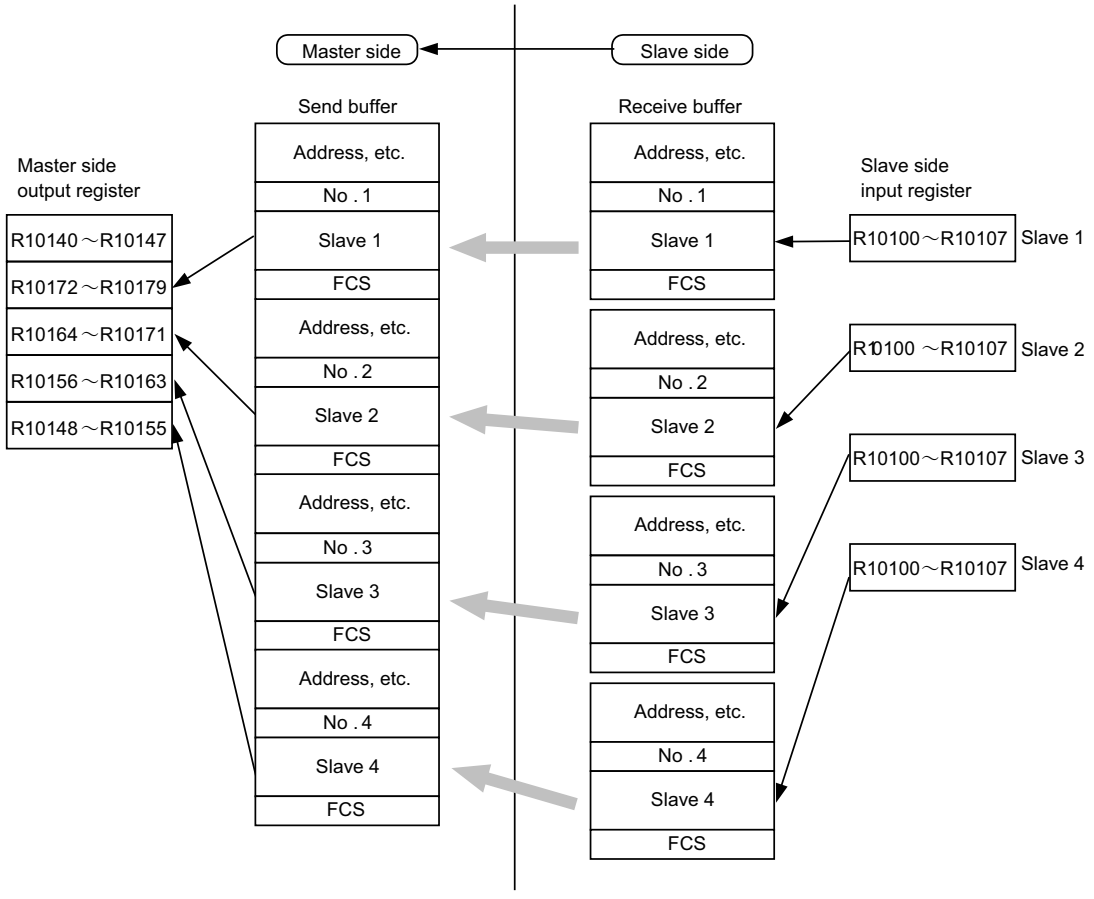
Operation

The R registers are used for the input/output data.
The same R registers are used as shown below of the master and slaves.

	Input data			Output data	
	Master side	Slave side		Master side	Slave side
R10100 to R10107	Not used	Input 0 (common for all slaves)	**R10140 to R10147**	Output 0 (common for all slaves)	Output(each slave station)
R10108 to R10115	Input 1 (slave 1 station)	Input (each slave station)	**R10148 to R10155**	Output 1 (slave 1 station)	Not used
R10116 to R10123	Input 2 (slave 2 station)	Not used	**R10156 to R10163**	Output 2 (slave 2 station)	Not used
R10124 to R10131	Input 3 (slave 3 station)	Not used	**R10164 to R10171**	Output 3 (slave 3 station)	Not used
R10132 to R10139	Input 4 (slave 4 station)	Not used	**R10172 to R10179**	Output 4 (slave 4 station)	Not used



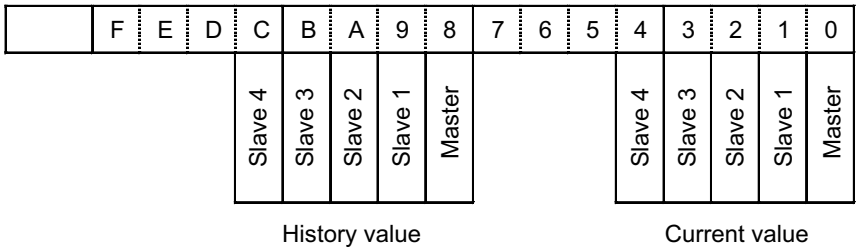
Flow of input/output data (master to slave)



Flow of input/output data (slave to master)

Communication status

The communication status can be confirmed with either the master or slave by using the file register.
The input/output data is not updated when communication is cutoff.
Current value: The bit for the current communication client is set.
History value: The bit for the client with which communication was established in the past is turned ON.
(Only the master or slave is set at the ladder cycle.)



Precautions

(1) Communication starts when the power for the master and slave is turned ON.
(2) For this communication, there must always be one master station. Data cannot be exchanged between slave stations.
(3) An alarm will not occur even if the communication is cut off.

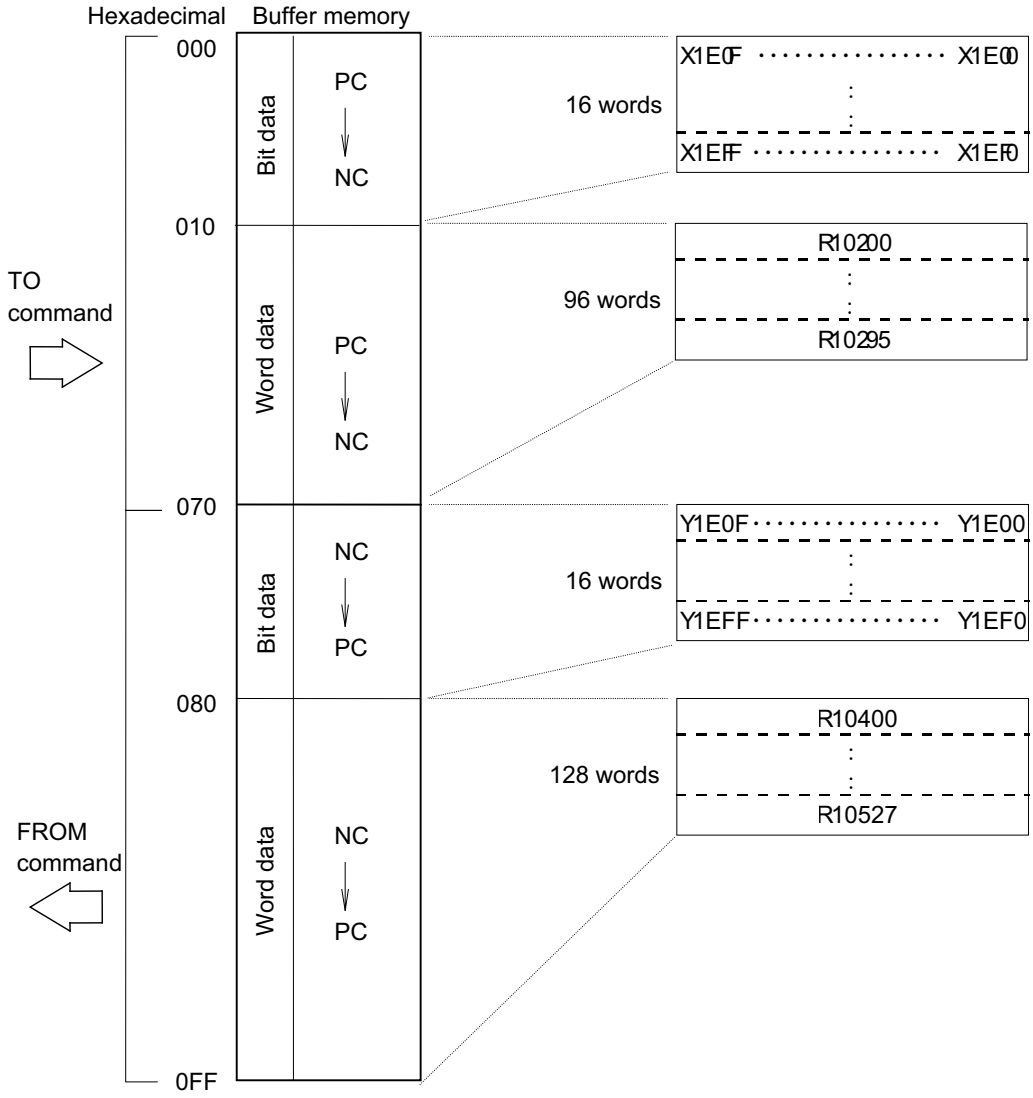
6.6.2 MELSEC Bus Connection

An external PLC (Mitsubishi MELSEC-A/QnA Series) can be connected with a bus.

Assigning the input/output I/F

The NC's internal buffer memory is configured of 112 words (bit data: 256 points, word data: 96 words) and 144 output words (bit data: 256 points, word data: 128 words). The input data sent from the MELSEC is stored in 000 to 06F, and is set in the NC input (X1E00 to X1EFF, R10200 to R10295) in that image.

The data set in NC output (Y1E00 to X1EFF, R10400 to R10527) by the built-in PLC is stored in the buffer memory 070 to FF in that image, and is sent to the MELSEC.



R register

If the FROM/TO command is not executed within 500ms (when R10190 value is 48 or more), emergency stop will be applied.

The time that there is no interrupt request from MELSEC is counted and stored in the R register.

R10190: Current timeout counter

R10191: Maximum timeout counter after power ON

R10192: Maximum timeout counter after system is started up (this is backed up)

6.6.3 MR-J2-CT Link

The MR-J2-CT link function connects the NC and MR-J2-CT (auxiliary axis), and controls up to six MR-J2-CT axes using command signals from the NC.

The number of connected MR-J2-CT axes is set with the parameters.

#	Item		Details	Setting range
1044 (PR)	auxno	MR-J2-CT Connections	Specify the number of MR-J2-CTs connected.	0 to 6

(Note) The MR-J2-CT will not start up if the set number of axes is not greater than the number of actual axes.

List of signals

(a) NC → MR-J2-CT (R9950 to R9985, R9998)

J2CT						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R9950	R9956	R9962	R9968	R9974	R9980	CTCM4	J2CT control command 4
R9951	R9957	R9963	R9969	R9975	R9981	CTCM3	J2CT control command 3
R9952	R9958	R9964	R9970	R9976	R9982	CTCM2	J2CT control command 2
R9953	R9959	R9965	R9971	R9977	R9983	CTCM1	J2CT control command 1
R9954	R9960	R9966	R9972	R9978	R9984	CTCML	J2CT control command position (L)
R9955	R9961	R9967	R9973	R9979	R9985	CTCMH	J2CT control command position (H)

J2CT control command 4 (R9950: CTCM4)		
bit	Abbrev.	Name
bit0	OV1	Override 1
bit1	OV2	Override 2
bit2	OV4	Override 4
bit3	OV8	Override 8
bit4	OV16	Override 16
bit5	OV32	Override 32
bit6	OV64	Override 64
bit7	OV	Override valid
bit8		Spare
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

J2CT control command 3 (R9951: CTCM3)		
bit	Abbrev.	Name
bit0	ST1	Station selection 1
bit1	ST2	Station selection 2
bit2	ST4	Station selection 4
bit3	ST8	Station selection 8
bit4	ST16	Station selection 16
bit5	ST32	Station selection 32
bit6	ST64	Station selection 64
bit7	ST128	Station selection 128
bit8	ST256	Station selection 256
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

J2CT control command 2 (R9952: CTCM2)		
bit	**Abbrev.**	**Name**
bit0	ST	Operation start
bit1	DIR	Rotation direction
bit2	STS	Arbitrary point feed command valid
bit3	PUS	Stopper positioning command valid
bit4	MP1	Incremental feed magnification 1
bit5	MP2	Incremental feed magnification 2
bit6	PR1	Operation parameter selection 1
bit7	PR2	Operation parameter selection 2
bit8		Spare
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

J2CT control command 1 (R9953: CTCM1)		
bit	**Abbrev.**	**Name**
bit0	*SVR	Servo OFF
bit1	QEMG	PLC emergency stop
bit2	*PRT1	Data protect 1
bit3	MRST	MC reset
bit4	*IT+	Interlock +
bit5	*IT-	Interlock -
bit6	RDF	Ready OFF
bit7	H	Handle mode
bit8	AUT	Automatic operation mode
bit9	MAN	Manual operation mode
bitA	J	Jog mode
bitB	ZRN	Reference position mode
bitC		
bitD	AZS	Zero point initialization mode
bitE	ZST	Reference pint setting
bitF	S	Incremental mode

J2CT control command position (L) (R9954: CTCML)		
bit	**Abbrev.**	**Name**
bit0 to bit15		Arbitrary coordinate (low-order) 1/1000mm (°) unit

J2CT control command position (H) (R9955: CTCMH)		
bit	**Abbrev.**	**Name**
bit0 to bit15		Arbitrary coordinate (high-order) 1/1000mm (°) unit

J2CT operation adjustment mode valid (R9998)		
bit	**Abbrev.**	**Name**
bit0	-	J2CT operation adjustment mode valid (common for all axes)

(b) MR-J2-CT → NC (R9900 to R9935, R9948)

J2CT						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R9900	R9906	R9912	R9918	R9924	R9930	CTST4	J2CT control status 4
R9901	R9907	R9913	R9919	R9925	R9931	CTST3	J2CT control status 3
R9902	R9908	R9914	R9920	R9926	R9932	CTST2	J2CT control status 2
R9903	R9909	R9915	R9921	R9927	R9933	CTST1	J2CT control status 1
R9904	R9910	R9916	R9922	R9928	R9934		J2CT control machine position (L)
R9905	R9911	R9917	R9923	R9929	R9935		J2CT control machine position (H)

J2CT status 4 (R9900: CTST4)		
bit	Abbrev.	Name
bit0	PSW1	Position switch 1
bit1	PSW2	Position switch 2
bit2	PSW3	Position switch 3
bit3	PSW4	Position switch 4
bit4	PSW5	Position switch 5
bit5	PSW6	Position switch 6
bit6	PSW7	Position switch 7
bit7	PSW8	Position switch 8
bit8	PMV	In positioning operation
bit9	PFN	Positioning completed
bitA	PSI	In stopper
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

J2CT status 3 (R9901: CTST3)		
bit	Abbrev.	Name
bit0	ST01	Station position 1
bit1	ST02	Station position 2
bit2	ST04	Station position 4
bit3	ST08	Station position 8
bit4	ST016	Station position 16
bit5	ST032	Station position 32
bit6	ST064	Station position 64
bit7	ST0128	Station position 128
bit8	ST0256	Station position 256
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

J2CT status 2 (R9902: CTST2)		
bit	Abbrev.	Name
bit0	AUTO	In automatic operation mode
bit1	MANO	In manual operation mode
bit2	JO	In jog mode
bit3	ARNN	In reference position return
bit4	ZRNO	In reference position return mode
bit5		
bit6	AZSO	In zero point initialization mode
bit7	SO	In incremental mode
bit8	AL1	MC alarm 1
bit9	AL2	MC alarm 2
bitA	AL4	MC alarm 4
bitB	BAL	Battery drop
bitC	ABS	Absolute position power shutoff movement over
bitD	ZSN	Absolute position loss
bitE	ZSF	Initialization setting completed
bitF	ZSE	Initialization setting error completed

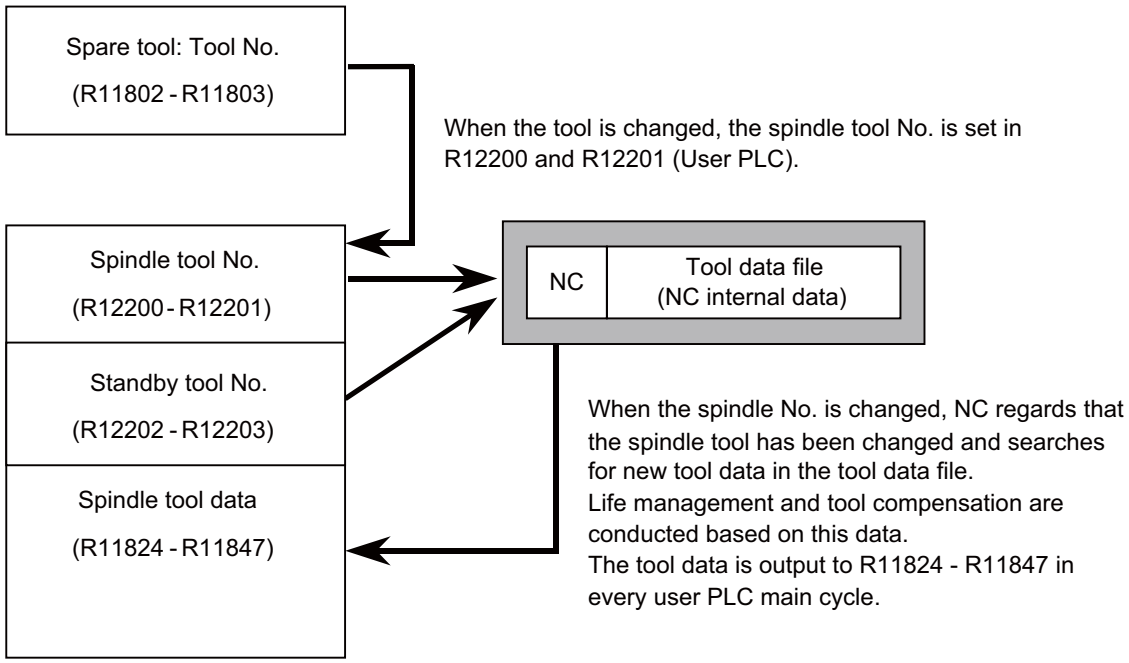
J2CT status 1 (R9903: CTST1)		
bit	Abbrev.	Name
bit0	RDY	Servo ready
bit1	INP	In-position
bit2	SMZ	Smoothing zero
bit3	AX1	Axis selection output
bit4	MVP	In axis plus motion
bit5	MVM	In axis minus motion
bit6	TLQ	In torque limit
bit7	ADJ	Adjusting machine
bit8	ZP	Reference position reached
bit9	RST	In reset
bitA	HO	In handle mode
bitB	MA	Controller ready completion
bitC	SA	Servo ready completion
bitD	JSTA	Automatic set position reached
bitE	JST	Set position reached
bitF	NEAR	Near set position

J2CT in operation adjustment mode (R9948)					
bit	AV	Name	bit	AV	Name
bit0	-	J2CT in operation adjustment mode 1st axis	bit4	-	J2CT in operation adjustment mode 5th axis
bit1	-	J2CT in operation adjustment mode 2nd axis	bit5	-	J2CT in operation adjustment mode 6th axis
bit2	-	J2CT in operation adjustment mode 3rd axis			
bit3	-	J2CT in operation adjustment mode 4th axis			

6.6.4 Tool Life Management Interface (M system)

The tool life is managed based on the spindle tool No. and standby tool No.
The spindle tool No. is used for the screen display data and for the tool for which the tool life is to be managed. The life management data for the tool to be managed is set in the spindle tool data.
The standby tool data is used as screen data.

Details



NC → PLC interface signal

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN TOOL LIFE MANAGEMENT	TLFO	XC2B	XD6B	XEAB	XFEB

[Function]

This signal is output during the tool life management.

[Operation]

In tool life management signal turns ON when the tool life management (#1103 T_Life) on the parameter is ON.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE OVER	TLOV	XC2E	XD6E	XEAE	XFEE

[Function]

This signal notifies that a tool has reached to its lifetime (usage data ≧ life data).

[Operation]

The signal turns ON when the usage data of tool is same as or has exceeded the life data. Note that this signal is only output and does not stop automatic operation or other operations of the controller.

<For tool life management I and III>

This signal turns ON when:

(1) "#1246 set18/bit04" is set to "0"

- The tool currently selected has reached the end of its life (Usage data ≧ life data).
  (The same timing as count up of usage data.)
- The tool has already reached the end of its life when selecting the tool.
  (The same timing as the tool function strobe 1 signal.)

(2) "#1246 set18/bit04" is set to "1"

- Even one tool in the currently selected group (for tool life management II, all registered tools) has reached the end of its life (Usage data >= life data).
  (The same timing as count up of usage data.)
- Even one tool in the group has already reached the end of its life when selecting the group.
  (The same timing as the tool function strobe 1 signal.)

This signal turns OFF when:

(1) "#1246 set18/bit04" is set to "0"

- The tool selection is finished.
  (When T command is issued. However, if the next tool has reached the end of its life, this signal remains ON.)
- The tool status for the tool currently selected has been cleared.

(2) "#1246 set18/bit04" is set to "1"

- The group selection is finished.
  (When T command is issued. However, even if one tool in the next selection group has not reached the end of its life, this signal remains ON.)
- Usage data is smaller than the life data (usage data < life data).

<For tool life management II>

The signal turns ON when:

(1) The last tool in the group currently selected has reached the end of its lifetime (Usage data ≧ life data). (The same timing as count up of usage data)

(2) All tools in the group have reached to their lifetimes at the time of group selection. (The same timing as tool function strobe 1 signal)

The signal turns OFF when:

(1) The group selection has been completed. (At T command. Note that if the next selected group is a life group, the signal remains ON.)

(2) The usage data for the group currently selected is cleared. (In case of "tool change reset signal" (TRST) is input, etc.)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL GROUP LIFE OVER		XC2F	XD6F	XEAF	XFEF

[Function]

This signal notifies that all tools in the tool group have reached to their lifetimes.

This signal is valid only for tool life management II.

[Operation]

The signal turns ON when all tools in the group mounted on the spindle have reached to their lifetimes or malfunction.

Note that this signal is only output and does not stop automatic operation or other operations of the controller.

The signal turns ON when:

(1) The last tool in the group mounted to the spindle has reached to its lifetime (Usage data ≧ life data). (Same timing as count up of usage data)

(2) Tool error signal has been input in respect to the last tool in the group mounted on the spindle.

(3) All tools in the group have reached to their lifetimes at time of mounting tools on the spindle.

The signal turns OFF when:

(1) Another group of tools is mounted on the spindle.(Note that if all tools of the group mounted have reached to their lifetimes, the signal remains ON.)

(2) The usage data for the group mounted on the spindle is cleared.

(3) The tool life management has been invalidated.

[Caution]

When this signal is used in the tool life management II, refer to the next ladder cycle after the spindle tool is changed.

(This signal will not change in the same cycle in which the spindle tool was changed.)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	M FUNCTION STROBE 1 to 4	MF1 to 4	XC60 to 3	XDA0 to 3	XEE0 to 3	X1020 to 3

[Function][Operation]

NC sends these signals to PLC when M function (M code) is executed.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	T FUNCTION STROBE 1 to 4	TF1 to 4	XC68 to B	XDA8 to B	XEE8 to B	X1028 to B

[Function][Operation]

NC sends these signals to PLC when output of tool data for spare tools is completed.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	M CODE DATA 1 to 4		R504 to 11	R704 to 11	R904 to 11	R1104 to 11

[Function][Operation]

These signals indicate No. designated with M code.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	T CODE DATA 1 to 4		R536 to 43	R736 to 43	R936 to 43	R1136 to 43

[Function][Operation]

These signals indicate No. designated with T code.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	GROUP IN TOOL LIFE MANAGEMENT		R567	R767	R967	R1167

[Function][Operation]

This signal outputs group No. currently in life management with the tool life management II.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE USAGE DATA		R628,9	R828,9	R1028,9	R1228,9

[Function][Operation]

This signal outputs usage data of tools currently in use with the tool life management II. (When multiple compensation Nos. are used, the total usage data per compensation No. is output.)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	NUMBER OF REGISTERED TOOL LIFE CONTROL TOOLS		R630	R830	R1030	R1230

[Function] [Operation]

This signal indicates number of tools currently in life management.

Spare tool data

$1	$2	$3	$4	Name	Details
R11800	R11850	R11900	R11950	T life mgmt Spare tool: Group No.	Group No. for spare tool
R11801	R11851	R11901	R11951		
R11802	R11852	R11902	R11952	Spare tool: Tool No.	Tool No. for spare tool
R11803	R11853	R11903	R11953		
R11804	R11854	R11904	R11954	Spare tool: Tool data flag/Status	Flag/Status for spare tool
R11805	R11855	R11905	R11955	Spare tool: Auxiliary data	Auxiliary data for spare tool
R11806	R11856	R11906	R11956	Spare tool: Cumulative usage time	Cumulative usage data for spare tool
R11807	R11857	R11907	R11957		
R11808	R11858	R11908	R11958	Spare tool: Service lifetime	Service lifetime for spare tool
R11809	R11859	R11909	R11959		
R11810	R11860	R11910	R11960	Spare tool: Cumulative usage count	Cumulative usage count for spare tool
R11811	R11861	R11911	R11961	Spare tool: Service life count	Service life count for spare tool
R11812	R11862	R11912	R11962	Spare tool: Cumulative usage wear amount	Cumulative usage wear amount for spare tool
R11813	R11863	R11913	R11963		
R11814	R11864	R11914	R11964	Spare tool: Service life wear amount	Service life wear amount for spare tool
R11815	R11865	R11915	R11965		
R11816	R11866	R11916	R11966	Spare tool: Length compensation amount	Length compensation amount for spare tool
R11817	R11867	R11917	R11967		
R11818	R11868	R11918	R11968	Spare tool: Radius compensation amount	Radius compensation amount for spare tool
R11819	R11869	R11919	R11969		
R11820	R11870	R11920	R11970	Spare tool: Length wear amount	Length wear amount for spare tool
R11821	R11871	R11921	R11971		
R11822	R11872	R11922	R11972	Spare tool: Radius wear amount	Radius wear amount for spare tool
R11823	R11873	R11923	R11973		

Active tool data

$1	$2	$3	$4	Name	Details
R11824	R11874	R11924	R11974	T life mgmt Active tool: Group No.	Group No. for active tool
R11825	R11875	R11925	R11975		
R11826	R11876	R11926	R11976	Active tool: Tool No.	Tool No. for active tool
R11827	R11877	R11927	R11977		
R11828	R11878	R11928	R11978	Active tool: Tool data flag/Status	Flag/status for active tool
R11829	R11879	R11929	R11979	Active tool: Auxiliary data	Auxiliary data for active tool
R11830	R11880	R11930	R11980	Active tool: Cumulative usage time	Cumulative usage time for active tool
R11831	R11881	R11931	R11981		
R11832	R11882	R11932	R11982	Active tool: Service lifetime	Service lifetime for active tool
R11833	R11883	R11933	R11983		
R11834	R11884	R11934	R11984	Active tool: Cumulative usage count	Cumulative usage count for active tool
R11835	R11885	R11935	R11985	Active tool: Service life count	Service life count for active tool
R11836	R11886	R11936	R11986	Active tool: Cumulative usage wear amount	Cumulative usage wear amount for active tool
R11837	R11887	R11937	R11987		
R11838	R11888	R11938	R11988	Active tool: Service life wear amount	Service life wear amount for active tool
R11839	R11889	R11939	R11989		
R11840	R11890	R11940	R11990	Active tool: Length compensation amount	Length compensation amount for active tool
R11841	R11891	R11941	R11991		
R11842	R11892	R11942	R11992	Active tool: Radius compensation amount	Radius compensation amount for active tool
R11843	R11893	R11943	R11993		
R11844	R11894	R11944	R11994	Active tool: Length wear amount	Length wear amount for active tool
R11845	R11895	R11945	R11995		
R11846	R11896	R11946	R11996	Active tool: Radius wear amount	Radius wear amount for active tool
R11847	R11897	R11947	R11997		

PLC → NC interface signal

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	AUTOMATIC MACHINE LOCK n-TH AXIS	AMLK1 to 8	Y8A0 to 7	Y8A8 to F	Y8B0 to 7	Y8B8 to F

[Function][Operation]

While this signal is being received, the tool life management is not performed.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	SINGLE BLOCK	SBK	YC12	YD52	YE92	YFD2

[Function][Operation]

While this signal is being received, the tool life management is not performed.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	DRY RUN	DRN	YC15	YD55	YE95	YFD5

[Function][Operation]

While this signal is being received, the tool life management is not performed.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	M FUNCTION FINISH 1	FIN1	YC1E	YD5E	YE9E	YFDE
A	M FUNCTION FINISH 2	FIN2	YC1F	YD5F	YE9F	YFDF

[Function][Operation]

Execution of the machining program will be held until this signal is received.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MISCELLANEOUS FUNCTION LOCK	AFL	YC5A	YD9A	YEDA	Y101A

[Function][Operation]

While this signal is being received, the tool life management is not performed.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL ALARM 1	TAL1	YC88	YDC8	YF08	Y1048

[Function]

This signal sets the tool data status during tool life management to status 3 (Tool alarm 1).

[Operation]

By turning ON the signal in the tool life management specification, status of tool data can be changed to "3".

This signal is validated when tool life management input signal (YC8B) is ON.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL ALARM 2	TAL2	YC89	YDC9	YF09	Y1049

[Function]

This signal sets the tool data status during tool life management to status 4 (Tool alarm 2).

[Operation]

By turning ON the signal in the tool life management specification, status of tool data can be changed to "4".
This signal is validated when tool life management input signal (YC8B) is ON.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USAGE DATA COUNT VALID	TCEF	YC8A	YDCA	YF0A	Y104A

[Function]

This signal validates tool life count during the tool life management.

[Operation]

The tool life count (usage time or usage count corresponding to tool) is validated in the tool life management specification.
This signal is validated when tool life management input signal (YC8B) is ON.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE MANAGEMENT INPUT	TLF1	YC8B	YDCB	YF0B	Y104B

[Function]

This signal validates the tool life management.

[Operation]

By turning ON the signal in the tool life management specification, the tool life management process is executed.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE MANAGEMENT DATA SORT		R2588	R2788	R2988	R3188

[Function][Operation]

This signal is a flag for tool life data sort necessary/unnecessary.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL GROUP NO. DESIGNATION		R2590,1	R2790,1	R2990,1	R3190,1

[Function]

The group No. is designated when clearing usage data of a group in which the tool life has been exceeded with the tool life management II or when forcibly changing the tool currently in use.

[Operation]

The group designation range is as follows.

For group designation: 1 to 9999 of group No.
For all groups: 65535(all 1)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	SPINDLE TOOL NO.		R12200, 1	R12210, 1	R12220, 1	R12230, 1

[Function][Operation]

This signal indicates spindle No. in use.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	STANDBY TOOL NO.		R12202, 3	R12212, 3	R12222, 3	R12232, 3

[Function][Operation]

This signal indicates standby tool No.

6.6.5 Tool Life Management Interface (L system)

The tool life is managed based on usage time and usage count of tools.

NC → PLC interface signal

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN TOOL LIFE MANAGEMENT	TLFO	XC2B	XD6B	XEAB	XFEB

[Function]

This signal is output during the tool life management.

[Operation]

In tool life management signal turns ON when the tool life management (#1103 T_Life) on the parameter is ON.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LIFE OVER	TLOV	XC2E	XD6E	XEAE	XFEE

[Function]

<For tool life management I>

This signal notifies that a tool has reached to its lifetime (Usage data ≧ Life data).

<For tool life management II>

This signal notifies that all tools in the tool group have reached to their lifetimes.

[Operation]

<For tool life management I>

The signal turns ON when usage data of tool is same as or has exceeded the life data. Note that this signal is only output and does not stop automatic operation or other operations of the controller.

<For tool life management II>

This signal turns ON when usage data of tools in a same group is same as or has exceeded the life data. Note that this signal is only output and does not stop automatic operation or other operations of the controller.

The signal turns ON when:

(1) The last tool in the group currently selected has reached to its lifetime (Usage data ≧ life data). (Same timing as count up of usage data)

(2) "Tool skip" signal has been input in respect to the last tool in the group currently selected.

(3) All tools in the group have reached to their lifetimes at the time of group selection. (Same timing as tool function strobe 1 signal)

The signal turns OFF when:

(1) The group selection has been completed. (At T command. Note that if the next selected group is a life group, the signal remains ON.)

(2) The usage data for the group currently selected is cleared. (In case of "tool change reset signal" (TRST) is input, etc.)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	NEW TOOL CHANGE	TCRQ	XC94	XDD4	XF14	X1054

[Function]

This signal notifies that a new tool (unused tool) in the group is selected in the tool life management II.

[Operation]

The signal turns ON when:

(1) The tool selected by T command tool selection is unused (status 0).

The signal turns OFF when:

(1) When T command is completed due to the M function finish signal (FIN1, FIN2).

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	LIFE PREDICTION		XC96	XDD6	XF16	X1056

[Function]

This signal notifies when remaining data, which is calculated by subtracting usage data from service life data, has reached its remaining life set value.

[Operation]

The life prediction is valid when the basic specification parameter "#1277 ext13 bit1" is 1. The signal will not be output when the remaining life data is 0 or larger than the life data.

Signal output judgment condition varies depending on the following parameter setting.

#1277 ext13 bit2 Switching the timing of the life prediction signal output

0: "Life data - usage data = remaining life data"

1: "Life data - usage data ≦ remaining life data"

#1277 ext13 bit3 Tool for which the life prediction signal is output

0: The signal is output for each tool.

1: The signal is output for the last tool of a group.

The signal turns ON when:

(1) Remaining life (life data - usage data) of the tool has reached to its remaining life setting value. (Same timing as count up of usage data)

(2) Remaining life (life data - usage data of the tool has reached to its remaining life setting value at the time of tool selection. (Same timing as TF output)

The signal turns OFF when:

(1) Group selection has completed. (At T command. Note that if the next selected group has a condition of turning ON the signal, the signal remains ON.)

(2) Tool has reached to its lifetime. (Same timing as count up of usage data)

(3) The usage data for the group currently selected is cleared. (In case that "tool change reset signal" (TRST) is input, etc.)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	GROUP IN TOOL LIFE MAN-AGEMENT		R567	R767	R967	R1167

[Function][Operation]

This signal outputs group No. currently in life management with the tool life management II.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	TOOL LIFE USAGE DATA		R628,9	R828,9	R1028,9	R1228,9

[Function][Operation]

This signal output usage data of tools currently being used with the tool life management II. (When multiple compensation Nos. are used, the total usage data per compensation No. is output.)

PLC → NC interface signal

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL-SKIP	TAL1	YC88	YDC8	YF08	Y1048

[Function]

Set the tool data status during tool life management to status 3 (tool-skip).

[Operation]

By turning ON the signal while tool life management specification is valid, status of tool data can be changed to "3".

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	USAGE DATA COUNT VALID	TCEF	YC8A	YDCA	YF0A	Y104A

[Function]

This signal validates tool life count during the tool life management.

[Operation]

The tool life count (usage time or usage count corresponding to tool) is validated with the tool life management specification.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL CHANGE RESET	TRST	YC8C	YDCC	YF0C	Y104C

[Function]

This signal is used to clear all tool usage data in a group with the tool life management II.

[Operation]

Select with the tool group No. designation (file register R2590, 2591) whether all groups that have exceeded their lifetimes or specific group to be cleared.

After this signal is input, the first tool of the group will be selected at the next group selection.

(Note) When the tool change reset or the tool skip is performed on the group currently selected, usage data count will be carried out on the tool used at the time of signal input until the next tool selection. Therefore, if a tool selected needs to be changed along with the signal input, select a group again. However, a tool may not be selected due to a preceding process if there is no movement command up to the next group selection after the signal input. In this case, contents of the preceding process can be invalidated by turning ON the "recalculation request" (CRQ) signal before selecting the group.

[Related signals]

(1) Recalculation request (CRQ: YC2B)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL GROUP NO. DESIGNATION		R2590,1	R2790,1	R2990,1	R3190,1

[Function]

The group No. is designated when clearing usage data of a group that has exceeded lifetime with the tool life management II or when forcibly changing tools currently in use.

[Operation]

The group designation range is as follows.

For group designation: 1 to 9999 of group No.

For all groups: 65535(all 1)

6.6.6 PLC Constants

The parameters #18001 to #18150 can be used as PLC constants.
The setting range is ±8 digits (-99999999 to 99999999)
When the data is set while the parameters #18001 to #18150 are displayed, the set data is set in the file register and backed up.
If the data is set at R register from the PLC side, the screen display will not change. To change the display, move to another screen and then select the PLC constants screen.

#	Corresponding file register	
	HIGH side	LOW side
18001	R7501	R7500
18002	R7503	R7502
18003	R7605	R7604
:	:	:
:	:	:
:	:	:
18049	R7797	R7796
18050	R7799	R7798

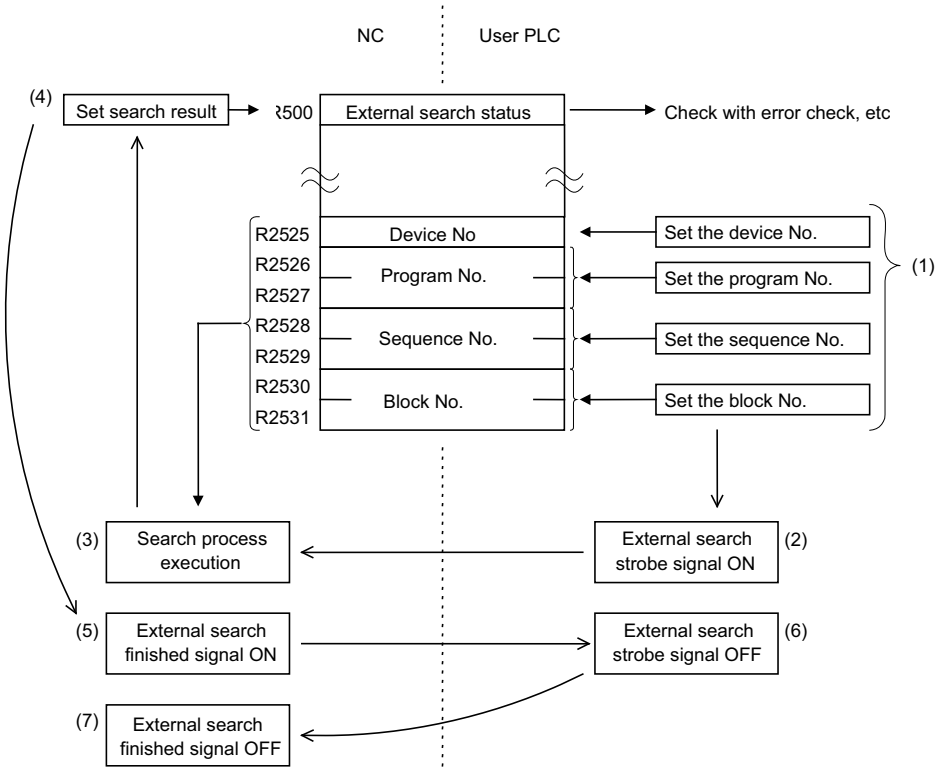
(1) Parameter input/output
The PLC constant data can be input and output with the parameters.
PLC constants are output with N1 to N150.

6.6.7 External Search

External search is a function that searches the machining program according to the machining program storage device, program No., sequence No., block No. designated from the user PLC.

Details

Flow of process for the external search (the 1st part system) is shown below.



[Operation]

(1) The user PLC sets the device, program No., sequence No., and block No.
(2) The user PLC sets the external search strobe signal ON.
(3) The NC searches for the target machining program from the designated device, program No., sequence No., and block No.
(4) The NC sets the search results as the external search status.
(5) The NC turns the external search finished signal ON.
(6) The user PLC turns the external search strobe signal OFF.
(7) The NC turns the external search finished signal OFF.

NC → PLC Interface signals

Signal name	Part system No.			
	$1	$2	$3	$4
EXTERNAL SEARCH FINISHED	XC1D	XD5D	XE9D	XFDD
EXTERNAL SEARCH STATUS	R500	R700	R900	R1100

(1) External search finished (XC1D)

This turns ON when the external search is finished. This also turns ON when an error occurs. This signal turns OFF when the "external search strobe" signal is turned OFF from the user PLC.

(2) External search status (R500)

The status at the end of the external search is output.
Refer to "External search status" for the details on status value.

PLC → NC Interface signals

Signal name	Part system No.			
	$1	$2	$3	$4
EXTERNAL SEARCH DEVICE NO.	R2525	R2725	R2925	R3125
EXTERNAL SEARCH PROGRAM NO.	R2526 R2527	R2726 R2727	R2926 R2927	R3126 R3127
EXTERNAL SEARCH SEQUENCE NO.	R2528 R2529	R2728 R2729	R2928 R2929	R3128 R3129
EXTERNAL SEARCH BLOCK NO.	R2530 R2531	R2730 R2731	R2930 R2931	R3130 R3131
EXTERNAL SEARCH STROBE	YC1D	YD5D	YE9D	YFDD

(1) External search device No. (R2525)

The device storing the machining program to be searched is designated with a No.

Device number	Device
0	Memory
1	HD (D drive)
2	IC card (E drive)
3	Floppy disk (A drive)
4	High-speed program server
5	Tape (RS232C)

(2) External search program No. (R2526, R2527)

Designate the program No. of the machining program to be searched as a binary.
The setting range is 1 to 99999999 (8 digits).

(3) External search sequence No. (R2528, R2529)

Designate the sequence No. of the machining program to be searched as a binary.
The setting range is 1 to 99999 (5 digits).

(4) External search block No. (R2530, R2531)

Designate the block No. as a binary.

The setting range is 1 to 99999 (5 digits).

(5) External search strobe (YC1D)

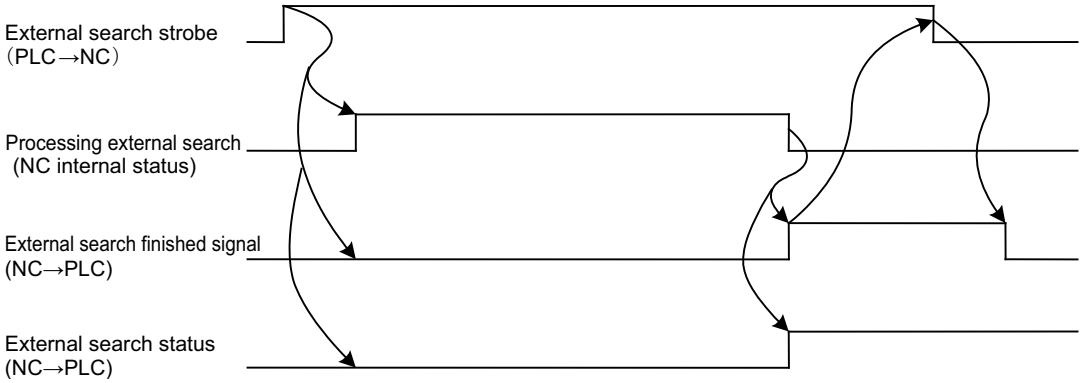
The NC starts the external search at the rising edge of this signal.

The combinations of designation conditions and correspondence of the search blocks are shown below.
Under each condition, the search block + block with designated block No. are searched.

Condition		Search block
Program No.	Sequence No.	
Designated	Designated	Designated sequence No. for designated program
Designated	Not designated (=0)	Head of designated program
Not designated (=0)	Designated	Designated sequence No. in currently selected program
Not designated (=0)	Not designated (=0)	Error: 4 (Refer to "External search status")

Timing chart

The timing chart for the external search is shown below.



External search status

The correspondence of the external search status values and details output from the NC based on the external search is shown below.

External search status value	Details	Remedy
0	Normally finished	----------
1	Operation search is being carried out	Wait for other function's operation search to finish before searching.
2	Search was attempted during the program operation	Stop the program before searching
3	A non-existed or disabled device was designated	Confirm the presence of the device, and that the device is within the specifications
4	The program file is not designated	Designate the program No. or sequence No.
5	The block with the designated program No., sequence No. or block No. was not found	----------
6	No external search specifications	Check the specifications

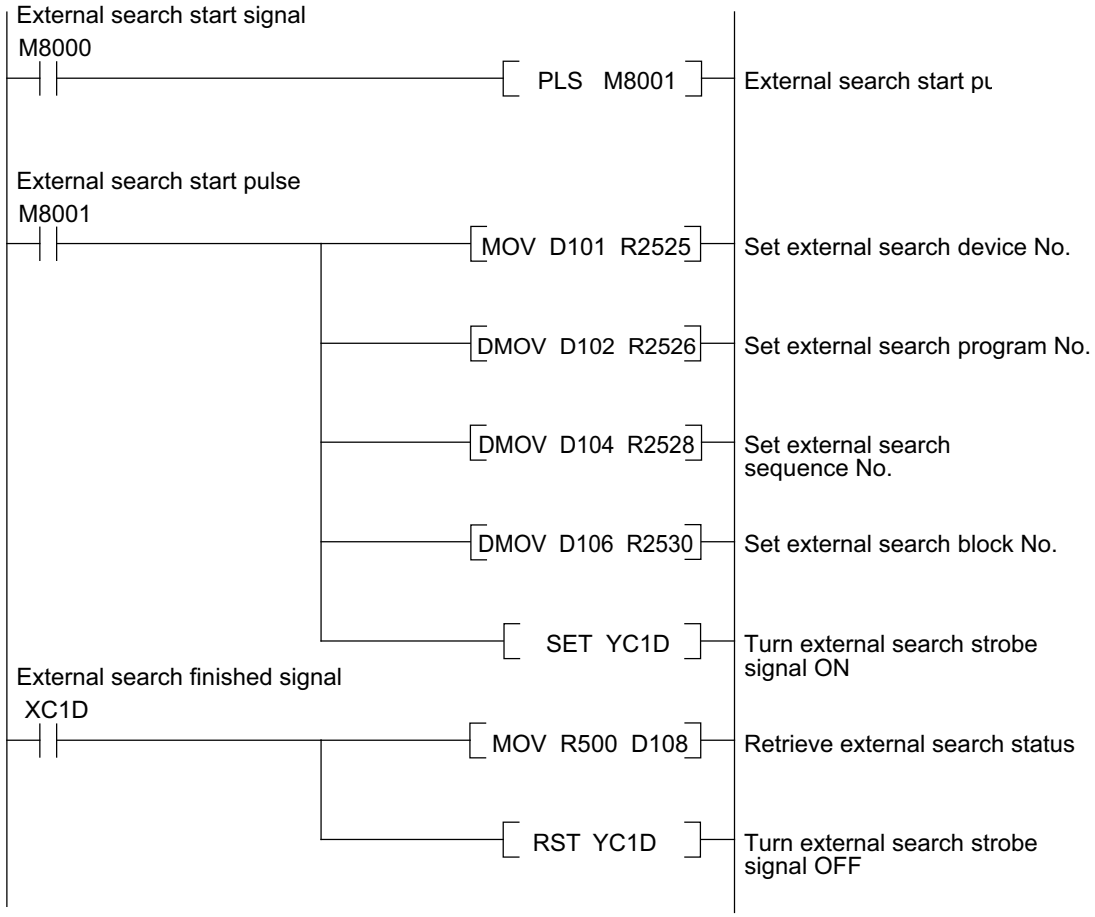
Precautions

(1) Even if the external search strobe has been already OFF when the NC finishes the external search, the external search finished signal will turn ON for one cycle of the user PLC.

(2) When the multi-part system program management is valid, the external search is executed for the machining programs of all part systems in batch with the "External search program No." set to $1.
Note that the "External search sequence No." and the "External search block No." for other part systems are separately set from $1.
The external search strobe is executed to all part systems in batch with the signal for $1.
The "External search strobe" signal is output for each part system, while the "External search finished" signal of 1st part system is output as common signal for all part systems.

Usage example

An example of the external search ladder for the 1st part system is shown below.



6.6.8 PLC Window

PLC Window is a function that uses the "read window" or "write window" arbitrary assigned to the R register's user area to read and write the CNC operation status, axis information, parameters and tool data, etc.

Details

The PLC window has "read window" for read and "write window" for write. The "read window" and "write window" designate arbitrary position of the R register with parameters (window start R register). Up to three window areas can be specified simultaneously for both "read window" area and "write window" area. This enables read/write window area to be split and used even when a part of the user area is fixed.

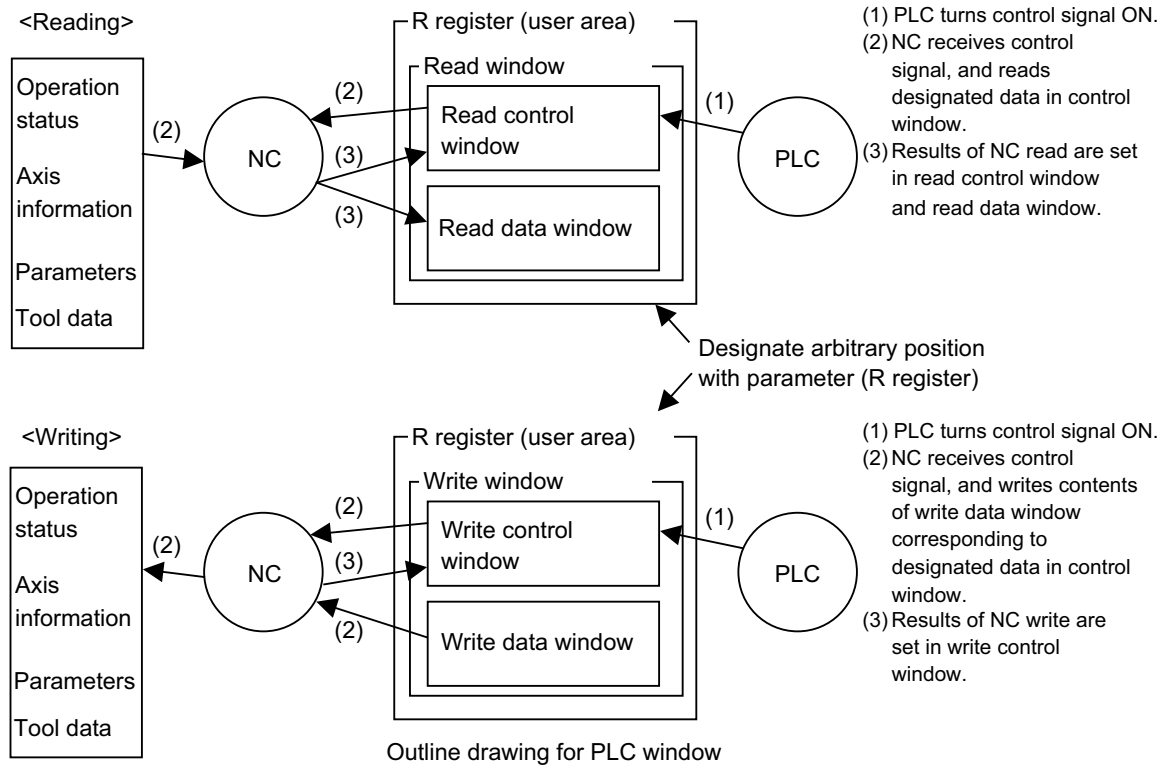
R registers that can be used

User area	R8300 to R9799	Backup area 1500 points
	R9800 to R9899	Non backup area 100 points
	R18300 to R19799	Backup area 1500 points
	R19800 to R19899	Non backup area 100 points
	R28300 to R29799	Backup area 1500 points
	R29800 to R29899	Non backup area 100 points

(Note that R register for window start must be an even number.)

16 R registers are used for one read window or write window.

The read window is further divided into the "read control window" and "read data window". The write window is also divided into the "write control window" and "write data window". Up to four data items can be successively read or written from the data designated in one read window or write window.



Outline drawing for PLC window

After reading, whether reading succeeded or failed and the number of data read will be displayed on the "read control window", and details on the "read data window".
After writing, whether writing succeeded or failed and number of data written will be displayed on the "writing control window"
When reading/writing is finished, bit0 (Refer to the section on "read window interface", "write window interface".) turns ON regardless of reading/writing successfulness. Number of data read/written is defined by the number of data actually read or written. When all reading /writing failed, it shows 0.
When two or more data are read/written, it finishes as soon as reading/writing is failed. For example, when the second reading/writing is illegal, it finishes on the right spot, even if the third data may be read/written normally. Consequently, the first data is the only one read/written successfully, resulting the number of data read/written to 1.

NC → PLC interface signal

For the PLC window interface, specify the start R register and the number of windows of read window 1,2,3, and write window 1,2,3 in the parameter (R424 to R435). Error status is set in (R37) when an error is found in the set parameter. 16 R registers are used for one read window or write window.

Signal name	Common for part system
PLC window parameter status	R37

(1) PLC window parameter error status (R37)

It is set when an error is found in the values set for R424 to R435.
When value is already set, it does not read or write.

Values of R37	Error details
0x8001	One of the values set for R424 to R427 exceed the setting range.
0x8002	Area of read window exceeds the R resister's user area 1.
0x8003	Area of write window exceeds the R resister's user area 1.
0x8004	Write window is found on the read window.
0x8005	Read window is found on the write window.
0x8006	Read window is found on the read window.
0x8007	Write window is found on the write window.
0x8008	Odd number is set for Reading/Writing start R register 1.
0x8101	One of the values set for R428 to R431 exceed the setting range.
0x8102	Area of read window 2 exceeds the R resister's user area.
0x8103	Area of write window 2 exceeds the R resister's user area.
0x8108	Odd number is set for Reading/Writing start R register 2.
0x8201	One of the values set for R432 to R435 exceed the setting range.
0x8202	Area of read window 3 exceeds the R resister's user area.
0x8203	Area of write window 3 exceeds the R resister's user area.
0x8208	Odd number is set for Reading/Writing start R register 3. The area is exceeded.

(Note) If an error occurs in one of the windows to be used, read/write is not possible in all the windows. Set from R424 to R435 without letting the window area overlap.

PLC → NC interface signals

Signal name	Common for part systems		
	n=1	n=2	n=3
PLC window Reading start R register n	R424	R428	R432
PLC window Number of read windows n	R425	R429	R433
PLC window Writing start R register n	R426	R430	R434
PLC window Number of write windows n	R427	R431	R435

(1) PLC window Reading start R register 1 to 3 (R424, R428, R432)

It sets the PLC window Reading start R register 1 to 3.
The setting range is 8300 to 9884. (Even number only)

R register	Details
R424	The value is not checked when the value of R425 is 0.
R428	The value is not checked when the value of R429 is 0.
R432	The value is not checked when the value of R433 is 0.

(2) PLC window Number of read windows 1 to 3 (R425, R429, R433)

It designates the number of read windows 1 to 3.
The setting range is 0 to 100. When it is 0, it does not read.

R register	Details
R425	The read windows 1 will be the consecutive area for the number of windows designated. The read windows start from the R register designated with R424.
R429	The read windows 2 will be the consecutive area for the number of windows designated. The read windows start from the R register designated with R428.
R433	The read windows 3 will be the consecutive area for the number of windows designated. The read windows start from the R register designated with R432.

(3) PLC window Writing start R register 1 to 3 (R426, R430, R434)

It sets PLC window Writing start R register 1 to 3.
The setting range is 8300 to 9884. (Even number only)

R register	Details
R426	The value is not checked when the value of R427 is 0.
R430	The value is not checked when the value of R431 is 0.
R434	The value is not checked when the value of R435 is 0.

(4) PLC window Number of write windows 1 to 3 (R427, R431, R435)

It designates number of write windows 1 to 3.
The setting range is 0 to 100. When it is 0, it does not write.

R register	Details
R427	The write windows 1 will be the consecutive area for the number of windows designated. The write windows start from the R register designated with R426.
R431	The write windows 2 will be the consecutive area for the number of windows designated. The write windows start from the R register designated with R430.
R435	The write windows 3 will be the consecutive area for the number of windows designated. The write windows start from the R register designated with R434.

Read window interface

(1) Read control window (Area where both PLC and NC set data)

R register	Item		Details
RA	Read control window	Control signal	Data will be read by turning bit0 ON. NC and PLC read asynchronously. When the reading is finished, the bit0 under "Status" of the reading results turns ON. When the bit0 under "Status" turns ON, turn OFF the bit0 of the control signal. In case of reading in constant, leave the bit0 ON.
RA+1		Section No.	Designate data type
RA+2		Section sub-ID NO.	Designate part system No. (1 to 4)
RA+3		Sub-section No.	Designate data
RA+4	Read control window	Data No.	Designate axis No. used in the part system and variable No., etc. (The axis No. is 1 to 8)
RA+5		Writing method	0: Read up to 4 consecutive data from the designated data No. 1: Read up to 4 consecutive data from the designated sub-section No. 2: Read up to 4 consecutive data from the designated section sub-ID No.
RA+6		Number to be read	Designate number to be read. Maximum number of data to be read is 4. If 5 or more is designated, the number of data is regarded as 4.
RA+7		Reading results bit0 to bit7: Status bit8 to bitF: Results	<Status> bit0: Read finished (It turns ON when reading is finished regardless of reading successfulness) bit1: blank bit2 to 7: Read error 0x01: Normally finished 0x41: Address illegal 0x45: Section No. illegal 0x49: Sub-section No. illegal 0x59: Not fit in the buffer 0x5D: Data type illegal 0x75: Unable to read 0x7D: Read write-only data 0x81: Axis designation illegal 0x85: Data No. illegal
			<Results>: Number of data read

(2) Read data window (Area where NC sets data)

R register	Item		Detail
RA+8 to 9	Read data window	Read data 1	
RA+10 to 11		Read data 2	
RA+12 to 13		Read data 3	
RA+14 to 15		Read data 4	

(Note) From the control signal to the number of data to be read are set by PLC. Reading result is the area where NC sets the data. Turn ON the control signal after setting RA+1 to RA+6.

Write window interface

(1) Writing control window (Area where both PLC and NC set data)

R register	Item		Details
RB	Writing control window	Control signal	Data will be written by turning bit0 ON. NC and PLC write asynchronously. When the writing is finished, The bit0 under "Status" of the writing result turns ON. When the bit0 under "Status" turns ON, turn OFF the bit0 of the control signal.
RB+1		Section No.	Designate data type
RB+2		Section sub-ID No.	Designate part system No. (1 to 4)
RB+3		Sub-section No.	Designate data
RB+4		Data No.	Designate axis No. used in the part system and variable No., etc. (The axis No. is 1 to 8)
RB+5		Writing method	0: Write up to 4 consecutive data from the designated data No. 1: Write up to 4 consecutive data from the designated sub-section No. 2: Write up to 4 consecutive data from the designated section sub-ID No.
RB+6		Number to be written	Designate number of data to be written. Maximum number of data to be written is 4. If 5 or more is designated, the number of data is regarded as 4.
RB+7		Writing results bit0 to bit7: Status bit8 to bitF: Results	<Status> bit0: Write finished (It turns ON when the writing is finished regardless of writing successfulness) bit1: Blank bit2 to 7: Write error 0x01: Normally finished 0x41: Address illegal 0x45: Section No. illegal 0x49: Sub-section No. illegal 0x59: Not fit in the buffer 0x5D: Data type illegal 0x6D: Written in read-only data 0x79: Unable to write data 0x81: Axis designation illegal 0x85: Data No. illegal
			<Results>: Number of data written

(2) Write data window (Area where PLC sets data) (R427)

R register	Item		Details
RB+8 to 9	Write data window	Write data 1	
RB+10 to 11		Write data 2	
RB+12 to 13		Write data 3	
RB+14 to 15		Write data 4	

(Note) From the control signal to the number to be written in the write control window are set by PLC. NC sets the writing results in the write control window.
Turn ON the control signal after setting RB+1 to RB+6 and RB+8 to RB+15 on write data window.

Precautions

(1) Set the read window start R register (R424, R428, R432) and the write window start R register (R426, R430, R434), securing enough space for the number of windows in between. When mistakenly set in the area, it does not read or write correctly. Up to 16 R registers are needed for one read window or write window.
(Example) In case the reading starts at R8300 and the number of read windowsis set to 10, it uses 160 registers in total. Therefore, the writingstart R register must be set in later than R8460.

(2) Area of read/write window must be within the user area. When reading/writing is attempted exceeding the user area, reading/writing finishes on the right spot.

(3) With this function, up to 100 windows can be read or written. Scan time in ladder may be extended, depending on the number of read/write windows.

(4) When 4 consecutive data are first read and then 3 consecutive data are read using the same window, the forth data will not be cleared to 0, leaving the first data read.

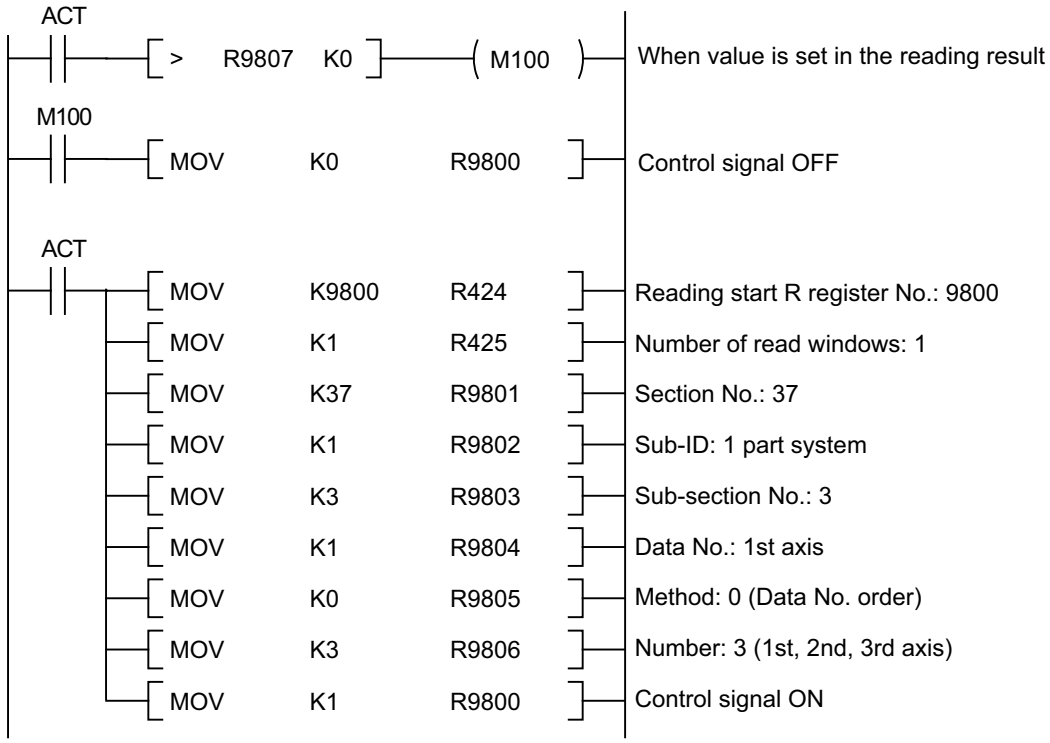
(5) When read control signal and write control signal are ON at the PLC stop, reading and writing are conducted because this function operates even while PLC is stopped.

(6) Read/write window area 1, 2, or 3 can be specified in an arbitrary order, as long as they are specified within R register user area.

(7) Using this function, do not create PLC in which parameters are written each time scan is performed.It might affect some performance. It might also affect the measurement tool such as MS configurator.

Usage example

An example of ladder for reading out the current position within 1st to 3rd axis machine coordinate system on the PLC window is shown below.



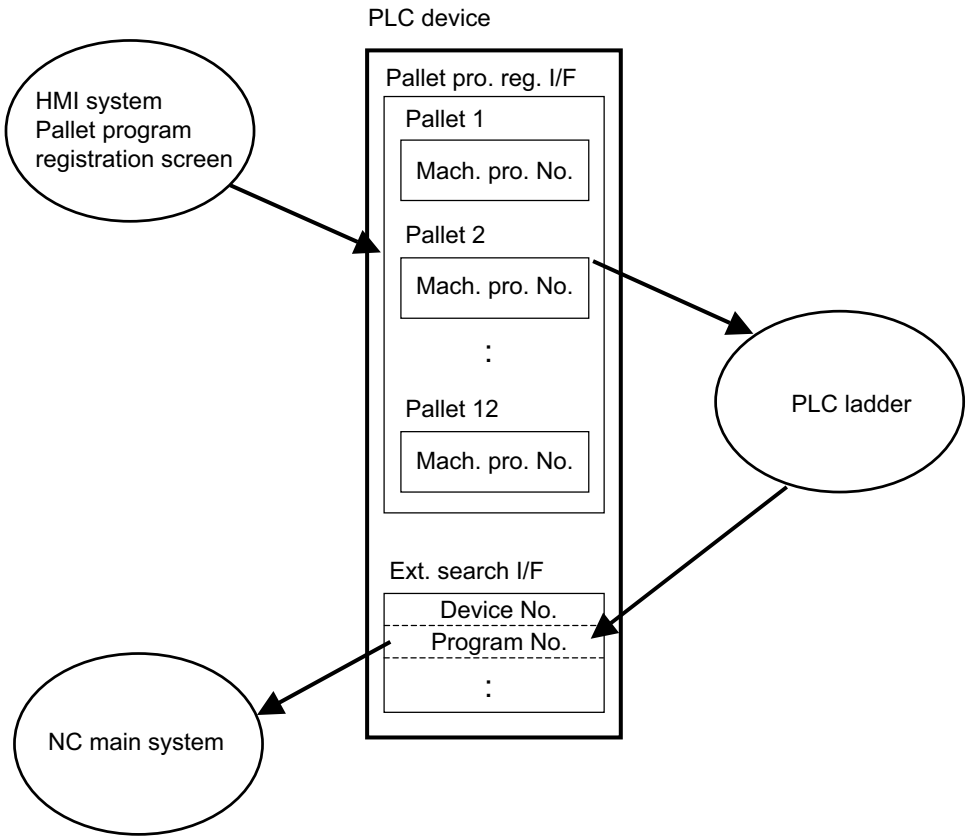
6.6.9 Pallet Program Registration

The pallet program registration function allows machining programs to be registered to each pallet of the automatic pallet changer (hereinafter APC) and supports setups of the machining.
Operation search for the registered program is executed by the PLC ladder using the external function.
This function is applicable to the machining center.
Also, an NC option "Pallet Program Registration" is required.

Operations

Machining programs are registered to each pallet in the "pallet program registration" screen under the group of setup screen.
Registered programs are output to the PLC devices.
As required, PLC ladder executes an external search by referring to the program No. registered in each pallet.
The number of pallets that can be registered differs depending on to which screen the pallets are registered.

- Standard pallet registration screen: Max. 2 pallets
- Pallet 4 page registration screen: Max. 12 pallets



Pallet registration function data flow

NC → PLC interface signal

Device	Signal name	
	Standard pallet registration screen	Pallet 4 page registration screen
X758	Spare	Pallet program registration Ext. workpiece coordinate transfer completion

Contact	Signal name	Signal abbreviation	Common for part systems
A	PALLET PROGRAM REGISTRATION EXT. WORKPIECE COORDINATE TRANSFER COMPLETION		X758

[Function][Operation]

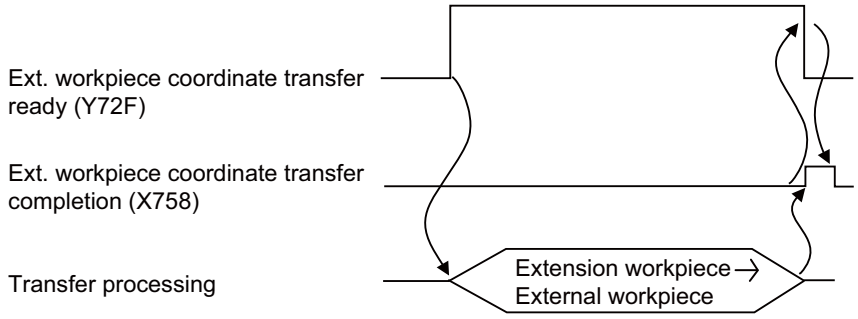
Completion of transfer from extension workpiece coordinate to external workpiece coordinate offset (EXT) during pallet 4 page registration is displayed.

This signal turns ON at the completion of transfer processing.

This signal turns OFF when external workpiece coordinate transfer ready is turned OFF.

The transferred external workpiece coordinate offset (EXT) will be effective as soon as when this signal is turned ON.

[Timing chart]



[Related signals]

(1) Pallet program registration Ext. workpiece coordinate transfer ready (Y72F)

Screen data is output to the following PLC devices.

Device	Signal name	
	Standard pallet registration screen	Pallet 4 page registration screen
R2100	Pallet program search valid/invalid state 0: Invalid 1: Valid	Pallet program search valid/invalid state 0: Invalid 1: Valid
R2101	Continuous start valid/invalid state 0: Invalid 1: Valid	Continuous start valid/invalid state 0: Invalid 1: Valid
R2102	Spare	Pallet registration specification 0: Standard pallet registration screen 1: Pallet 4 page registration screen
R2103	Spare	Number of valid pallets (Setting range: 2 to 12)
R2110	Pallet 1 Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card	Pallet 1 0° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2111	Pallet 1 Machining valid/invalid state 0: Invalid 1: Valid	Pallet 1 0° Machining valid/invalid state 0: Invalid 1: Valid
R2112,R2113	Pallet 1 Machining program No.	Pallet 1 0° Machining program No.
R2114	Pallet 1 Auxiliary data	Pallet 1 0° Auxiliary data
R2115	Spare	Spare
R2116	Pallet 2 Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card	Pallet 1 90° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2117	Pallet 2 Machining valid/invalid state 0: Invalid 1: Valid	Pallet 1 90° Machining valid/invalid state 0: Invalid 1: Valid
R2118,R2119	Pallet 2 Machining program No.	Pallet 1 90° Machining program No.
R2120	Pallet 2 Auxiliary data	Pallet 1 90° Auxiliary data
R2121	Spare	Spare
R2122	Spare	Pallet 1 180° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2123	Spare	Pallet 1 180° Machining valid/invalid state 0: Invalid 1: Valid
R2124,R2125	Spare	Pallet 1 180° Machining program No.
R2126	Spare	Pallet 1 180° Auxiliary data
R2127	Spare	Spare
R2128	Spare	Pallet 1 270° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2129	Spare	Pallet 1 270° Machining valid/invalid state 0: Invalid 1: Valid
R2130,R2131	Spare	Pallet 1 270° Machining program No.
R2132	Spare	Pallet 1 270° Auxiliary data

Device	Signal name	
	Standard pallet registration screen	Pallet 4 page registration screen
R2133	Spare	Spare
R2134	Spare	Pallet 2 0° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2135	Spare	Pallet 2 0° Machining valid/invalid state 0: Invalid 1: Valid
R2136,R2137	Spare	Pallet 2 0° machining program No.
R2138	Spare	Pallet 2 0° Auxiliary data
R2139	Spare	Spare
R2140	Spare	Pallet 2 90° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2141	Spare	Pallet 2 90° Machining valid/invalid state 0: Invalid 1: Valid
R2142,R2143	Spare	Pallet 2 90° Machining program No.
R2144	Spare	Pallet 2 90° Auxiliary data
R2145	Spare	Spare
R2146	Spare	Pallet 2 180° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2147	Spare	Pallet 2 180° Machining valid/invalid state 0: Invalid 1: Valid
R2148,R2149	Spare	Pallet 2 180° Machining program No.
R2150	Spare	Pallet 2 180° Auxiliary data
R2151	Spare	Spare
R2152	Spare	Pallet 2 270° Machining program device No. 0: Memory 1: HD 2: DS 3: FD 4: Memory card
R2153	Spare	Pallet 2 270° Machining valid/invalid state 0: Invalid 1: Valid
R2154,R2155	Spare	Pallet 2 270° Machining program No.
R2156	Spare	Pallet 2 270° Auxiliary data
R2157	Spare	Spare
R2158 to R2397	Spare	Data for pallet 3 to 12 can be registered in the same manner.

PLC → NC interface signal

Device	Signal name	
	Standard pallet registration screen	Pallet 4 page registration screen
Y72E	Pallet program registration In APC execution 0: In place 1: In execution	Pallet program registration In APC execution 0: In place 1: In execution
Y72F	Spare	Pallet program registration Ext. workpiece coordinate transfer ready 0: Transfer not ready 1: Transfer ready After the signals relating to pallet information in the machine and index plane of the pallet in the machine are set, PLC sets this signal. When this signal is turned to "1", NC system transfers the extension workpiece coordinate offset data to external workpiece coordinate offset (EXT).

Con-tact	Signal name	Signal ab-breviation	Common for part sys-tems
A	PALLET PROGRAM REGISTRA-TION EXT. WORKPIECE COOR-DINATE TRANSFER READY		Y72F

[Function][Operation]

When transferring external workpiece coordinate offset (EXT) in the pallet 4 page registration, turn this signal ON. NC starts transfer processing at the rising edge of this signal.

When the external workpiece coordinate transfer completion signal is turned ON, turn this signal OFF.

It takes approx. 8ms from the start to the end of transfer processing. If the transfer completion signal is not turned ON even after 8ms has passed since the transfer ready signal was turned ON, reconsider the value of R register 4100 and 4102.

NC turns the external workpiece coordinate transfer completion signal OFF at the falling edge of this signal.

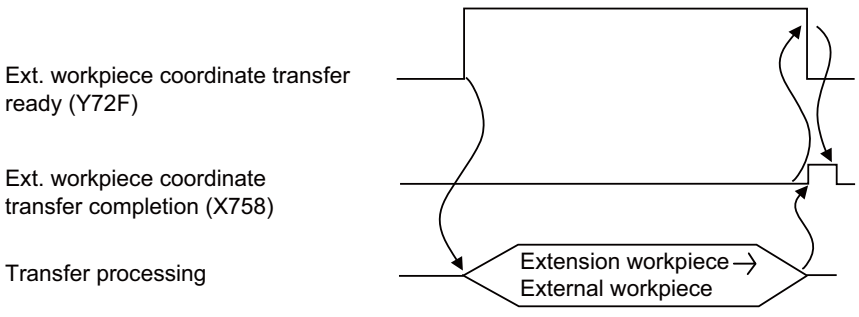
When turning the transfer ready signal ON from the machining program, recalculation request and M function finish (FIN1 or FIN2) must be turned ON after the external workpiece coordinate transfer completion signal is turned ON.

When recalculation is not requested, operation of the pre-read machining program will be carried out using the external workpiece coordinate offset prior to the change.

When M function has been completed before transfer is completed, the external workpiece coordinate offset data to be used in the machining program will not be changed from the one prior to the change until the transfer completion signal is turned ON.

This signal must be turned ON while the external workpiece coordinate transfer completion signal is OFF.

[Timing chart]



[Related signals]

(1) Pallet program registration Ext. workpiece coordinate transfer completion (X758)

Device	Signal name	
	Standard pallet registration screen	Pallet 4 page registration screen
R4100	Pallet information in the machine bit0 :ON - Pallet 1 in the machine bit1 :ON - Pallet 2 in the machine : bit11:ON Pallet 12 in the machine	Pallet information in the machine bit0 :ON - Pallet 1 in the machine bit1 :ON - Pallet 2 in the machine : bit11:ON - Pallet 12 in the machine
R4101	Auxiliary function 0: Not available, 1: Available	Auxiliary function 0: Not available, 1: Available
R4102	Spare	Index plane of the pallet in the machine 0:0°, 1:90°, 2:180°, 3:270°
R4103	Spare	Machining valid/invalid setting disabled (For pallet details) 0: Invalid (Machining setting enabled) 1: Valid (Machining setting disabled)
R2111	Spare (PLC → NC setting not possible on the standard pallet registration screen)	Pallet 1 0° Machining valid/invalid state 0: Invalid 1: Valid
R2117	Spare (PLC → NC setting not possible on the standard pallet registration screen)	Pallet 1 90° Machining valid/invalid state 0: Invalid 1: Valid
R2123	Spare	Pallet 1 180° Machining valid/invalid state 0: Invalid 1: Valid
R2129	Spare	Pallet 1 270° Machining valid/invalid state 0: Invalid 1: Valid
R2135	Spare	Pallet 2 0° Machining valid/invalid state 0: Invalid 1: Valid
R2141	Spare	Pallet 2 90° Machining valid/invalid state 0: Invalid 1: Valid
R2147	Spare	Pallet 2 180° Machining valid/invalid state 0: Invalid 1: Valid
R2153	Spare	Pallet 2 270° Machining valid/invalid state 0: Invalid 1: Valid
		Machining data for pallet 3 to 12 can be registered in the same manner.

Precautions

(1) Only the program with a file name using decimal number (1 to 99999999) can be registered.Program in HD, DS, FD and memory card can be registered besides one in NC memory; however, the program is limited to the one in root directory.

(2) Number of pallets to be registered: ・Standard pallet registration screen: Max. 2 pallets ・Pallet 4 page registration screen: Max. 12 pallets

(3) Error message appears according to the PLC device value regardless of the operation status.

(4) The setting range for auxiliary function data is -32768 to 32767.

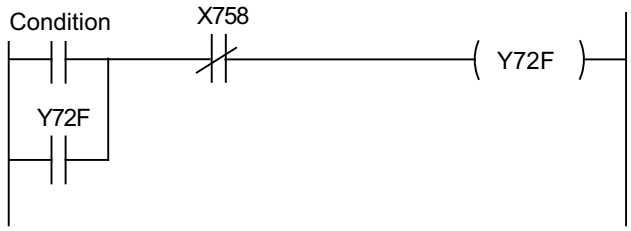
(5) The parameter "#11001 APC type (APC screen display type selection)" and "#11002 Valid pallet num (Number of pallets designation)" are set to R register 912/913 only at the power ON.

(6) When external workpiece coordinate transfer ready (Y78F) is turned ON/OFF without a break, transfer is carried out, but the transfer completion signal (X758) will not be output.

(7) This function is available only in the 1st part system, no matter which part system it is operated in.

Usage example

An example of ladder when external workpiece coordinate offset (EXT) is transferred in the pallet 4 page registration is given below.



6.6.10 Chopping

With this function, the chopping axis constantly moves back and forth independently of the program operation during executing the machining program.

NC → PLC interface signal

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN CHOPPING START	CHOP	XC80	XDC0	XF00	X1040

[Function][Operation]

This signal turns ON in the state of chopping start.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	BASIC POSITION →UPPER DEAD POINT PATH FLAG	CHP1	XC81	XDC1	XF01	X1041

[Function][Operation]

This signal turns ON while moving from the basic position to the upper dead center point.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	UPPER DEAD POINT → BOTTOM DEAD POINT PATH FLAG	CHP2	XC82	XDC2	XF02	X1042

[Function][Operation]

This signal turns ON while moving from the upper dead center point to the bottom dead center point.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	BOTTOM DEAD POINT → UPPER DEAD POINT PATH FLAG	CHP3	XC83	XDC3	XF03	X1043

[Function][Operation]

This signal turns ON while moving from the bottom dead center point to the upper dead center point.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	UPPER DEAD POINT → BASIC POSITION PATH FLAG	CHP4	XC84	XDC4	XF04	X1044

[Function][Operation]

This signal turns ON while moving from the upper dead center point to the basic position.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	IN CHOPPING MODE	CHPMD	XC85	XDC5	XF05	X1045

[Function][Operation]

This signal turns ON in the state of chopping mode.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	STROKE COMPENSATION COMPLETION		XC86	XDC6	XF06	X1046

[Function][Operation]

This signal turns ON when the difference between the commanded stroke and the actual stroke has reached the tolerance specified with the parameter (#2080 chwid) as a result of compensation of the commanded position.
When speed fluctuates, such as when movement is stopped or chopping control data is changed, this signal is turned OFF.
While "Chopping compensation update prevented" (CHPRCC) signal is turned ON, this signal will not be turned OFF even if the speed fluctuates.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING COMPENSATION UPDATED PREVENTED	CHPRCC	XC7F	XDBF	XEFF	X103F

[Function]

This signal indicates that the machine is in the state where it does not update the chopping compensation amount.

[Operation]

While this signal is turned ON:
- The chopping compensation amount is not updated.
- The stroke compensation completion signal does not OFF.

When the control data is updated, turn this signal OFF and then update the chopping compensation amount.

[Related signals]

(1) Chopping compensation update prevention request (CHPRCR: YCD7)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING ERROR NO.		R554	R754	R954	R1154

[Function]

This signal notifies the user PLC the alarm details when an alarm occurs during chopping operation.

[Operation]

Chopping error No. and the details are as shown below.

Error No.	Details	Classification
0	No error	-
1	Number of cycles for chopping is zero. (Operates when the number of cycles is 1)	A
2	(Chopping axis feedrate) > (Cutting feed clamp speed) (The feedrate is clamped at the cutting feed clamp speed.)	A
3	(Acceleration of chopping axis) > (Cutting feed clamp speed)/(Cutting feed time constant) (The acceleration is clamped at (Cutting feed clamp speed)/(Cutting feed time constant))	A
4	(Number of cycles for chopping) > (1056/min) (The number of cycles for chopping is clamped at 1056/min.)	A
5	Chopping axis zero point return is not completed.	B
6	Chopping override is zero.	B
7	Commanded axis is the chopping axis.	B
8	The bottom dead center point position is zero.	B
9	The chopping axis is a manual feed axis.	B
10	Interlock	B
11	Stored stroke limit or stroke end	B
20	There is no specification for chopping.	-
21	Chopping control data area exceeds the R register area designated for the chopping control data. Chopping control data area and compensation amount record area are overlapped. Compensation amount record area exceeds R register's backup area (R8300 to R9799). ((Rm+14 x N sets+4) > 9799)	C
22	Multiple chopping axes are specified by the PLC interface.	C
23	Chopping axis is not specified by either PLC interface or parameter.	C
24	Compensation method is set to other than 0/1.	C
25	The mode for the compensation value fixed method is set to other than 0(playback mode) or 1(record mode).	C
26	Data No. for the control data is a negative value.	C
27	Chopping axis's "#2081 chclsp" (Chopping clamp speed) and "#2002 clamp" (Cutting clamp speed) are both set to "0".	C
28	Chopping axis was changed during chopping operation. (Chopping axis cannot be changed during chopping.)	C
29	Rotary axis was specified as chopping axis.	C
30	Rapid traverse override valid/invalid is set to other than 0(invalid) or 1(valid).	A
31	The setting unit for the chopping override is other than 0 (1 %) or 1 (0.01 %).	A

Classification A:	The error is retained during chopping operation. The error is cleared at the rising edge of the chopping parameter valid signal after the chopping control data is corrected, or when the NC is reset.
Classification B:	The error is cleared after the alarm factor is removed, or when the NC is reset.
Classification C:	The error is cleared at the falling edge of the chopping parameter valid signal, or when the NC is reset. The chopping control data will not become valid while the alarm is occurring.

[Related signals]

(1) Chopping signal (CHPS: YC30)

PLC → NC interface signals

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CHOPPING	CHPS	YC30	YD70	YEB0	YFF0

[Function]

This signal validates the chopping function.

[Operation]

The chopping mode is entered at the rising edge of this signal.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CHOPPING PARAMETER VALID		YC34	YD74	YEB4	YFF4

[Function]

This signal validates the chopping control data assigned to R register.

[Operation]

(1) The chopping control data is validated at the rising edge of this signal.

(2) This signal must be turned OFF after confirming the chopping start ready completion signal is turned ON. Chopping start ready completion signal is included in the control status within the chopping control data.

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CHOPPING COMPENSATION UPDATE PREVENTION REQUEST	CHPRCR	YCD7	YE17	YF57	Y1097

[Function] [Operation]

This signal prevents the chopping compensation amount from being updated.

[Related signals]

(1) Chopping compensation update prevented (CHPRCC: XC7F)

Contact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	CHOPPING OVERRIDE	CHPOV	R2503	R2703	R2903	R3103

[Function]

The chopping override can be set in the range between 0 and 100%.

The value is set directly in the R register for chopping override. (The code method setting is not available.)

The data is set in R2503.

[Operation]

(1) Only the chopping override is valid for the chopping operation.When rapid traverse override valid is commanded from the PLC window, the rapid traverse override can be validated for the rapid traverse between the basic position and upper dead center point.The rapid traverse override can be set with either the code method (1, 25, 50, 100%) or the file register (value setting) method (0 to 100%, 1% increment).

(2) The chopping override is set between 0 and 100%.Select either "1 %" or "0.01%" using the control data for the setting unit.If a value outside the range from 0 to 100% is set, the override will be clamped at 100%.

(3) Set the data with one command.

(4) If the "Chopping override" signal is set to "0", "M01 OPERATION ERROR 0150" will occur.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CHOPPING CONTROL DATA ADDRESS		R2587	R2787	R2987	R3187

[Function][Operation]

This signal designates the chopping control data head No. (R register No.) assigned to R register.

R register area that can be used for assigning the chopping control data is as shown below.

R8300 to R9768 (Backup area)

R9800 to R9886 (Non back up area)

[Caution]

(1) Setting error occurs if an odd number is set.

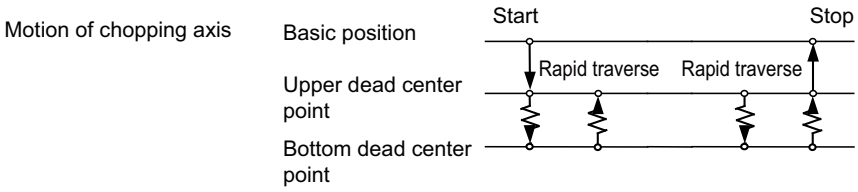
(2) When the backup area is used, set the area ahead of the compensation amount record area (#1324 chop_R).

(3) Error occurs if the chopping control data overlaps with the other part system or the compensation amount record area.

Chopping operation start

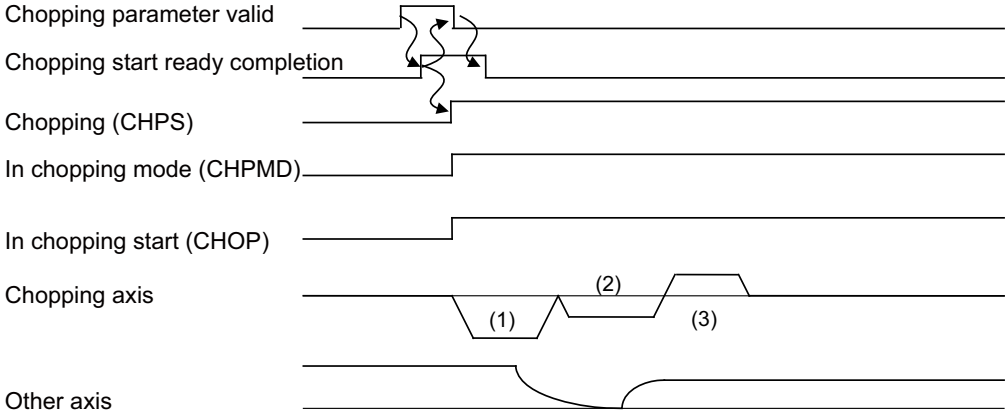
The chopping mode is entered at the rising edge of the "Chopping" signal (CHPS), and the chopping operation is started based on the position determined with the program, etc.
The chopping control sequence is the following.

・When the chopping axis is not moving, chopping is started immediately.
・ When the chopping axis is moving, chopping is valid from the next block in the automatic mode, and an operation alarm will occur in the manual mode.

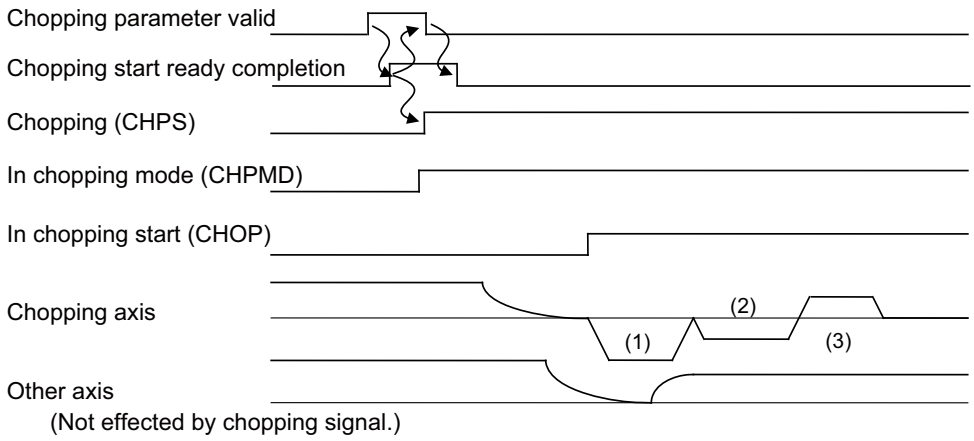


(1) In automatic mode

(a) When the chopping axis is not moving:



(b) When the chopping axis is moving:

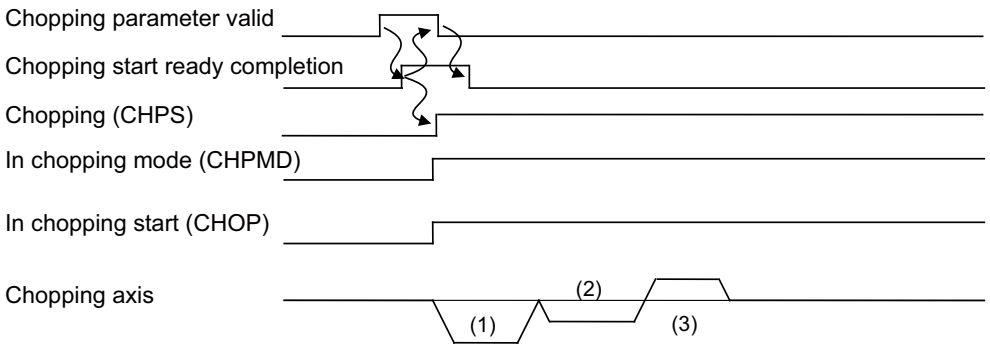


The "In chopping start" is entered after the chopping axis movement has been completed.

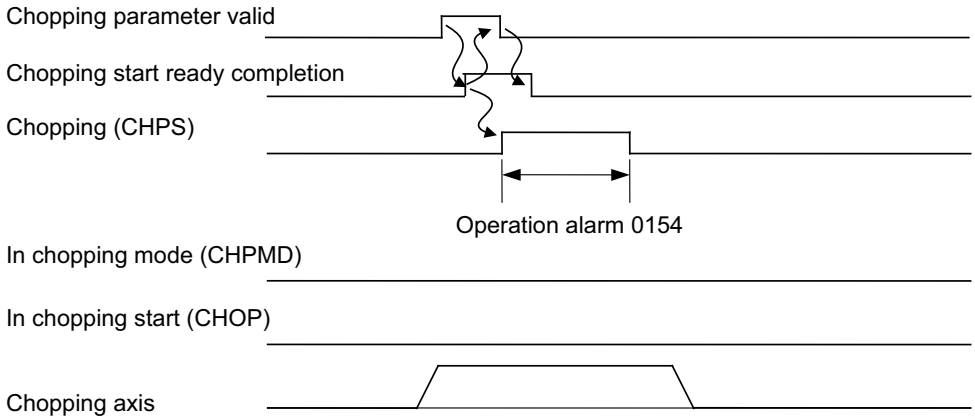
(2) In manual mode

In the jog and step mode, when the chopping axis is not moving, the chopping operation is started at the rising edge of the "Chopping" signal.If the "Chopping" signal is turned ON when the chopping axis is moving, the OPERATION ALARM 0154 will occur, and the chopping will not be started.(Rising edge of the "Chopping" signal is ignored.)

(a) When the chopping axis is not moving:



(b) When the chopping axis is moving:

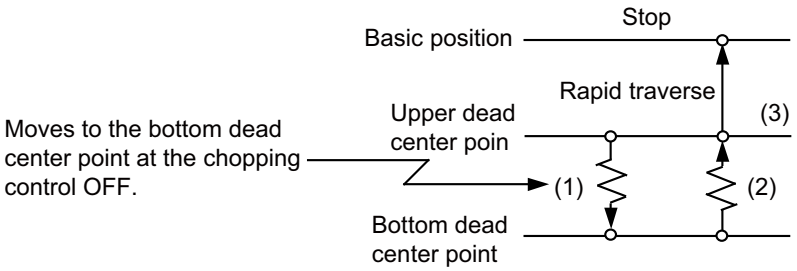


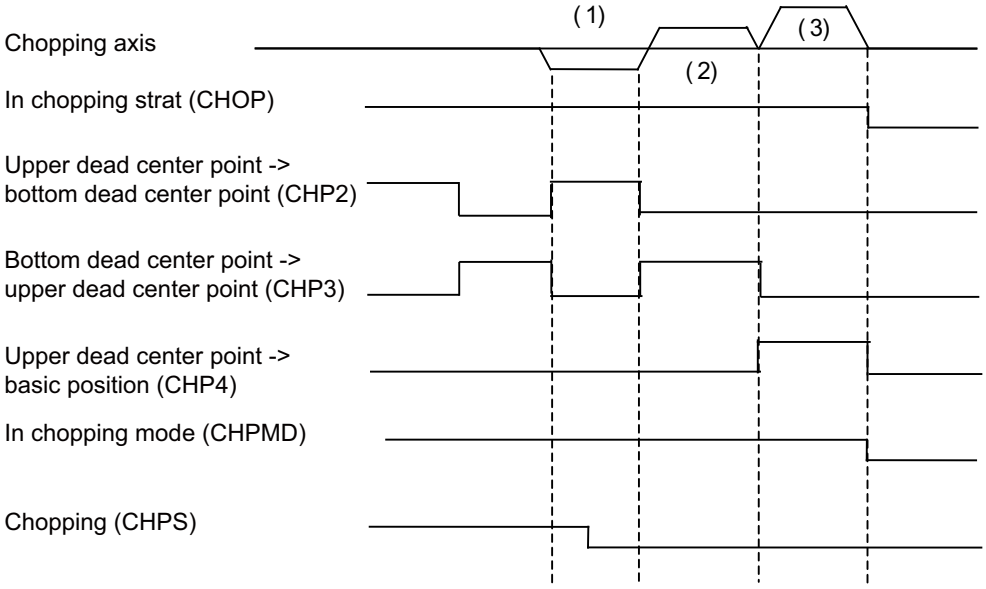
In the handle mode, when the chopping axis is not selected for the handle axis, the chopping operation is started at the rising edge of the "Chopping" signal.
If the "Chopping" signal is turned ON when the chopping axis is selected for the handle axis, the OPERATION ALARM 0154 will occur, and the chopping will not be started.

Chopping operation stop

The chopping operation is stopped at the falling edge of the "Chopping" signal from the PLC.
The chopping axis moves to the basic position with the rapid traverse after executing the chopping operation to the upper dead center point.
The chopping axis once moves to the bottom dead center point even in the middle of moving from the upper dead center point to the bottom dead center point.

Stopping motion of chopping axis

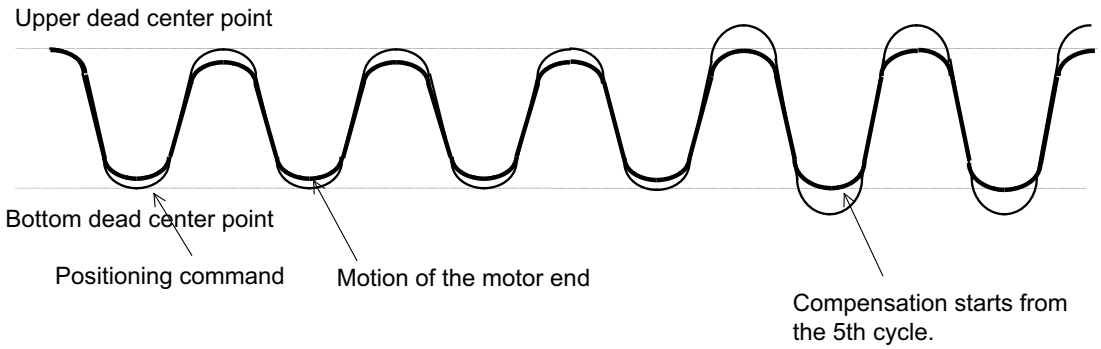




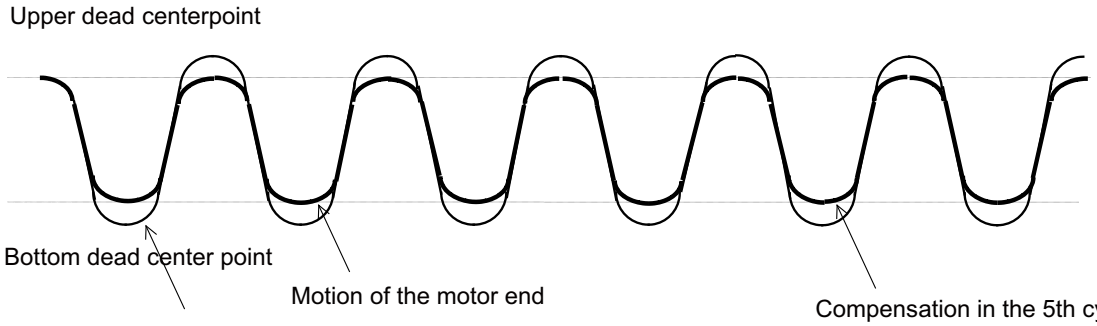
The "In chopping start" and the "In chopping mode" signals are turned OFF after returning to the basic position completes.

Chopping compensation method

Because this function involves high-speed repetitive motions, the positioning method allowing compensation based on the calculation from the machinery operation (feedback position of the motor end) is adapted, rather than the method using in-position check. Compensation amount used for positioning is calculated every 4 cycles from the start of chopping operation, based on the difference between the commanded position and feedback position. Then the compensation amount is added to the positioning command for the next cycle so that the difference between the commanded position and feedback position will disappear. (Compensation value sequential update method)



However, with this method, if the grindstone contacts with the workpiece, the chopping width before and after compensation may be differed, and which may affect the machining surface. In this case, the compensation value fixed method is appropriate.
With the compensation amount fixed method, compensation amount based on a dry run operation is recorded in advance so that, in the real operation, compensation is carried out from the first positioning to the bottom dead center point using the compensation amount recorded earlier.



Positioning command:
Select the compensation value fixed method and set the compensation amount so that compensation is carried out from the first bottom dead center point position since the operation has started.

The stroke compensation completion signal is output when the difference between the commanded stroke and the actual stroke has reached the tolerance specified with the parameter (#2080 chwid).

(1) Compensation value sequential update method

Every chopping command starts with "0" compensation amount. Compensation amount is calculated every 4-cycle chopping operation, and then the compensation is carried out.

<Prevent From Updating the Chopping Compensation Amount>

With the compensation value sequential update method, the stroke normally fluctuates by changing the speed of chopping operation. Turn the stroke compensation completion signal OFF to update the compensation amount automatically.

However, if the amount of change in the chopping operation is small and the fluctuation of the stroke is small, it might not need to update the compensation amount.

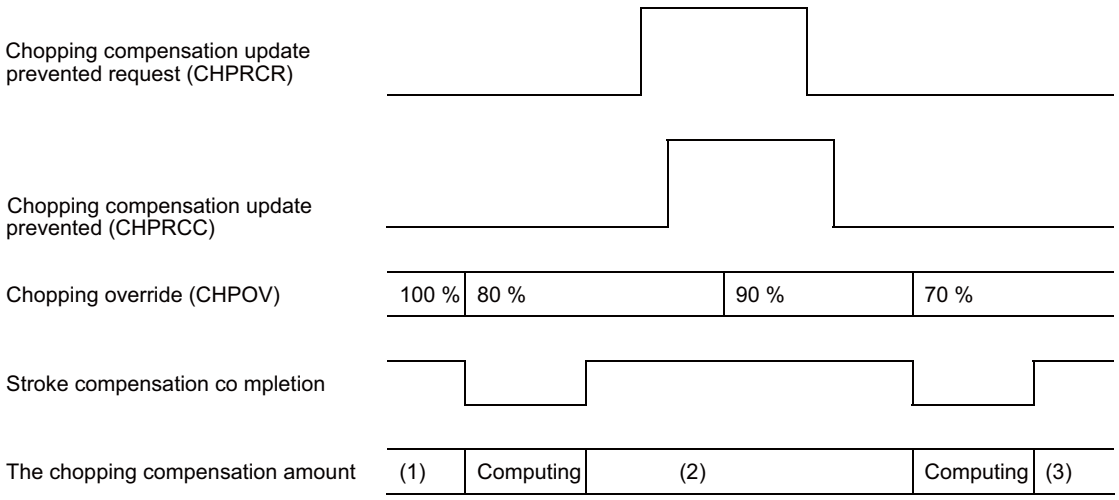
Use "Chopping compensation update prevented request" signal (CHPRCR) in this situation.

"Chopping compensation update prevented" signal (CHPRCC) is turned ON when the "Chopping compensation update prevented request" signal (CHPRCR) is turned ON.

While "Chopping compensation update prevented" signal (CHPRCR) is turned ON:

- The chopping compensation is not updated.
- The stroke compensation completion signal does not turn OFF.

When the control data is updated, turn "Chopping compensation update prevented request" signal (CHPRCR) OFF and then update the chopping compensation amount.



(1): Chopping compensation amount when the chopping override (CHPOV) is worth 100 %.
(2): Chopping compensation amount when the chopping override (CHPOV) is worth 80 %.
(3): Chopping compensation amount when the chopping override (CHPOV) is worth 70 %.

(2) Compensation value fixed method

Compensation amount fixed method includes the record mode and the playback mode.

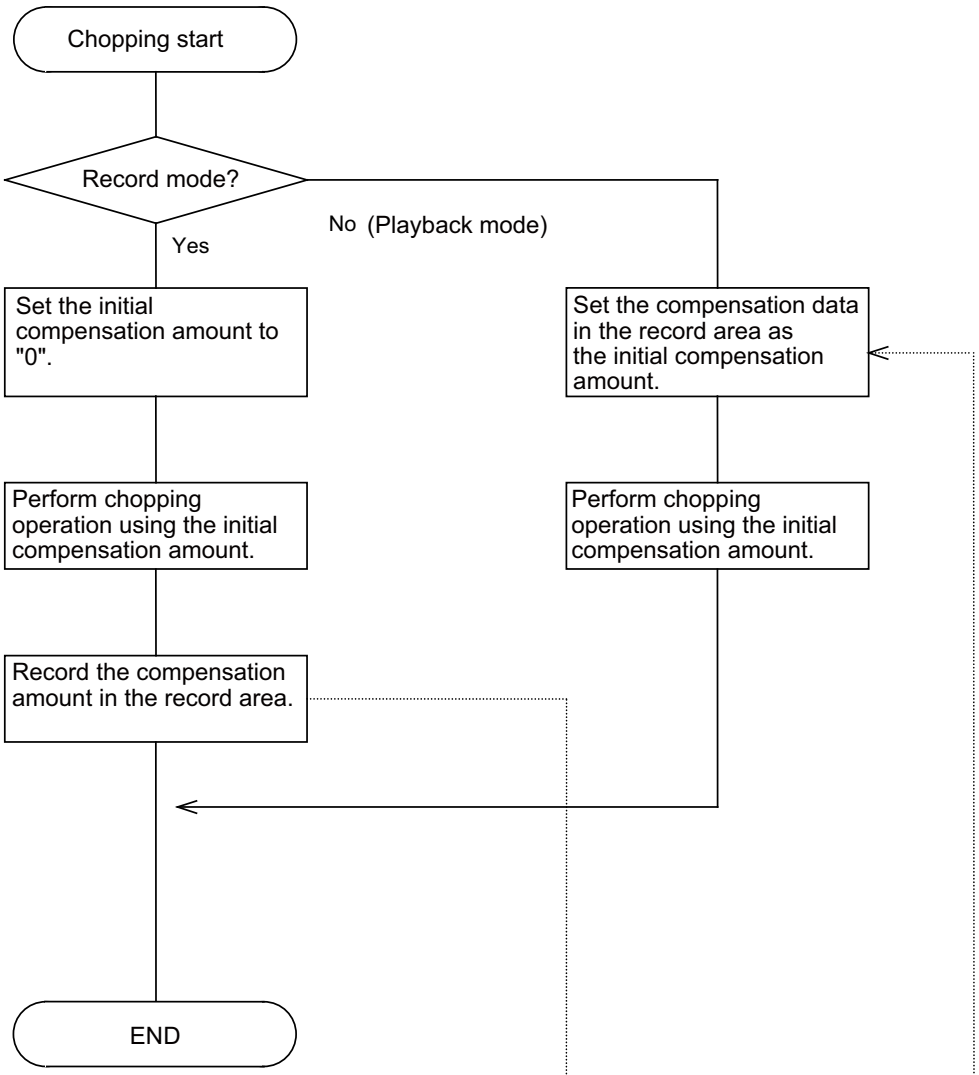
<Record mode>

- Override, command axis, upper/bottom dead center point position, number of cycles, and compensation amount are recorded as the chopping control data.
- Compensation amount record area is specified with R register.
- Compensation amount record area is determined by the number of R registers to be secured.
  14 consecutive R registers are required for 1 set of record.
- Compensation amount is always updated in the record mode.

<Playback mode>

- Chopping operation is started using the data (override, command axis, upper/bottom dead center point position, number of cycles, compensation amount) recorded in the record mode.
  Compensation amount is not calculated during playback mode.

<The operation of the compensation amount fixed method>



Compensation amount record area (R register: For N sets)

	Error status	Completion status	Command - Feedback
0	Override | Axis | Up dead pt. | Bottom dead pt. | No. of cycles | Compen. amnt (Width) | Compen. amnt (Ctr) | (Open to user)		
1	Override | Axis | Up dead pt. | Bottom dead pt. | No. of cycles | Compen. amnt (Width) | Compen. amnt (Ctr) | (Open to user)		
N-2	Override | Axis | Up dead pt. | Bottom dead pt. | No. of cycles | Compen. amnt (Width) | Compen. amnt (Ctr) | (Open to user)		
N-1	Override | Axis | Up dead pt. | Bottom dead pt. | No. of cycles | Compen. amnt (Width) | Compen. amnt (Ctr) | (Open to user)		

14 R registers are required per one set.
For N sets, the number of R registers required is 14*N+4.

Chopping control data

Rn is specified with the PLC device (chopping control data address).

Data to be used differs depending on whether the compensation value sequential update method is applied or compensation amount fixed method is applied.

Update : Specify with the compensation value sequential update method

Fixed : Specify with the compensation value fixed method

Rn	a:	Control status	(Rn)	Update	Method
Rn+1		bit3 : Chopping start ready completion This turns OFF at the falling edge of the chopping parameter valid signal. bitF : Error occurred This turns ON if an alarm occurrs when the chopping parameter valid signal is turned ON. The details of error is notified with bit9 to C. (Note) bit9 : Chopping error bitA : Chopping specifications is not available bitB : Compensation method is set to other than 0/1 bitC : Multiple chopping axes are specified			
Rn+2	b:	Not used	(Rn+1)	Update	Fixed
Rn+3	c:	Compensation method	(Rn+2)	Update	Fixed
Rn+4		0000(HEX) : Compensation value sequential update method 0001(HEX) : Compensation value fixed method			
Rn+5	d:	The setting unit for the chopping override	(Rn+3)	Sequential update	Fixed
Rn+6		0000(HEX): 1 % (unit) 0001 (HEX): 0.01 % (unit)			
	e:	Rapid traverse override valid/invalid	(Rn+4)	Update	
Rn+8		This sets the rapid traverse override valid/invalid in respect to the movement speed between the basic position and the upper dead center point. 0 : Invalid 1 : Valid			
	f:	Chopping axis designation	(Rn+5)	Update	
Rn+10		bit0 : 1st axis bit1 : 2nd axis : : bit7 : 8th axis		Select any one of the existing axes using bit. When no axis is specified, the axis whose base specification parameter "chop_ax" is "1" (the smallest No. of axis) within the same part system is selected.	
		bit8 to F : Not used (Set to "0".)			
Rn+12	g:	Upper dead center point	(Rn+6[low], Rn+7[high])	Update	
		This sets the movement amount of basic position -> upper dead center point with the code. Use the setting and display unit (#1003 iunit) for setting.			
Rn+13	h:	Bottom dead center point	(Rn+8[low], Rn+9[high])	Update	
		This sets the distance of upper dead center point -> bottom dead center point with the code. Use the setting and display unit for setting.			
	i:	Number of cycles	(Rn+10[low], Rn+11[high])	Update	
		This sets the number of cycles for chopping cycle. (Unit: Number of cycles/min)			
	j:	Operation mode with the compensation value fixed method	(Rn+12)		Fixed
		0000(HEX) : Playback mode 0001(HEX) : Record mode			
	k:	Data No.	(Rn+13)		Fixed
		This specifies what number data (n-th data) from the head of the record area (specified by the parameter) to be used. (Both the record mode and playback mode must be specified. 1st data area is specified with 0.)			

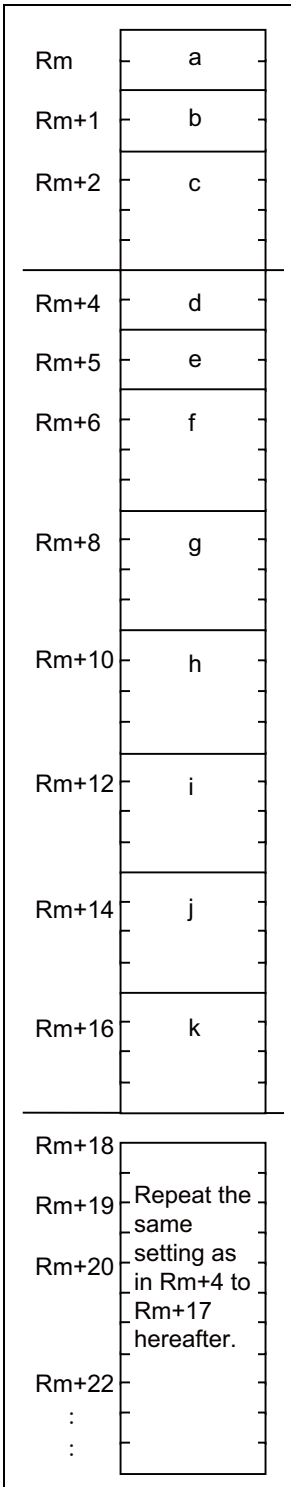
(Note) If an alarm occurs when the chopping parameter valid signal is turned ON, Rn bit is turned ON. Alarm details is output to the chopping error No. (R554), as well.

Rn bit	Error	Cause
BITA BITF	Option error	There is no specification for chopping.
BITB BITF	Compensation method error	Compensation method is set to other than 0(Compensation value sequential update type) or 1(Compensation value fixed type).
BITC BITF	Illegal number of axes error	Multiple chopping axes are specified by the PLC interface.
BIT9 BITF	Chopping error	Part system commanded by PLC interface is not valid.
		Chopping axis is not specified by either PLC interface or parameter.
		Rotary axis is specified as the chopping axis.
		Rapid traverse override valid/invalid is set to other than 0(invalid) or 1(valid).
		Data No. of the control data is a negative value.
		Compensation amount record area exceeds R register backup area (R8300 to R9799). ((Rm+14xN sets+4) > 9799.)
		The mode for the compensation value fixed method is set to other than 0(playback mode) or 1(record mode).
		Number of cycles is 0 or less, or over 1056. (If 0 or less, 1 is applied. If exceeds 1056, 1056 is applied.)
		Acceleration determined by the parameter exceeds clamp/chtL. (The number of cycles is reduced.)
		When the chopping axis is changed during chopping operation. (Chopping axis is not changed during chopping.)
		F(feedrate) exceeds the clamp speed. (The speed is clamped to the clamp speed (#2081 chclsp).)
		Chopping axis's #2081 chclsp (chopping clamp speed) and #2002 clamp (cutting clamp speed) are both set to "0".

The error bit shown above is not turned ON in the following cases. However, chopping error No. is output.
- Control data area exceeds the R register area designated for the control data.
- Control data area and compensatioin amount record area are overlapped.

Chopping control data: Compensation amount record area (Dedicated for compensation value fixed method)

Rm is specified with the parameter (#1324 chop_R).



a:	Error status (in playback mode)		(Rm)
	bit0 : This is turned ON when the difference between the motor end feedback amplitude width and the commanded width has exceeded the tolerance set with the parameter (#2080 chwid).		
b:	Chopping compensation amount record completion status (in record mode)		(Rm+1)
	bit0 : "1" at completion of recording bit1 : "1" when recording is not completed		
c:	Command - Feedback		(Rm+2[low], Rm+3[high])
	[In playback mode] Difference between the motor end feedback amplitude width and the commanded width is stored when the difference has exceeded the tolerance set with the parameter (#2080 chwid). [In record mode] Difference between command and feedback is stored every time the compensation amount is calculated.		
d:	Rapid traverse override valid/invalid		(Rm+4)
	Set the rapid traverse override valid/invalid in respect to the movement speed between the basic position and upper dead center point. 0 : Invalid 1 : Valid		
e:	Chopping axis designation		(Rm+5)
	bit0 : 1st axis bit1 : 2nd axis : : bit7 : 8th axis		Select any one of the existing axes using bit. When no axis is specified, the axis whose base specification parameter "chop_ax" is "1" (the smallest No. of axis) within the same part system is selected.
	bit8 to F : Not used (Set to "0".)		
f:	Upper dead center point		(Rm+6[low], Rm+7[high])
	Set the movement amount of basic position -> upper dead center point with the code. Use the setting and display unit (#1003 iunit) for setting.		
g:	Bottom dead center point		(Rm+8[low], Rm+9[high])
	Set the distance of upper dead center point -> bottom dead center point with the code. Use the setting and display unit for setting.		
h:	Number of cycles		(Rm+10[low], Rm+11[high])
	Set the number of cycles for chopping cycle. (Unit: Number of cycles/min)		
i:	Compensation amount (Width)		(Rm+12[low], Rm+13[high])
	Compensation amount to be added to the chopping upper/bottom dead center point command. In the playback mode, this is used for amplitude compensation. When started with the record mode, this is automatically stored.		
j:	Compensation amount (Center)		(Rm+14[low], Rm+15[high])
	Compensation amount to be added to the chopping upper/bottom dead center point command. In the playback mode, this is used for compensating the center of amplitude. When started with the record mode, this is automatically stored.		
k:	Data to be opened		(Rm+16[low], Rm+17[high])
	Use this for managing the compensation amount record area, etc. by using ladder of the user.		

Procedures for setting the chopping control data

(1) Set the chopping control data to R register.

(2) Turn the chopping parameter valid signal ON.

Chopping control data is written into the current parameter area inside the NC at the rising edge of the chopping parameter valid signal and is reflected to the chopping operation.

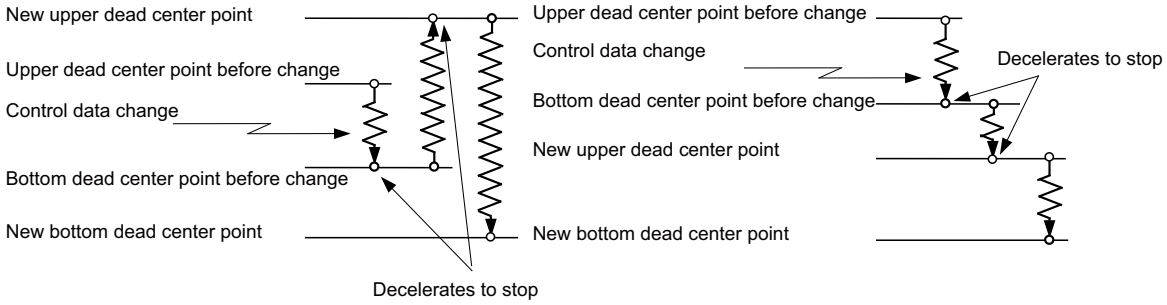
Turn the chopping parameter valid signal OFF after confirming that the chopping start ready completion signal in the control status (Rn) within the chopping control data is turned ON.

Setting the chopping control data during chopping

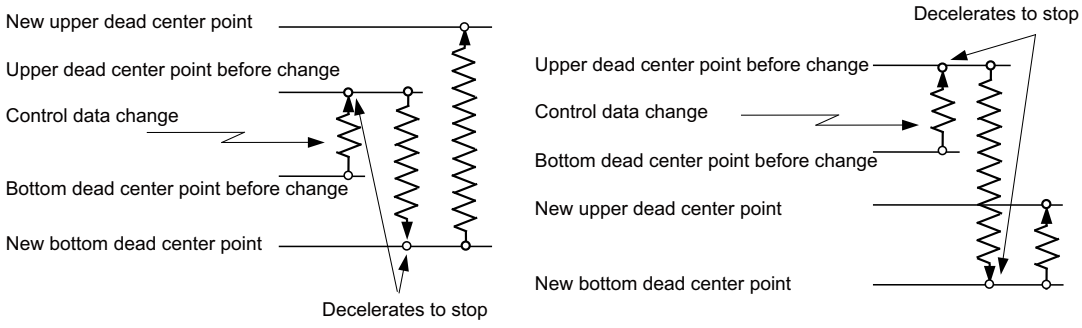
Chopping control data can be set during chopping.

When the chopping parameter valid signal is turned ON, the chopping axis decelerates to stop once at the upper or bottom dead center point to be changed. As soon as decelerating to stop, chopping operation is carried out with the changed chopping control data.

The upper and bottom dead center points are switched while moving from the upper dead center point to the bottom dead center point.



The upper and bottom dead center points are switched while moving from the bottom dead center point to the upper dead center point.



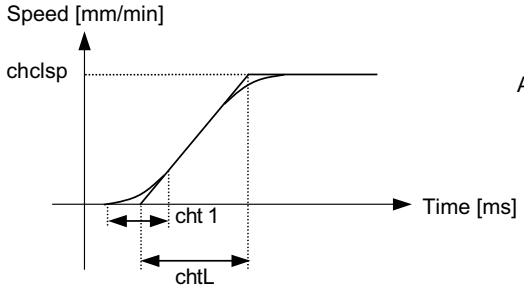
Chopping control data can be changed at any time in the chopping start state. Checking the NC side status or considering the timing is not necessary.

Chopping axis cannot be changed during chopping operation.

(Note) When the chopping parameter valid signal is turned ON, the chopping axis decelerates to stop once even if the chopping control data has not been changed, and which may result in longer cycle time.

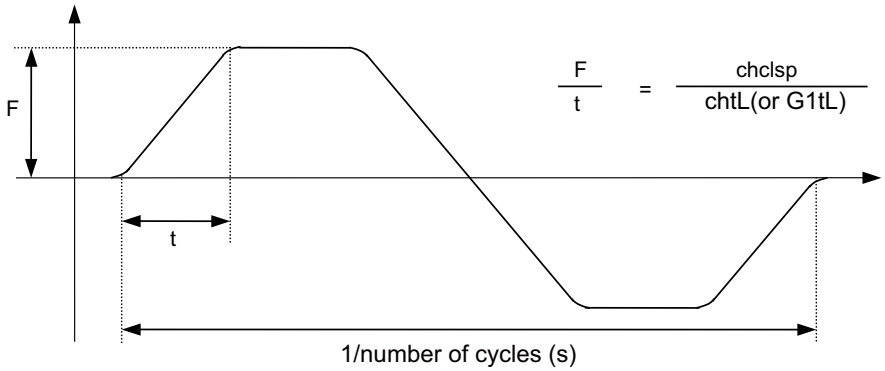
Chopping feedrate

The chopping axis feedrate is clamped at the chopping axis clamp speed (#2081 chclsp). When "0" is set to the chopping clamp speed, the chopping axis feedrate is clamped at the G1 clamp speed (#2002 clamp). The acceleration/ deceleration time constant is set with chopping axis acceleration/deceleration time constant (#2141 chtL). When "0" is set to the chopping axis acceleration/deceleration time constant, the chopping axis linear acceleration/deceleration time constant (#2007 G1tL) is used.



$$\text{Acceleration } \alpha = \frac{\text{chclsp}}{\text{chtL(or G1tL)}}$$

When the upper dead center point, bottom dead center point and number of cycles are set with chopping control data, the speed pattern in which acceleration a is "clamp speed/time constant" will be commanded to the servo drive unit.



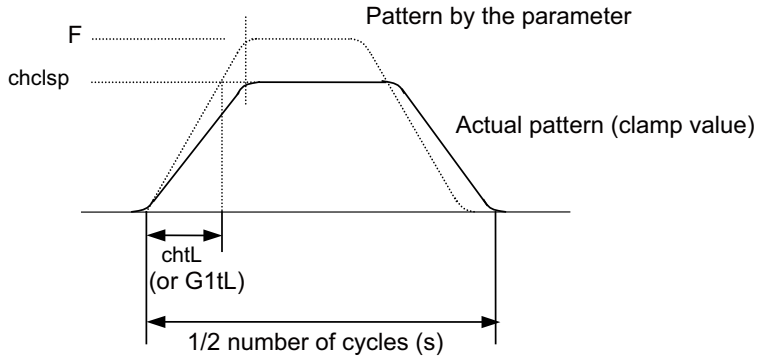
$$\frac{F}{t} = \frac{\text{chclsp}}{\text{chtL(or G1tL)}}$$

When the specified chopping control data is illegal, the alarm is returned to the buffer (Rn). In the following cases, the number of cycles or feedrate is converted into the value controllable with NC (clamp value) upon occurrence of the alarm.

(1) When the number of cycles is 0:
Number of cycles is 1/min.

(2) When F exceeds chclsp:

The following indicates that F exceeds chclsp when the speed pattern is calculated based on the acceleration of chclsp/chtL. (The number of cycles becomes smaller than that of specified.)



(3) When the number of cycles is 1056/min or more:

The number of cycles is clamped at 1056/min.

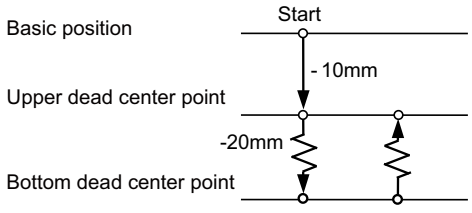
Setting example for the compensation value sequential update method

The following data is set using R8300 to R8311 as buffer area.

Data	Decimal	HEX	Setting details
Rapid traverse override valid/invalid	1	0001	Valid
Chopping axis designation	4	0004	1st part system Z axis (3rd axis)
Upper dead center point (increment amount from the basic position)	-10000	FFFFD8F0	-10000 (setting and display unit)
Bottom dead center point (increment amount from the upper dead center point)	-20000	FFFFB1E0	-20000 (setting and display unit)
Number of cycles	50	00000032	50/min

R8300	0000	Control status
R8301	0000	Not used
R8302	0000	Compensation method (Compensation value sequential update method)
R8303	0000	Setting unit for the override (1%)
R8304	0001	Rapid traverse override valid
R8305	0004	Chopping axis designation
R8306	D8F0 FFFF	Upper dead center point
R8308	B1E0 FFFF	Bottom dead center point
R8310	0032 0000	Number of cycles

Chopping axis operation

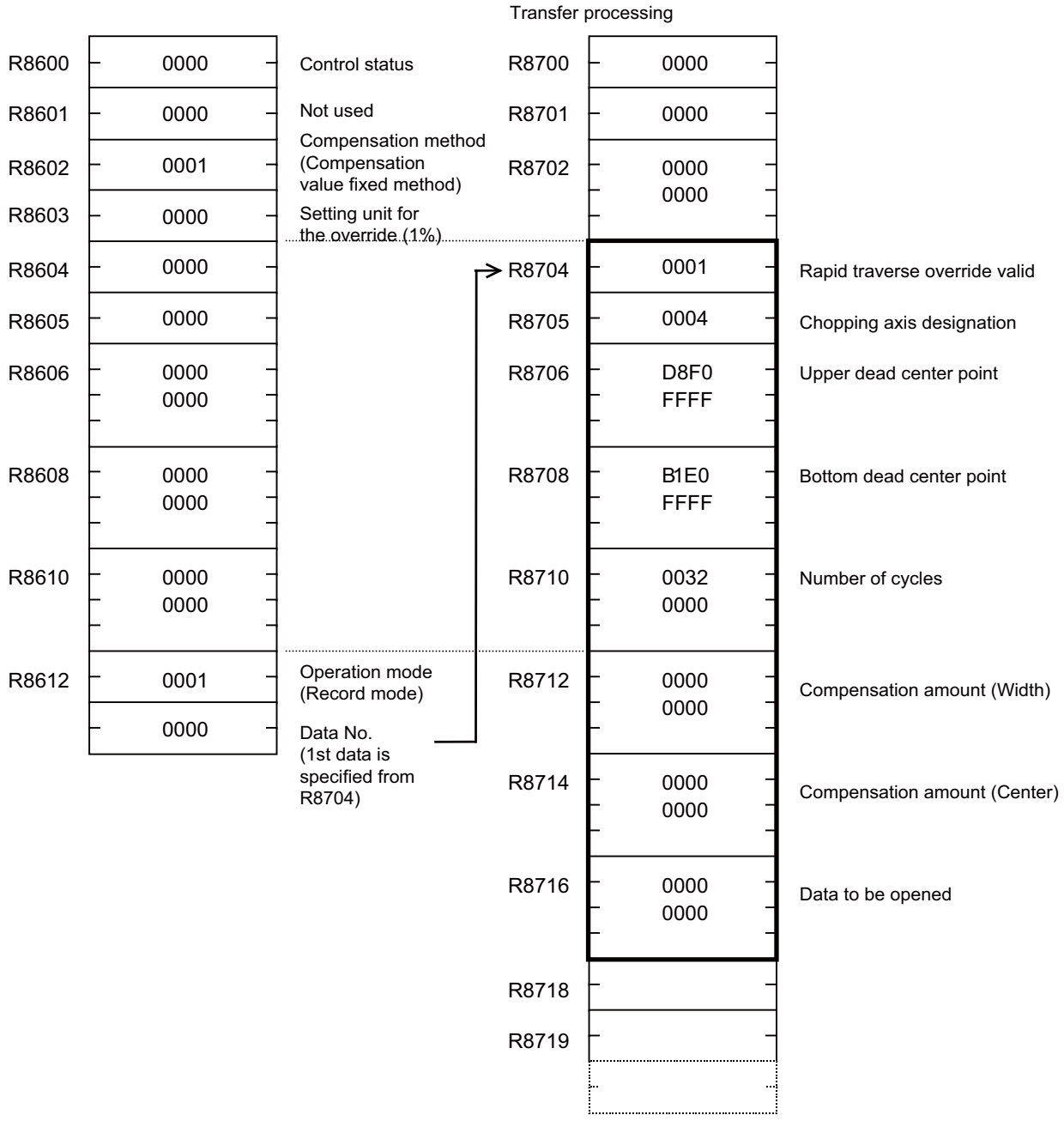


Setting example for the compensation value fixed method

The following data is set using R8600 to R8613 as buffer area.

R8700(#1324 chop_R = 8700) is used for the compensation amount record area.

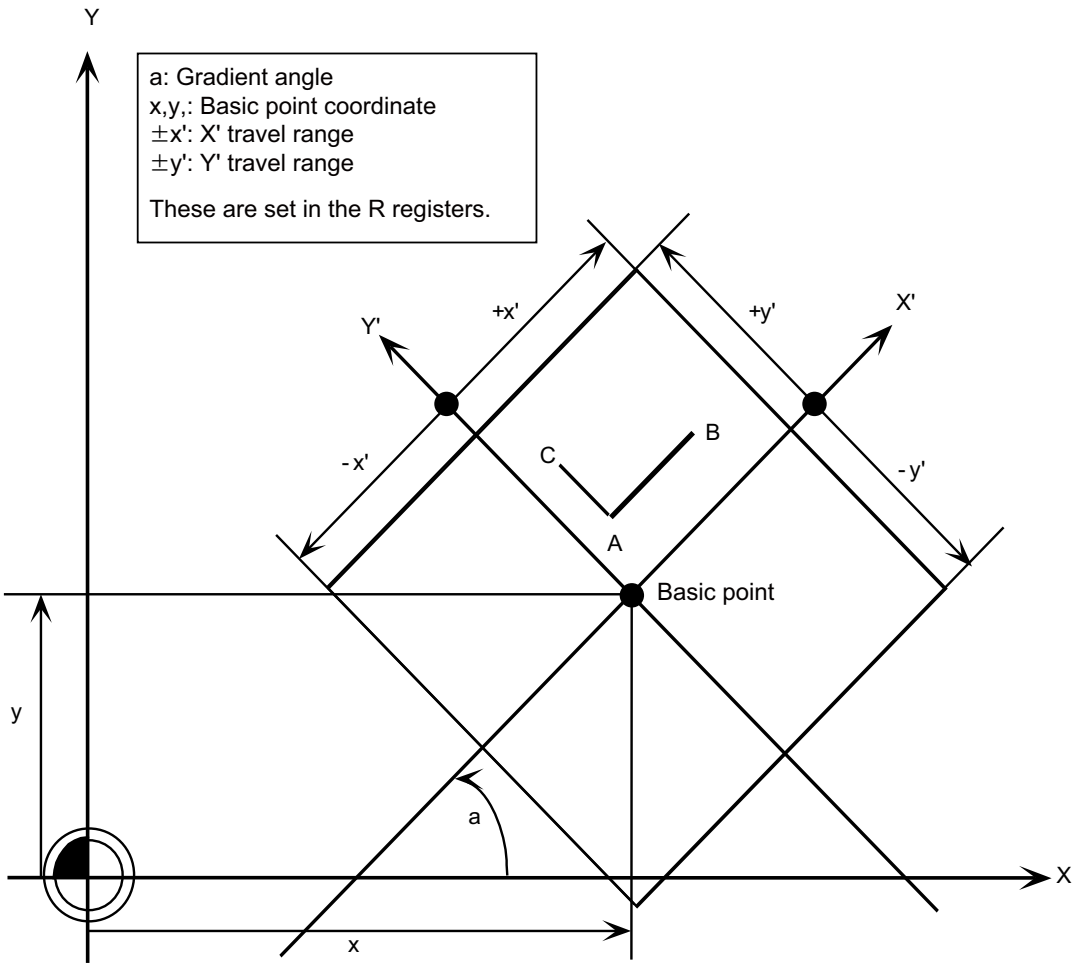
Data	Decimal	HEX	Setting details
Rapid traverse override valid/invalid	1	0001	Valid
Chopping axis designation	4	0004	1st part system Z axis (3rd axis)
Upper dead center point (increment amount from the basic position)	-10000	FFFFD8F0	-10000 (setting and display unit)
Bottom dead center point (increment amount from the upper dead center point)	-20000	FFFFB1E0	-20000 (setting and display unit)
Number of cycles	50	00000032	50/min



6.6.11 Circular Feed in Manual Mode

By specifying a hypothetical coordinate on the machine coordinate from the user PLC, oblique linear interpolation or circular interpolation is executed with jog/handle feed, manual rapid traverse or incremental feed of either X-axis or Y-axis.
This function is valid only in the jog mode, handle mode, manual rapid traverse mode or incremental mode. This function cannot be used in the other manual modes and automatic operation modes.
This function works for the X axis and Y axis. This function cannot be used for the other NC axes and PLC axis. When this function is valid, all the axes other than X axis and Y axis move as usual.

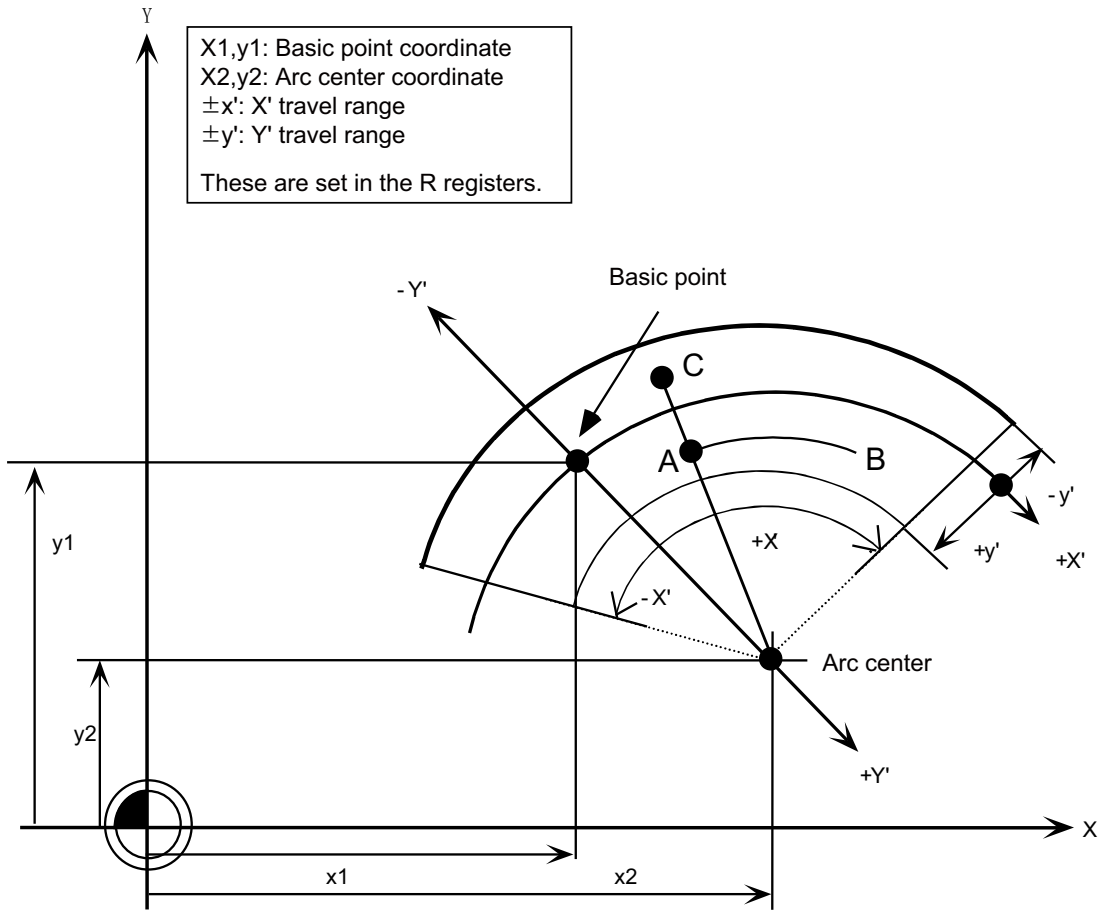
Oblique linear interpolation



When the circular feed in manual mode (oblique linear interpolation) is valid:
• Jog/handle feed of X-axis moves in parallel with X'-axis (see above).
• Jog/handle feed of Y-axis moves in parallel with Y'-axis (see above).

Circular interpolation

By specifying a hypothetical coordinate on the machine coordinate as shown in the figure below, jog/handle feed can be executed on the hypothetical coordinate.



When the circular feed in manual mode (circular interpolation) is valid:
- Jog/handle feed of X-axis moves on the arc having the distance from the arc center to the current position as its radius.
- Jog/handle feed of Y-axis moves on the line connecting the current position and the arc center.

Operation

The following shows how to validate the circular feed in manual mode.

(1) Select either JOG mode or handle mode.

(2) Set the following data to the specified R registers.

In the oblique linear interpolation: basic point coordinate (x, y), gradient angle (a), travel range (±x', ±y'), and operation mode (linear).

In the circular interpolation: basic point coordinate (x1, y1), arc center coordinate (x2, y2), travel range (±x', ±y'), and operation mode (arc).

(3) Turn ON the "Circular feed in manual mode valid" signal.

When these above are commanded during the axis movement by JOG or handle feed, both X and Y axes automatically stop before these commands turn valid.

Jog/handle synchronous mode during circular feed in manual mode

Jog/handle synchronous mode can be designated during circular feed in manual mode. Operations during jog/handle synchronous mode are as follows.

(1) Oblique linear interpolation
<When handle feed is designated during JOG feed operation>
When the designation is for the handled axis, JOG feed will still be applied.
When the designation is for the other axis, both JOG and handle feeds will be applied for respective axes. G0 time constant will be applied in the handle feed.
<When JOG feed is designated during handle feed operation>
When the designation is for the handled axis, JOG feed will be applied instead of handle feed.
When the designation is for the other axis, handle feed will still be applied.

(2) Circular interpolation
<When handle feed is designated during JOG feed operation>
When the designation is for the handled axis, JOG feed will still be applied.
When the designation is for the other axis, both JOG and handle feeds will be applied for respective axes. G0 time constant will be applied in the handle feed.
<When JOG feed is designated during handle feed operation>
When the designation is for the handled axis, JOG feed will be applied instead of handle feed.
When the designation is for the other axis, handle feed will still be applied. G0 time constant will be applied in the handle feed.

Precautions

(1) This function is available in the JOG or handle mode, manual rapid traverse and incremental feed.
(2) This function can be used for X and Y axes. Cannot be used for the other axes including PLC axis. When this function is used, the axes other than X and Y axes operate in usual way.
(3) When the manual interlock is applied to either X or Y axis, the both axes stop.
(4) The following cases do not allow the circular feed in manual mode. In these cases, all axes cannot be moved until the "Circular feed in manual mode valid" signal is turned OFF.
(a) Either X or Y axis is in the machine lock. (The machine lock is canceled then.)
(b) The reference position return is not completed for either X or Y axis.
(c) Either X or Y axis is in the servo OFF.
(d) NC applies the "In auto operation "start"" (OP), the emergency stop or reset.
(e) The current position is out of the designated travel range.
(f) An illegal value has been set to the R register.
(5) Executing the automatic operation turns this function invalid. In this case, all axes cannot be moved until the "Circular feed in manual mode valid" signal is turned OFF.
(6) When this function is used, the feedrate is clamped so that the combined speed of the X and Y axes will not exceed the slower rapid traverse feedrate of the two axes.
(7) When this function is ON and the either axis is moving beyond the travel range, both axes stop.
(8) When this function is ON, if a change of the travel range makes the current position out of the range, both X and Y axes cannot be moved until the range is amended to include the current position.
(9) When the status of the "Circular feed in manual mode valid" signal is changed, the axis being moved in the manual mode temporarily stops for safety.
(10) If the current position overlaps with the arc center in the linear-circular mode, Y axis can be moved within the minimum travel range of X axis.
(11) Circular feed in manual mode is invalid at 0-degree gradient in the linear-linear mode.

NC → PLC interface signal

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	IN CIRCULAR FEED IN MANU-AL MODE		XC4F	XD8F	XECF	X100F

[Function]

This signal indicates that the circular feed in manual mode is valid.

[Operation]

This signal turns ON when the "Circular feed in manual mode valid" signal turns ON.

[Caution]

This signal does not turn ON in the cases of (4) in "Precautions" column written before.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE CURRENT POSITION X		R636,7	R836,7	R1036,7	R1236,7
A	CIRCULAR FEED IN MANUAL MODE CURRENT POSITION Y		R640,1	R840,1	R1040,1	R1240,1

[Function]

The current positions of X' and Y' axes on the hypothetical coordinate are set when the circular feed in manual mode is valid.

[Operation]

The current positions of X' and Y' axes on the hypothetical coordinate are set while the "Circular feed in manual mode valid" signal is ON.

In the "circular-linear" mode, the current position of X' on the hypothetical coordinate is set by the angle (0.000° to 360.000°) from the basic point.

The hypothetical coordinate value to be set is in the following state.

"Linear-linear" hypothetical coordinate	Y' axis: mirror image is not valid
"Circular-linear" hypothetical coordinate	X' axis: "+" indicates the inverse (CW) direction Y' axis: mirror image is not valid

[Caution]

(1) This data is valid only when the "Circular feed in manual mode being valid" signal is ON. If the signal is OFF, the current position data is uncertain (the value is not ensured).

(2) The current positions are output with "0.5*PLC setting unit".

(3) When "1" is set to the parameter "#1040 M_inch", this data is output by inch.

[Related signals]

(1) In circular feed in manual mode (XC4F)

PLC → NC interface signal

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE VALID		YC7E	YDBE	YEFE	Y103E

[Function]

This signal is used to execute JOG or handle feed for the X and Y axes on the specified coordinate ("linear-linear" or "circular-linear").

[Operation]

After this signal turns ON in the JOG or handle mode, the X and Y axes move on the specified hypothetical coordinate. (The coordinate and so on are specified with the R registers explained below.)

[Caution]

(1) This signal does not effect on the operation of the axes other than X and Y axes, nor the PLC axis.

(2) This signal does not turn ON in the cases of (4) in "Precautions" column written before.

[Related signals]

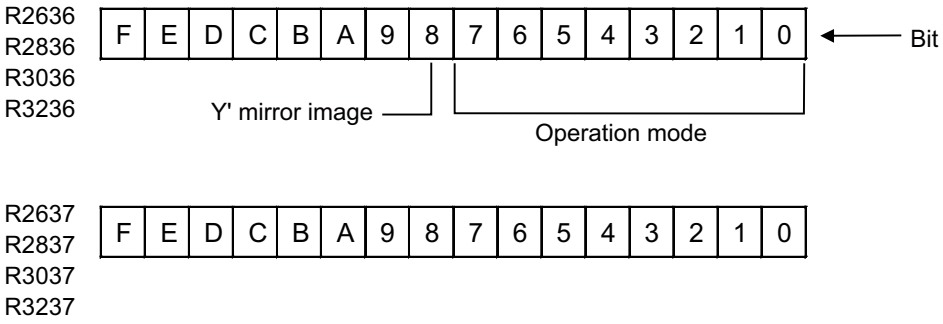
(1) In circular feed in manual mode (XC4F)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE OPERATION MODE DATA		R2636,7	R2836,7	R3036,7	R3236,7

[Function]

The operation mode for the circular feed in manual mode is designated.

[Operation]



・Operation mode: Designate the coordinate setting.

Setting value	Description
1	Linear-linear coordinate is selected.
2	Circular-linear coordinate is selected. ("+" indicates the CW direction of X'.)
3	Circular-linear coordinate is selected. ("+" indicates the CCW direction of X'.)

The setting value other than above is invalid.

・ Y' mirror image: Reverse the "+" direction of Y'.

Setting value	Description
1	Y' mirror image is not valid
2	Y' mirror image is valid

[Caution]

(1) This data is valid when the "Circular feed in manual mode valid" signal is ON.

(2) The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE BASIC POINT X DATA		R2644,5	R2844,5	R3044,5	R3244,5
A	CIRCULAR FEED IN MANUAL MODE BASIC POINT Y DATA		R2648,9	R2848,9	R3048,9	R3248,9

[Function]

Designate a basic point on the hypothetical coordinate.

[Operation]

Designate a basic point on the hypothetical coordinate using the machine coordinate system.

The setting range differs in each PLC setting unit.

	PLC setting unit	
	mm	inch
(B)	± 99999.999mm	± 3937.0078inch
(C)	± 9999.9999mm	± 393.70078inch

[Caution]

(1)This data is valid when the "Circular feed in manual mode valid" signal is ON.

(2)The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.

(3)The basic point coordinate is designated with "0.5*PLC setting unit"

(4)When "1" is set to the parameter "#1040 M_inch", set the data by inch.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE X+ DATA		R2652,3	R2852,3	R3052,3	R3252,3
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE X- DATA		R2656,7	R2856,7	R3056,7	R3256,7
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE Y+ DATA		R2660,1	R2860,1	R3060,1	R3260,1
A	CIRCULAR FEED IN MANUAL MODE TRAVEL RANGE Y- DATA		R2664,5	R2864,5	R3064,5	R3264,5

[Function]

Designate the travel range on the hypothetical coordinate.

[Operation]

Designate the travel ranges with the value in the "+" or "-" direction on the hypothetical coordinate. Set the hypothetical coordinate value in the following state.

"Linear-linear" hypothetical coordinate	Y' axis: mirror image is not valid
"Circular-linear" hypothetical coordinate	X' axis: "+" indicates the inverse (CW) direction Y' axis: mirror image is not valid

In the "circular-linear" mode, set the travel range of X' by the angle from the basic point on the hypothetical coordinate. The setting range differs in each PLC setting unit.

	PLC setting unit		
	mm	inch	angle
(B)	± 99999.999mm	± 3937.0078inch	± 360.000°
(C)	± 9999.9999mm	± 393.70078inch	± 360.0000°

[Caution]

(1)The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.

(2)The basic point is treated as zero point on the hypothetical coordinate.

(3)The basic point coordinate is designated with "0.5*PLC setting unit"

(4)When "1" is set to the parameter "#1040 M_inch", set the data by inch.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	CIRCULAR FEED IN MANUAL MODE GRADIENT/ARC CEN-TER X DATA		R2668,9	R2868,9	R3068,9	R3268,9
A	CIRCULAR FEED IN MANUAL MODE GRADIENT/ARC CEN-TER Y DATA		R2672,3	R2872,3	R3072,3	R3272,3

[Function]

Designate the gradient on the "linear-linear" hypothetical coordinate, or the arc center on the "circular-linear" hypothetical coordinate.

[Operation]

How to designate differs in each operation mode.

Operation mode is "1"	Use the X-Y ratio to designate the gradients of X axis on the machine coordinate and X' axis on the hypothetical coordinate. Signs are available. "+" indicates the CCW direction from the X axis. If the gradient is 45°, X and Y should have the same value.
Operation mode is 2 or 3	Designate an arc center on the hypothetical coordinate using the machine coordinate system.

The setting range differs in each PLC setting unit.

	PLC setting unit	
	mm	inch
(B)	± 99999.999mm	± 3937.0078inch
(C)	± 9999.9999mm	± 393.70078inch

[Caution]

(1)This data is valid when the "Circular feed in manual mode valid" signal is ON.

(2)The data, when changed while the "Circular feed in manual mode valid" signal is ON, is not valid.

(3)The basic point coordinate is designated with "0.5*PLC setting unit"

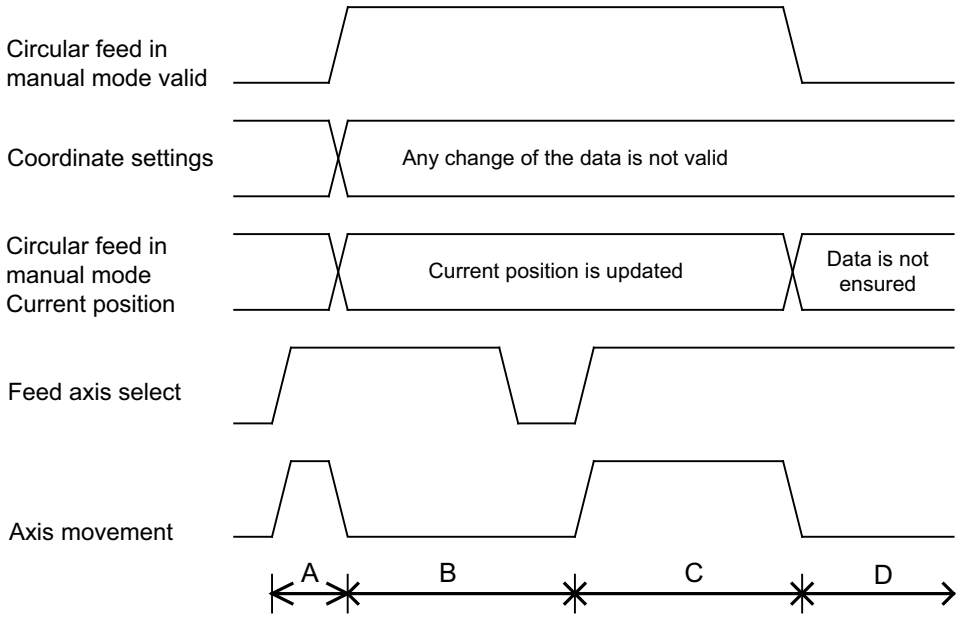
(4)When "1" is set to the parameter "#1040 M_inch", set the data by inch.

[Related signals]

(1) Circular feed in manual mode valid (YC7E)

Timing chart

The timing chart for the circular feed in manual mode is shown below.



A: Moves in the normal mode.
B: Stops for the coordinate change.
C: Moves on the hypothetical coordinate that has been set.
D: Stops for the coordinate change.

(Note) Not only X and Y axes but also the other axes stop during the coordinate change.

6.6.12 Manual Speed Command

In the memory or MDI mode, validate the manual speed command and select any one of handle feed, jog (manual feed) or manual rapid traverse so that the automatic operation is carried out at the feedrate.
With a command in the (-) direction, the program path can be reversed.Note that, however, program path can be reversed only within the currently executing block and not beyond the block.
Whether or not to execute reverse run with a command in the (-) direction is set with the PLC interface.

(1) When giving the manual speed command in multiple part systems, the speed differs depending on the type of the manual speed command.
- Manual speed command (the parameter "#1365 manualFtype" is set to "0")
  Similarly to the case of only one part system, the axis moves with the speed of handle, JOG or manual rapid traverse in multiple part systems.
- Manual speed command 2 (the parameter "#1365 manualFtype" is set to "1")
  For multiple part systems, the axis moves with the speed of handle, JOG or manual rapid traverse which is multiplied by the program command speed ratio.
  The program command speed ratio is each part system's speed ration when the reference program command speed (the fastest program command speed across executing part systems) is 100%.

		Type	
		Manual speed command	**Manual speed command 2**
Feedrate	Handle feed	Feedrate of 1st handle's 1st axis (the handle magnification is for each part system)	Feedrate of 1st handle's 1st axis * program command speed ratio (The handle magnification of the smallest part system No. across the part systems where the manual speed command is valid)
	JOG (manual) feed	JOG feedrate of each part system	The JOG feedrate of the smallest part system No. across the part systems where the manual speed command is valid * program command speed ratio
	Manual rapid traverse	Rapid traverse feedrate of each part system's 1st axis	The rapid traverse feedrate of the smallest part system No. across the part systems where the manual speed command is valid * program command speed ratio
Clamp		For the cutting command: The cutting clamp speed of each axis (#2002 clamp) For the rapid traverse command: The rapid traverse feedrate of each axis (#2001 rapid)	Same as the "Manual speed command" or "program command speed * the setting value of the parameter "#19005"", whichever the smallest.
Reverse run		Stops when it is reached to the block start point for each axis.	When any one of the part systems is reached to the block start point, other part systems also stop.

(Example) For the handle feed of the manual speed command 2
[Each speed]
Feedrate of 1st handle's 1st axis: 4000mm/min
Program command speed of 1st part system: F1000
Program command speed of 2nd part system: F500
Program command speed of 3rd part system: F2000
[Each part system's feedrate by the manual speed command 2]
1st part system: 2000mm/min (program command speed ratio: 50%)
2nd part system: 1000mm/min (program command speed ratio: 25%)
3rd part system: 4000mm/min (program command speed ratio: 100%)

(2) The automatic operation is paused by turning ON this signal while starting the operation automatically.

(3) Command this to the 1st handle's 1st axis for the handle mode, or to the 1st axis for the JOG mode. If it is commanded to the other axis, the error "M01 Internal interlock axis exists 0005" will occur.

(4) When this function is valid, MST or dwell commands are executed the same as in the normal automatic operation. Therefore, if MST is commanded to the same block as the movement block, the program does not move to the next block before the MST command is completed.

(5) The manual speed is clamped when the entered speed exceeds the clamp speed.

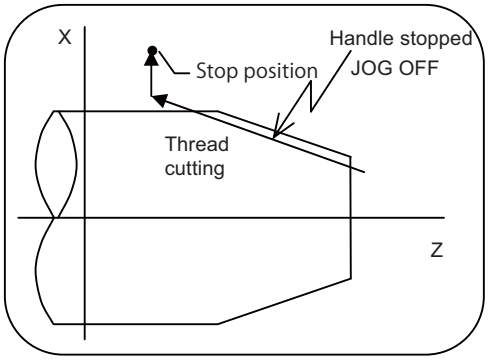
(6) In the creep control of the dog type reference position return, the "reference position return creep speed" is applied regardless of the entered manual speed.

(7) To stop the movement by handle and changed to the automatic operation, turn OFF the "Manual feed command valid" signal and the handle mode, and then execute the automatic operation start with the memory mode ON.

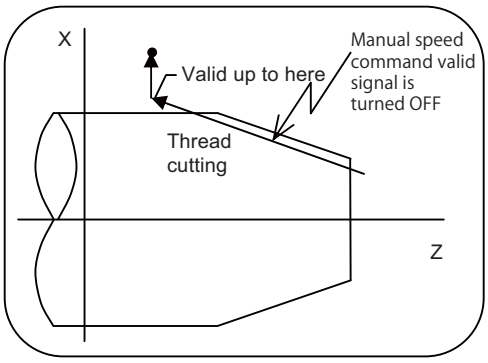
(8) If the cutting override is "0", the movement occurs by the manual speed when other than JOG manual speed command is given. No movement occurs in the JOG mode.

(9) In the synchronous tapping, cuttings follow the commands in the program. The manual speed command does not effect on the operation. Neither stopping the handle move nor turning OFF the JOG mode stops the operation.

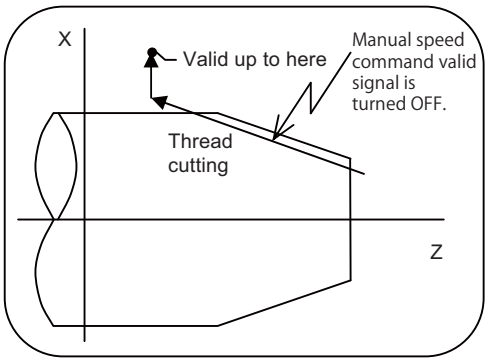
(10) When the parameter "#1247 set19/bit1" (thread cutting operation selection when the manual speed command is valid) is set to "1", the axis moves in accordance with the program command while the thread cutting is in progress or until the next block's end point of where the thread cutting is completed (the G33 mode has ended).
Even if the handle is stopped or the JOG is turned OFF while in this movement, the axis will not stop until it moves to the next block's end point of where the thread cutting is completed.



(11) If the manual speed command valid signal is turned OFF while executing this function, this function becomes invalid even during the axis is traveling. However, in the synchronous tapping or thread cutting, the manual speed command is kept valid until the end of these processes: turning OFF the "Manual speed command valid" signal does not effect on these processes.
When the parameter "#1247 set19/bit1" is set to "1", even if the manual speed command is turned OFF while executing the thread cutting, this signal is valid until the next block's end point of where the thread cutting is completed.

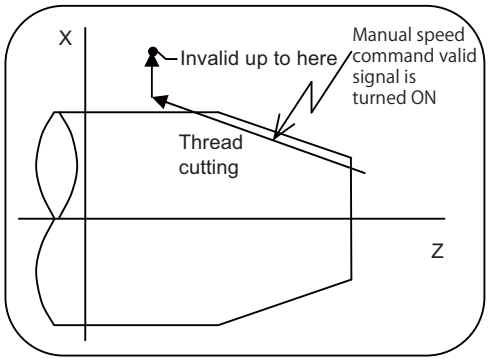


When the parameter "#1247 set19/bit1" is set to "0".



When the parameter "#1247 set19/bit1" is set to "1".

(12) If the manual speed command valid signal is turned ON while starting the operation automatically, the automatic operation is paused. However, even if the manual speed command valid signal is turned ON while executing the thread cutting, the manual speed command is kept invalid until the next block's end point of where the thread cutting is completed.

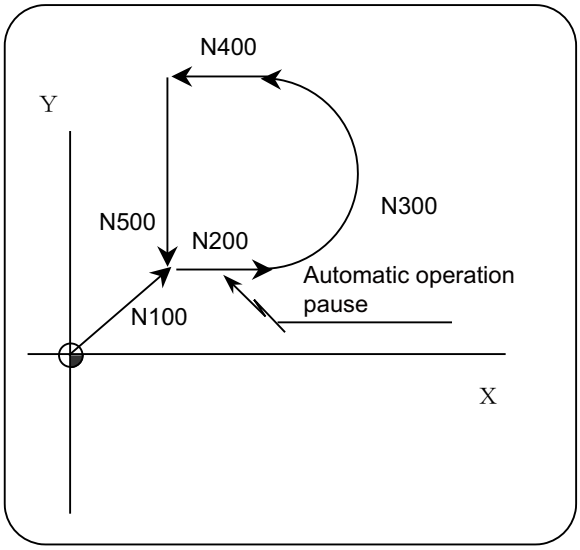


(13) Both manual and automatic interlocks are available when the manual speed command is valid.

Direction designated in the machining program Example) 100/-100 is set for the X direction of the 1st axis	
Program X100	Program X-100
(Forward run)	(Forward run)
Automatic interlock+: Available	Automatic interlock+: Not available
Automatic interlock-: Not available	Automatic interlock-: Available
Manual interlock+: Available	Manual interlock+: Available
Manual interlock-: Not available	Manual interlock-: Not available
(Reverse run)	(Reverse run)
Automatic interlock+: Available	Automatic interlock+: Not available
Automatic interlock-: Not available	Automatic interlock-: Available
Manual interlock+: Not available	Manual interlock+: Available
Manual interlock-: Available	Manual interlock-: Not available

Operation example

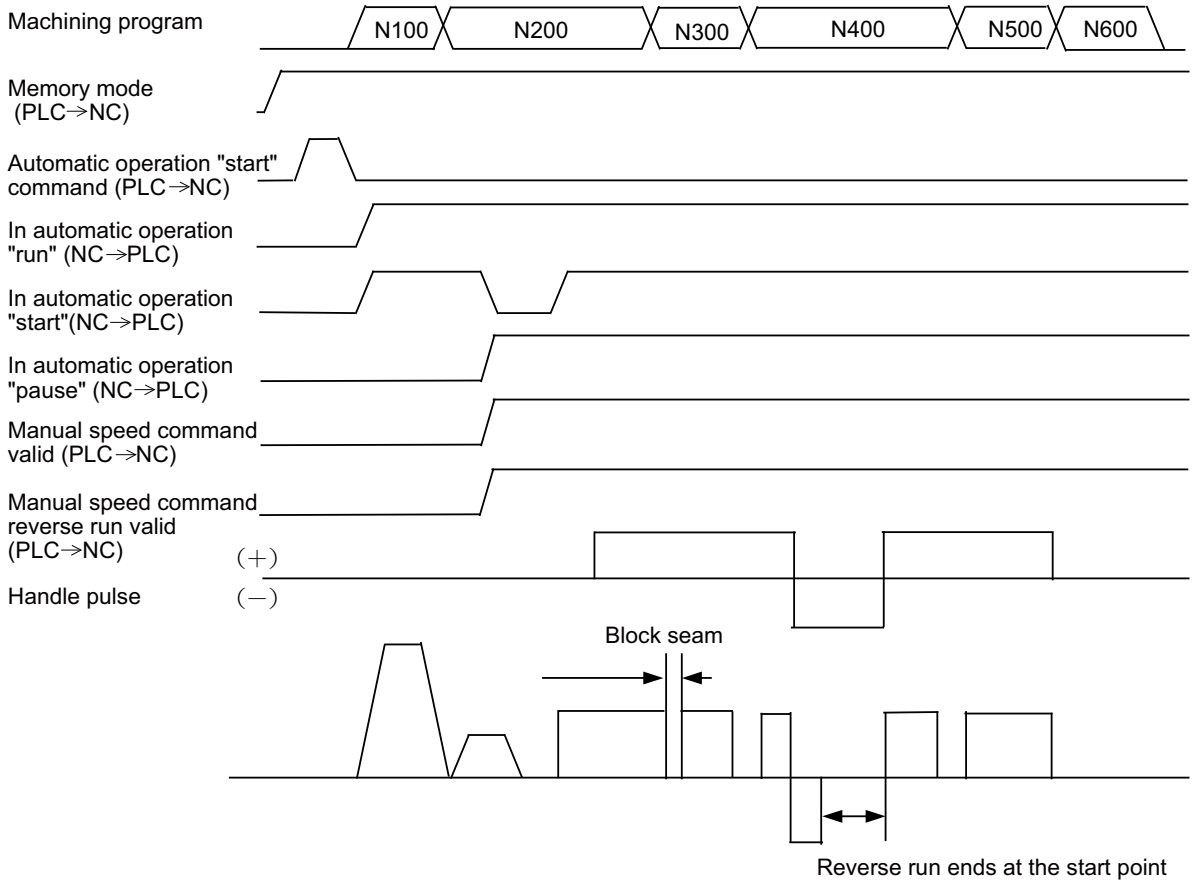
<Machining program>
N100 G91 G0 X10. Y10.
N200 G1 X10. F1000
N300 G3 Y20. J10. F200
N400 G1 X-10. F1000
N500 G1 Y-20.
N600 M30



[Operation example 1

(When giving the manual speed command in automatic operation "run" of a machining program)]

(1) Search a machining program and execute the automatic operation start in memory mode.
(2) Command the automatic operation pause during the N200 block execution.
(3) Turn ON the "Manual speed command valid" and "Manual speed command reverse run valid" signals, as well as the handle mode. (Keep the memory mode ON.)
(4) When 1st handle is rotated in the (+) direction, the axis moves in the blocks with the handle feedrate.
(5) When the handle is rotated in the (-) direction, the movement is reversed against the program. The reversed movement ends at the block start point. (Cannot return to the previous block.)
(6) The handle, which keeps rotating in the (+) direction after the block has ended, continues the blocks N300 to N500 with the handle feedrate.
(7) Command M30 at N600 block to end the program by NC reset or completion.

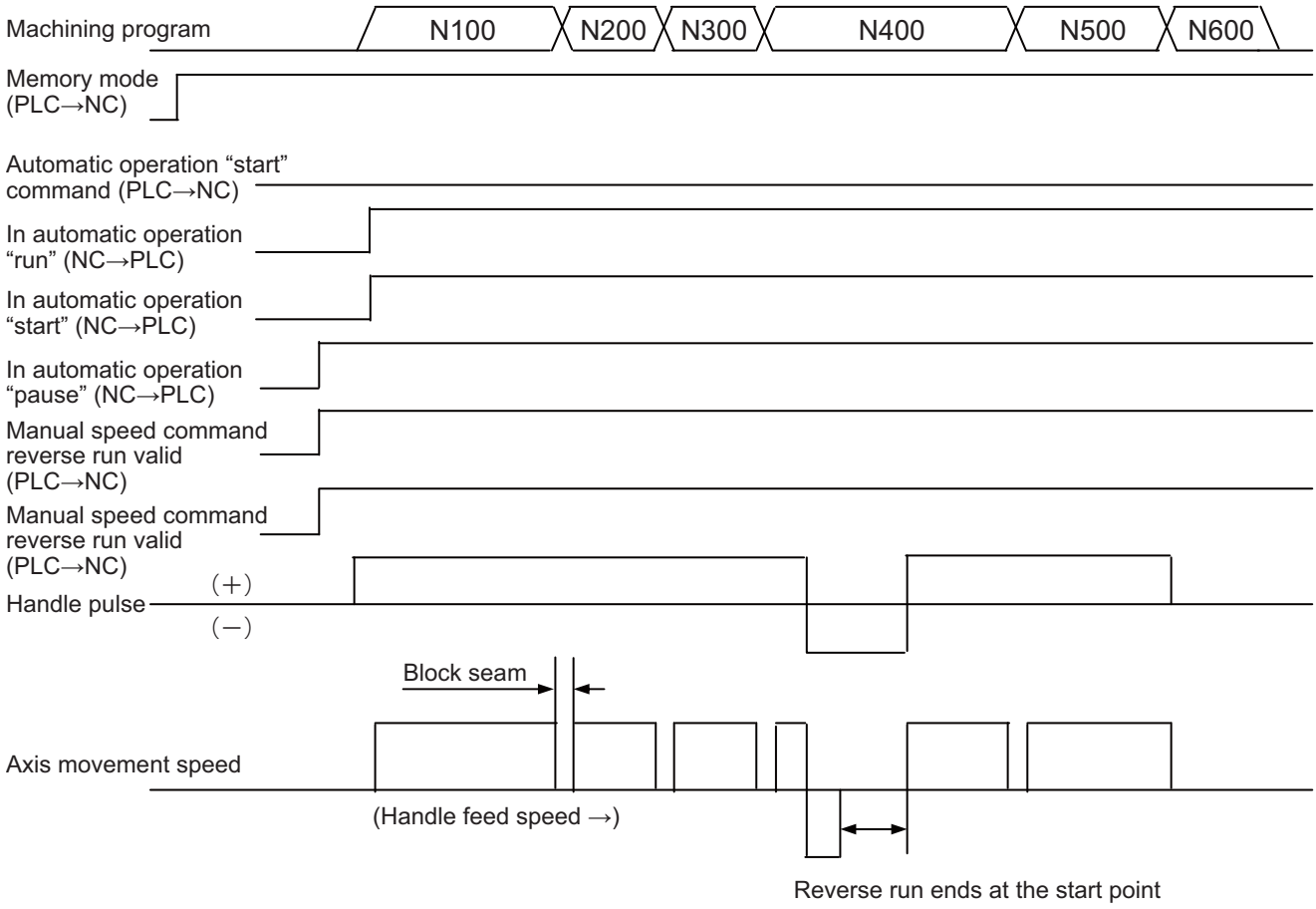


(Note) When the reverse run is not valid, the movement follows the machining program, not the handle feed direction.

[Operation example 2 (When giving the manual speed command at the start of machining program)]

(1) Search the machining program. Turn ON memory mode.
(2) Turn ON memory mode, the "manual speed command valid" signal and handle mode.
(3) When the handle is rotated in the (+) direction, the axis starts to move with the handle feedrate from the head block.

The rest of the operation is same as the operation example 1.



6.6.12.1 Manual Speed Command (when the parameter "#1365 manualFtype" is set to "0")

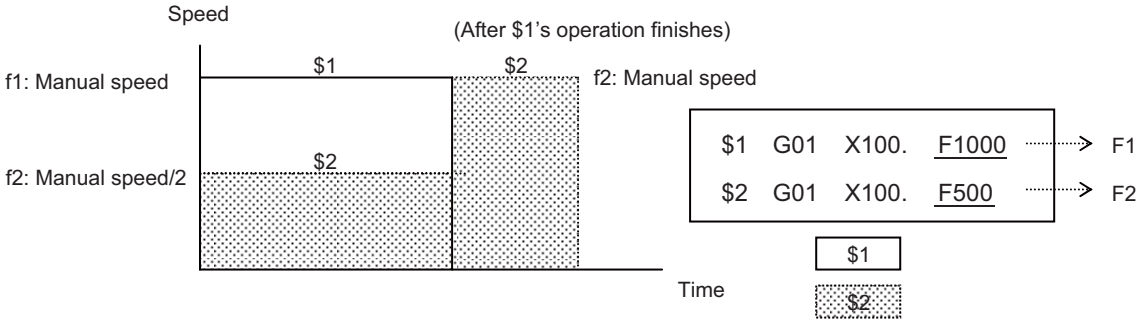
(1) The feedrate is set as follows depending on the manual mode:
- In handle mode
  The feedrate of the 1st handle's 1st axis is applied.
- In JOG mode
  The manual feedrate for each part system is applied.
- In manual rapid traverse mode
  The rapid traverse speed of the 1st axis for each part system is applied.

(2) When a cutting command is given, the feedrate is limited by the cutting clamp feedrate (#2002 clamp) of each axis's parameter.
When a rapid traverse command is given, the feedrate is limited by the rapid traverse feedrate of each axis's parameter.

(3) For the reverse run, the axis stops when it is reached to the block start point in each part system.

6.6.12.2 Manual Speed Command (when the parameter "#1365 manualFtype" is set to "1")

This command adjusts the handle/JOG/manual feedrate while executing the manual speed command in two or more part systems to the feedrate which matches the ratio of program command of each part system in execution. The ratio is based on the fastest program command speed among the blocks in execution.
This can make the state of progress across part systems to nearly the same state as the normal automatic operation.
"Program F command speed * the setting value of #19005 (%)" limits the feedrate by setting the value in proportion to the program command speed to the parameter "#19005 manual Fcmd2 clamp".



f1 = Manual speed * (F1 / Fm) (Note 1)(Note 2)
f2 = Manual speed * (F2 / Fm) (Note 1)(Note 2)

Note that the feedrate F1 is limited by "F1 * the setting value of #19005 (%)". (Note 3)
The feedrate F2 is limited by "F2 * the setting value of #19005 (%)".(Note 3)

(Note 1) For the part system that the manual speed command is valid, the manual speed is set as follows depending on the manual mode:
- In the handle mode
  The feedrate of 1st handle's 1st axis is applied.
- In the JOG mode
  All part systems whose manual speed command is enabled, the manual feedrate of the smallest number's part system is applied.
- In the manual rapid traverse mode
  All part systems whose manual speed command is enabled, the 1st axis's rapid traverse feedrate of the smallest number's part system is applied.

Across the part systems that the manual speed command is valid, the override of the smallest number's part system is valid.

(Note 2) Fm is the feedrate F1 or F2, whichever is faster.

(Note 3) For the cutting command, the feedrate is limited by the cutting clamp feedrate parameter (#2002 clamp) of each axis.
For the rapid traverse feedrate command, the feedrate is limited by the rapid traverse feedrate parameter (#2001 rapid) of each axis.

(1) The feedrate is set as follows depending on the manual mode:
- In the handle mode
  The feedrate of the 1st handle's 1st axis * program command speed ratio
  (The handle magnification of the smallest number's part system across the part systems that the manual speed command is enabled)
- In the JOG mode
  Among the part systems in which the manual speed command is enabled, the JOG feedrate of the smallest number's part system * program command speed ratio
- In the manual rapid traverse mode
  Among the part systems in which the manual speed command is enabled, the 1st axis's rapid traverse feedrate of the smallest number's part system * program command speed ratio

  (Example) In JOG mode
  - When the "manual speed command valid" signal of the 1st and 2nd part system is ON
    Feedrate = JOG feedrate of the 1st system * program command speed ratio
  - When the "manual speed command valid" signal is ON only for 2nd part system
    Feedrate = JOG feedrate of the 2nd system * program command speed ratio

(2) The feedrate is limited by the following speed, whichever is slower:
- Program command speed * the setting value of #19005 (%)
- For the cutting command, the cutting clamp feedrate parameter (#2002 clamp) of each axis
  For the rapid traverse command, the rapid traverse feedrate parameter (#2001 rapid) of each axis

(3) In the reverse run involving two or more part systems, once any of the part systems reaches to the block start, rest of the part systems also stop.
(Example)

$1 G00 X100. G01 X200. F1000	$2 G00 X50. G01 X200. F1000

- When a reverse run starts at the second block $1:X120. $2:X170.
  When $1 reaches X100. (block start), $2 stops at X150.

A reverse run operation is not applied to a part system that is executing the following types of commands/blocks; G code with which a reverse run is prohibited (such as G33: thread cutting, G04: dwell), or an MSTB block (except for a timing synchronization between part systems with M code).
(Example)

$1 G00 X100. G33 X200.U0.F1.S600 F1000	$2 G00 X50. G01 X200. F1000

- When a reverse run starts at the second block $1:X120. $2:X170.
  In $1, the axis stops. (Reverse run impossible)
  In $2, the axis moves to X50. (block start), then stops.

(4) For the rapid traverse (G0), the axis moves with the composite speed of the rapid traverse axis, and other than G0, the axis moves with the ratio of the command speed across the part systems.

(5) The program command speed ratio is calculated as "S command value * command value F" of the program as the program command speed. S command value is used in the commanded part system.
If S command is "0", the handle/JOG/manual traverse feedrate of the smallest number's part system in which the manual speed command is valid is applied.

(6) If the program command speed is "0", the handle/JOG/manual traverse feedrate of the smallest number's part system in which the manual speed command is valid is applied.

(7) During the forward run, the handle/JOG/manual traverse feedrate of the smallest number's part system in which the manual speed command is valid is applied for thread cutting.
When the parameter "#1247 set19/bit1" is set to "1", the movement speed follows the program command for thread cutting and the movement up to the end point of the next block in which the thread cutting is finished (the G33 mode has ended.).
When performing thread cutting in the 1st part system, the handle speed/JOG/manual traverse feedrate of the 1st part system is applied to other part systems in which thread cutting is not being performed.

(8) If the manual speed command is executed in only one part system, the program command speed ratio becomes "1"; therefore, the handle speed/JOG/manual traverse feedrate of the executed part system is applied. It is possible to limit the feedrate with "Program F command speed * Setting value (%) of #19005".

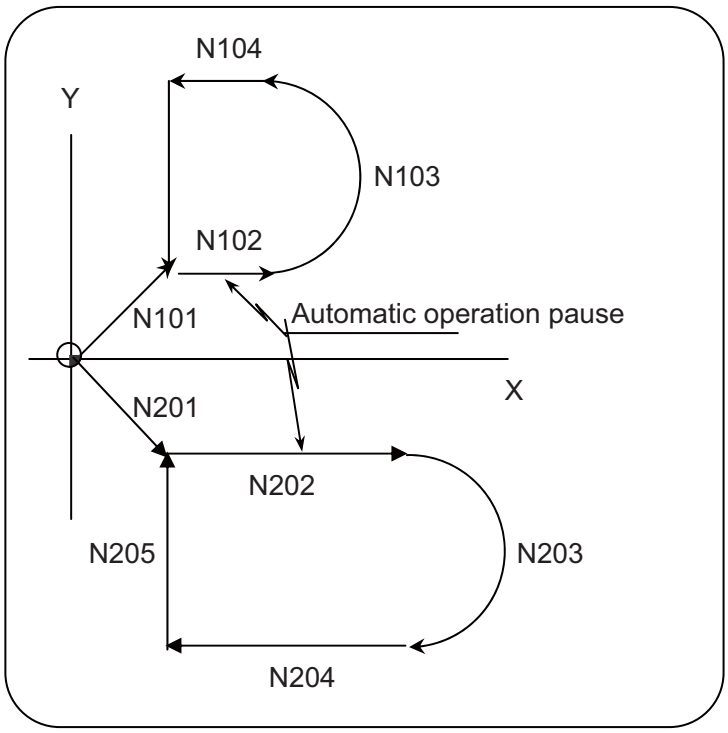
Operation example

<Machining program of 1st part system>

```
N101 G91 G0 X10. Y10.
N102 G1 X10. F100
N103 G3 Y20. J10. F600
N104 G1 X-10. F50
N105 G1 Y-20.
N106 M30
```

<Machining program of 2nd part system>

```
N201 G91 G0 X10. Y-10.
N202 G1 X20. F200
N203 G3 Y-20. J-10. F1200
N204 G1 X-20. F100
N205 G1 Y20.
N206 M30
```



[Operation example 1

(When the manual speed command is enabled at the second block in both the 1st and 2nd part systems)]

(1) Search a machining program and execute the automatic operation start of the 1st and 2nd part systems in memory mode.

(2) Command the automatic operation pause during the N102, N202 block execution.

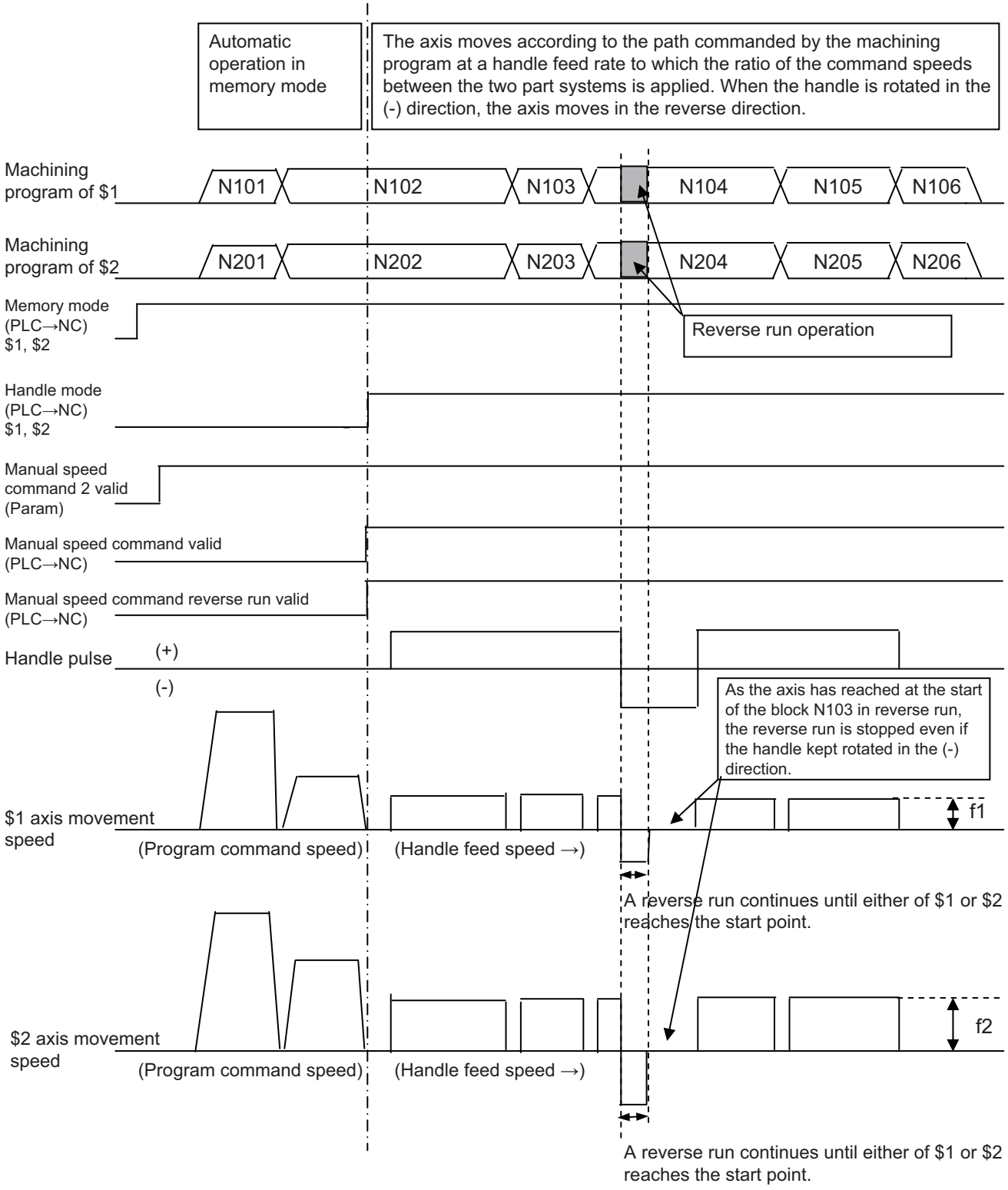
(3) Turn ON the "Manual speed command valid" signal, "Manual speed command reverse run valid" signal, and handle mode of the 1st and 2nd part systems. (Keep the memory mode ON.)

(4) When the 1st handle is rotated in the (+) direction, the axes in the blocks of the 1st and 2nd part systems continue to move at speeds to which the ratio of the automatic operation feed rates is applied to the handle feedrates.
Feedrates of each part system are as below:
(Example) When the handle is rotated with the handle feedrate of 10.0mm/min:
Block N102 of 1st part system, command speed F100...Feedrate is 5.0 [mm/min]
Block N202 of 2nd part system, command speed F200…Feedrate is 10.0 [mm/min]

(5) When the handle is rotated in the (-) direction, the movement is reversed against the program.
In this case, the ratio of the automatic operation feed rates is applied to the handle feed rates.
However, when either of $1 or $2 reaches the block start point, the reversed movements of the both part systems end. (Cannot return to the previous block.)

(6) The handle, which keeps rotating in the (+) direction after the block has ended, continues the blocks N103 to N105/N203 to N205 with the handle feed rate.

(7) Command M30 at the N106, N206 blocks to end the program by NC reset or completion.



The movement speed value of f1, f2 is calculated by multiplying the command speed ratio between two part systems by the handle speed.

(Note) When the reverse run is not valid, the movement follows the machining program, not the handle feed direction.

[Operation example 2

(When the manual speed command is enabled at the third block of the 1st part system and the second block of the 2nd part system)]

(1) Search a machining program and execute the automatic operation start of the 1st part system in memory mode.

(2) A while after, execute the automatic operation start of the 2nd part system.

(3) Command the automatic operation pause during the N103, N202 block execution.

(4) Turn ON the "Manual speed command valid" and "Manual speed command reverse run valid" signals of $1 and $2, as well as the handle mode of $1 and $2. (Keep the memory mode ON.)

(5) When the 1st handle is rotated in the (+) direction, the axes in the blocks of 1st and 2nd part systems continue to move at speeds to which the ratio of the automatic operation feed rates is applied to the handle feedrates. Feedrates of each part system are as below.

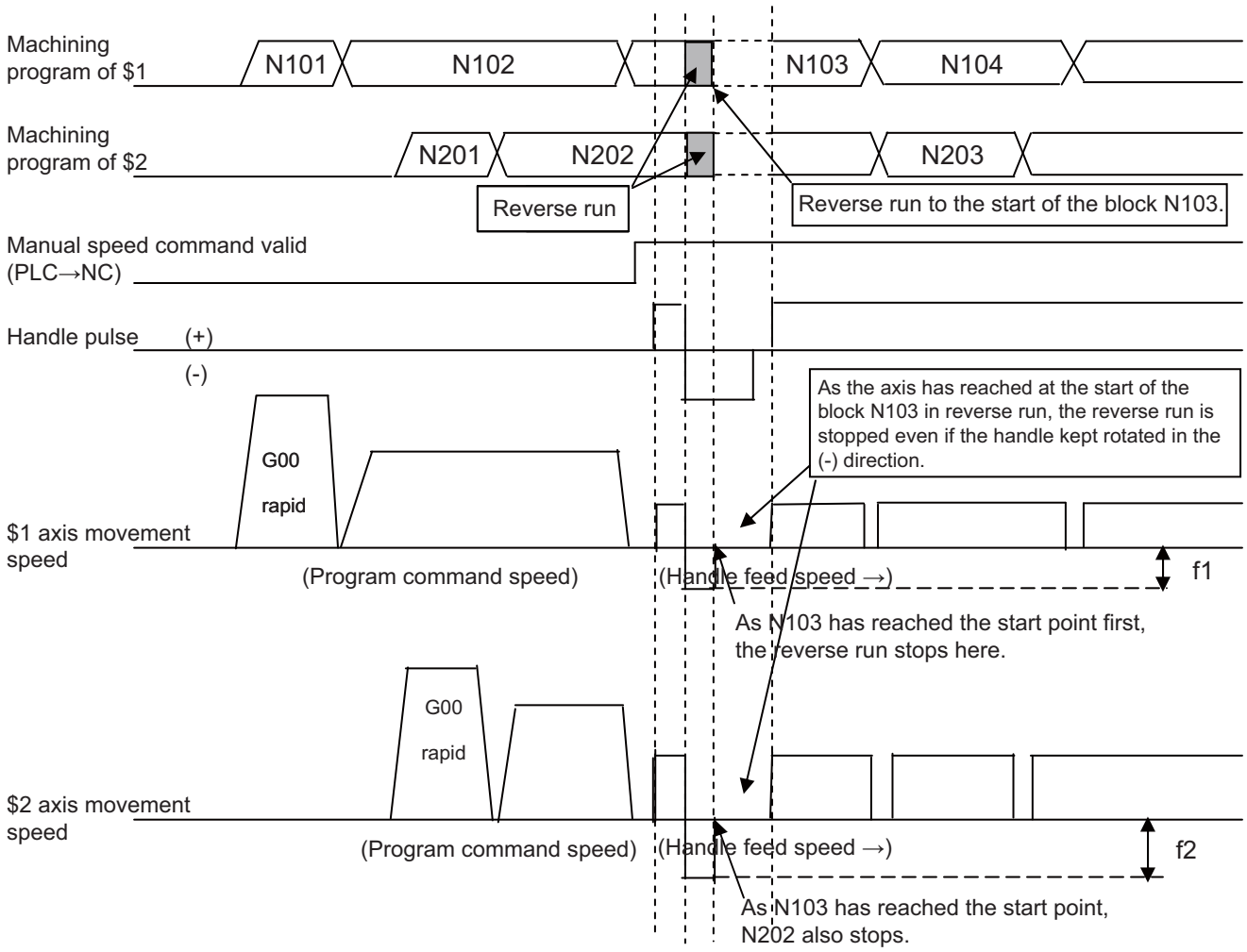
(Example) When the handle is rotated with the handle feedrate 10.0 mm/min:

N103 block of 1st part system, command speed F600...Feedrate is 2.0 [mm/min]

N202 block of 2nd part system, command speed F200…Feedrate is 10.0 [mm/min]

(6) In this case, the ratio of the automatic operation feedrates is applied to the handle feedrates. However, when either of $1 or $2 reaches the block start point, the reversed movements of the both part systems end. (Cannot return to the previous block.)

(Example) Between the blocks N103 and N202, if the block N103 first reaches the start point, the axis of the block N202 stops even if the block has not been finished.



The movement speed value of f1, f2 is calculated by multiplying the command speed ratio between the two part systems by the handle speed.

Restrictions and precautions regarding manual speed command 2

(1) When using this function involving multiple part systems, the manual mode (handle/JOG/rapid traverse), the manual speed command reverse run valid signal and the manual speed command sign reversed signal must be the same between part systems where the manual speed command is enabled.

(2) When using rapid traverse (G0) in this function, set "#1086 G0Intp" to "0".
If "#1086 G0Intp" is set to "1" (Non-interpolation), the handle speed/JOG/manual rapid traverse rate of the smallest part system No. among the part systems where the manual speed command is enabled is applied to the G0 speed. However, relations of travel paths and travel speeds between part systems may be different from those of an actual automatic operation.

(3) The handle speed/JOG/manual rapid traverse rate of the smallest part system No. among part systems where the manual speed command is enabled is applied to a movement from the intermediate point to the reference position of G28/G30 (reference position return) and a movement from the start point to the intermediate point of G29. These movements are non-interpolation type; therefore, machining conditions (related to travel paths and travel speeds) between part systems may be different from those of an actual automatic operation.

(4) For constant surface speed control, the S command before commanding the constant surface speed control is used.
When constant surface speed control is used, the relation of feedrates between part systems may be different from the ratio of the actual travel speeds of the tools.

(5) For an inverse time feed, the relation of feedrates between part systems may be different from the ratio of the actual travel speeds of the tools.

(6) If a reverse run operation is carried out at a single block stop in any of the part systems, the block which is in the single block stop moves to the next block. The other part systems carry out the reverse run only during the movement.

(7) If any of part systems is in a timing synchronization (a timing synchronization by a ! code or M code, or a timing synchronization with the start point designated (G115/G116)), the rest of the part systems cannot carry out a reverse run.

(8) This function uses the handle speed/JOG/manual rapid traverse rate of the smallest No.'s part system in which the manual speed command is enabled. In the case of using this function in multiple part systems, if the "manual speed command valid" signal is switched (ON - OFF) while the handle/JOG feed is still carried out, the part system which uses the handle/JOG/manual rapid traverse speed may change and the moving axis's feedrate may also change. Switch the manual seed command valid signal after stopping the handle/JOG feed.

6.6.12.3 Precautions

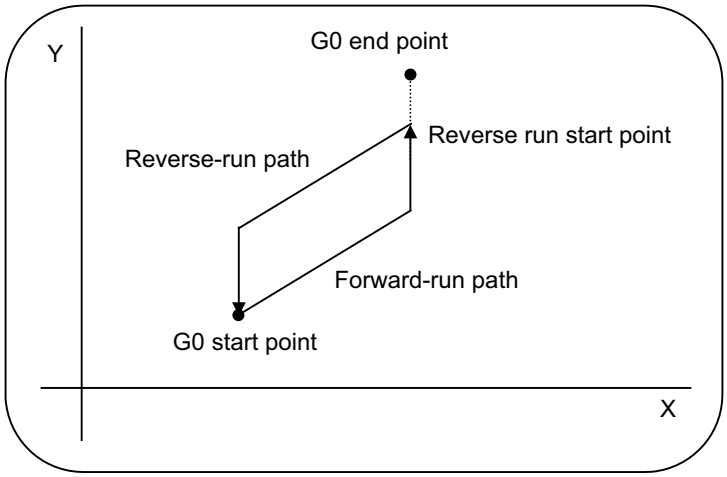
(1) The execution of the manual speed command ignores the automatic operation start.

(2) If the asynchronous tapping is executed while the manual speed command is valid, the pitch will not be the same as commanded.

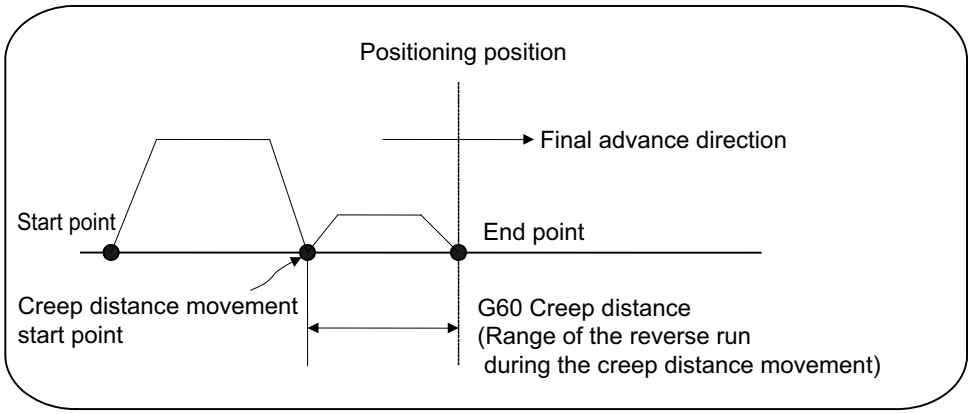
(3) The reverse run cannot be executed in the following operations:
- Dog-type reference position return
- In cutting cycle in the synchronous or asynchronous tap
- In shift amount operation in a fixed cycle
- In tool center point control
- In normal line control
- In milling interpolation/pole coordinate interpolation/cylindrical interpolation
- Thread cutting (G33) .
- Exponential interpolation.
- Spline interpolation.
- NURBS interpolation.
- Tool change position return or 2nd/3rd/4th reference position return (from the intermediate point to the block end).
- Reference position return (G28, G29).

When G28 is commanded, however, the reverse run is available from the start point and to the intermediate point.
When G29 is commanded, the reverse run is available from the intermediate point to the end point

(4) If a forward run has been executed at rapid traverse (G0) with non-interpolation, the reverse run may not have the same path.



(5) During the creep distance movement in the unidirectional positioning (G60), a reverse run ends at the creep distance movement start point.



(6) In the corner chamfering/corner R, a reverse run ends at the start point of the corner chamfering/corner R.

(7) If the 3-dimensional circular interpolation has been carried out beyond the intermediate point, a reverse run ends at the intermediate point.

(8) In the tool compensation, a reverse run is executed within the block of the compensation.

(9) In the fixed cycles, a reverse run is executed for each one block of fixed cycle.
(10) Neither mode of high accuracy control, high-speed high-accuracy control nor high speed machining is available when the manual speed command is valid.
(11) Turn OFF the "Tool length measurement 1" (TLM) signal before starting a machining program with the manual feed command. Otherwise, "M01 Internal interlock axis exists 0005" will occur.

6.6.12.4 List of Signals

NC->PLC interface signal

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	IN MANUAL SPEED COMMAND VALID		XC48	XD88	XEC8	X1008

[Function]

This signal indicates that the "Manual speed command valid" signal has turned ON and the manual speed command is valid in the controller.

[Operation]

This signal turns ON when the "Manual speed command valid" signal has turned ON and the manual speed command has been enabled in NC.

This signal turns OFF when the "Manual speed command valid" signal has turned OFF and the manual speed command has been disabled in NC.

[Related signals]

(1) Manual speed command valid (YC9D)

PLC → NC interface signal

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	TOOL LENGTH MEASUREMENT 1	TLM	YC20	YD60	YEA0	YFE0

[Function]

"Tool length manual measurement 1" is selected by this signal.

For M system, "Tool length manual measurement 1 and 2" functions are used by this signal.

[Operation]

When the signal (TLM) is turned ON (1), amount of tool length to be corrected is calculated automatically in the controller.

[Caution]

(1) This signal is invalid if the tool length screen is not selected.

(2) The calculation result is read when INPUT key is pressed.

(3) Turn this signal OFF before executing a program with manual speed command.

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MANUAL SPEED COMMAND VALID		YC9D	YDDD	YF1D	Y105D

[Function]

This signal is used to run the machining program with handle feedrate or JOG feedrate (manual feedrate).

[Operation]

After this signal is ON, manual speed (handle or manual feedrate) is applied to the axis feedrate in the whole automatic operation: the speed commanded in the program is not used.

If the program has not started, the automatic operation start is executed with handle or manual feedrate.

The manual operation mode decides whether the manual feedrate or handle feedrate is used.

- In handle mode

  The program under operation is executed at the feedrate of the 1st handle, 1st axis.

  During the reset, block stop or pause in the automatic operation mode, the automatic operation starts at the time when the handle feedrate has been commanded.

  When the reverse run is valid, a command in the (+) direction makes the movement as in the program, while a command in (-) direction reverses the movement against the program. The reversed movement, however, is available only within the current block.

- In JOG mode

  The program under operation is executed at the manual feedrate as long as the JOG mode signal is ON for the 1st axis.

  During the reset, block stop or pause in the automatic operation mode, the automatic operation starts at the time when the JOG mode has been turned ON.

  When the reverse run is valid, a command in the (+) direction makes the movement as in the program, while a command in (-) direction reverses the movement against the program. The reversed movement, however, is available only within the current block.

  When the "Rapid traverse" signal is ON, the axis moves at the rapid traverse feedrate.

[Caution]

(1) Turning ON this signal in the automatic operation leads the automatic operation pause.

(2) While this signal is ON, the "Automatic operation "start" command" signal is not valid.

(3) When the automatic operation is carried out with the manual speed command, the "In automatic operation "pause"" signal is output regardless of the axis movement.

(4) The manual speed command makes the movement follow the command on the 1st axis, even though the other axis is commanded in the program. Any commands to the other axes lead "M01 OPERATION ERROR 0005" (Internal interlock axis exists).

(5) The following G commands or modal make the movement different from that in the normal automatic operation.

G00: The manual feedrate is applied, not the rapid traverse feedrate.

G28: The manual feedrate is applied, not the reference position return feedrate.

G31: The manual feedrate is applied, not the skip feedrate. The movement when the skip signal is input, however, is the same as in the normal operation.

G33, G34 to 36 (L system): The thread cutting (G33), the variable lead thread cutting (G34: L system only), and the arc thread cutting (G35/36: L system only) operate in the same manner as the dry run. The manual feed rate is applied.

(When the parameter "#1247 set19/bit1" is set to "1", it operates according to the program command.)

G95: The feed per rotation operates the same as the dry run.

F1-digit feed: The manual feedrate is applied, not the F1-digit feedrate. The "F1-digit commanded" signal is not output, either.

(6) Only the 1st handle is used. The other handles are ignored.

(7) When this signal is valid, the feedrate is not changed by the Inch/Metric changeover command (G20/G21), nor by the rotary axis command speed tenfold.

(8) The manual interruption and the thread cutting cycle retract are available when this signal is ON. The automatic handle interruption, as well as the manual operation in the manual/auto simultaneous mode, cannot be used on the 1st axis because the axis applies the manual input upon this signal.

[Related signals]

(1) Manual speed command sign reversed (YC9E)
(2) Manual speed command reverse run valid (YC9F)
(3) In automatic operation "pause" (SPL: XC14)
(4) In manual speed command valid (XC48)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MANUAL SPEED COMMAND SIGN REVERSED		YC9E	YDDE	YF1E	Y105E

[Function]

When the manual speed is commanded, this signal reverses the direction that has been commanded with the handle feed or JOG feed.

[Operation]

When this signal is ON, a speed command in the (+) direction reverses the movement against the program. (Note that this operation is not available unless the reverse run is valid.) A command in the (-) direction makes the movement as commanded in the program.

Manual speed command Reverse run valid	Manual speed command Sign reversed	Movement direction	
		by (+) operation	by (-) operation
OFF	(Invalid)	+	+
ON	OFF	+	-
ON	ON	-	+
In the modals that do not allow the reverse run (thread cutting and synchronous tapping)		+	The operation is ignored

[Caution]

This signal is not valid when the "Manual speed command Reverse run valid" signal is OFF.

[Related signals]

(1) Manual speed command valid (YC9D)
(2) Manual speed command reverse run valid (YC9F)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MANUAL SPEED COMMAND REVERSE RUN VALID		YC9F	YDDF	YF1F	Y105F

[Function]

This signal allows the manual speed command in the (-) direction to reverse the movement against the program.

[Operation]

When this signal turns ON during the manual speed is commanded, a speed command in the (-) direction in handle or JOG mode reverses the movement against the program.

When this signal is OFF, a command in the (-) direction makes the same movement as commanded in the (+) direction: the movement follows the program.

[Caution]

(1) The reverse run is available within the block in execution. The reversed axis movement stops at the start point of the block in execution.

(2) Unless all the axes stop, this signal cannot be changed ON/OFF. The ON/OFF change of this signal during the axis movement is realized after all the axes have stopped.

(3) The reverse run is not allowed in the following operations. The axis stays stopped if a speed command is given in the (-) direction.

(a) In the reference position return (G28, G29). When G28 is commanded, however, the reverse run is available from the start point and to the intermediate point. When G29 is commanded, the reverse run is available from the intermediate point to the end point.

(b) In cutting cycle in the synchronous or asynchronous tap.

(c) In shift amount operation in a fixed cycle.

(d) In tool center point control.

(e) In normal line control.

(f) In milling interpolation, pole coordinate rotation or cylindrical interpolation.

(g) When the thread cutting command (G33) is given.

(h) In exponential interpolation.

(i) In spline interpolation.

(j) In NURBS interpolation.

(k) In tool change position return or 2nd/3rd/4th reference position return (from the intermediate point to the block end).

[Related signals]

(1) Manual speed command valid (YC9D)

(2) Manual speed command sign reversed (YC9E)

6.6.13 Arbitrary Reverse Run

This function allows a program to run the executed blocks backward (hereinafter called "reverse run") after the block stop in the automatic operation.

The following steps are available:

- Execute the reverse run to the point to go back,
- Run the reversed blocks again following the program (hereinafter called "forward run") and
- Continue the remaining blocks from the point of the interruption.

Maximum 200 blocks can be executed in the reverse run.

Only the 1st to 3rd axes of each part system can be used for this function.

This function is an option.

Term definition

The following terms are used in this section.

Term	Definition
Reverse run information	Data of the program blocks that have been executed under the conditions written later in "(1) Saving the reverse run data" in the "Reverse run information" column.
Reverse run	Running the executed blocks backward based on the reverse run information. A reverse run starts at the specified point in a block, ends at the specified point in one previous block.
Forward run	Running the program again from the reverse run end point to the start point based on the reverse run data.
Reverse run control	Execution of the reverse/forward run.

Reverse run information

(1) Saving the reverse run data

When all the following conditions are met, NC saves the data of the executed program blocks as reverse run information.

The conditions differ according to the setting value of the parameter "#1338 rev data save trg".

#1338 rev data save trg	Conditions
0	"Reverse run control mode" (RVMD) signal is ON The program is under the memory or MDI mode During the valid G code modal written later in the "Valid G codes" column
1	Under the macro interrupt (M96) command "Reverse run control mode" (RVMD) signal is ON The program is under the memory or MDI mode During the valid G code modal written later in the "Valid G codes" column

NC saves the data of the latest 200 blocks as reverse run information. If a block has moved before 200th, the reverse run information of the block is deleted accordingly.

Movements in the reverse/forward run are not saved as reverse run information.

The reverse run information is not saved in the program check or restart search.

(2) Clearing the reverse run information

NC initializes the reverse run information if one of the following is executed.

- "Reverse run control mode" (RVMD) signal is turned OFF and ON
- "NC reset 1" (NRST1) signal is turned ON
- "NC reset 2" (NRST2) signal is turned ON
- "Reset & rewind" (RRW) signal is turned ON

Valid G code

Only the specified G codes allow the reverse run. Valid G codes are shown below.

The G codes out of the list are invalid. Do not execute the reverse run to the invalid G codes.

G code group	Valid/Invalid	Valid G code (default G code if invalid)
00	○	G04, G52*, G53*, G60, G65, G92*, G92.1*, M96(ION), M97(I0F), M98(G22) (Note 2), M99* (G23*)
01	○	GO0, G01, G02, G03
02	○	G17
03	○	G90, G91
04	×	G23(G23.1)
05	×	G94, G95 (Note 3) (According to the modal when the reverse run information is started to be stored.)
06	○	G20, G21
07	×	G40
08	×	G49
09	×	G80
10	×	G98
11	○	G50, G51
12	○	G54, G55, G56, G57, G58, G59, G54.1
13	×	G64
14	○	G66, G66.1, G67
15	×	G40.1(G15)
16	×	G69(G69.1)
17	×	G97
18	×	G15
19	○	G50.1, G51.1, (G62)
21	×	G07.1 OFF, G13.1(G11)

(Note 1) Insert G04; before the G code with "*".

(Note 2) The figure rotation cannot be executed with M98(G22).

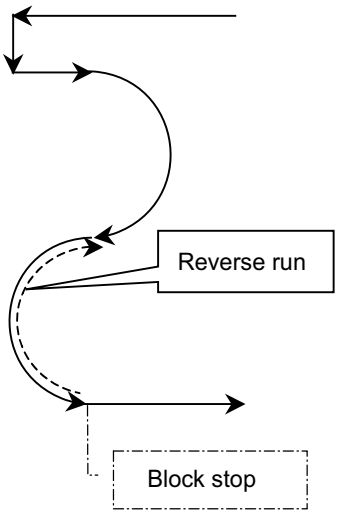
(Note 3) In G95 modal, the reverse/forward run is executed with "the last commanded speed * spindle speed (mm/rev)"

(Note 4) The G codes in "( )" are used for M2 format.

Reverse run

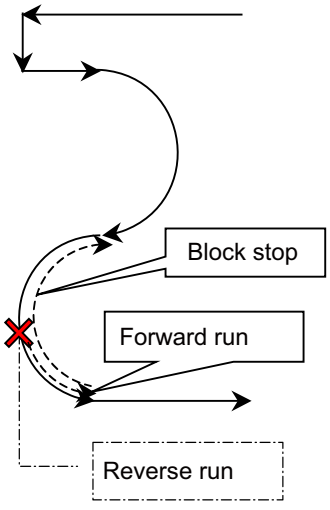
(1) When the "Automatic operation "start" command" (ST) signal is turned ON and OFF under all the following conditions, NC starts the reverse run based on the reverse run information. The same conditions are required to start the reverse run during the forward run.
- "Reverse run control mode" (RVMD) signal is ON
- In the automatic operation stop: "In automatic operation "run"" (OP) is ON, "In automatic operation "start"" (STL) is OFF, "In automatic operation "pause"" (SPL) is OFF
  or in the automatic operation pause: "In automatic operation "run"" (OP) is ON, "In automatic operation "start"" (STL) is OFF, "In automatic operation "pause"" (SPL) is ON
- The "Reverse run" (VRV) signal is ON

(2) If the "Automatic operation "start" command" signal is turned ON and OFF during the automatic operation stop, the reverse run starts from the block stop point.




```
N01 G90 G54 X0 Y0 ;
N02 G91 G01 X50. F500 ;
N03 Y-20. ;
N04 X20. ;
N05 G02 Y-50. R25. ;
N06 G03 Y-50. R25. ;
N07 G01 X30. ;
M02 ;
```

(3) If the "Automatic operation "start" command" signal is turned ON and OFF during the automatic operation pause, the reverse run starts after the execution for the remaining distance of the command. Therefore, the reverse run usually must be started during the automatic operation stop.




```
N01 G90 G54 X0 Y0 ;
N02 G91 G01 X50. F500 ;
N03 Y-20. ;
N04 X20. ;
N05 G02 Y-50. R25. ;
N06 G03 Y-50. R25. ;
N07 G01 X30. ;
M02 ;
```

(4) The following shows the movement when the "Reverser run" (VRV) signal is turned ON/OFF in different operation states.

Operation	Movement
The "Reverse run" signal is turned ON/OFF during the automatic operation	The setting value of the parameter "#1338 rev data save trg" decides as follows. 0: The movement stops immediately. A block stop is executed. The next cycle start executes the reverse/forward run according to the "Reverse run" signal. 1: The movement does not stop immediately. A block stop or block pause is required to execute the reverse run. The next cycle start after the block stop executes the reverse/forward run according to the "Reverse run" signal. The next cycle after the block pause runs the remaining distance before executing the reverse/forward run following the "Reverse run" signal.
The "Reverse run" signal is turned ON during the block pause	The next cycle runs the remaining distance before executing the reverse/ forward run following the "Reverse run" signal.
The "Reverse run" signal is turned ON during the block stop	The next cycle executes the reverse/forward run following the "Reverse run" signal.

(5) In the following case, NC outputs "M01 OPERATION ALARM (0119)", decelerates and stops the movement.
- All the saved reverse run information have been consumed in the reverse run
- In the normal operation (not in the reverse/forward run) while the "Reverse run control mode" signal is ON, 8 consecutive blocks with no movement have been detected.

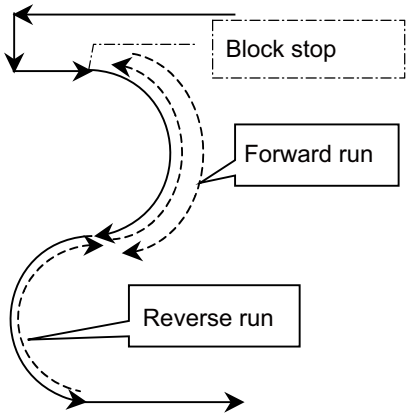
(6) The "Automatic operation "pause"" (*SP) signal and the "Single block" (SBK) signal are available in the reverse run.

(7) If the following signals are turned ON during the reverse run, NC resets the whole automatic operation.
- "NC reset 1" (NRST1)
- "NC reset 2" (NRST2)
- "Reset & rewind" (RRW)

Forward run

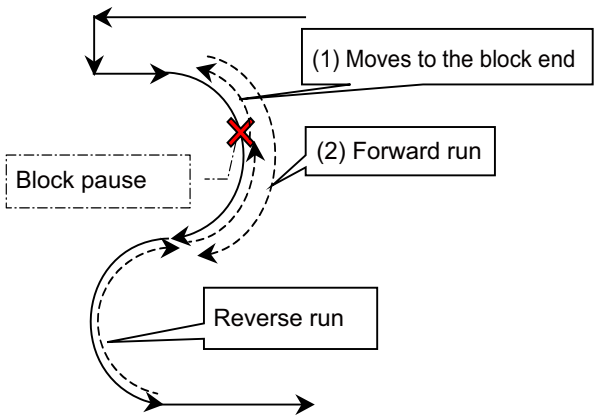
(1) When the "Automatic operation "start" command" (ST) signal is turned ON and OFF under all the following conditions, NC starts the forward run based on the reverse run information.
- "Reverse run control mode" (RVMD) signal is ON
- In the automatic operation stop: "In automatic operation "run"" (OP) is ON, "In automatic operation "start"" (STL) is OFF, "In automatic operation "pause"" (SPL) is OFF
or in the automatic operation pause: "In automatic operation "run"" (OP) is ON, "In automatic operation "start"" (STL) is OFF, "In automatic operation "pause"" (SPL) is ON
- The "Reverse run" (VRV) signal is OFF

(2) If the "Automatic operation "start"" signal is turned ON and OFF during the automatic operation stop, the forward run starts from the block stop point.




```
N01 G90 G54 X0 Y0 ;
N02 G91 G01 X50. F500 ;
N03 Y-20. ;
N04 X20. ;
N05 G02 Y-50. R25. ;
N06 G03 Y-50. R25. ;
N07 G01 X30. ;
M02 ;
```

(3) If the "Automatic operation "start" command" signal is turned ON and OFF during the automatic operation pause, the forward run starts after the execution for the remaining distance of the command. Therefore, the forward run usually must be started during the automatic operation stop.




```
N01 G90 G54 X0 Y0 ;
N02 G91 G01 X50. F500 ;
N03 Y-20. ;
N04 X20. ;
N05 G02 Y-50. R25. ;
N06 G03 Y-50. R25. ;
N07 G01 X30. ;
M02 ;
```

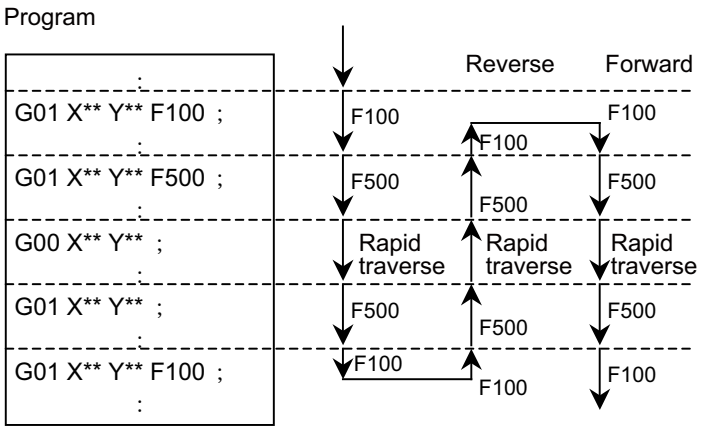
(4) After the forward run has completed to the block where the reverse run had started, the movement continues to execute the remaining machining programs that had been automatically stopped. If the "Single block" signal is ON, the movement stops at each block end.

(5) The "Automatic operation "pause" command" (*SP) signal and the "Single block" (SBK) signal are available in the forward run.

(6) If the following signals are turned ON during the forward run, NC resets the whole automatic operation.
- "NC reset 1" (NRST1)
- "NC reset 2" (NRST2)
- "Reset & rewind" (RRW)

Feedrate (F) in the reverse/forward run

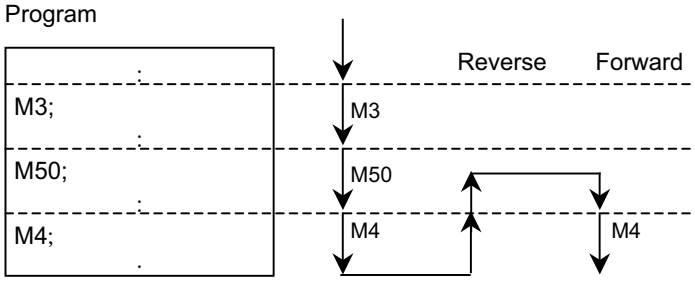
The reverse/forward run applies the feedrate specified with F command in the normal operation. Cutting feed override, rapid traverse override and dry run can be used on the F command.



M command in the reverse/forward run

If any M command is given at the reverse run start and later on, NC does not output the "M code data" signal (R504 to R511) or the "M function strobe" (MFn) signal.

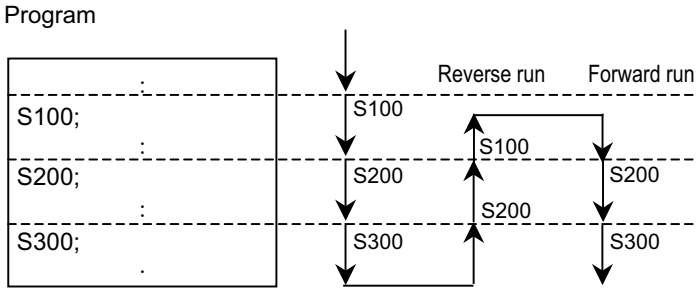
In the forward run, M code data is output according to the program. Then the "M function strobe" signal is turned ON. Note that only the last one M command is output when the several M commands are given to a block. Note also that no M command is output from the M command block where the forward run has started.



No M code output during the reverse run

S, T and 2nd miscellaneous function command in the reverse/forward run

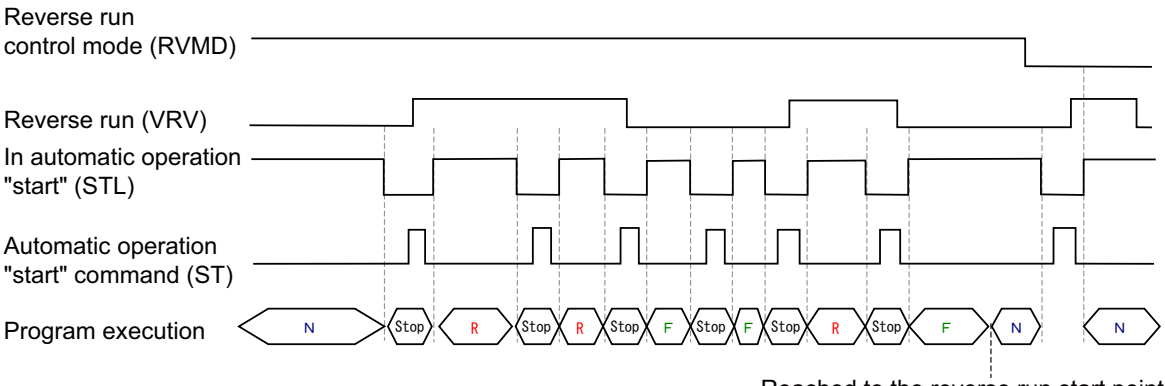
In the reverse run, NC outputs an S command only upon a change of the modal value: the S command with the changed modal value is output to "S code data" (R512 to R519) and then the "S function strobe" (SFn) signal is turned ON.
In the forward run, NC outputs S commands to "S code data" according to the program, and then turns ON the "S function strobe" signal.
T command and 2nd miscellaneous command are also output only upon changes of the value: each code data is output and each strobe signal is turned ON.



Outputs upon modal changes

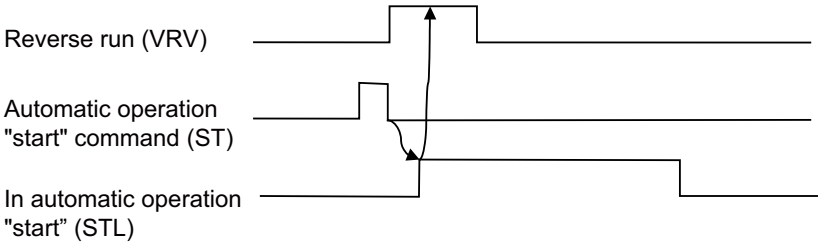
Timing chart

Reverse/forward run with the "Reverse control mode" and "Reverse run" signals



N: Normal operation
R: Reverse run
F: Forward run

How the "Reverse run" signal works with the signals for the operation start



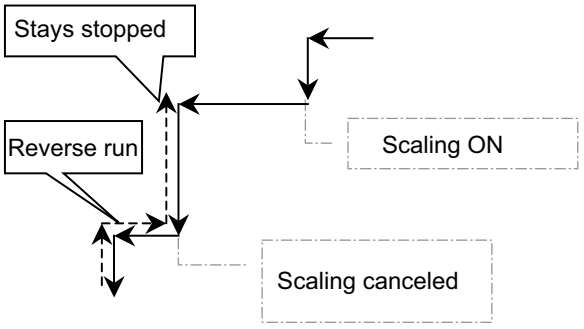
Do not turn OFF the signal STL when the reverse run has started.

Restrictions

(1) A buffer correction to the block for the reverse/forward run is not allowed in the reverse run control (reverse/forward run). The buffer correction is available to the blocks after the block where the reverse run starts.

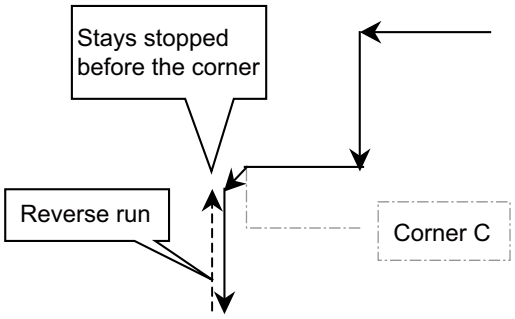
(2) If a verification stop has been executed in the normal operation, a reverse run control (reverse/forward run) stops at the verification point in the block. On the other hand, if no verification stop has been executed in the block in the normal operation, the verification stop cannot be executed at the verification point specified during the reverse run control.

(3) Execute a scaling (G51) command before turning ON the "Reverse run control mode" signal. If the command is executed during the reverse run, the movement stops and stays at the reverse run start point in the block before the scaling command.




```
N01 G90 X10. ;
N02     Y -10. ;
N03 G51 X10. Y-10. P2. ;
N04     X -20. ;
N05     Y -20. ;
N06 G50 ;
N06     X -30. ;
N07     Y -30. ;
N06     X -40. ;
N07     Y -40. ;
M02 ;
```

(4) Corner R/C, linear angle command and geometric command are not successfully executed during the reverse run. Corner R/C stays stopped before the corner.




```
N01 G91 X100. ;
N02     Y -100. ;
N03     X -100. ,C10. ;
N04     Y -100. ;
M02 ;
```

(5) The consecutive number of "blocks with no movement" must be 7 or less in the program to be executed in the reverse run control mode. When containing 8 or more blocks, insert G04;(dwell) before the 8th block. When the number of "blocks with no movement" reaches 8 in a row in the reverse run control mode, the alarm "M01 Reverse run impossible 0119" occurs.

(6) Be sure to insert a G04;(dwell) block before G92, G52 and G53 commands.

(7) When using a sub program in the program executed in the reverse run control mode, insert a G04;(dwell) block before each block of sub program call (M98) and sub program return (M99).

(8) This function cannot be used with the reference position retract. Turning ON the "Reference position retract" (RTN) signal in the reverse run control mode clears the reverse run information.

(9) "M code independent output" (M00, M01, M02 and M30) signals are not output in the reverse run.

(10) Only the linear-type rotary axis can be under the reverse run control.

(11) Do not turn ON/OFF the "Optional block skip" (BDTn) signal under the reverse run control (in the reverse/forward run). The path after the change is the same as in the normal operation.
(12) The axis movement, which has been executed in other modes than memory and MDI modes (in MDI interrupt, manual operation or macro interrupt for example) under the reverse run control, must be returned before the reverse run starts. Unless the movement is returned, the reverse run of the program starts with the current position regarded as end point of the last block that has been executed in the memory or MDI mode.
(13) Tool life is not changed by the reverse run control (reverse/forward run).
(14) The reverse run control cannot be used with the PLC interrupt. Do not use the "PLC interrupt" (PIT) signal under the reverse run control.

Using macro interrupt

(1) Outline

The macro interrupt function helps starting the reverse run in the middle of the block.
Using the macro interrupt, which employs a user macro function, will be useful when a tool has broken: this helps moving the tool from where it has broken to the point where the tool is changed, and then returning it to the program path after the tool change.
An interrupt program has to instruct to move the tool to the tool change position, as well as to return it to the program path.

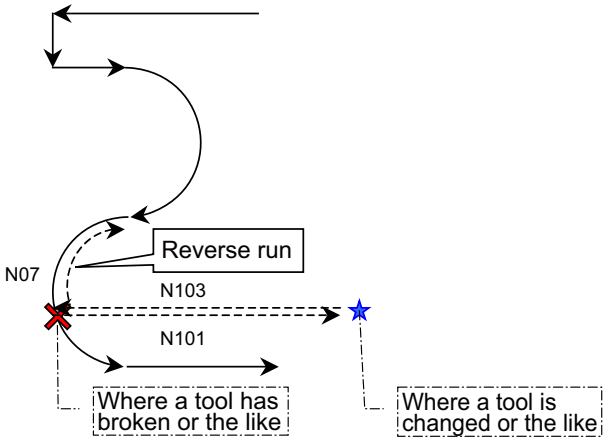
Use the parameter "#1113 INT_2"(Interrupt type 2 validity) to decide where to interrupt. Set "0" to the parameter to execute the macro interrupt in the middle of the block.

(2) Operation example

<To return the tool to the interruption point and start a cycle again>

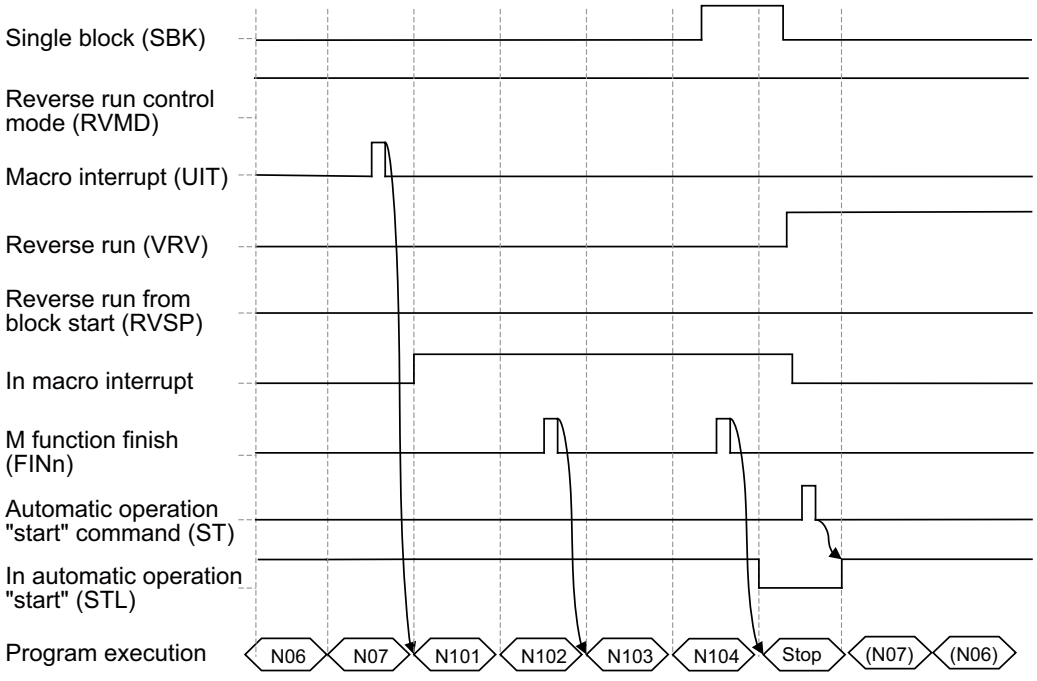
Keep the "Reverse run from block start" (RVSP) signal OFF when starting a reverse run.

To execute a reverse run after returning from the macro program, carry out a block stop when returning, turn ON the "Reverse run" (VRV) signal and then start the cycle. When the reverse run is not executed, the block stop is not required.




```
N01 G90 G54 X0 Y0 ;
N02 M96 P1001 ;
N03 G91 G01 X50. F500 ;
N04 Y-20.
N05 X20.
N06 G02 Y50. R25. ;
N07 G03 Y50. R25. ;
N08 G01 X30. ;
M97 ;
M02 ;
```

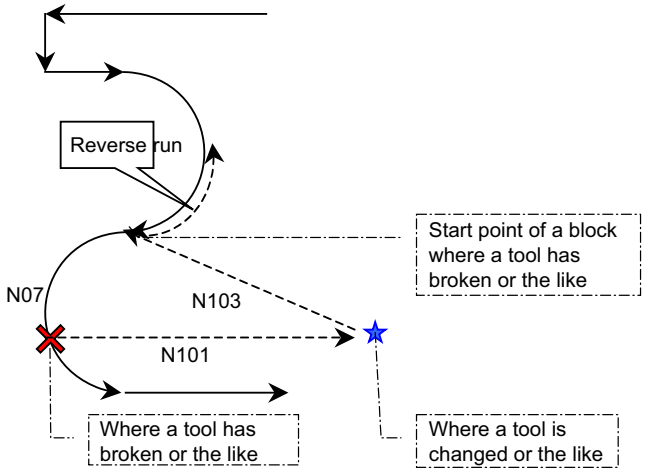
```
O1001 ;
#101=#5001#102=#5002
N101 G90 X70. ;
N102 M0 ;
N103 G90 G53 X#101 Y#102;
N104 M0 ;
G04 ;
M99 ;
```



Reverse run in "( )"
Forward run in "[ ]"

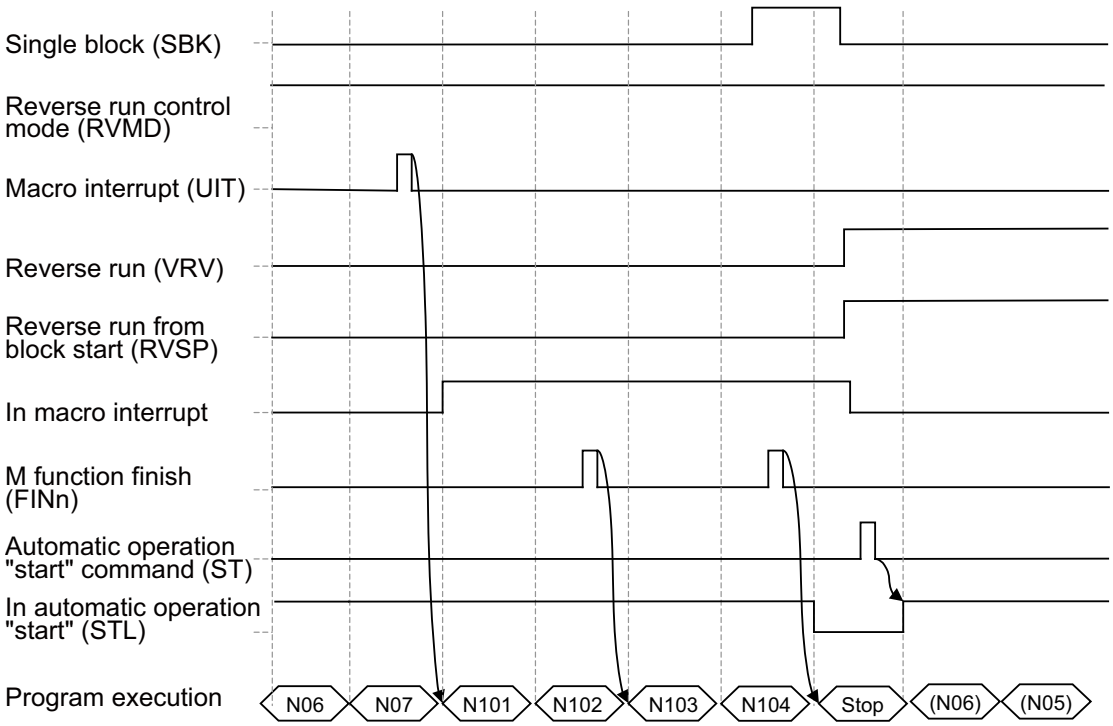
<To return to the start point in the block under the interruption and start a reverse run>

Turn ON the "Reverse run from block start" (RVSP) signal when starting the reverse run.




```
N01 G90 G54 X0 Y0 ;
N02 M96 P1002 ;
N03 G91 G01 X50. F500 ;
N04 Y-20.
N05 X20.
N06 G02 Y50. R25. ;
N07 G03 Y50. R25. ;
N08 G01 X30. ;
M97 ;
M02 ;
```

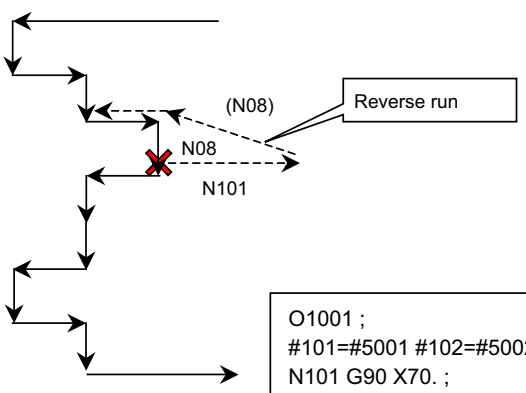
```
O1002 ;
#101=#5121 #102=#5122;
N101 G90 X70. ;
N102 M0 ;
N103 G90 G53 X#101 Y#102;
N104 M0 ;
G04 ;
M99 ;
```



(3) Precautions

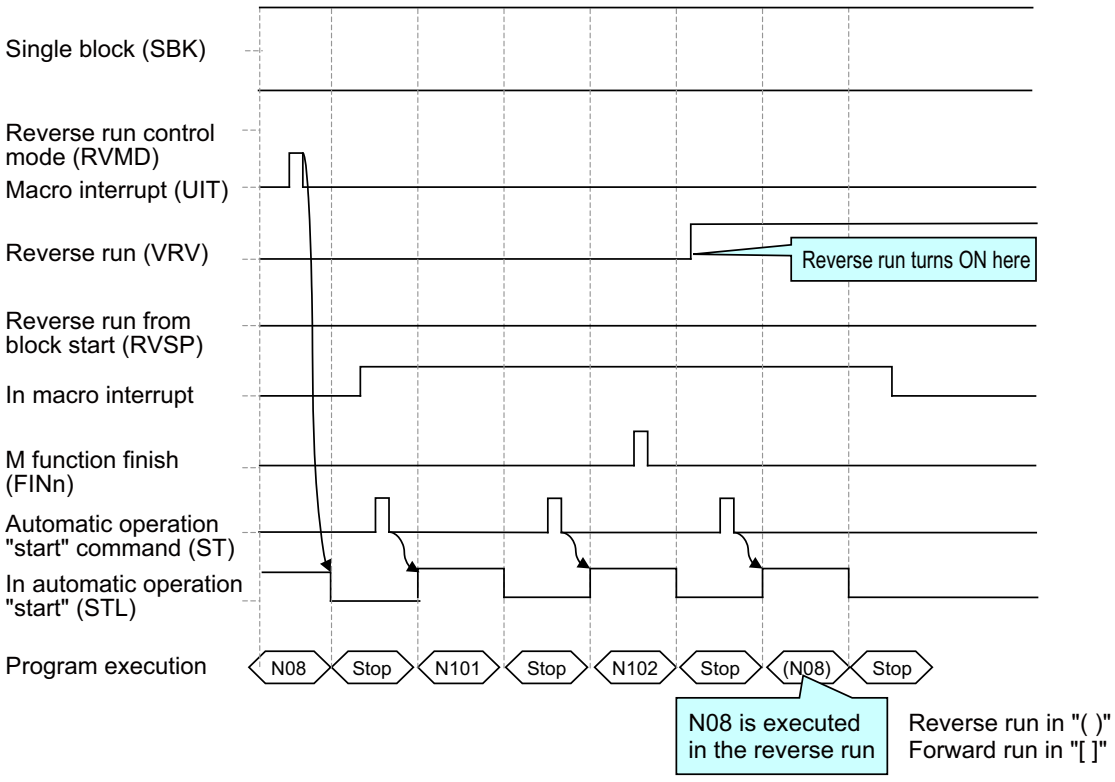
(a) Make sure to start a reverse run on the point (or the block start point) where the interruption occurs.

If a reverse run starts with a block stop in a macro interrupt program, the movement seems to start at the point (or the block start point) where the interruption occurs.

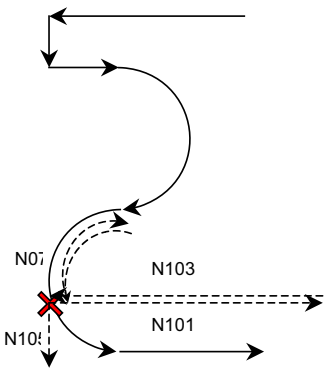



```
O1001 ;
#101=#5001 #102=#5002;
N101 G90 X70. ;
N102 M0 ;
N103 G90 G53 X#101 Y#102;
N104 M0 ;
G04 ;
M99 ;
```

```
N01 G90 G54 X0 Y0 ;
N02 M96 P1001 ;
N03 G91 G01 X50. F500 ;
N04 Y-20.
N05 X20.
N06 Y-15.
N07 X25.
N08 Y-20.
N09 X-25.
N10 Y-15.
N12 Y-15.
N13 X-25.
N14 Y-20.
N15 X25.
N16 Y-15.
N17 X30.
M97 ;
M02 ;
```

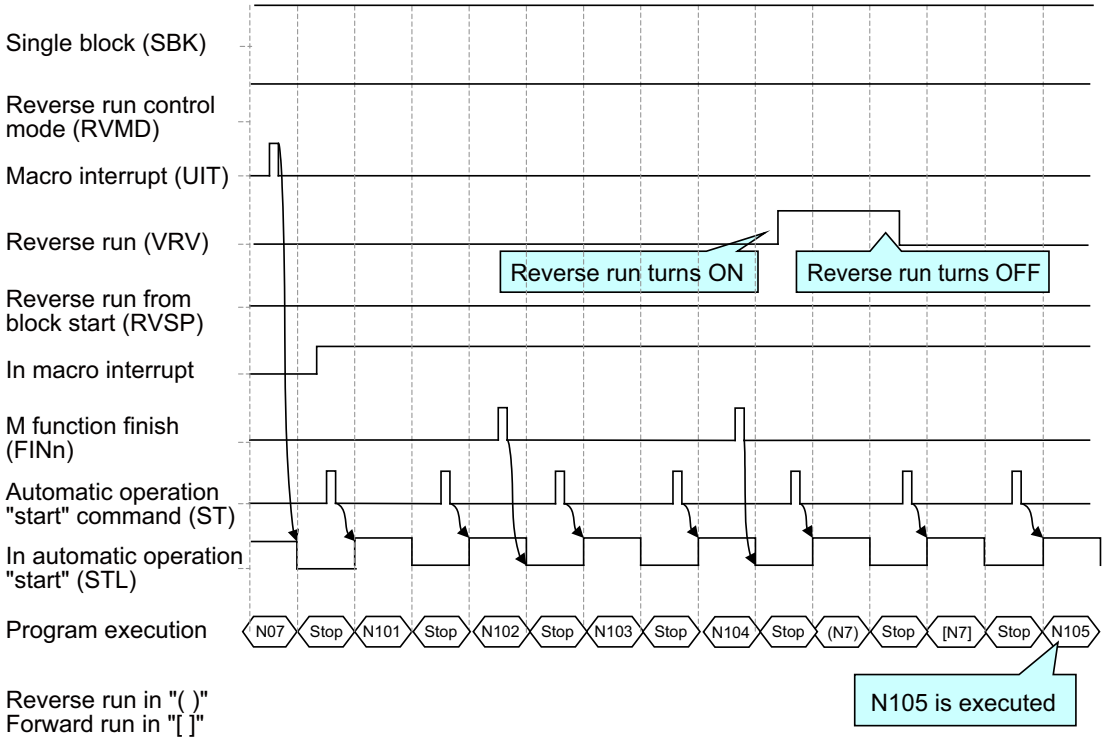


(b) In a macro interrupt program, start a reverse run at the point (or the block start point) where the interruption occurs and which a M99 (complete sub program) block follows.
If a reverse run has started with a block stop in the macro interrupt program, the movement returns to the interruption start point in the forward run, and then jumps to the next block of the reverse run start block in the macro interrupt program.




```
N01 G90 G54 X0 Y0 ;
N02 M96 P1002 ;
N03 G91 G01 X50. F500 ;
N04 Y-20.
N05 X20.
N06 G02 Y50. R25. ;
N07 G03 Y50. R25. ;
N08 G01 X30. ;
M02 ;
```

```
O1002 ;
#101=#5001 #102=#5002;
N101 G90 X70. ;
N102 M0 ;
N103 G90 G53 X#101 Y#102;
N104 M0 ;
N105 G01 Y20. ;
G04 ;
M99 ;
```



(c) While the reverse run is executed, the "Macro interrupt" signal is ignored.

System variable

The following shows the system variables used in the reverse run control.

(1) Position information

Position information Axis No.	End point coordinate of block immediately before	Start point coordinate of block with a macro interrupt	End point coordinate of block with a macro interrupt
1	#5001	#5121	#5141
2	#5002	#5122	#5142
3	#5003	#5123	#5143
:	:	:	:
n	#5000 + n	#5120 + n	#5140 + n
Reading during movement	Yes	Yes	Yes

(2) Reverse run information

Variable number	Usage	Description	Range
#31100	Number of available blocks for reverse run	+1 added number of the blocks that retained the reverse run information while the "Reverse run control mode" signal was ON	0 to 201
#31101	Counter of available blocks for reverse run	Number of available blocks for reverse run (value of #31100) when the "Reverse run" signal turned ON to start. Turns "0" when the forward run has been executed for all the blocks. Shows "0" in the normal operation.	0 to 201

PLC → NC interface signal

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	REVERSE RUN	VRV	YC27	YACA	YAD2	YADA

[Function]

This signal is used to select reverse/forward run in the arbitrary reverse run.

[Operation]

Forward run is executed when this signal is OFF.

Reverse run is executed when this signal is ON.

This signal is available only in the reverse run control mode.

[Related signals]

(1) Reverse run from block start (RVSP: YD08)

(2) Macro interrupt priority (RVIT: YD09)

(3) Reverse run control mode (RVMD: YD0A)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	REVERSE RUN FROM BLOCK START	RVSP	YD08	YE48	YF88	Y10C8

[Function]

This signal is used to designate where a reverse run starts in the arbitrary reverse run.

[Operation]

When this signal is OFF, a reverse run starts from the block stop point.

When this signal is ON, a reverse run starts from the start point of the block where the movement stopped.

Return to the start point for the reverse run from block start, turn this signal ON, and then start an automatic operation.

Keep this signal ON until the "In auto operation "start"" signal (STL) turns ON.

This signal is available only in the reverse run control mode.

[Related signals]

(1) Macro interrupt priority (RVIT: YD09)

(2) Reverse run control mode (RVMD: YD0A)

(3) Reverse run (VRV: YC27)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	MACRO INTERRUPT PRIORITY	RVIT	YD09	YE49	YF89	Y10C9

[Function]

In the arbitrary reverse run, turning ON the "Macro interrupt" (UIT) signal executes a block stop during the reverse run. Then this signal is used to select the operation when an automatic operation is started while the "Reverse run" (VRV) signal is OFF.

[Operation]

When this signal is OFF, a forward run is executed with the fall of the "Automatic operation "start" command" signal.
When this signal is ON, a macro interrupt program is executed with the fall of the "Automatic operation "start" command" signal.
This signal is available only in the reverse run control mode.

[Related signals]

(1) Reverse run from block start (RVSP: YD08)
(2) Reverse run control mode (RVMD: YD0A)
(3) Reverse run (VRV: YC27)

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	REVERSE RUN CONTROL MODE	RVMD	YD0A	YE4A	YF8A	Y10CA

[Function]

This signal is used to save the reverse run information used for the reverse run control in the arbitrary reverse run.

[Operation]

When this signal is ON, the reverse run information is saved.
Turn this signal ON at the start of the block where the reverse run control is executed. Turn it OFF when resetting.
Turn ON the "Recalculation request" signal (CRQ) when turning ON this signal.
Unless the recalculation is requested, the reverse run information does not include the block that has been created by pre-reading.

[Related signals]

(1) Reverse run from block start (RVSP: YD08)
(2) Macro interrupt priority (RVIT: YD09)
(3) Reverse run (VRV: YC27)
(4) Recalculation request (CRQ: YC2B)

6.6.14 PLC Axis Indexing

6.6.14.1 Functions

PLC axis indexing is used to move the PLC axis to the positioning destination or an arbitrary coordinate position. This function is applied to tool exchange and magazine control.

[Positioning command methods]

(1) Station method

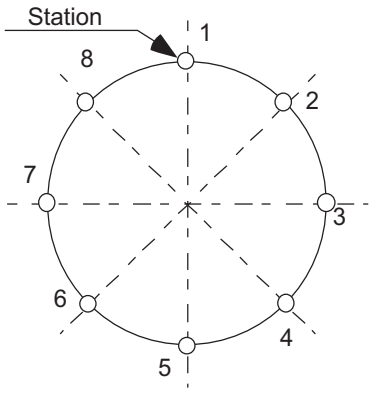
The axis will be positioned to the destination (station) that has been decided.

There are two assigning methods: Uniform assignment and arbitrary coordinate assignment.

・Uniform assignment

One rotation (360°) of the rotary axis will be equally divided to determine the stations.

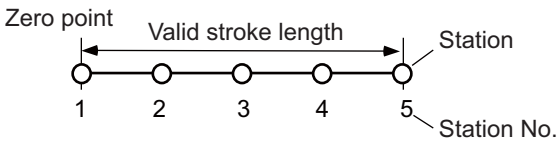
(Maximum number of divisions: 360)



[Setting 8 stations (8 divisions)]

[For linear axis]

A valid stroke will be equally divided to determine the station. (Maximum number of divisions: 359)



[Setting 5 stations]

・Arbitrary coordinate assignment

A station will be assigned to an arbitrary coordinate set in each table

(2) Arbitrary coordinate designation method

An arbitrary coordinate will be directly designated in PLC program for positioning.

[Operation functions]

- Automatic mode
  Stations will be determined automatically.
- Manual mode
  Stations will be determined manually.
  While the start signal is ON, the axis will be rotated at a constant speed. When the start signal is OFF, the axis will be positioned at the nearest station.
- JOG mode
  The axis will be rotated at constant speed.
- Incremental feed
  The axis will be moved by the designed amount.
- Manual handle feed
  The axis will be moved by the manual pulse generator.
- Reference position return
  The axis will be positioned at the reference position.

[Feed functions]

- Feed rate selection
  Automatic mode and manual mode can have each four different feed rates to be designated in the PLC program.
- Acceleration/deceleration method
  Four different combination can be set from the acceleration/deceleration patterns (linear or S-pattern acceleration/deceleration) and the acceleration/deceleration time constants. The combination will be selected in the PLC program.
  Select acceleration/deceleration type with parameter: the acceleration/deceleration with constant time or the one with a constant angle of inclination.
- Short-cut control
  A least movement distance is automatically judged when a rotary axis is rotated.

6.6.14.2 PLC Axis Indexing Interface

List of signals

(a) PLC → NC (R8050 to R8085, R8098)

PLC indexing axis						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R8050	R8056	R8062	R8068	R8074	R8080	AUXCM4	PLC axis indexing control command 4
R8051	R8057	R8063	R8069	R8075	R8081	AUXCM3	PLC axis indexing control command 3
R8052	R8058	R8064	R8070	R8076	R8082	AUXCM2	PLC axis indexing control command 2
R8053	R8059	R8065	R8071	R8077	R8083	AUXCM1	PLC axis indexing control command 1
R8054	R8060	R8066	R8072	R8078	R8084		PLC axis indexing control command position (L)
R8055	R8061	R8067	R8073	R8079	R8085		PLC axis indexing control command position (H)

PLC axis indexing control command 4 (R8050: AUXCM4)		
bit	Abbrev.	Name
bit0	OV1	Speed override 1
bit1	OV2	Speed override 2
bit2	OV4	Speed override 4
bit3	OV8	Speed override 8
bit4	OV16	Speed override 16
bit5	OV32	Speed override 32
bit6	OV64	Speed override 64
bit7	OVR	Speed override valid
bit8		Spare
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

PLC axis indexing control command 3 (R8051: AUXCM3)		
bit	Abbrev.	Name
bit0	ST1	Station selection 1
bit1	ST2	Station selection 2
bit2	ST4	Station selection 4
bit3	ST8	Station selection 8
bit4	ST16	Station selection 16
bit5	ST32	Station selection 32
bit6	ST64	Station selection 64
bit7	ST128	Station selection 128
bit8	ST256	Station selection 256
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

PLC axis indexing control command 2 (R8052: AUXCM2)		
bit	**Abbrev.**	**Name**
bit0	ST	Operation start
bit1	DIR	Rotation direction
bit2	STS	Arbitrary point feed command valid
bit3		
bit4	MP1	Incremental feed magnification 1
bit5	MP2	Incremental feed magnification 2
bit6	PR1	Operation parameter selection 1
bit7	PR2	Operation parameter selection 2
bit8		Spare
bit9		Spare
bitA		Spare
bitB		Spare
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

PLC axis indexing control command 1 (R8053: AUXCM1)		
bit	**Abbrev.**	**Name**
bit0	*SVF	Servo OFF
bit1		
bit2		
bit3	MRST	Master reset
bit4	*IT+	Interlock+
bit5	*IT-	Interlock-
bit6	RDF	Ready OFF
bit7	H	Handle feed operation mode
bit8	AUT	Automatic operation mode
bit9	MAN	Manual operation mode
bitA	J	JOG operation mode
bitB	ZRN	Reference position return mode
bitC		
bitD	AZS	Basic point initialization setting mode
bitE	ZST	Basic point setting
bitF	S	Incremental mode

PLC axis indexing operation adjustment mode valid (R8098)		
bit	**Abbrev.**	**Name**
bit0	-	PLC indexing axis operation adjustment mode valid (common for all axes)

(b) NC → PLC (R8000 to R8035, R8048)

PLC indexing axis						Abbrev.	Signal name
1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis		
R8000	R8006	R8012	R8018	R8024	R8030	AUXST4	PLC axis indexing control status 4
R8001	R8007	R8013	R8019	R8025	R8031	AUXST3	PLC axis indexing control status 3
R8002	R8008	R8014	R8020	R8026	R8032	AUXST2	PLC axis indexing control status 2
R8003	R8009	R8015	R8021	R8027	R8033	AUXST1	PLC axis indexing control status 1
R8004	R8010	R8016	R8022	R8028	R8034		PLC axis indexing control machine position (L)
R8005	R8011	R8017	R8023	R8029	R8035		PLC axis indexing control machine position (H)

PLC axis indexing control status 4 (R8000: AUXST4)		
bit	Abbrev.	Name
bit0	PSW1	Position switch 1
bit1	PSW2	Position switch 2
bit2	PSW3	Position switch 3
bit3	PSW4	Position switch 4
bit4	PSW5	Position switch 5
bit5	PSW6	Position switch 6
bit6	PSW7	Position switch 7
bit7	PSW8	Position switch 8
bit8		Spare
bit9		Spare
bitA		Spare
bitB	NST	Start not possible
bitC		Spare
bitD		Spare
bitE		Spare
bitF		Spare

PLC axis indexing control status 3 (R8001: AUXST3)		
bit	Abbrev.	Name
bit0	STO1	Station position 1
bit1	STO2	Station position 2
bit2	STO4	Station position 4
bit3	STO8	Station position 8
bit4	STO16	Station position 16
bit5	STO32	Station position 32
bit6	STO64	Station position 64
bit7	STO128	Station position 128
bit8	STO256	Station position 256
bit9	PSW9	Position switch 9
bitA	PSW10	Position switch 10
bitB	PSW11	Position switch 11
bitC	PSW12	Position switch 12
bitD	PSW13	Position switch 13
bitE	PSW14	Position switch 14
bitF	PSW15	Position switch 15

PLC axis indexing control status 2 (R8002: AUXST2)		
bit	Abbrev.	Name
bit0	AUTO	In automatic operation mode
bit1	MANO	In manual operation mode
bit2	JO	In JOG operation mode
bit3	ARNN	In reference position return
bit4	ZRNO	In reference position return mode
bit5		
bit6	AZSO	In basic point initialization setting mode
bit7	SO	In incremental mode
bit8	AL1	Alarm 1
bit9	AL2	Alarm 2
bitA	AL4	Alarm 4
bitB	BAL	Battery drop
bitC	ABS	Absolute position power shutoff movement over
bitD	ZSN	Absolute position data loss
bitE	ZSF	Initialization setting completed
bitF	ZSE	Initialization setting error completed

PLC axis indexing control status 1 (R8003: AUXST1)		
bit	Abbrev.	Name
bit0	RDY	Servo ready
bit1	INP	In-position
bit2	SMZ	Smoothing zero
bit3	AX1	Axis selection output
bit4	MVP	In axis plus motion
bit5	MVM	In axis minus motion
bit6	TLQ	In torque limit
bit7		
bit8	ZP	Reference position reached
bit9	RST	In reset
bitA	HO	In handle feed operation mode
bitB	MA	Controller ready completion
bitC	SA	Servo ready completion
bitD	JSTA	Automatic set position reached
bitE	JST	Set position reached
bitF	NEAR	Near set position

PLC axis indexing In operation adjustment mode (R8048)					
bit	AV	Name	bit	AV	Name
bit0	-	PLC indexing axis in operation adjustment mode 1st axis	bit4	-	PLC indexing axis in operation adjustment mode 5th axis
bit1	-	PLC indexing axis in operation adjustment mode 2nd axis	bit5	-	PLC indexing axis in operation adjustment mode 6th axis
bit2	-	PLC indexing axis in operation adjustment mode 3rd axis			
bit3	-	PLC indexing axis in operation adjustment mode 4th axis			

Details of operation command signals (PLC → NC)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 1	AUXCM1	R8053	R8059	R8065	R8071	R8077	R8083

Contact	Signal name	Signal abbreviation	bit
B	Servo OFF	*SVF	AUXCM1/bit0

[Function][Operation]

When the Servo OFF signal is set to "0" (B contact), the control axis enters the servo OFF status. No matter which operation mode the servo is in and turned OFF, the axis movement will stop, and the servo will turn OFF. The axis movement restarts when the servo is turned ON again.

If the axis moves for any reason while the servo is OFF, it can be selected whether to compensate that movement amount when the servo turns ON the next time. Select with parameter "#1064 svof".

(1) When carrying out movement amount compensation (#1064 svof = 1)

When the servo is OFF, the coordinates are always updated by the amount the axis has moved. When the servo is OFF, the coordinates show the machine position.

(2) When not carrying out movement amount compensation (#1064 svof = 0)

When the servo is OFF, the coordinates are not updated even when the axis moves. When the servo is OFF, the coordinates show the machine position when the servo is OFF.

When the servo is turned ON, the axis is moved to the position where the servo was turned OFF.

When the servo is OFF and the axis movement exceeds the excessive error width (designated with parameter "#2226 SV026"), a servo alarm occurs.

[Caution]

(1) The actual servo OFF operation is validated after In-position (INP) is completed. When using a mechanical clamp, carry out the clamp operation after confirming the in-position status.

(2) When the power is turned ON, the Servo OFF signal turns OFF ("0") and the servo OFF function becomes valid. It is necessary before operation to turn the Servo OFF signal ON ("1") in the PLC program to release the servo OFF.

Contact	Signal name	Signal abbreviation	bit
A	Master reset	MRST	AUXCM1/bit3

[Function]

This signal resets the PLC indexing axis.

[Operation]

When this signal is ON, the following reset operations are carried out.

(1) The axis movement decelerates to a stop.

(2) Alarms that can be released by the reset are released.

(3) The In reset (RST) signal is output.

(4) The operation alarm is released while resetting.

[Related signals]

(1) In reset (RST: AUXST1/bit9)

Contact	Signal name	Signal abbreviation	bit
A	Interlock+	*IT+	AUXCM1/bit4

[Function][Operation]

When the control axis is moving in the (+) direction, this signal decelerates and stops the axis movement immediately. When this signal is OFF from before movement, the motion is stopped in the same manner as without starting. In any case the movement is started or restarted by turning this signal ON.

Contact	Signal name	Signal abbreviation	bit
A	Interlock-	*IT-	AUXCM1/bit5

[Function][Operation]

This is the same as the Interlock + (IT+) signal, the only difference being the direction.

Contact	Signal name	Signal abbreviation	bit
A	Ready OFF	RDF	AUXCM1/bit6

[Function]

This is a signal to turn OFF the READY status.

[Operation]

When put into a READY OFF status, the power supply to the servomotor is shut off, and the contactor control output is simultaneously turned OFF. If the motor is in operation, it will stop by a dynamic brake stop or a deceleration control stop. Servo ready completion (SA) and Servo ready (RDY) are also turned OFF, but an alarm does not occur. When this signal is turned OFF, the machine immediately returns to the original state.

[Related signals]

(1) Servo ready completion (SA: AUXST1/bitC)

(2) Servo ready (RDY: AUXST1/bit0)

Contact	Signal name	Signal abbreviation	bit
A	Handle feed operation mode	H	AUXCM1/bit7

[Function]

This signal selects the handle feed operation mode.

[Operation]

The axis will move for the amount determined by input pulse multiplied by feed magnification after this signal is turned ON, each signal [Operation parameter selection (PR1, PR2) and Incremental feed magnification (MP1, MP2)] is determined, and the handle pulse is input.

[Caution]

(1) Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

(2) The handle mode acceleration/deceleration time is the acceleration/deceleration time constant 2 linear acceleration/deceleration of the selected operation parameter group.

[Related signals]

(1) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

(2) Incremental feed magnification 1, 2 (MP1, MP2: AUXCM2/bit4,5)

Contact	Signal name	Signal abbreviation	bit
A	Automatic operation mode	AUT	AUXCM1/bit8

[Function]

This signal selects the automatic operation mode.

[Operation]

Turn this signal ON, set Station selection 1 to 256 (ST1 to ST256) and then turn Operation start (ST) ON to move the axis to the designated station. The shortcut control or the rotation direction can be selected with parameters.

[Caution]

Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

[Related signals]

(1) Rotation direction (DIR: AUXCM2/bit1)

(2) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

(3) Station selection 1 to 256 (ST1 to ST256: AUXCM3/bit0 to 8)

Con-tact	Signal name	Signal ab-breviation	bit
A	Manual operation mode	MAN	AUXCM1/bit9

[Function]

This signal selects the manual operation mode.

[Operation]

When the rotation direction is designated and Operation start (ST) is turned ON, the axis will begin moving, and the rotation will continue in the designated direction until Operation start is turned OFF. When Operation start turns OFF, the axis will be positioned to the nearest station.

[Caution]

Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

[Related signals]

(1) Rotation direction (DIR: AUXCM2/bit1)

(2) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Con-tact	Signal name	Signal ab-breviation	bit
A	JOG operation mode	J	AUXCM1/bitA

[Function]

This signal selects the JOG operation mode.

[Operation]

When the rotation direction is designated and Operation start (ST) is turned ON, the axis will begin moving, and the rotation will continue in the designated direction until Operation start is turned OFF. Unlike the manual operation mode, when Operation start is turned OFF, the axis immediately decelerate to a stop.

[Caution]

Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101 Aux ax no operation mode".

[Related signals]

(1) Rotation direction (DIR: AUXCM2/bit1)

(2) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Con-tact	Signal name	Signal ab-breviation	bit
A	Reference position return mode	ZRN	AUXCM1/bitB

[Function]

This signal selects the reference position return mode.

[Operation]

When this signal (ZRN) is turned ON, the reference position return mode is designated. To start the reference position return, turn this signal ON, select the operation parameter group, then turn ON the Operation start (ST) signal.

When the absolute position coordinate system has been established in the absolute position specifications, the high-speed return will be applied in every operation.

[Related signals]

(1) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Con-tact	Signal name	Signal ab-breviation	bit
A	Basic point initialization setting mode	AZS	AUXCM1/bitD

[Function]

This signal selects the mode that initializes the basic point for the absolute position detection system.

[Operation]

When this signal is turned ON, the basic point initialization setting mode is held until the NC power is turned OFF. (Cannot be canceled)

When the stopper method is selected by setting "1" to "#2049 type", the torque limit value and the excessive error detection width in the operation parameter group 4 are automatically selected.

Con-tact	Signal name	Signal ab-breviation	bit
A	Basic point setting	ZST	AUXCM1/bitE

[Function]

This signal turns ON when designating the basic point with the basic point initialization in the absolute position detection system.

[Operation]

When this signal is turned ON in the basic point initialization setting mode, the designated position is set as the absolute position basic point.

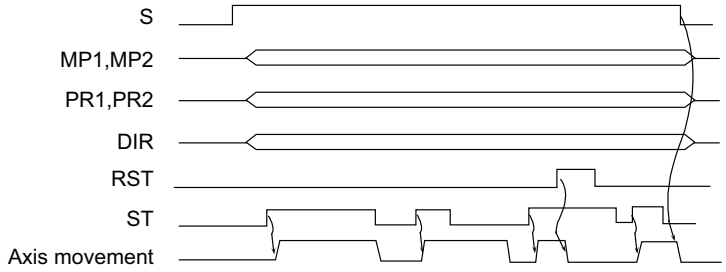
Con-tact	Signal name	Signal ab-breviation	bit
A	Incremental mode	S	AUXCM1/bitF

[Function]

This signal selects the incremental mode.

[Operation]

After turning ON this signal, designate the operation parameter group (with PR1 and PR2), the incremental feed magnification (with MP1 and MP2) and the rotation direction (with DIR). Then turn ON the Operation start (ST) signal to move the axis.



[Caution]

(1) Turning this signal ON when other operation modes are ON will result in the operation alarm "M01 0101".

(2) In the incremental mode, the axis travel will be maintained at a constant amount, even if the Operation start signal is OFF.

[Related signals]

(1) Operation parameter selection 1, 2 (PR1, PR2: AUXCM2/bit6,7)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 2	AUXCM2	R8052	R8058	R8064	R8070	R8076	R8082

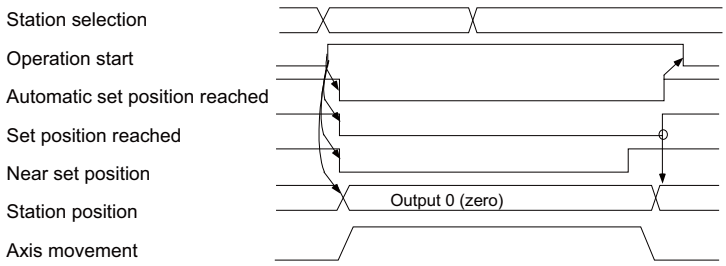
Contact	Signal name	Signal abbreviation	bit
A	Operation start	ST	AUXCM2/bit0

[Function][Operation]

When this signal is turned ON in an operation mode, the operation will start. The Operation start signal is handled as a status, so the ON status must be maintained until the operation is finished.

Operation movement in each operation mode

(1) Automatic operation mode



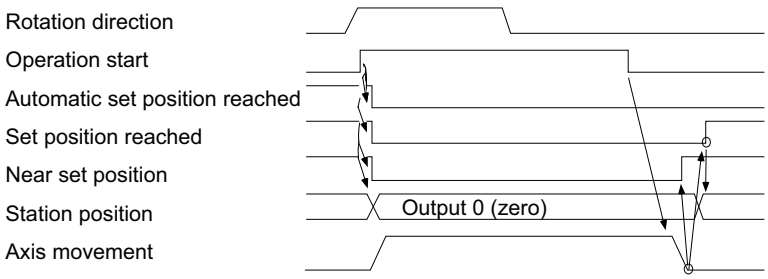
Station selection (ST1 to ST256) and Operation parameter selection (PR1, PR2) are established before inputting the Operation start signal. These two signals are read in by the startup of the Operation start signal, so they are held even if they are changed after the startup.

When the Operation start signal is input, the output signals related to the set position all turn OFF. Station position will be output as "0". When the positioning is completed, Automatic set position reached (JSTA) and Set position reached (JST) is output. Then turn the Operation start signal OFF.

When the Operation start signal is turned OFF during axis movement, the axis will stop at the nearest station. Note that for a linear axis, if there is not a nearest point in the movement direction, the commanded station becomes the nearest point.

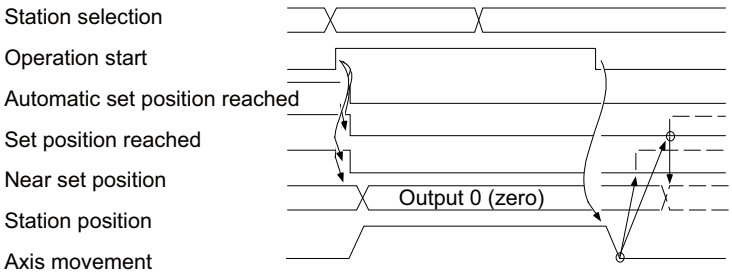
(Note) When the shortcut function is OFF for the rotating axis, the positioning direction can be designated with Rotation direction (DIR).

(2) Manual operation mode



Rotation direction (DIR) and Operation parameter selection (PR1, PR2) are established before inputting the Operation start signal. These two signals are read in by the startup of the Operation start signal, so they are held even if they are changed after the startup.
When the Operation start signal is input, the output signals related to the set position all turn OFF. Station position will be output as "0".
While the Operation start signal is ON, the rotation continues in the designated direction. When the Operation start signal is turned OFF, a positioning is carried out to the nearest station where the axis can stop in the rotation direction. Note that for a linear axis, if there is no nearest point in the movement direction, the axis will immediately decelerate to a stop.
When the positioning is completed, Set position reached (JST) is output.
(Note) Automatic set position reached (JSTA) will not be output.

(3) JOG operation mode



Rotation direction (DIR) and Operation parameter selection (PR1, PR2) are established before inputting the Operation start signal. These two signals are read in by the startup of the Operation start signal, so they are held even if they are changed after the startup.
When the Operation start signal is input, the output signals related to the set position all turn OFF. Station position will be output as "0". While the Operation start signal is ON, the rotation continues in the designated direction. When the Operation start signal is turned OFF, the axis decelerates to a stop. Set position reached (JST) and Near set position (NEAR) are output if the axis is stopped within each tolerable width from the station position.

Contact	Signal name	Signal abbreviation	bit
A	Rotation direction	DIR	AUXCM2/bit1

[Function]

This signal designates the rotation direction of the operation in each operation mode.

[Operation]

Turn this signal ON to designate the rotation direction before inputting the Operation start (ST) signal.

This signal is invalid in the automatic operation mode when the shortcut control is set and selected by the parameter.

When the shortcut control is not selected, a positioning is carried out in the direction designated by this signal.

This signal is read in at the startup of Operation start (ST). The signal changes are ignored after the startup.

DIR	Axis rotation direction	Station movement direction
0	Forward run	Direction of increasing station No.
1	Reverse run	Direction of decreasing station No.

The actual motor rotation direction is reversed by changing the setting of parameter "#1018 ccw".

[Related signals]

(1) Operation start (ST: AUXCM2/bit0)

Contact	Signal name	Signal abbreviation	bit
A	Arbitrary point feed command valid	STS	AUXCM2/bit2

[Function][Operation]

This signal selects the mode that executes the positioning, with the command unit specified by "#1005 plcunit", to the arbitrary position (coordinate) transferred from the NC. Automatic operation mode (AUT) must be turned ON simultaneously with Arbitrary point feed command valid.

[Related signals]

(1) Automatic operation mode (AUT: AUXCM1/bit8)

Contact	Signal name	Signal abbreviation	bit
A	Incremental feed magnification 1, 2	MP1,MP2	AUXCM2/bit4,5

[Function][Operation]

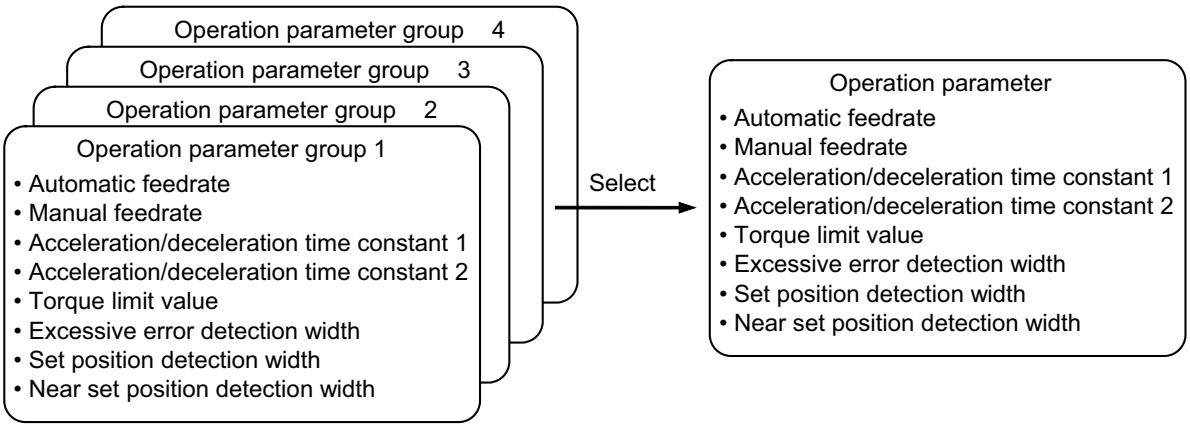
This signal selects the incremental feed amount and the handle feed magnification. In the handle feed, the movement amount per handle pulse is selected.

MP2	MP1	Feed amount
0	0	0.001°
0	1	0.01°
1	0	0.1°
1	1	1°

Con-tact	Signal name	Signal ab-breviation	bit
A	Operation parameter selection 1, 2	PR1,PR2	AUXCM2/bit6,7

[Function][Operation]

This signal selects one parameter group to be actually used from four parameter groups that designate the axis feed operation. The parameter group cannot be changed while Operation start (ST) is ON. (The group is held in NC.)
If Smoothing zero is confirmed for the target axis, the operation parameter group can be changed with the Operation start. Changing the parameter setting values of the time constant, torque limit value and excessive error detection width, however, is not possible unless Smoothing zero is confirmed for all the NC axes. The parameter values, if changed during the NC axis movement, are valid after the smoothing zero is confirmed.



PR2	PR1	Selected operation parameter group
0	0	1
0	1	2
1	0	3
1	1	4

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 3	AUXCM3	R8051	R8057	R8063	R8069	R8075	R8081

Contact	Signal name	Signal abbreviation	bit
A	Station selection 1 to 256	ST1 to ST256	AUXCM3/bit0 to 8

[Function]

This signal designates an index station No. in the automatic operation mode.

[Operation]

Set an index station No. before inputting Operation start (ST) in the automatic operation mode.

Input a 9-digit binary number. An input "000000001" corresponds to station No.1.

This signal is read in at the startup of Operation start (ST). The signal changes are ignored after the startup.

When this signal is set to "000000000" and the automatic operation is started, a one station rotation special command will result. (Note that this cannot be used when the station positions are determined in non-uniform assignments.)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL COMMAND 4	AUXCM4	R8050	R8056	R8062	R8068	R8074	R8080

Contact	Signal name	Signal abbreviation	bit
A	Speed override 1 to 64	OV1 to OV64	AUXCM4/bit0 to 6

[Function][Operation]

This signal designates the override value added to the selected feedrate. Set a binary value for the override. Values over 100% are regarded as 100%.

Effective feedrate = (Selected speed * Speed override) / 100

Contact	Signal name	Signal abbreviation	bit
A	Speed override valid	OVR	AUXCM4/bit7

[Function][Operation]

This is a signal to validate the speed override. When this signal is turned OFF, the set feedrate becomes the operation speed without calculating the override.

Details of operation status signals (NC → PLC)

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 1	AUXST1	R8003	R8009	R8015	R8021	R8027	R8033

Contact	Signal name	Signal abbreviation	bit
A	Servo ready	RDY	AUXST1/bit0

[Function]

This signal indicates that the servo system is in an operable status.

[Operation]

This signal turns ON when:

(1) The servo system diagnosis is normally completed after turning the power ON.

(2) The servo alarm, which had occurred, has been released by Master reset (MRST).

(3) The emergency stop has been released.

(4) Ready OFF (RDF) or Servo OFF (*SVF) has been released.

This signal turns OFF when:

(1) Servo ready completion (SA) is turned OFF.

(2) The Servo OFF signal is input and the drive unit is in a servo OFF state.

[Related signals]

(1) Master reset (MRST: AUXCM1/bit3)

(2) Ready OFF (RDF: AUXCM1/bit6)

(3) Servo OFF (*SVF: AUXCM1/bit0)

(4) Servo ready completion (SA: AUXST1/bitC)

Contact	Signal name	Signal abbreviation	bit
A	In-position	INP	AUXST1/bit1

[Function]

This signal notifies that the control axis is in-position.

[Operation]

This signal turns ON when:

(1) Smoothing zero (SMZ) is turned ON and the droop is within the range set in the parameters.

This signal turns OFF when:

(1) Smoothing zero (SMZ) is turned OFF. (When there is a movement command.)

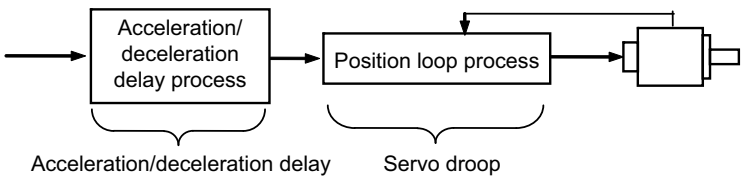
(2) The droop exceeds the range set in the parameters.

[Caution]

(1) In-position (INP) may turn ON, even during movement, when the axis is moving at extremely low speeds.

(2) The in-position detection range is set in the parameter "#2224 SV024 In-position detection width".

(3) In the servo ready OFF state, Smoothing zero (SMZ) turns OFF when the travel amount of servomotor is detected. Therefore, In-position (INP) also turns OFF. In axis plus motion (MVP) or In axis minus motion (MVN) turns ON depending on the detected movement direction. Note that Smoothing zero (SMZ), In axis plus motion (MVP) and In axis minus motion (MVN) will not change in the servo OFF state without error correction, because detected servomotor travel amount becomes a droop amount.



[Related signals]

(1) Smoothing zero (SMZ: AUXST1/bit2)

Con-tact	Signal name	Signal ab-breviation	bit
A	Smoothing zero	SMZ	AUXST1/bit2

[Function][Operation]

This signal indicates that the acceleration/deceleration process in the built-in controller is finished, and that no command to the control section remains.

Con-tact	Signal name	Signal ab-breviation	bit
A	Axis selection output	AX1	AUXST1/bit3

[Function]

This signal indicates that the control axis has received the movement command.

[Operation]

This signal turns ON in the following cases, and turns OFF after Smoothing zero (SMZ) is detected.

(1) In automatic operation mode

This signal turns ON while Operation start (ST) is ON and the axis is moving.

(2) In manual operation mode

This signal turns ON while Operation start (ST) is ON and the axis is moving.

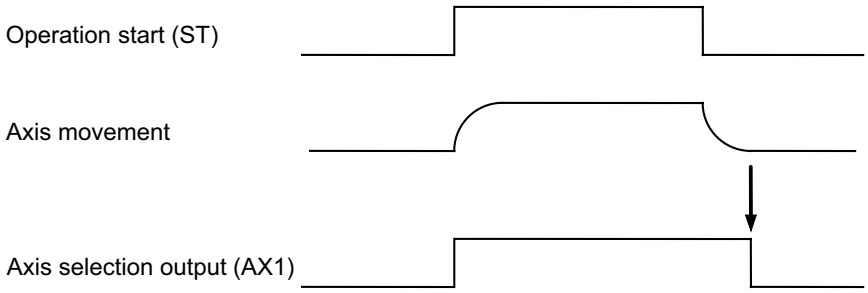
(3) In JOG operation mode

This signal turns ON while Operation start (ST) is ON and the axis is moving.

(4) In reference poisition return mode

This signal turns ON while Operation start (ST) is ON and the axis is moving.

When an interlock is applied, this signal remains ON even when the servo is OFF. This signal turns OFF atthe emergency stop.



[Related signals]

(1) Operation start (ST: AUXCM2/bit0)

Con-tact	Signal name	Signal ab-breviation	bit
A	In axis plus motion	MVP	AUXST1/bit4

[Function]

This signal indicates that the axis is moving in the (+) direction.

[Operation]

This signal turns ON when the axis starts moving in the (+) direction, turns OFF after Smoothing zero (SMZ) is detected or the axis starts moving in the (-) direction.

[Related signals]

(1) Smoothing zero (SMZ: AUXST1/bit2)

Contact	Signal name	Signal abbreviation	bit
A	In axis minus motion	MVM	AUXST1/bit5

[Function]

This signal indicates that the axis is moving in the (-) direction.

[Operation]

This signal turns ON when the axis starts moving in the (-) direction, turns OFF after Smoothing zero (SMZ) is detected or the axis starts moving in the (+) direction.

[Related signals]

(1) Smoothing zero (SMZ: AUXST1/bit2)

Contact	Signal name	Signal abbreviation	bit
A	In torque limit	TLQ	AUXST1/bit6

[Function][Operation]

This signal indicates that the control axis is at the current limit value. This signal turns ON when the motor output torque (motor current) is limited at the torque limit value of the selected operation parameter group.

Contact	Signal name	Signal abbreviation	bit
A	Reference position reached	ZP	AUXST1/bit8

[Function]

Thsi signal indicates that the control axis is on the reference position.

[Operation]

This signal turns ON when the reference position is reached in the reference position return mode.

If the reference position is reached in other operation modes or by other commands, the signal will not turn ON.

This signal turns OFF when:

(1) The axis is moved by a travel command, etc.

(2) An emergency stop has been activated due to an emergency stop input or a servo alarm occurrence, etc.

(3) The axis has moved in the servo OFF state.

[Related signals]

(1) Reference position return mode (ZRN: AUXCM1/bitB)

Contact	Signal name	Signal abbreviation	bit
A	In reset	RST	AUXST1/bit9

[Function]

This signal indicates that the built-in controller is being reset.

[Operation]

The signal turns ON when:

(1) Master reset (MRST) is turned ON.

(2) Master reset (MRST) is turned ON and the built-in controller is being reset.

(3) In an emergency stop status.

[Related signals]

(1) Master reset (MRST: AUXCM1/bit3)

Contact	Signal name	Signal abbreviation	bit
A	In handle feed operation mode	HO	AUXST1/bitA

[Function][Operation]

This signal indicates that handle feed operation mode is selected.

Con-tact	Signal name	Signal ab-breviation	bit
A	Controller ready completion	MA	AUXST1/bitB

[Function]

This signal indicates that the controller is in a status to carry out normal operation.

[Operation]

This signal turns ON when:

(1) Normal operation has begun after the power ON.

This signal turns OFF when:

(1) The power is turned OFF.

(2) An error with the controller, such as CPU error or memory error, has been detected.

(3) A servo error, which cannot be released unless the controller is first turned OFF, has occurred.

Con-tact	Signal name	Signal ab-breviation	bit
A	Servo ready completion	SA	AUXST1/bitC

[Function]

This signal indicates that the servo system is ready for normal operation. In other words, the servo system (position control) is not working when the signal is OFF.

[Operation]

The signal turns ON when:

(1) The servo system diagnosis is normally completed after the power ON.

(2) The servo alarm, which had occurred, has been released by Master reset (MRST).

(3) The emergency stop has been released.

(4) Ready OFF (RDF) is turned OFF.

This signal turns OFF when:

(1) Controller ready completion (MA) is turned OFF.

(2) A servo alarm has occurred.

(3) Emergency stop is issued.

(4) Ready OFF (RDF) is turned OFF.

[Caution]

(1) With Servo OFF (*SVF), Servo ready completion (SA) will not turn OFF as long as there are no separate conditions for turning the SA OFF.

[Related signals]

(1) Master reset (MRST: AUXCM1/bit3)

(2) Ready OFF (RDF: AUXCM1/bit6)

(3) Controller ready completion (MA: AUXST1/bitB)

Con-tact	Signal name	Signal ab-breviation	bit
A	Automatic set position reached	JSTA	AUXST1/bitD

[Function]

In the automatic operation, this signal notifies that the positioning to the commanded station No. is completed. The tolerable ON width is as same as that of Set position reached (JST).

[Operation]

The signal turns ON when:

(1) The positioning to the designated station No. is completed in the automatic operation mode. The signal actually turns ON before the positioning is completed, when the tolerable width is entered.

The signal turns OFF when:

(1) When the Operation start signal is input in any of the operation modes.

(2) When the axis deviates outside the tolerable width.

[Caution]

(1) In automatic operation, this signal does not turn ON when positioning to the nearest station is carried out by the Operation start signal OFF.

(2) When this signal is ON, it does not turn OFF if the same station No. index is started.

(3) When the positioning to the station is completed in manual mode and the same station No. index is started, this signal turns ON. However, there is no movement.

(4) Once turned OFF, this signal does not turn ON again even if the axis returns within the tolerable width.

(5) During the emergency stop or the servo OFF, the axis movement, once deviated outside the output width of Set position reached, returns within the tolerable width, turns this signal ON again if "#12802 aux_Cont1/bit4" is OFF; does not turn it ON if "#12802 aux_Cont1/bit4" is ON.

Con-tact	Signal name	Signal ab-breviation	bit
A	Set position reached	JST	AUXST1/bitE

[Function]

This signal notifies that the positioning to the station position has been completed. It is ON when the machine position is at any of the station positions. The tolerable ON width is set with a parameter.

[Operation]

The signal turns OFF when:

(1) The positioning to the station is completed in automatic or manual operation. The signal actually turns ON before the positioning is completed, when the tolerable width is entered.

(2) The stop position after JOG operation is the station position or within the tolerable width.

(3) The reference position return position corresponds to those of the stop position in (2).

Other than the above conditions, this signal normally monitors the machine position, and carries out comparisons between stations. Therefore, this signal is output even when the machine moves to a station position outside the operation.

The signal turns OFF when:

(1) The Operation start signal is input in any of the operation modes. When the operation is started by the Operation start signal, this signal will not turn ON, even when a station position is passed during operation.

(2) The axis deviates outside the tolerable width.

Con-tact	Signal name	Signal ab-breviation	bit
A	Near set position	NEAR	AUXST1/bitF

[Function]

This signal notifies that the machine position is near the station.

[Operation]

It operates in the same manner as the Set position reached (JST), but the tolerable width is set with a different parameter. The tolerable width is generally set larger than that of Set position reached. This signal is generally used at the mechanical clamp or the like just before the completion of the positioning.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 2	AUXST2	R8002	R8008	R8014	R8020	R8026	R8032

Contact	Signal name	Signal abbreviation	bit
A	In automatic operation mode	AUTO	AUXST2/bit0

[Function][Operation]

This signal indicates that the automatic operation mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In manual operation mode	MANO	AUXST2/bit1

[Function][Operation]

This signal indicates that the manual operation mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In JOG operation mode	JO	AUXST2/bit2

[Function][Operation]

This signal indicates that the JOG operation mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In reference position return	ARNN	AUXST2/bit3

[Function][Operation]

This signal indicates that the machine is in the reference position return.

Contact	Signal name	Signal abbreviation	bit
A	In reference position return mode	ZRNO	AUXST2/bit4

[Function][Operation]

This signal indicates that the reference position return mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In basic point initialization setting mode	AZSO	AUXST2/bit6

[Function][Operation]

This signal indicates that the basic point initialization setting mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	In incremental mode	SO	AUXST2/bit7

[Function][Operation]

This signal indicates that the incremental mode has been selected.

Contact	Signal name	Signal abbreviation	bit
A	Alarm 1	AL1	AUXST2/bit8

[Function][Operation]

This signal indicates that an alarm has occurred requiring the power to be turned ON again after the cause is removed.

Contact	Signal name	Signal abbreviation	bit
A	Alarm 2	AL2	AUXST2/bit9

[Function][Operation]

This signal indicates that an alarm has occurred which can be released by the Master reset (MRST) signal after the cause is removed.

Contact	Signal name	Signal abbreviation	bit
A	Alarm 4	AL4	AUXST2/bitA

[Function][Operation]

This signal indicates that an operation alarm or absolute position alarm has occurred.

Contact	Signal name	Signal abbreviation	bit
A	Absolute position power shutoff movement over	ABS	AUXST2/bitC

[Function][Operation]

This signal indicates that the axis moved beyond the tolerable amount while the control power was OFF in the absolute position system.

Contact	Signal name	Signal abbreviation	bit
A	Absolute position data loss	ZSN	AUXST2/bitD

[Function][Operation]

This signal indicates that the absolute position data has been lost in the absolute position system.

Contact	Signal name	Signal abbreviation	bit
A	Initialization setting completed	ZSF	AUXST2/bitE

[Function][Operation]

This signal indicates that in the absolute position system the basic point initialization setting has completed normally, and that the absolute position coordinates have been established.

Contact	Signal name	Signal abbreviation	bit
A	Initialization setting error completed	ZSE	AUXST2/bitF

[Function][Operation]

This signal indicates that the basic point initialization setting has not finished normally in the absolute position system.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 3	AUXST3	R8001	R8007	R8013	R8019	R8025	R8031

Contact	Signal name	Signal abbreviation	bit
A	Station position 1 to 256	STO1 to STO256	AUXST3/bit0 to 8

[Function][Operation]

This signal shows a 9-digit binary No. of the present station.

This signal outputs the station position when Set position reached (JST) is ON, "0" when Set position reached is OFF.

Signal name	Signal abbreviation	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis
PLC AXIS INDEXING CONTROL STATUS 4	AUXST4	R8000	R8006	R8012	R8018	R8024	R8030

Con-tact	Signal name	Signal ab-breviation	bit
A	Position switch 1 to 15	PSW1 to PSW15	AUXST4/bit0 to 7 AUXST3/bit9 to F

[Function][Operation]

This signal turns ON when the axis is within the setting range of the respective position switches.

Con-tact	Signal name	Signal ab-breviation	bit
A	Start not possible	NST	AUXST4/bitB

[Function][Operation]

This signal turns ON when the Operation start signal is turned ON for non PLC indexing axis.

Differences from MR-J2-CT interface

PLC interface for PLC axis indexing has the following differences from MR-J2-CT interface.

Please keep these differences in mind when using the existing user PLC.

Signal name		MR-J2-CT	PLC axis indexing
Control command 1 /bit1	PLC emergency stop	Provided	Not provided No emergency stop can be executed for each drive unit. Use the NC signal, PLC emergency stop (QEMG:YC2C), if needed. Note that the emergency stop of the controller means the stop of all axes, which turns OFF the other signals such as Servo ready completion (SA).
Status 1 /bit7	Adjusting machine	Provided	Not provided This signal indicates that the machine is being adjusted with a setup software. The software, however, is not available with this function.
Status 3 /bit9 to F	Position switch 9 to 15	Not provided	Provided 8 points were originally provided for position switch. 15 points are provided for this function.
Status 4 /bitB	Start not possible	Not provided	Provided This signal turns ON when the Operation start signal is turned ON for non PLC indexing axis.

6.6.14.3 NC Axis Control Selection

This function allows to control the NC axes with the PLC axis indexing interfaces. The signal's ON/OFF selects which controls the axis; NC or PLC.

PLC → NC interface signal

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	NC AXIS CONTROL SELEC-TION n-TH AXIS	-	YAC0 to 7	YAC8 to F	YAD0 to 7	YAD8 to F

[Function]

This signal is used to select the control method over the NC axes which can be operated under PLC control.

0: PLC control

1: NC control

[Operation]

When this signal is ON, the axis is controlled with a machining program. (The axis is handled as NC axis.)

When this signal is OFF, the axis is controlled with the PLC axis indexing interfaces. (The axis is handled as PLC axis.)

The following shows the correspondence of axis Nos. and device Nos.

Device No.	Signal name	Device No.	Signal name
YAC0	NC axis control selection 1st axis	YAC4	NC axis control selection 5th axis
YAC1	NC axis control selection 2nd axis	YAC5	NC axis control selection 6th axis
YAC2	NC axis control selection 3rd axis	YAC6	NC axis control selection 7th axis
YAC3	NC axis control selection 4th axis	YAC7	NC axis control selection 8th axis

[Caution]

(1) This signal is available only for the NC axis which can be operated under PLC control. "The NC axis which can be operated under PLC control" has the axis No. for PLC axis indexing, designated by "#12800 chgauxno".

(2) Turn ON/OFF this signal after confirming that the axis is not moving.

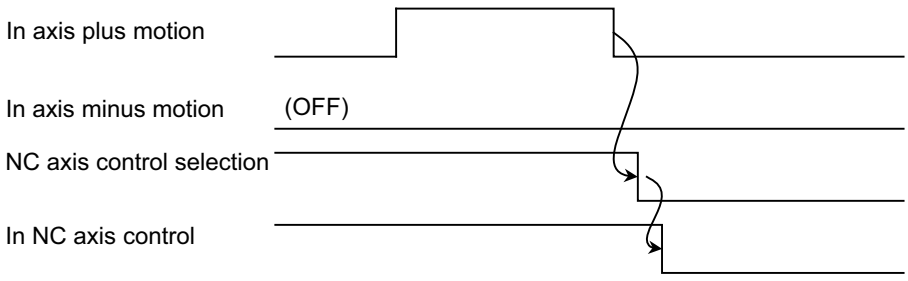
Turning this signal ON/OFF during the axis movement leads an operation error. The axis decelerates and stops then.

(Usage example) When the parameters are set as follows

Axis No.	1	2	3	4	5
#1013 axname	X	Y	Z	A	C
#12800 chgauxno	0	0	0	1	2

A-axis and C-axis can be operated under PLC control. To operate the A-axis under NC control, turn the signal YAC3 ON. The signals YAC0 to YAC2 and YAC5 to YAC7 are not available.

[Timing chart]



[Related signals]

(1) In NC axis control n-th axis (XA20 to XA27)

NC → PLC interface signal

Con-tact	Signal name	Signal ab-breviation	$1	$2	$3	$4
A	IN NC AXIS CONTROL n-TH AXIS	-	XA20 to 7	XA28 to F	XA30 to 7	XA38 to F

[Function]

This signal indicates the control status (NC control or PLC control) of the NC axis which can be operated under PLC control.

[Operation]

This signal turns ON when the NC axis is under NC control.

This signal turns OFF when the NC axis is under PLC control.

The following shows the correspondence of axis Nos. and device Nos.

Device No.	Signal name	Device No.	Signal name
XA20	In NC axis control 1st axis	XA24	In NC axis control 5th axis
XA21	In NC axis control 2nd axis	XA25	In NC axis control 6th axis
XA22	In NC axis control 3rd axis	XA26	In NC axis control 7th axis
XA23	In NC axis control 4th axis	XA27	In NC axis control 8th axis

[Caution]

(1) "The NC axis which can be operated under PLC control" has the axis No. for PLC axis indexing, designated by "#12800 chgauxno".

(2) If the axis is moving, turning ON/OFF the "NC axis control selection n-th axis" leads an operation error. The signal is changed to ON/OFF after the axis has decelerated and stopped.

[Related signals]

(1) NC axis control selection n-th axis (YAC0 to YAC7)

6.6.15 CC-Link

6.6.15.1 Outline

NC module can be connected to the PLC network to serve as the master (Ver.2 mode)/local (Ver.1 mode, Ver.2 mode) station of the MELSEC CC-Link.
CC-Link is the abbreviation of Control & Communication Link.
For CC-Link, refer to the following documents.
"CC-Link Specification (Overview/Protocol)" (BAP-05026-J) issued by CC-Link Partner Association
"CC-Link System Master/Local Module User's Manual" (SH-080394-EJ) issued by Mitsubishi Electric Corp.

In order to use CC-Link, it is necessary to install the CC-Link master/local module in the NC control module. If not installed, it cannot be connected to the PLC network, and the screen for the CC-Link related parameters will not be displayed. Even if the CC-Link master/local module is installed, but the cable is not connected, the alarm "Z68 CC-Link unconnected" will occur. For names of each section of the communication module and how to set the module, refer to "CC-Link(Master/Slave) Specifications Manual(BNP-C3039-214)".
If the NC is a local station, it is dealt as an intelligent device station.

6.6.15.2 List of Signals

(1) Machine Input/Output Signal Allocation By CC-Link

Input/output device allocation when CC-Link module is mounted is as shown below.

	RIO only			With CC-Link communication			
	RIO1	RIO2	RIO3	RIO1	RIO2	RIO3	CC-Link communication
Input	X00 : XFF	X100 : X1FF	X200 : X2FF	X00 : XFF	X100 : X1FF	X200 : X2FF	X0 : X5FF
Output	Y00 : YFF	Y100 : Y1FF	Y200 : Y2FF	Y00 : YFF	Y100 : Y1FF	Y200 : Y2FF	Y0 : Y5FF

(Note) When using CC-Link communication, do not duplicate the devices used by actual RIO.

(2) File Register By CC-Link

Device	Description
R8300 to R9799	User backup area
R9800 to R9899	User work area

(3) List of Special Relays and Registers

The data link status can be checked with bit data (link special relays: SB) and word data (link special registers: SW). This is used by reading to the device specified in a parameter.

Special relay (SB area)

Description	Access
SB0000 to SB003F	For write
SB0040 to SB01FF	For read

Special register (SW area)

Description	Access
SW0000 to SW003F	For write
SW0040 to SW01FF	For read

Refer to "CC-Link (Master/Slave) specifications Manual for details on the special relay and special register.

6.6.16 Manual Feed for 5-axis Machining

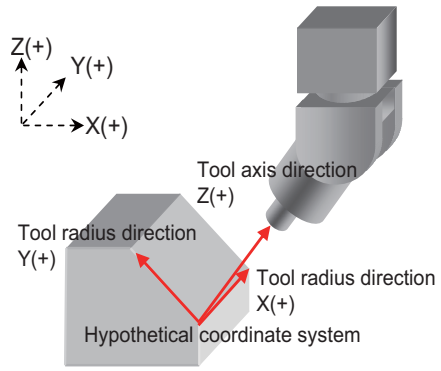
6.6.16.1 1.Outline

The "Manual feed for 5-axis machining" function enables the manual feed (jog, incremental or handle mode) for axes of a hypothetical coordinate system.
When a travel command is executed in the hypothetical coordinate system, the NC can move more than one axis according to the tool orientation and table inclination, which facilitates the setup process.

This function has two feed modes: "Feed in hypothetical coordinate system" and "Rotation with the tool tip as the center".
A travel command to linear axis is processed as a feed in hypothetical coordinate system, so the manual feed is carried out in hypothetical coordinate system.
A travel command to rotary axis is processed as a rotation with the tool tip as the center. The commanded rotary axes and the three linear axes are used to perform the manual feed while maintaining the positional relationship between the workpiece and tool tip.

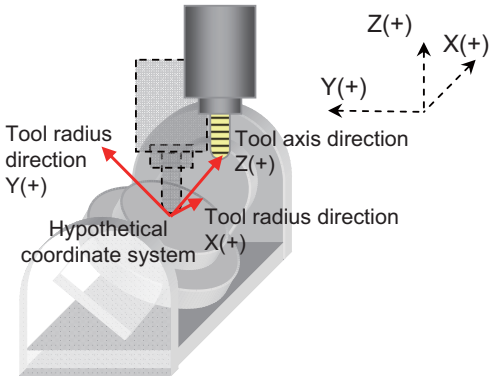
This function is an optional function.

[Tool tilt A-C axis]



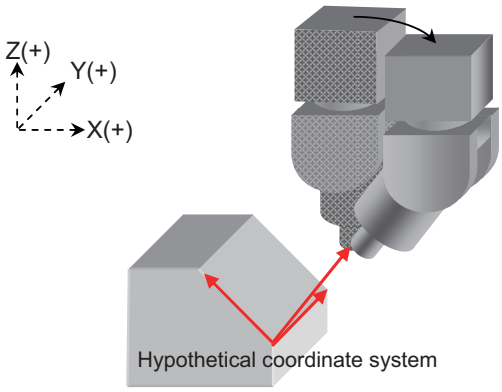
Linear axis travel command:
Feed in hypothetical coordinate system

[Table tilt A-C axis]



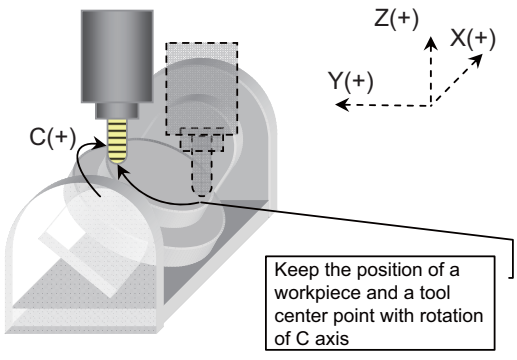
Linear axis travel command:
Feed in hypothetical coordinate system

[Tool tilt A-C axis]



Rotary axis travel command:
Rotation with the tool tip as the center

[Table tilt A-C axis]



Rotary axis travel command:
Rotation with the tool tip as the center

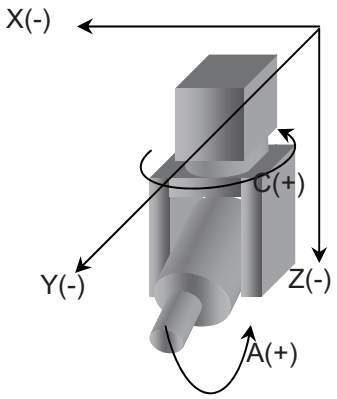
6.6.16.2 System Configuration

(1) Machine Configuration

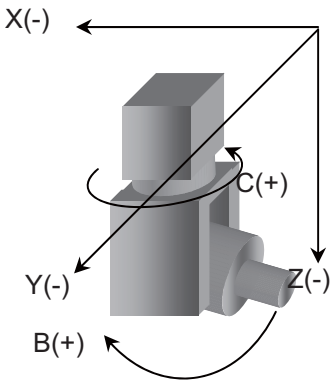
This function is compatible with each of the tool tilt , table tilt and compound types of machine configuration.

(a) Tool tilt

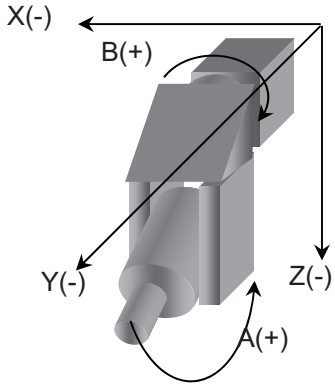
[A-C axis]



[B-C axis]

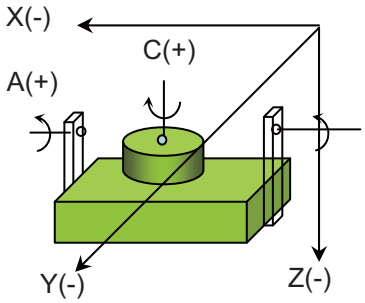


[A-B axis]

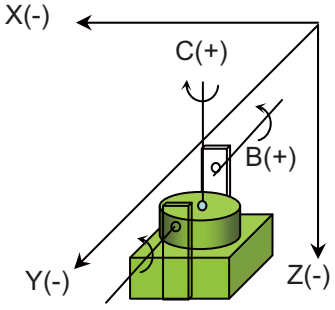


(b) Table tilt

[A-C axis]

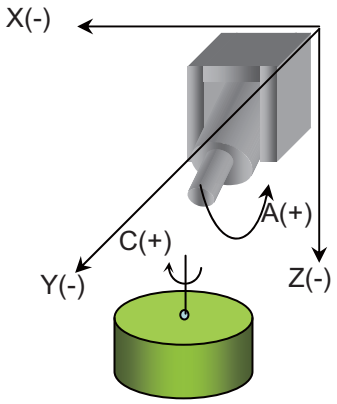


[B-C axis]

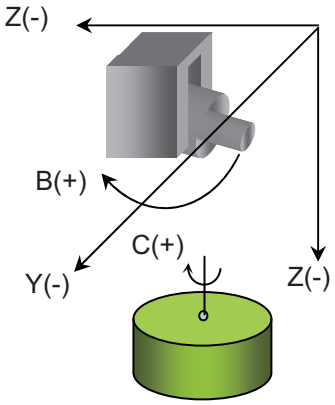


(c) Compound

[A-C axis]



[B-C axis]

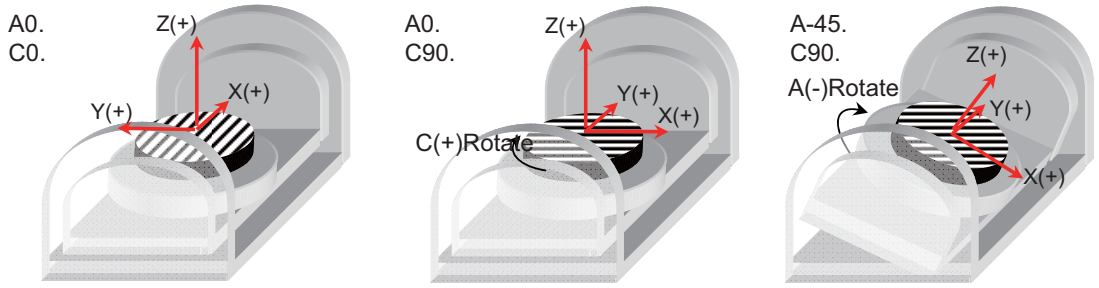


(2) Hypothetical Coordinate System

There are three types of hypothetical coordinate system: table coordinate system, feature coordinate systemand tool axis coordinate system.

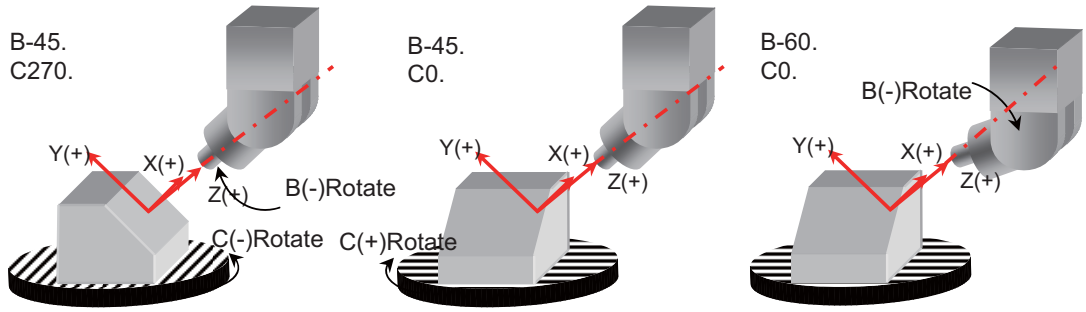
(a) Table coordinate system

On table tilt type/compound type machines, axes move with the rotation of the rotary axis in the coordinate system fixed on the table.
(Example) Table tilt A-C axis



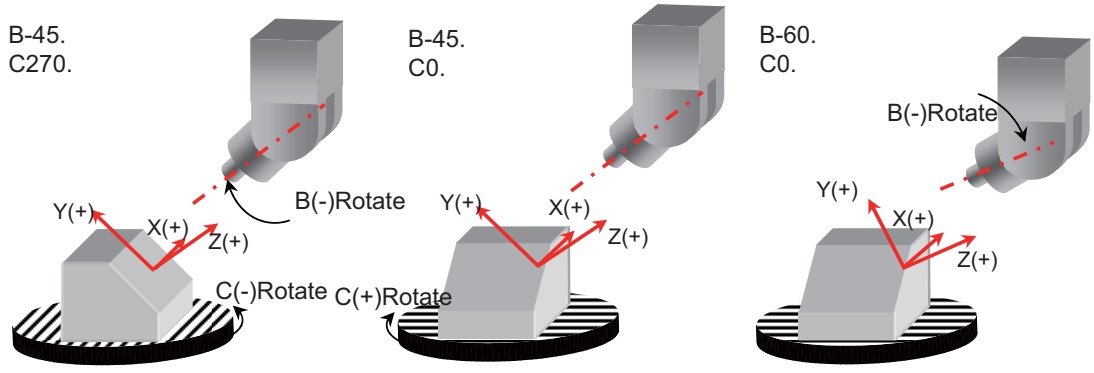
(b) Feature coordinate system

On all types of machines, the coordinate system does not move with the rotation of the rotary axis in the coordinate system executing a program command such as the inclined surface machining command.
(Example) Compound tilt B-C axis



(c) Tool axis coordinate system

On tool tilt/compound tilt type machines, axes move with the rotation of the tool axis in the coordinate system in which the Z axis direction becomes parallel to that of the tool axis.
(Example) Compound tilt B-C axis



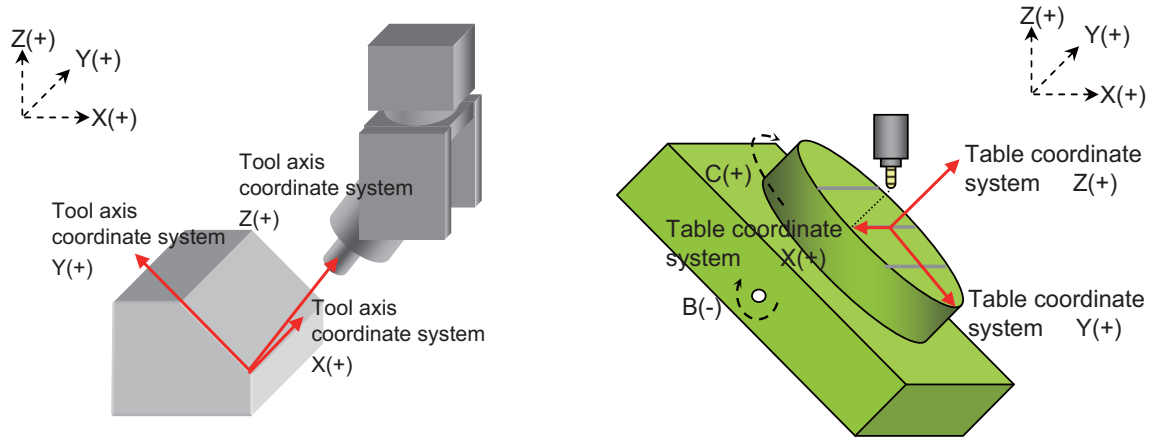
6.6.16.3 Detailed Specifications

When a hypothetical coordinate system is selected using a PLC signal during manual feed (jog, incremental or handle mode) or at handle interrupt in automatic operation, manual feed can be performed in the selected coordinate system.

This function has two feed modes: "Feed in hypothetical coordinate system" and "Rotation with the tool tip as the center".

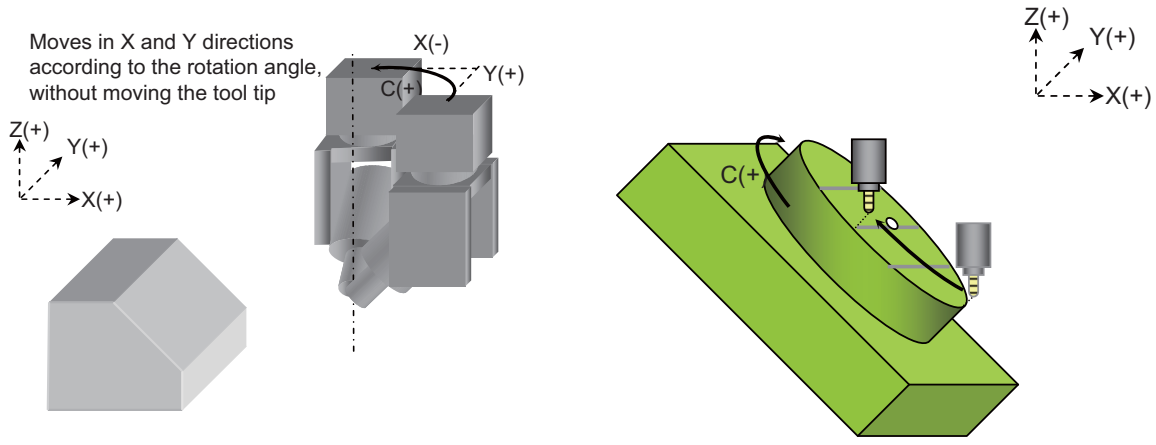
"Feed in hypothetical coordinate system" is applied to a linear axis travel command. The manual feed is carriedout in hypothetical coordinate system using the three linear axes.

Tool tilt (feed direction after A axis rotates by +45° and C by -90°) Table tilt (after B axis rotates by -45° and C by +90°)



"Rotation with the tool tip as the center" is applied to a rotary axis travel command. The manual feed is carried out using the rotary axes and the three linear axes so that the positional relationship between the workpiece and tool tip can be kept.

Tool tilt (feed direction when C axis rotates by +90°) Table tilt (feed direction when C axis rotates by +90°)



Select the hypothetical coordinate system from among the table, feature or tool axis coordinate system.
If not selected, standard manual feed and interruption are carried out in the machine coordinate system.

6.6.16.3.1 Requirements for Manual Feed for 5-axis Machining

When all of the following requirements are met, the manual feed for 5-axis machining is carried out.

(1) The rotary axis configuration parameter "#7912 NO_MANUAL" is "0" (Manual feed for 5-axis machining is valid).
(2) Selected mode is either jog, incremental or handle.
(3) A hypothetical coordinate system is being selected.Or,"Rotation with the tool tip as the center" is being selected.
(4) Not in a state where axis travel is disabled; such as during alarm occurrence, during manual interlock, and when the axis has reached the soft limit, etc.

6.6.16.4 Operation Example:Feed in Hypothetical Coordinate System

A linear axis travel command is processed as "Feed in hypothetical coordinate system". Manual feed is performed in a hypothetically defined coordinate system using three linear axes.

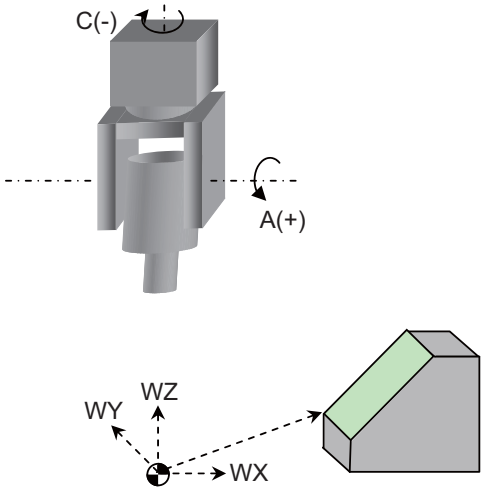
6.6.16.4.1 Coordinate System Selection - Tool Axis Coordinate System Example

Axis travel is performed in each direction of the tool axis coordinate system.The below example is the operation with the 1st handle in the tool tilt type A-C axis configuration.

[Operation step]

(1) Select the handle mode.

(2) Travel in the Z axis direction by 220. from the workpiece coordinate zero point.
Rotate around the A axis by +45° and around the C axis by -90°.

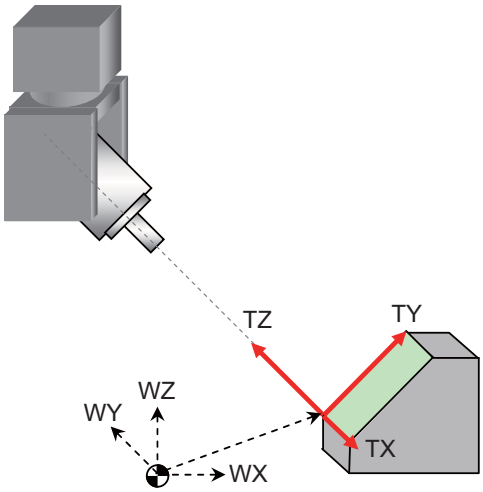


Workpiece coordinate system:WX,WY,WZ
Tool axis coordinate system:TX,TY,TZ

	Workpiece coordinate	Tool axis movement
X	0.000	0.000
Y	0.000	0.000
Z	220.000	220.000
A	45.000	45.000
C	270.000	270.000

(3) Select the tool axis coordinate system (YD1B/1, YD1C/0, YD1D/0) as a hypothetical coordinate system.

(4) Travel in the TX, TY and TZ directions of the tool axis coordinate system.



X+1.motion			Y+1.motion			Z+1.motion		
	Workpiece coordinate	Tool axis movement		Workpiece coordinate	Tool axis movement		Workpiece coordinate	Tool axis movement
X	0.000	**1.000**	X	**0.707**	0.000	X	**-0.707**	0.000
Y	**-1.000**	0.000	Y	0.000	**1.000**	Y	0.000	0.000
Z	220.000	220.000	Z	**220.707**	220.000	Z	**220.707**	**221.000**
A	45.000	45.000	A	45.000	45.000	A	45.000	45.000
C	270.000	270.000	C	270.000	270.000	C	270.000	270.000

6.6.16.4.2 Coordinate System Selection - Table Coordinate System Example

Axis travel is performed in each of the X, Y and Z directions on the rotating table surface.
The below example is the operation with the 1st handle in the table tilt type B-C axis configuration.

[Operation step]
(1) Select the handle mode.
(2) Select the table coordinate system (YD1B/0, YD1C/1, YD1D/0) as a hypothetical coordinate system.
(3) Travel in the X direction by 100. and in the Z axis direction by 50. from the workpiece coordinate zero point.
Rotate around the C axis by +90° and around the B axis by -45°.

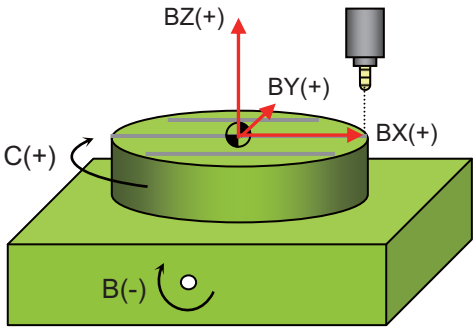
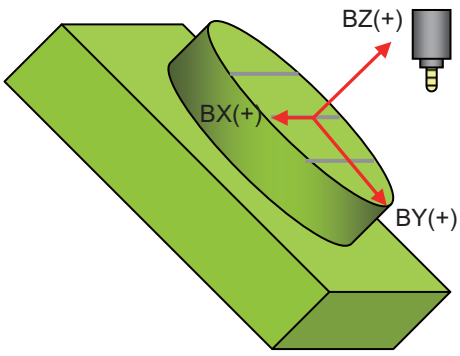


Table coordinate system:BX,BY,BZ

C motion after X and Z motion		
	Workpiece coordinate	Table coordinate
X	100.000	0.000
Y	0.000	100.000
Z	50.000	50.000
B	0.000	0.000
C	90.000	90.000

B motion		
	Workpiece coordinate	Table coordinate
X	100.000	0.000
Y	0.000	35.355
Z	50.000	106.066
B	-45.000	-45.000
C	90.000	90.000

(4) Travel in the BX,BY and BZ directions of the table coordinate system.



X+1.motion		
	Workpiece coordinate	Table coordinate
X	100.000	**1.000**
Y	**-1.000**	35.355
Z	50.000	106.066
B	-45.000	-45.000
C	90.000	90.000

Y+1.motion		
	Workpiece coordinate	Table coordinate
X	**100.707**	0.000
Y	0.000	**36.355**
Z	**49.293**	106.066
B	-45.000	-45.000
C	90.000	90.000

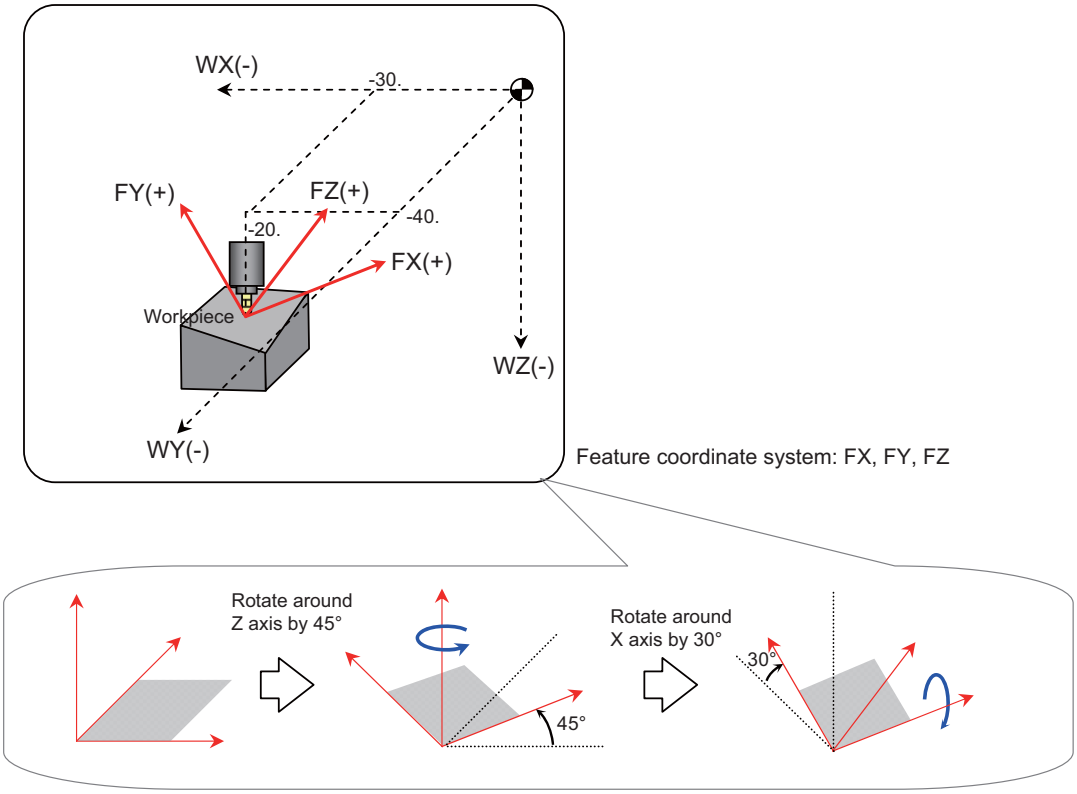
Z+1.motion		
	Workpiece coordinate	Table coordinate
X	**100.707**	0.000
Y	0.000	35.355
Z	**50.707**	**107.066**
B	-45.000	-45.000
C	90.000	90.000

6.6.16.4.3 Coordinate System Selection - Feature Coordinate System Example

Axis travel is performed in each of the X, Y and Z directions of the feature coordinate system that has been defined for Workpiece installation error compensation or Inclined surface machining function.
The below example is the operation with the 1st handle when a feature coordinate system is defined using the G code.

[Operation step]

(1) Define a feature coordinate system in the MDI mode.
G68.2 X-30. Y-40. Z-20 I45. J30.K0
(2) Select the handle mode.
(3) Travel in the X direction by -30., in the Y direction by -40. and in the Z direction by -20.
(4) Select the feature coordinate system (YD1B/0, YD1C/0, YD1D/1) as a hypothetical coordinate system.
(5) Travel in the FX, FY and FZ directions of the inclined surface.



X+1.motion		
	Workpiece coordinate	Inclined surface coordinate
X	**-29.293**	**1.000**
Y	**-39.293**	0.000
Z	-20.000	0.000
A	0.000	0.000
C	0.000	0.000

Y+1.motion		
	Workpiece coordinate	Inclined surface coordinate
X	**-30.612**	0.000
Y	**-39.388**	**1.000**
Z	**-19.500**	0.000
A	0.000	0.000
C	0.000	0.000

Z+1.motion		
	Workpiece coordinate	Inclined surface coordinate
X	**-29.647**	0.000
Y	**-40.353**	0.000
Z	**-19.134**	**1.000**
A	0.000	0.000
C	0.000	0.000

(Motion vector on WK coordinate)
X: $1/\sqrt{2}$ = +0.707
Y: $1/\sqrt{2}$ = +0.707
Z: -

(Motion vector on WK coordinate)
X: $\sqrt{3}/2*1/(-\sqrt{2})$ = -0.612
Y: $\sqrt{3}/2*1/\sqrt{2}$ = +0.612
Z: 1/2 = +0.5

(Motion vector on WK coordinate)
X: $1/2*1/\sqrt{2}$ = +0.353
Y: $1/2*1/(-\sqrt{2})$ = -0.353
Z: $\sqrt{3}/2$ = +0.866

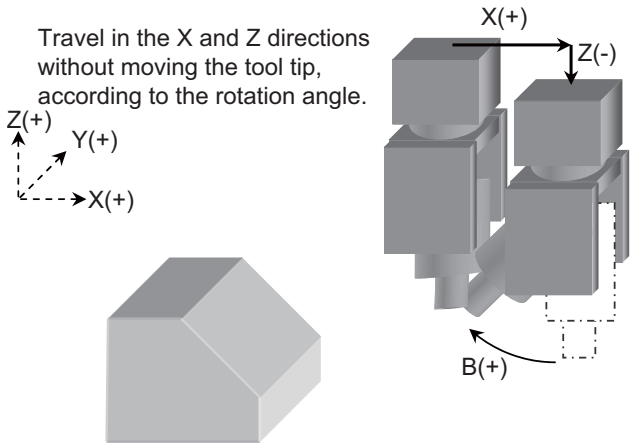
6.6.16.5 Rotation with Tool Tip as Center

A rotary axis travel command is processed as "Rotation with the tool tip as the center". Manual feed is carried out using the rotary axes and the three linear axes so that the positional relationship between the workpiece and tool tip can be kept.

6.6.16.5.1 Machine Configuration - Tool Tilt Example

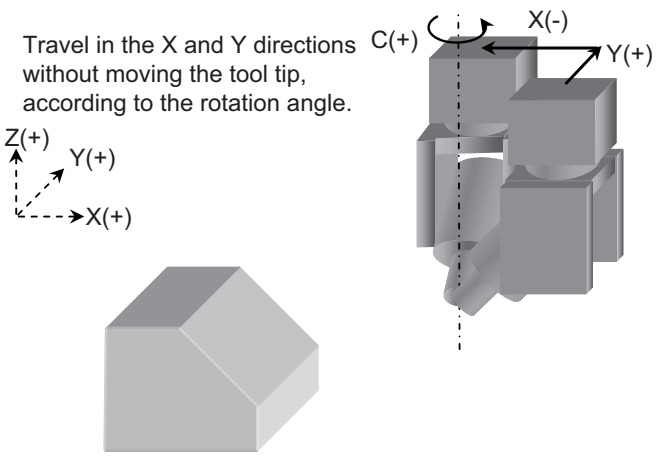
Tool orientation is changed without moving the tool tip.
The below example is the operation with the 1st handle in the tool tilt type B-C axis configuration, when #7936 (Height axis rotation center offset) is set to "10.".

[Operation step]
(1) Select the handle mode.
(2) Select "Rotation with the tool tip as the center" (YD27/1).
(3) Confirm the in tool center point rotation (XD27) signal.
(4) Select the tool direction (YD1B/1, YD1C/0, YD1D/0) as a hypothetical coordinate system.
(5) Set "#8043 Tool HDL FD OFS".
(6) Rotate around the B axis by +45°.



	Workpiece coordinate	Tool axis movement
X	7.071	0.000
Y	0.000	0.000
Z	-7.071	0.000
B	45.000	45.000
C	0.000	0.000

(7) Rotate around the C axis by 90°.



	Workpiece coordinate	Tool axis movement
X	0.000	0.000
Y	7.071	0.000
Z	-7.071	0.000
B	45.000	45.000
C	90.000	90.000

6.6.16.5.2 Machine Configuration - Table Tilt Example

The tool moves so that the positional relationship between the workpiece and tool tip is kept.
The below example is the operation with the 1st handle in the table tilt type B-C axis configuration.

[Operation step]
(1) Select the handle mode.
(2) Select "Tool center point rotation" (YD27/1).
(3) Confirm the in tool center point rotation (XD27) signal.
(4) Select the table coordinate system (YD1B/0, YD1C/1, YD1D/0) as a hypothetical coordinate system.
(5) Travel in the X direction by 100., and in Z by 100. from the workpiece coordinate zero point.
(6) Set "#8043 Tool HDL FD OFS".
(7) Rotate around the B axis by -45°.

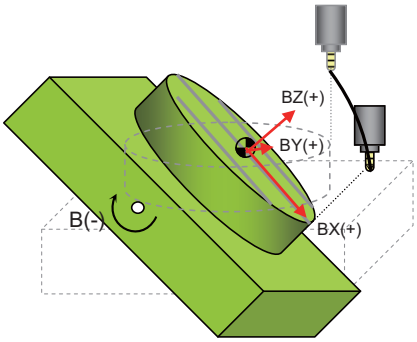
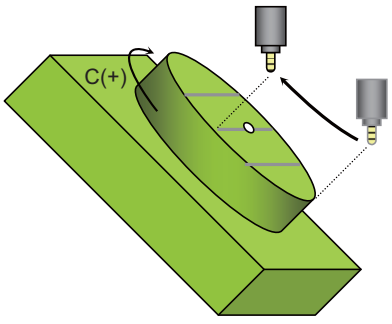


Table coordinate system:BX,BY,BZ

	Workpiece coordinate	Table coordinate
X	100.000	100.000
Y	0.000	0.000
Z	100.000	100.000
B	0.000	0.000
C	0.000	0.000

X	**141.421**	100.000
Y	0.000	0.000
Z	**0.000**	100.000
B	**-45.000**	-45.000
C	0.000	0.000

(8) Rotate around the C axis by +90°.



	Workpiece coordinate	Table coordinate
X	**70.711**	100.000
Y	**-100.000**	0.000
Z	**70.711**	100.000
B	-45.000	-45.000
C	**90.000**	90.000

6.6.16.5.3 Tool Length Offset Amount

The length (tool length offset amount) from the tool tip to the holder edge is required for the tool to move keeping the positional relationship between a workpiece and the tool tip in "Rotation with the tool tip as the center".
Use an offset amount of the tool length offset command (G43/G44) for automatic operation.
Use the machining parameter "#8043 Tool HDL FD OFS" for manual feed.
When the tool length offset amount is "0", the tool moves keeping the positional relationship between a workpiece and the holder edge in "Rotation with the tool tip as the center"; therefore, if a tool is actually mounted, interference with a workpiece, etc. may occur.

6.6.16.6 Feed Amount Reset

If any of the following conditions is met, the manual interruption amount is reset. Thus, Manual interrupt amount counter and Tool axis movement counter are cleared.

(1) Dog-type reference position return is completed
(2) Emergency stop is cancelled
    - External emergency stop button ON ' OFF
    - PLC emergency stop signal ON ' OFF
(3) Reset & Rewind signal is ON when the parameter "#8173 Hold intr amount" is set to "0"
(4) NC Reset 1 or NC Reset 2 signal is ON when the parameter "#8173 Hold intr amount" is set to "0"
(5) The axis to which G92 has been given during automatic operation
(6) The axis to which Origin set or Origin zero has been commanded
(7) Any of the coordinate system selection signals has changed, regardless of the present operation mode

6.6.16.7 Position Display Counter

Position display counter indicates as follows during the manual feed for 5-axis machining.

(1) Tool axis travel amount

This counter indicates the tool's travel amount in the tool axis coordinate system.
Note, however, that this counter is not updated in one of the following cases.
- When a selected hypothetical coordinate system is not tool axis coordinate system
- When the manual absolute is ON

Manual absolute	Selected coordinate system	Tool axis travel amount
ON	-	Not update
OFF	Tool axis coordinate system	A travel amount in the tool axis coordinate system is displayed
	Others	Not update

(2) Table coordinate system counter

This counter indicates the position in the table coordinate system.
Note, however, that this counter is not updated while the manual absolute is OFF.

Manual absolute	Selected coordinate system	Table coordinate system counter
ON	Tool axis coordinate system	A position in the table coordinate system is displayed.
	Others	
OFF	-	Not update

(3) Inclined surface counter

This counter indicates the position in the feature coordinate system.
While the inclined surface machining command is disabled, a position in the workpiece coordinate system is displayed instead.
Note, however, that this counter is not updated while the manual absolute is OFF.

Manual absolute	Inclined surface machining command	Selected coordinate system	Feature coordinate system counter
ON	ON	Feature coordinate system	A position in the feature coordinate system is displayed.
		Others	
	OFF	Feature coordinate system	A position in the workpiece coordinate system is displayed.
		Others	
OFF	-	-	Not update

(4) Manual interruption amount

While the inclined surface machining command is enabled, this counter indicates a manual interruption amount in the feature coordinate system.

If a hypothetical coordinate system is being selected while the inclined surface machining command is disabled, a position in the selected hypothetical coordinate system is displayed.

If a hypothetical coordinate system is not selected while the inclined surface machining command is disabled, a position in the machine coordinate system is displayed.

Note, however, that this counter is not updated while the manual absolute is ON.

Manual absolute	Inclined surface machining command	Selected coordinate system	Manual interruption amount
ON	-	-	Not update
OFF	ON	-	An interruption amount in the feature coordinate system is displayed.
	OFF	Selected	An interruption amount in the selected coordinate system is displayed.
		Not selected	An interruption amount in the machine coordinate system is displayed.

6.6.16.8 Signal List

6.6.16.8.1 Hypothetical Coordinate System Selection

For each manual mode and handle to use, this signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

The 1st to the 3rd handles are available.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (JOG,INC) in tool axis coordinate system	MJCT	YD18	YE58	YF98	Y10D8
A	Manual feed for 5-axis machining (JOG,INC) in table coordinate system	MJCB	YD19	YE59	YFB9	Y10D9
A	Manual feed for 5-axis machining (JOG,INC) in feature coordinate system	MJCF	YD1A	YE5A	YFBA	Y10DA

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out by jog feed or incremental feed.

[Related signals]

(1) Jog mode (J:YC00)

(2) Incremental mode (S:YC02)

(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (1st handle) in tool axis coordi-nate system	MH1CT	YD1B	YE5B	YFBB	Y10DB
A	Manual feed for 5-axis machining (1st handle) in table coordinate system	MH1CB	YD1C	YE5C	YFBC	Y10DC
A	Manual feed for 5-axis machining (1st handle) in feature coordinate system	MH1CF	YD1D	YE5D	YFBD	Y10DD

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out on the 1st handle axis.

[Related signals]

(1) 1st handle axis selection code (HS11 to HS116:YC40 to 4)

(2) 1st handle valid (HS1S:YC47)

(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (2nd handle) in tool axis coordi-nate system	MH2CT	YD1E	YE5E	YFBE	Y10DE
A	Manual feed for 5-axis machining (2nd handle) in table coordinate system	MH2CB	YD1F	YE5F	YFBF	Y10DF
A	Manual feed for 5-axis machining (2nd handle) in feature coordinate system	MH2CF	YD20	YE60	YFA0	Y10E0

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out on the 2nd handle axis.

[Related signals]

(1) 2nd handle axis selection code (HS21 to HS216:YC48 to C)

(2) 2nd handle valid (HS2S:YC4F)

(3) Tool center point rotation (TCPRC:YD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Manual feed for 5-axis machining (3rd handle) in tool axis coordi-nate system	MH3CT	YD21	YE61	YFA1	Y10E1
A	Manual feed for 5-axis machining (3rd handle) in table coordinate system	MH3CB	YD22	YE62	YFA2	Y10E2
A	Manual feed for 5-axis machining (3rd handle) in feature coordinate system	MH3CF	YD23	YE63	YFA3	Y10E3

[Function]

This signal is used to select the hypothetical coordinate system, in which the manual feed for 5-axis machining is carried out.

It is possible to set different coordinate systems for each mode or handle.

[Operation]

This signal is used to select the coordinate system in which the manual feed for 5-axis machining is carried out on the 3rd handle axis.

[Related signals]

(1) 3rd handle axis selection code (HS31 to HS316:YC50 to 4)

(2) 3rd handle valid (HS3S:YC57)

(3) Tool center point rotation (TCPRC:YD27)

(Note 1) If more than one bit among the three hypothetical coordinate system selection bits is turned ON, the operation alarm "M01 5-ax manual feed coord sys err 0231" is output. This alarm disables both automatic and manual operations.
To cancel this alarm, turn OFF all the hypothetical coordinate system selection bits, or select only one bit (turn OFF the other two bits).

(Note 2) If you select the hypothetical coordinate system with the rotary axis configuration parameter "#7912 NO_MANUAL" set to "1" (Manual feed for 5-axis machining is disabled), standard manual feed is carried out.

(Note 3) If you select the hypothetical coordinate system without the option of the manual feed for 5-axis machining, standard manual feed is carried out. No alarm is displayed.

(Note 4) If you have changed the hypothetical coordinate system during axis movement, the axis decelerates and stops.

6.6.16.8.2 Selected Coordinate System Output

For each manual mode and handle to use, this signal is used to inform of the hypothetical coordinate system in which the manual feed for 5-axis machining is carried out.

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (JOG,INC)	MJST	XD18	XE58	XF98	X10D8
A	Table coordinate system in manual feed for 5-axis machining (JOG,INC)	MJSB	XD19	XE59	XF99	X10D9
A	Feature coordinate system in manual feed for 5-axis machining (JOG,INC)	MJSF	XD1A	XE5A	XF9A	X10DA

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out by the jog or incremental feed.

When this signal is ON, jog feed or incremental feed is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The hypothetical coordinate system for the manual feed for 5-axis machining (JOG, INC) has been selected during jog feed or incremental feed.

This signal turns OFF when:

(1) The hypothetical coordinate selection for the manual feed for 5-axis machining (JOG, INC) is turned OFF.

(2) The jog feed or incremental feed mode is turned OFF.

[Related signals]

(1) In jog mode (JO:XC00)

(2) In incremental mode (SO:XC02)

(3) Manual feed for 5-axis machining (JOG,INC) in tool axis coordinate system

(4) Manual feed for 5-axis machining (JOG,INC) in table coordinate system

(5) Manual feed for 5-axis machining (JOG,INC) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (1st handle)	MH1ST	XD1B	XE5B	XF9B	X10DB
A	Table coordinate system in manual feed for 5-axis machining (1st handle)	MH1SB	XD1C	XE5C	XF9C	X10DC
A	Feature coordinate system in manual feed for 5-axis machining (1st handle)	MH1SF	XD1D	XE5D	XF9D	X10DD

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out on the 1st handle axis.

When this signal is ON, the feed on the 1st handle axis is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The 1st handle feed is valid, the axis selection signal is ON and the hypothetical coordinate system for manual feed for 5-axis machining (1st handle) is selected.

This signal turns OFF when:

(1) The selection of the hypothetical coordinate system for manual feed for 5-axis machining (1st handle) is turned OFF.

(2) The 1st handle valid signal is turned OFF.

(3) The axis selection signal is turned OFF.

[Related signals]

(1) 1st handle axis selection code (HS11 to HS116:YC40 to 4)

(2) 1st handle valid (HS1S:YC47)

(3) Manual feed for 5-axis machining (1st handle) in tool axis coordinate system

(4) Manual feed for 5-axis machining (1st handle) in table coordinate system

(5) Manual feed for 5-axis machining (1st handle) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (2nd handle)	MH2ST	XD1E	XE5E	XF9E	X10DE
A	Table coordinate system in manual feed for 5-axis machining (2nd handle)	MH2SB	XD1F	XE5F	XF9F	X10DF
A	Feature coordinate system in manual feed for 5-axis machining (2nd handle)	MH2SF	XD20	XE60	XFA0	X10E0

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out on the 2nd handle axis.

When this signal is ON, the feed on the 2nd handle axis is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The 2nd handle feed is valid, the axis selection signal is ON and the hypothetical coordinate system for manual feed for 5-axis machining (2nd handle) is selected.

This signal turns OFF when:

(1) The selection of the hypothetical coordinate system for manual feed for 5-axis machining (2nd handle) is turned OFF.

(2) The 2nd handle valid signal is turned OFF.

(3) The axis selection signal is turned OFF.

[Related signals]

(1) 2nd handle axis selection code (HS21 to HS216:YC48 to C)

(2) 2nd handle valid (HS2S:YC4F)

(3) Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system

(4) Manual feed for 5-axis machining (2nd handle) in table coordinate system

(5) Manual feed for 5-axis machining (2nd handle) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool axis coordinate system in manual feed for 5-axis machining (3rd handle)	MH3ST	XD21	XE61	XFA1	X10E1
A	Table coordinate system in manual feed for 5-axis machining (3rd handle)	MH3SB	XD22	XE62	XFA2	X10E2
A	Feature coordinate system in manual feed for 5-axis machining (3rd handle)	MH3SF	XD23	XE63	XFA3	X10E3

[Function]

This signal indicates the coordinate system in which the manual feed for 5-axis machining is carried out on the 3rd handle axis.

When this signal is ON, the manual feed on the 3rd handle axis is carried out in the coordinate system of the signal.

[Operation]

This signal turns ON when:

(1) The 3rd handle feed is valid, the axis selection signal is ON and the hypothetical coordinate system for manual feed for 5-axis machining (3rd handle) is selected.

This signal turns OFF when:

(1) The selection of the hypothetical coordinate system for manual feed for 5-axis machining (3rd handle) is turned OFF.

(2) The 3rd handle valid signal is turned OFF.

(3) The axis selection signal is turned OFF.

[Related signals]

(1) 3rd handle axis selection code (HS31 to HS316:YC50 to 4)

(2) 3rd handle valid (HS3S:YC57)

(3) Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system

(4) Manual feed for 5-axis machining (3rd handle) in table coordinate system

(5) Manual feed for 5-axis machining (3rd handle) in feature coordinate system

(6) In tool center point rotation (TCPRS:XD27)

(Note 1) If more than one bit, among the bits for selecting hypothetical coordinate system for each manual feed, has turned ON, all the selected coordinate system outputs for each manual feed do not turn ON.

(Note 2) When the rotary axis configuration parameter “#7912 NO_MANUAL” is set to "1" (Manual feed for 5-axis machining is invalid), the selected coordinate system output signal does not turn ON.

(Note 3) If a hypothetical coordinate system is selected without the "Manual feed for 5-axis machining" option, the selected coordinate system output signal does not turn ON.

6.6.16.8.3 Tool Center Point Rotation

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	Tool center point rotation	TCPRC	YD27	YE67	YFA7	Y10E7

[Function]

This signal informs the operation of the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle).

[Operation]

It operates with keeping the positional relationship of tool center point looking from the workpiece, when the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle) is operated.

<table>
<tr><th colspan="5">Input</th><th colspan="2">output</th></tr>
<tr><th rowspan="2">#7912
NO_MANUAL</th><th colspan="3">Hypothetical coordinate system selection signal</th><th>Tool center point rotation signal</th><th rowspan="2">Selection coordinate system</th><th rowspan="2">Tool center point rotary valid/invalid</th></tr>
<tr><th>YD18</th><th>YD19</th><th>YD1A</th><th>YD27</th></tr>
<tr><td rowspan="5">Valid</td><td colspan="3" rowspan="2">All 0</td><td>0</td><td rowspan="2">Machine coordinate system selection</td><td>Invalid</td></tr>
<tr><td>1</td><td>Valid</td></tr>
<tr><td colspan="3" rowspan="2">Only any one of them is 1</td><td>0</td><td rowspan="2">In accordance with the hypothetical coordinate system selection signal</td><td>Invalid</td></tr>
<tr><td>1</td><td>Valid</td></tr>
<tr><td colspan="3">Other than above</td><td>0 / 1</td><td colspan="2">The operation error "M01 Manual feed for 5-axis machining/Selecting coordinate system illegal 0231"</td></tr>
<tr><td>Invalid</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0 / 1</td><td>Machine coordinate system selection</td><td>Invalid</td></tr>
</table>

[Related signals]

(1) Manual feed for 5-axis machining (JOG, INC) in tool axis coordinate system
(2) Manual feed for 5-axis machining (JOG, INC) in table coordinate system
(3) Manual feed for 5-axis machining (JOG, INC) in feature coordinate system
(4) Manual feed for 5-axis machining (1st handle) in tool axis coordinate system
(5) Manual feed for 5-axis machining (1st handle) in table coordinate system
(6) Manual feed for 5-axis machining (1st handle) in feature coordinate system
(7) Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system
(8) Manual feed for 5-axis machining (2nd handle) in table coordinate system
(9) Manual feed for 5-axis machining (2nd handle) in feature coordinate system
(10) Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system
(11) Manual feed for 5-axis machining (3rd handle) in table coordinate system
(12) Manual feed for 5-axis machining (3rd handle) in feature coordinate system

6.6.16.8.4 Tool Center Point Rotation Output

Con-tact	Signal name	Signal abbreviation	$1	$2	$3	$4
A	In tool center point rotation	TCPRS	XD27	XE67	XFA7	X10E7

[Function]

This signal informs the operation of the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle).

[Operation]

This signal informs that it operates with keeping the positional relationship of tool center point looking from the workpiece, when the rotation axis of manual feed for 5-axis machining (JOG/incremental/handle) is operated.

[Related signals]

(1) Tool axis coordinate system in manual feed for 5-axis machining (JOG,INC)
(2) Table coordinate system in manual feed for 5-axis machining (JOG,INC)
(3) Feature coordinate system in manual feed for 5-axis machining (JOG,INC)
(4) Tool axis coordinate system in manual feed for 5-axis machining (1st handle)
(5) Table coordinate system in manual feed for 5-axis machining (1st handle)
(6) Feature coordinate system in manual feed for 5-axis machining (1st handle)
(7) Tool axis coordinate system in manual feed for 5-axis machining (2nd handle)
(8) Table coordinate system in manual feed for 5-axis machining (2nd handle)
(9) Feature coordinate system in manual feed for 5-axis machining (2nd handle)
(10) Tool axis coordinate system in manual feed for 5-axis machining (3rd handle)
(11) Table coordinate system in manual feed for 5-axis machining (3rd handle)
(12) Feature coordinate system in manual feed for 5-axis machining (3rd handle)

6.6.16.9 Cautions

(1) Speed clamp

Apply a speed limit so that the rapid traverse rate or cutting feed clamp speed is not exceeded by the speed calculated by distributing the travel amount in the hypothetical coordinate system among each machine axis direction.

Clamp the rotary axis feedrate so that the manual feedrate of a linear axis does not exceed the linear axis feedrate of "Rotation with the tool tip as the center" with the JOG/incremental feed. When using the handle feed, clamp the rotary axis feedrate so that the linear axis feedrate does not exceed the rapid traverse rate (#2001 rapid) or cutting feed clamp speed (#2002 clamp).

(2) Acceleration, Deceleration and time constant

Set the same cutting feed acceleration/deceleration type and same time constant for all the axes involved in the manual feed for 5-axis machining (They have to be the same, because the interpolation is made using the travel amounts distributed to each axis).

(3) Feed amount

The incremental feed amount and handle feed amount by one pulse are expressed with the feed amount in the composite direction of the selected coordinate system. When Initial inch is selected, the increment is in one inch unit.

(4) Restart after alarm restoration

When the operation error "M01 Multi ax for 5-ax manual feed 0230" or "M01 5-ax manual feed coord sys err 0231" occurs during axis movement, the moving axis decelerates and stops. The axis does not restart movement even after the alarm has been cancelled.

If you want to resume the axis movement, give the command to the axis again.

(5) Magnification

The available range of the incremental feed magnification is between 1 and 100000.

The magnification for handle feed is between 1 and 1000. If a speed is clamped, the number of pulses and the axis' travel amount do not match. In this case, however, the counter display and the machine position value are matched.

(6) Machine lock

For an axis to which the manual machine lock signal is ON, the [Machine position] counter is locked. If a travel command is given to the manual machine lock axis, axis travel is made by the travel amounts distributed to each axis, but the manual machine lock axis itself does not move.

(7) Feed axis

The axis Nos. specified for the manual feed for 5-axis machining (jog, incremental or handle mode) are the same as those for normal manual feed.

However, the manual feed for 5-axis machining is enabled only for the axes that have been set in the rotary axis configuration parameters.

Linear axes:

X axis in the hypothetical coordinate system: The axis set in #7900(RCDAX_I)

Y axis in the hypothetical coordinate system: The axis set in #7901(RCDAX_J)

Z axis in the hypothetical coordinate system: The axis set in #7902(RCDAX_K)

Rotary axes:

- Tool tilt type

  The axes set in #7922(ROTAXT1) and #7932(ROTAXT2)

- Compound type

  The axes set in #7922(ROTAXT2) and #7952(ROTAXT2)

- Table tilt type

  The axes set in #7942(ROTAXW1) and #7952(ROTAXW2)

The example below is when the handle feed (1st handle) is carried out in the tool tilt type configuration equipped with 8 NC axes (XYZUVWAC) by setting the 1st, 2nd and 3rd axes as linear axes, and 7th and 8th axes as rotary axes in the 1st part system.

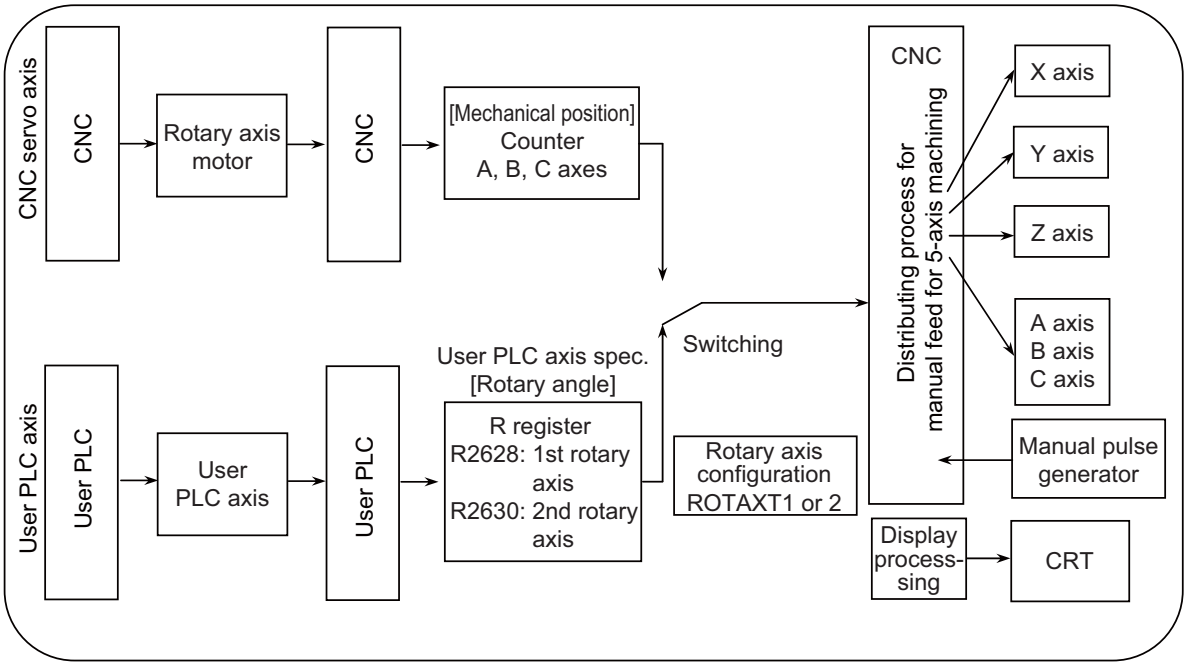
$1	Abbrev.	Details	Setting
YC40	HS11	1st handle axis selection code 1	See below
YC41	HS12	1st handle axis selection code 2	See below
YC42	HS14	1st handle axis selection code 4	See below
YC43	HS18	1st handle axis selection code 8	See below
YC44	HS116	1st handle axis selection code 16	0
YC47	HS1S	1st handle valid	1
YD18	MH1CT	Manual feed for 5-axis machining (1st handle) in tool axis coordinate system	See below
YD19	MH1CB	Manual feed for 5-axis machining (1st handle) in table coordinate system	See below
YD1A	MH1CF	Manual feed for 5-axis machining (1st handle) in feature coordinate system	See below

Corresponding handle axis No.	YD27	YD18	YD19	YD1A	YC43	YC42	YC41	YC40	Condition
X axis (1st axis) selected	0/1	0	0	0	0	0	0	1	Normal manual feed
Y axis (2nd axis) selected	0/1	0	0	0	0	0	1	0	
Z axis (3rd axis) selected	0/1	0	0	0	0	0	1	1	
U axis (4th axis) selected	0/1	0	0	0	0	1	0	0	
V axis (5th axis) selected	0/1	0	0	0	0	1	0	1	
W axis (6th axis) selected	0/1	0	0	0	0	1	1	0	
A axis (7th axis) selected	0	0	0	0	0	1	1	1	
	1	0	0	0	0	1	1	1	Tool center point rotation
C axis (8th axis) selected	0	0	0	0	1	0	0	0	Normal manual feed
	1	0	0	0	1	0	0	0	Tool center point rotation
X axis (1st axis) selected	0/1	Either one of these is 1			0	0	0	1	Feed in hypothetical coordinate system
Y axis (2nd axis) selected	0/1	Either one of these is 1			0	0	1	0	
Z axis (3rd axis) selected	0/1	Either one of these is 1			0	0	1	1	
U axis (4th axis) selected	0/1	Either one of these is 1			0	1	0	0	Normal manual feed
V axis (5th axis) selected	0/1	Either one of these is 1			0	1	0	1	
W axis (6th axis) selected	0/1	Either one of these is 1			0	1	1	0	
A axis (7th axis) selected	0	Either one of these is 1			0	1	1	0	
	1	Either one of these is 1			0	1	1	1	Tool center point rotation
C axis (8th axis) selected	0	Either one of these is 1			1	0	0	0	Normal manual feed
	1	Either one of these is 1			1	0	0	0	Tool center point rotation

6.6.16.10 Relation with Other Function

6.6.16.10.1 Relation with rotary axis angle designation (user PLC axis specification)

To perform the manual feed for 5-axis machining for user PLC axis specifications, write the rotary axis angle to the R register via user PLC program. The data input increment is the same as of the PLC setting increment (#1005 plcunit).



(1) R register

$1	$2	$3	$4	Abbrev.	Description	Setting range
R2628 R2629	R2828 R2829	R3028 R3029	R3228 R3229		Angle of the user PLC axis spec. 1st rotary axis R2628 (lower)/R2629 (upper)	0 to ± 720000 (1deg./1000)
R2630 R2631	R2830 R2831	R3030 R3031	R3230 R3231		Angle of the user PLC axis spec. 2nd rotary axis R2630 (lower)/R2631 (upper)	0 to ± 720000 (1deg./1000)

(2) Data write example

The example below is when writing "90°" to A axis and "180°" to C axis in the A-C axis configuration.
When "#1005 plcunit" is B

<A axis>

90 × 1000 = 90000 ┤├[DMOV K90000 R2628]─
angle 1/1000° system unit

<C axis>

180 × 1000 = 180000 ┤├[DMOV K180000 R2630]─
angle 1/1000° system unit

(3) Cautions

(a) Rotation with the tool tip as the center is disabled during use of a user PLC axis.

(b) Do not change the rotary axis angle of a user PLC axis during the manual feed for 5-axis machining.
Right after the rotary axis angle has been changed, the rotary axis operates by calculating the position in the hypothetical coordinate system based on that angle. Therefore, the movement may fail to be along the hypothetical coordinate system.

(c) When the user PLC axis' angle is written in the R register, only the tool tip value counter on the position display screen is updated, but the other counters are not updated.

(d) For user PLC axis specifications, the contents of the tool tip value counter are not displayed.
Instead, the angle of the user PLC axis set in the R register is displayed in the [Rotation angle] counter on the tool tip display screen.

(e) For user PLC axis specifications, the automatic operation handle interruption for 5-axis machining is not available for a rotary axis.

6.6.16.10.2 Relation with Tool Handle Feed & Interrupt Function

The "Manual feed for 5-axis machining" function can be used together with the "Tool handle feed & interrupt" function. When the conditions for the both functions are met, the manual feed for 5-axis machining is given priority.
The handle feed operation is the same between the two functions for the tool tilt type machine configuration. Note, however, that the operation is different between them for the table tilt and compound type configurations.

The list below shows the combination of the parameters and signals and the corresponding operation (the signals below are for $1).

Manual feed for 5-axis machining		Tool handle feed & interrupt		Operation (Note2)		
Manual feed for 5-axis machining is invalid #7912 NO_MANUAL	Hypothetical coordinate system selection(Note1) JOG :YD18 to YD1A HDL1:YD1B to YD1D HDL2:YD1E to YD20 HDL3:YD21 to YD23	Tool handle invalid #7904 NO_TIP	Tool handle mode YC5E	Standard	Tool	5-axis
0	0	0	0	○		
0	0	0	1		○	
0	0	1	0	○		
0	0	1	1		○ (Note3)	
0	1	0	0			○
0	1	0	1			○
0	1	1	0			○
0	1	1	1			○
1	0	0	0	○		
1	0	0	1		○	
1	0	1	0	○		
1	0	1	1		○ (Note3)	
1	1	0	0	○		
1	1	0	1		○	
1	1	1	0	○		
1	1	1	1		○ (Note3)	

(Note1) This is based on the assumption that the device bits suitable for the mode, handle No. and selected coordinate system are turned ON.

(Note2) Standard: Standard manual feed
Tool: Tool handle feed & interrupt when handle is selected, or standard manual feed when a tool other than handle is selected
5-axis: Manual feed for 5-axis machining

(Note3) The tool handle mode is being selected, although the tool handle is disabled. Thus the axis does not move by handle operation.
(No alarm occurs)
In a mode other than handle mode, standard manual feed is carried out.

6.6.16.10.3 Relation with Other Functions

(1) When the conditions for the manual feed for 5-axis machining are not met, and no alarm is output, the standard jog feed, incremental feed, handle feed, handle interruption and tool handle feed & interrupt functions are usable as before.
(2) In the case of manual jog or incremental feed, the speed is limited under the cutting clamp speed. In the case of manual handle feed, the speed is limited below the rapid traverse clamp speed.
(3) During External deceleration, the feed rate drops below the external deceleration rate.
(4) When interruption is made during dwell, the dwell count operation is stopped to carry out the interruption. When the interruption is complete, the dwell count operation is resumed.
(5) When the manual ABS switch is OFF, a position in the workpiece or local coordinate system is deviated by the manual feed amount or interruption amount.
(6) When the dog-type reference position return is complete, the manual interruption amount is cancelled.
(7) The manual interruption amount is cancelled by NC reset 1, NC reset 2 or Reset & Rewind.
(8) When Emergency stop is cancelled, the manual interruption amount is also cancelled.
(9) When G92 or Origin set is executed, the manual interruption amount of the commanded axis is cancelled.
When setting the values, select either tool tip or tool base using the parameter.
(10) If there is any moving axis whose Stroke end signal is ON, the operation alarm "M01 H/W stroke end axis exists 0006" is output, which disables both the manual feed for 5-axis machining and interruption.
When the signal of any of the moving axes turns ON, all the manually fed axes decelerate and stop.
(11) The manual feed for 5-axis machining and interruption are enabled within the soft limit range of each axis.
If any moving axis has exceeded the soft limit range, the operation alarm "M01 S/W stroke end axis exists 0007" is output, which disables both the manual feed for 5-axis machining and interruption.
When any of the moving axes is at the soft limit, all the manually fed axes decelerate and stop before crossing over the limit.
(12) If there is any moving axis whose Manual interlock signal is ON, the operation alarm "M01 External interlock axis exists 0004" is output, which disables both the manual feed for 5-axis machining and interruption.
When the signal of any of the moving axes turns ON, all the manually fed axes decelerate and stop.
(13) If there is any moving axis whose Servo OFF signal is OFF, the operation alarm "M01 Internal interlock axis exists 0005" is output, which disables both the manual feed for 5-axis machining and interruption.
When the signal of any of the moving axes turns OFF, all the manually fed axes decelerate and stop.
(14) If there is any moving axis whose Control axis detach signal is ON, the operation alarm "M01 Internal interlock axis exists 0005" is output, which disables both the manual feed for 5-axis machining and interruption.
When the signal of any of the moving axes turns ON, all the manually fed axes decelerate and stop.
(15) Do not include a chopping axis in the manual feed for 5-axis machining.
If it is included, the travel amount of the chopping axis is ignored.
(16) If synchronization control is used together with this function, set the master axis No. to the rotary axis configuration parameters. If you set the slave axis No., the operation fails. Note that the slave axis also has to return to the zero point.
(17) Manual arbitrary feed is executed in the machine coordinate system, even when a hypothetical coordinate system is being selected for the manual feed for 5-axis machining.
(18) Do not carry out the manual feed for 5-axis machining while Manual arc feed is enabled.
If Manual arc feed is enabled while a hypothetical coordinate system is being selected for the manual feed for 5-axis machining, or if a hypothetical coordinate system is selected for the manual feed for 5-axis machining while Manual arc feed is being enabled, the operation alarm "M01 Multi ax for 5-ax manual feed 0230" is output.
(19) If you carry out the manual feed for 5-axis machining while the "Simultaneous operation of manual and automatic modes" function is being enabled, turn ON the "Manual/automatic simultaneous valid axis" signal of the three linear axes and two rotary axes that are set in the rotary axis configuration parameters.
Note that if you have failed to turn ON this signal for all the three linear axes and two rotary axes, the distributed manual travel amount is superimposed on the travel amount for automatic operation, and the movement may fail to be along the hypothetical coordinate system.
(20) The setting of the rotary axis configuration parameter "#7912 NO_MANUAL" can be read out using the "Parameter input by program" function or system variables. The read value is the one at the point of execution.

(21) The setting of the rotary axis configuration parameter "#7912 NO_MANUAL" (Selection of the "Manual feed for 5-axis machining" function) can be changed using the "Parameter file input" or "Parameter input by program" function or system variables.

(22) Automatic operation handle interruption for 5-axis machining is disabled to a rotary axis.
If a travel command is given to a rotary axis, the interruption to the rotary axis is ignored.

(23) When performing the automatic operation handle interruption for 5-axis machining, the speed of the handle interrupt axis (automatic travel speed + interruption speed by manual pulse generator) is controlled so that the speed will not exceed the axis' clamp speed. The speed is clamped to the cutting feed clamp speed during cutting feed, and clamped to the rapid traverse clamp speed during rapid traverse feed.

(24) When manual tool length measurement or workpiece position measurement is carried out while a hypothetical coordinate system is being selected for the manual feed for 5-axis machining, the operation alarm "M01 5-ax manual feed coord sys err 0231" is output.

(25) The values in the machine coordinate system are displayed on the play back edit screen, even when a hypothetical coordinate system is being selected for the manual feed for 5-axis machining.

7

Spindle Control

Spindle speed can be directly controlled by an 8-digit S code command.
When the S command function specifications are valid, the controller selects an appropriate spindle gear stage corresponding to the 8-digit command following the S code and outputs (spindle gear shift command) it to the machine side (PLC). The controller also outputs S command data (analog voltage or serial connection data) corresponding to the gear input (spindle gear select input) and spindle speed specified by the machine side (PLC).

7.1 Related Parameters

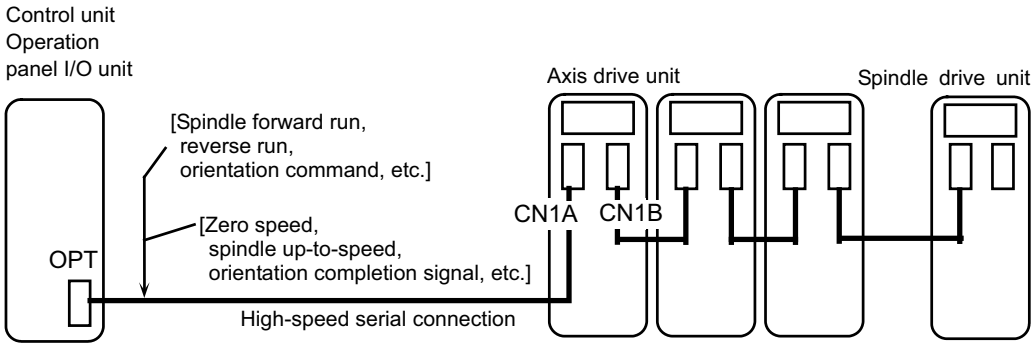
The PLC can have up to four gear stages.
The table below lists the four gear stages and the corresponding parameters.

	Parameters									
Parameter name	**Spindle limit speed**	**Maximum spindle speed**	**Spindle shift speed**	**Tap cycle maximum speed**	**Oriented speed**	**Minimum speed**	**Output signal**		**Input signal**	
Gear stage							**GR2**	**GR1**	**GI1**	**GI2**
1	Slimt1 #3001	Smax1 #3005	Ssift1 #3009	Stap1 #3013	Sori #3021	Smin #3023	0	0	0	0
2	Slimt2 #3002	Smax2 #3006	Ssift2 #3010	Stap2 #3014			0	1	0	1
3	Slimt3 #3003	Smax3 #3007	Ssift3 #3011	Stap3 #3015			1	0	1	0
4	Slimt4 #3004	Smax4 #3008	Ssift4 #3012	Stap4 #3016			1	1	1	1

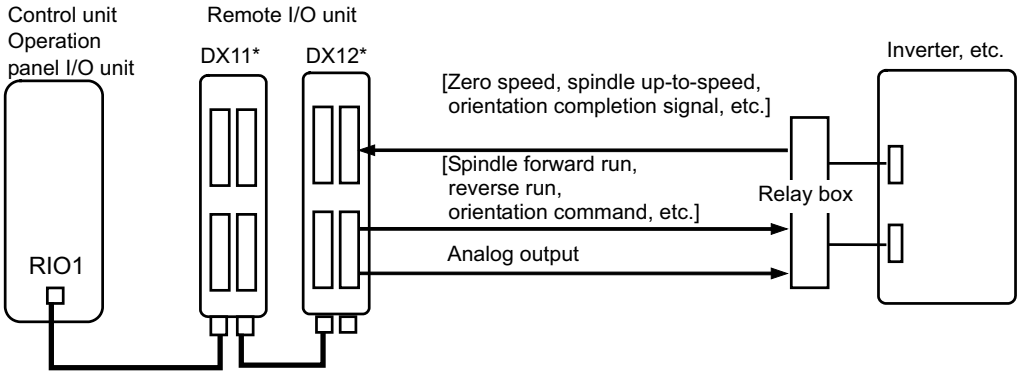
(Note 1) The upper line shows the parameter name, and the bottom line shows the parameter No.
(Note 2) Set the parameter for the gear stage not being used to 0.

7.2 Connection Method

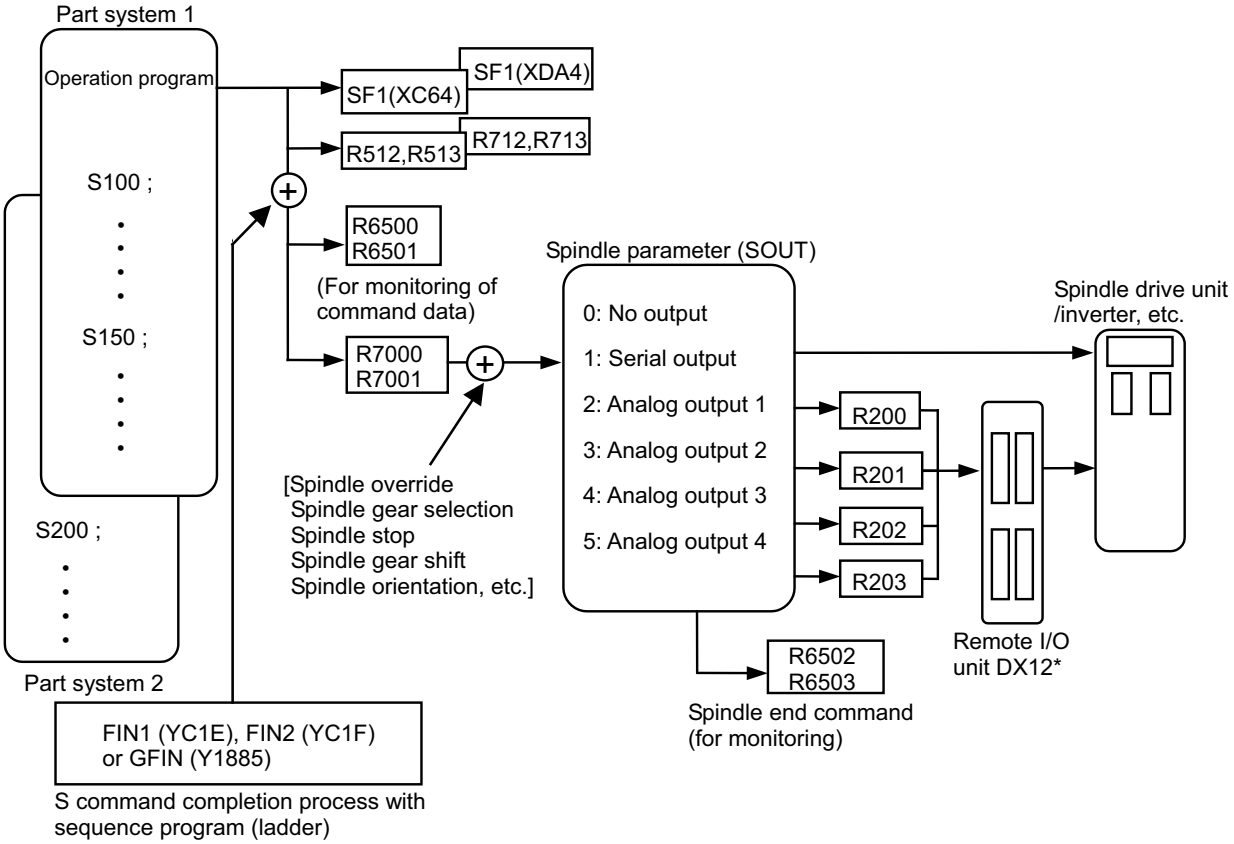
To serially connect the controller and spindle controller



To analog connect the controller and spindle controller



7.3 Flow of Spindle (S) Data



Outline explanation

(1) The spindle command start signal (SF1) is output when the spindle (S) command is issued.
(2) After the designated processes is executed by SF1 with the sequence program, the M function finish or gear shift completion signal is returned to the controller.
(3) Data corresponding to the S command is output to file registers R6500 and R6501 or R7000 or R7001 with the completion signal. The speed is output to R6500, R6501 and R7000, R7001.
(4) The R7000 and R7001 data is transferred to the spindle drive unit with serial communication according to the spindle parameter SOUT value or is transferred to the inverter, etc., as analog voltage via the remote I/O unit.

(Note) If the spindle command is issued from multiple part systems, the command issued later will be applied.

8

Handling of M, S, T, B Functions

The following abbreviations are used in the subsequent explanations.

(1) Miscellaneous function (command) M function (command)
(2) Spindle function (command) S function (command)
(3) Tool function (command) T function (command)
(4) 2nd miscellaneous function (command) B function (command)
(5) Miscellaneous function strobe 1 to 4 MF (MF1, 2, 3, 4)
(6) Spindle function strobe 1 to 4 SF (SF1, 2, 3, 4)
(7) Tool function strobe 1 to 4 TF (TF1, 2, 3, 4)
(8) 2nd miscellaneous function strobe 1 to 4 BF (BF1, 2, 3, 4)
(9) Miscellaneous function finish 1, 2 FIN1, FIN2

8.1 Command Format

(1) The maximum number of commands that can be issued in one block are shown below.

Function	Maximum number of commands(when released to user)
M function	4 commands
S function	2 or 4 commands (Form : Sn = xxxx)
T function	1 command
B function	1 command

(2) The command can have up to eight digits.
(3) The number of S functions depends on the model.
(4) A program error will not occur even if more commands than the maximum number are issued. The latter commands will be valid.
(EX.) When five T commands are issued though only one T command can be used.

T 01 T 02 T03 T 04 T 05 ;

The last four T commands are valid.

8.2 Miscellaneous Function Finish

After the PLC (machine) finished the specified operations for the M, S, T, B commands output with automatic operation (memory, MDI, or tape) or manual numerical commands from the CNC, the finish signal will be returned to the CNC. However, there are two types of finish signals as shown below. Use these accordingly in one sequence.

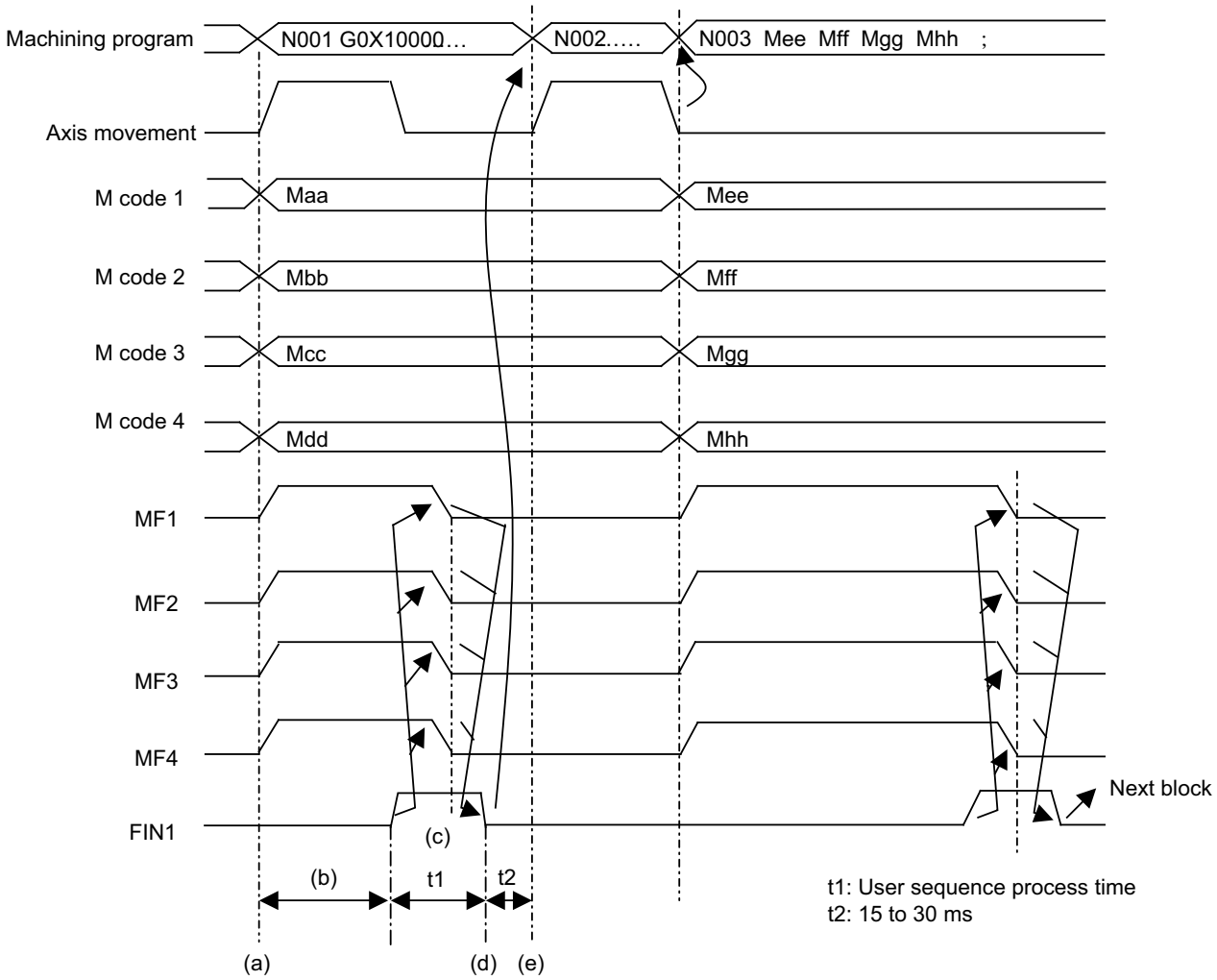
(1) FIN1 ... CNC proceeds to next block at falling edge of finish signal (FIN1).
(2) FIN2 ... CNC proceeds to next block at rising edge of finish signal (FIN2).

The details for FIN1 and FIN2 are also described in the explanation of each interface signal.
Examples of the M function are given in the following section.

8.2.1 Operation Sequence 1 (Using FIN1 with M Command)

[Example of machining program]

N001 G0X10000 Maa Mbb Mcc Mdd ;
N002 G0Z-2000;
N003 Mee Mff Mgg Mhh ;



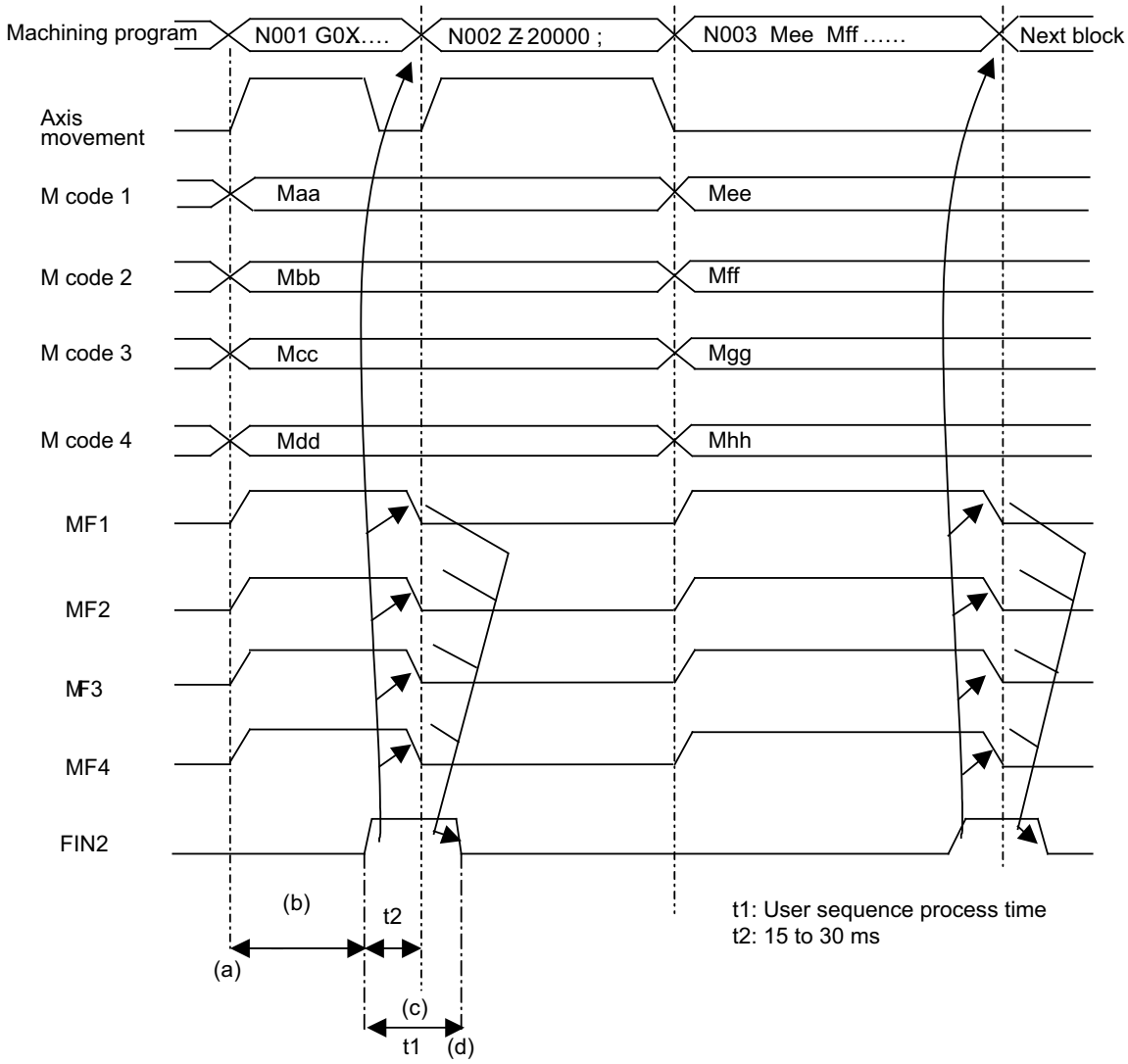
[Explanation of operation]

(a) The CNC outputs the M code data n (BCD) and MFn to the PLC (machine).
Refer to the section "Precautions Related to M, S, T, B Functions" for details on the M code data and MF output timing.
(b) The PLC (machine) confirms that the MF signal has turned ON, reads the M code data, and executes the specified operation. Then, it turns FIN1 ON.
(c) The CNC confirms that FIN1 has turned ON, and then turns MF OFF.
(d) The PLC (machine) confirms that MF has turned OFF, and then turns FIN1 OFF.
(e) The CNC confirms that FIN1 has turned OFF, and then proceeds to the next block.

8.2.2 Operation Sequence 2 (Using FIN2 with M Command)

[Example of machining program]

N001 G0X10000 Maa Mbb Mcc Mdd ;
N002 G0Z-20000;
N003 Mee Mff Mgg Mhh ;



[Explanation of operation]

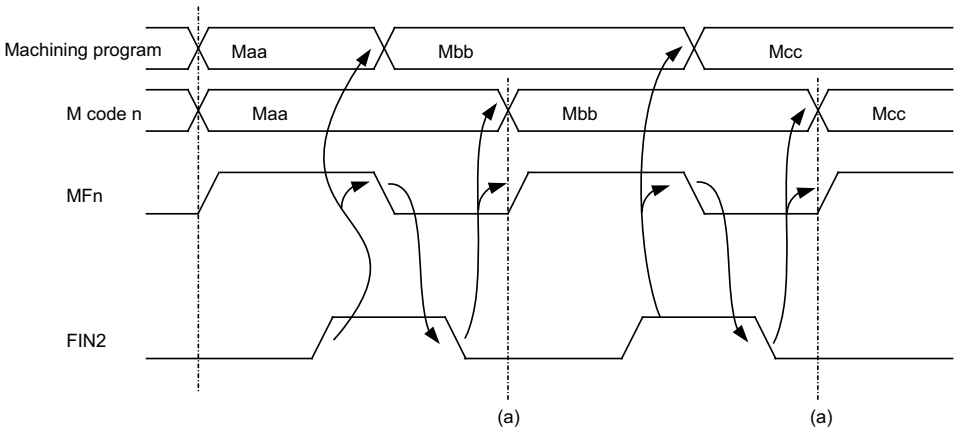
(a) The CNC outputs the M code data n (BCD) and MFn to the PLC (machine).
Refer to the section "Precautions Related to M, S, T, B Functions" for details on the M code data and MF output timing.

(b) The PLC (machine) confirms that the MF signal has turned ON, reads the M code data, and executes the specified operation. Then, it turns FIN2 ON.

(c) The CNC confirms that FIN2 has turned ON, and proceeds to the next block simultaneously with the turning OFF of MF.

(d) The PLC (machine) confirms that MF has turned OFF, and then turns FIN2 OFF.

8.2.3 When M Commands Continue (Using FIN2 with M Command)



[Explanation of operation]

The general operation is the same as "Operation sequence 2" on the previous page.

(a) The CNC confirms that FIN2 has turned OFF, and then output the next code signal and MF.

8.3 M Code Independent Output

The following four types of M codes output "M code independent output" signal (decode signals) separately from their code signals and MF.
The M code independent output is generally used with the following details, but the CNC outputs only the decode signal, and the operation and finish signal processes, etc., are carried out by the user PLC (machine).

M00: Program stop

<Example of process>The block stop state is entered when M00 is commanded.

M01: Optional stop

<Example of process>The block stop state is entered when M01 is commanded and the optional stop selection switch is selected.

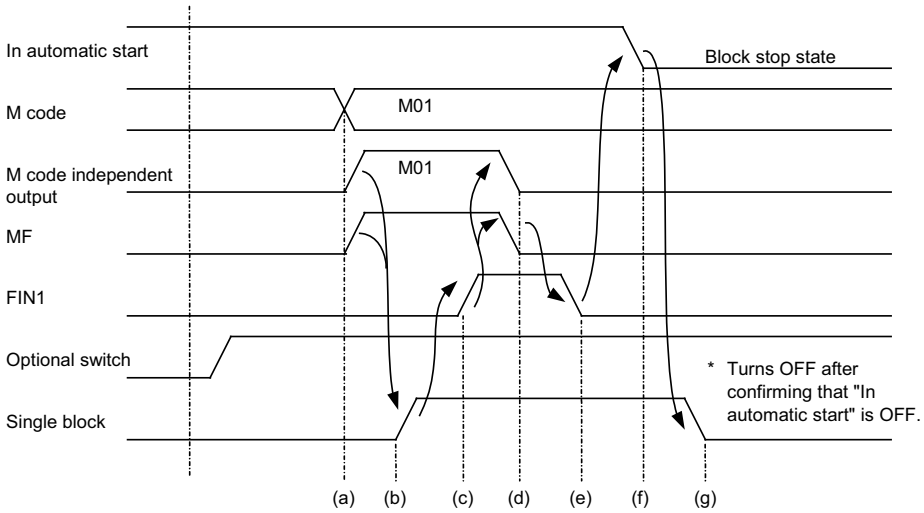
M02, M30: Program end

<Example of process>When M02 or M30 is commanded, "Reset" or "Reset & rewind" is returned to the CNC, and the reset state is entered.

8.3.1 Operation Sequence

The "M code independent output" signal turns ON when M00, M01, M02 or M30 is commanded during automatic operation (memory, MDI or tape) or by the manual numerical command, and turns OFF with the "FIN1", "FIN2", "Reset 1", "Reset 2" or "Reset & rewind" signal.

Example of M01 process (stopping the block with the M01 command)



[Explanation of operation]

(a) The CNC outputs the M code data and MF to the PLC (machine).
Refer to the section "Precautions Related to M, S, T, B Functions" for details on the M code data and MF output timing.

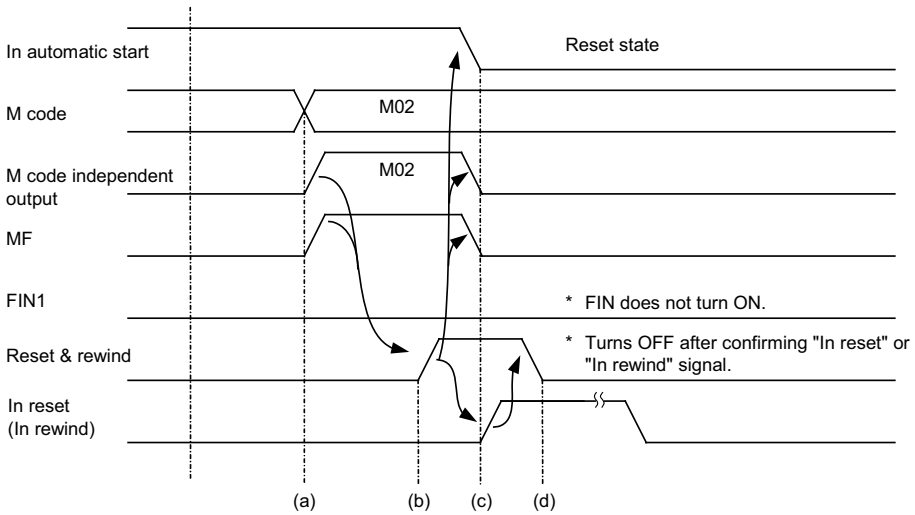
(b)(c) The PLC (machine) confirms that the MF signal has turned ON, and then carries out the specified operation. It then confirms that the "Optional switch" is ON, and then turns "Single block" and "FIN1" ON.

(d)(e) The CNC confirms that FIN1 has turned ON, and then turns the MF and "M code independent output" signal OFF. The PLC (machine) confirms that MF has turned OFF, and then turns FIN1 OFF.

(f) The CNC confirms that FIN1 has turned OFF, and then turns "In automatic start" signal OFF.

(g) The PLC (machine) confirms that "In automatic start" signal has turned OFF, and then turns the "Single block" OFF at the next automatic start.

Example of M02 process (carrying out "Reset & rewind" with M02 command)



[Explanation of operation]

(a) The CNC outputs the M code data and MF to the PLC (machine).
Refer to the section "Precautions Related to M, S, T, B Functions" for details on the M code data and MF output timing.

(b) The PLC (machine) confirms that the MF signal has turned ON, and then carries out the specified operation. It then turns "Reset & rewind" ON.

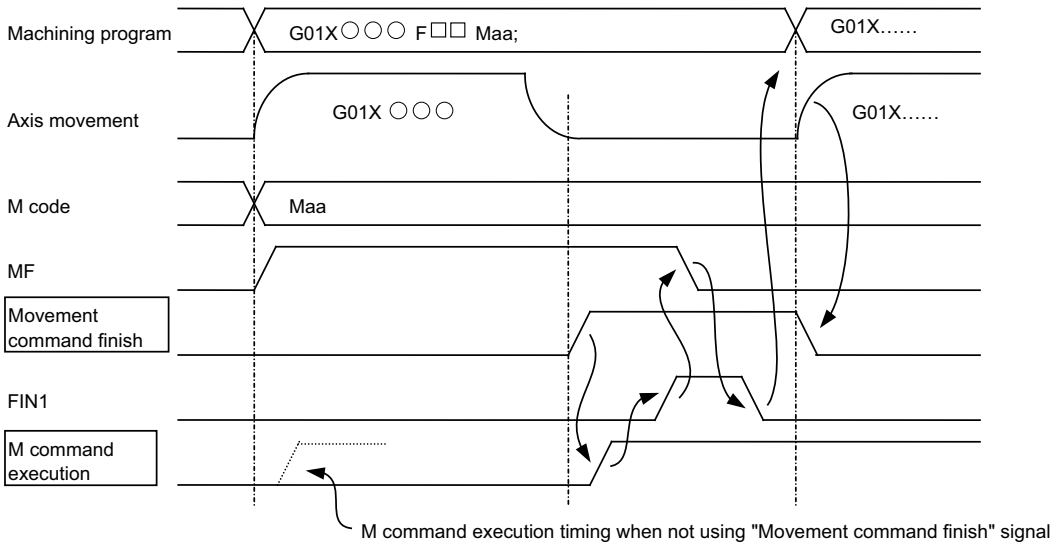
(c) The CNC confirms that "Reset & rewind" has turned ON, then turns MF, "M code independent output" and "In automatic start" OFF, and then starts the rewinding operation.

(d) The PLC (machine) confirms the "In reset" or "In rewind" signals, and then turns the "Reset & rewind" signal OFF.

8.4 Axis Movement and M Commands

If an M command is issued in the same block as a movement command, whether to process the M command simultaneously with the movement command or to process it after the movement is finished, depends on the "Movement command finish (DEN)" signal output from the CNC.

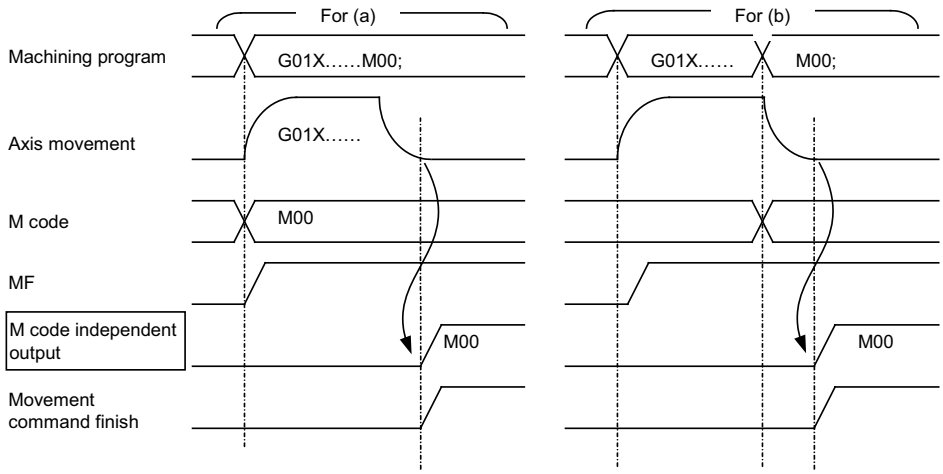
Axis movement and general M command (To execute M command after movement command is finished)



Axis movement and M code independent output command

(a) When the M code independent output command is issued in the same block as a movement command, the M code independent output will be output after the movement command is finished.

(b) Even when the M code independent output command is issued without movement command, it will be output after the axis movement in the previous command block is finished.



(Note 1) Refer to the section "M Code Independent Output" for details on the PLC (machine) process for the M code independent output.

8.5 Precautions

(1) M code data and MF output timing (Also applies to S, T, B signal)
When the built-in PLC is used, the M code data n and MFn are output simultaneously to the user PLC.
When outputting the M code data and MF to the machine with the user PLC of built-in PLC, insert an appropriate time timer on the MF side.

(2) The finish signals (FIN1, FIN2) are commonly used for the M, S, T, B functions, so turn them ON under the conditions where all function operations have been finished.

(3) When the "M function lock" signal (AFL) is turned ON, the M, S, T, B functions (including M commands in fixed cycle) issued during automatic operation (memory, MDI or tape) and manual numerical command, will not be executed. In other words, the code signal, MF, SF, TF and BF signals will not be output (updated). However, when the M code independent output (M00, M01, M02, M30) is commanded, the "M code independent output", "M code data" and MF will be output as usual.

(4) The 2nd miscellaneous (B) function can be selected from address A, B or C using the setup parameters. The "B function" refers to when address "B" is selected.

Appendix 1

List of PLC Window Data

Appendix 1.1 Section No. List

Section No.	Details	Write	Axis designation	System designation	Remarks
1	System information (Per part system)	Not possible	Invalid	Valid	
2	System information (Common for part systems)	Not possible	Invalid	Invalid	
3	File System information	Not possible	Invalid	Valid	
4	Common variable (Per part system #100-)	Possible	Invalid	Valid	
5	Common variable (Common for part systems #400-)	Possible	Invalid	Invalid	
6	Local variables	Not possible	Invalid	Valid	
8	Workpiece coordinate system offset (Workpiece coordinate)	Possible	Valid	Valid	
9	Workpiece coordinate system offset (Extension workpiece coordinate)	Possible	Valid	Valid	
10	Workpiece coordinate system offset (Local coordinate)	Possible	Valid	Valid	
11	Workpiece coordinate system offset (Other coordinate system)	Possible	Valid	Valid	
12	Tool offset per part-system (Type1)	Possible	Invalid	Valid	
13	Tool offset per part-system (Type2)	Possible	Invalid	Valid	
14	Tool offset per part-system (Type3)	Possible	Invalid	Valid	
18	Life management data M system only, no group No. In the order of registration	Possible (partially not possible)	Invalid	Valid	
19	Life management information	Not possible	Invalid	Valid	
20	Tool registration	Possible (partially not possible)	Invalid	Valid (partially invalid)	
21	Spindle ・standby	Not possible (partially possible)	Invalid	Magazine No. (partially invalid)	
22	Tool measurement	Not possible	Invalid (partially valid)	Valid	
25	File information	Not possible	Invalid	Invalid	
33	Speed information	Not possible	Invalid	Valid	
34	Spindle information	Not possible	Valid	Invalid	
35	Operation status	Not possible	Invalid	Valid (partially invalid)	
36	Axis status	Not possible	Valid (partially invalid)	Valid	
37	Counter	Not possible	Valid (partially invalid)	Valid	

Section No.	Details	Write	Axis designation	System designation	Remarks
38	MSTB execution status	Possible (partially not possible)	Invalid	Invalid (partially valid)	
40	Cumulative time	Possible (partially not possible)	Invalid (partially valid)	Invalid (partially valid)	
41	G modal	Not possible	Invalid (partially valid)	Valid	
42	F modal	Not possible	Invalid	Valid	
43	MSTB modal	Not possible	Invalid	Invalid	
45	Program execution status	Not possible	Invalid	Valid	
46	Program tree	Not possible	Invalid	Valid	
47	Program tree for graphic check	Not possible	Invalid	Valid	
59	Servo monitor	Not possible (partially possible)	Valid	Invalid	
60	Servo motor (PLC axis)	Not possible (partially possible)	Valid	Invalid	
62	Synchronous error monitor	Not possible	Invalid	Invalid	
63	Spindle monitor	Not possible (partially possible)	Valid	Invalid	
64	Power supply monitor	Not possible (partially possible)	Valid	Invalid	
65	Auxiliary axis drive unit monitor	Not possible	Valid	Invalid	
66	Hardware configuration	Not possible	Invalid	Invalid	
67	Software configuration	Not possible	Invalid	Invalid	
72	Auxiliary axis control	Possible (partially not possible)	Valid (partially invalid)	Invalid	
74	Sampling parameters	Possible (partially not possible)	Invalid	Invalid	
95	Reference position return parameters	Possible	Valid	Invalid	
96	Servo parameters	Possible	Valid	Invalid	
97	Spindle specification parameters	Possible	Valid	Invalid	
98	Spindle parameters	Possible	Valid	Invalid	
100	Auxiliary axis ・axis parameters	Possible	Valid	Invalid	
101	Absolute position parameters	Possible	Valid	Invalid	
102	Machine error compensation parameters	Possible	Invalid	Invalid	
104	Position switch	Possible	Invalid	Valid (partially invalid)	
106	Macro list	Possible	Invalid	Invalid	
107	PLC constants	Possible	Invalid	Invalid	
108	PLC timer	Possible (partially not possible)	Invalid	Invalid	

Appendix 1 List of PLC Window Data

Section No.	Details	Write	Axis designation	System designation	Remarks
109	PLC counter	Possible (partially not possible)	Invalid	Invalid	
110	PLC bit selection	Possible	Invalid	Invalid	
118	Anshin-net 1	Possible	Invalid	Invalid	
119	Anshin-net 2	Possible	Invalid	Invalid	
120	PLC switch	Possible (partially not possible)	Invalid	Invalid	
121	Operation parameters	Possible	Invalid	Invalid	
122	Input/Output parameters	Possible	Invalid	Invalid	
123	Computer link parameters	Possible	Invalid	Invalid	
124	Ethernet parameters	Possible	Invalid	Invalid	
125	Barrier	Possible	Invalid	Invalid (partially valid)	
126	Base parameters	Possible (partially not possible)	Invalid	Valid (partially invalid)	
127	Axis parameters	Possible	Valid	Valid	
128	Rotary axis configuration parameters	Possible	Invalid	Valid	
140	Ladder I/F (common)	Not possible	Invalid	Valid (partially invalid)	
150	User open I/F parameter	Not possible (partially possible)	Invalid	Invalid	
151	User open I/F data	Not possible (partially possible)	Invalid	Invalid	

Appendix 1.2 Sub-section No. List

Section No. : 1 **System information (Separate for part systems)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Number of axes in part system (Cross configuration)	Integer	R
		2	Number of axes in part system (Base configuration)		
		100	Number of common variable (#100-) sets		

Section No. : 2 **System information (Common variables)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Number of part systems	Integer	R
		2	Total number of NC axes (NC)		
		3	Total number of control axes (NC+PLC+SP)		
		4	Number of spindles		
		5	Number of PLC axes		
		6	Number of auxiliary axes		
		7	File system		
		8	Number of common variable (#500-) sets		
		9	Information on maximum number of registered machining programs		
		10	Number of power supply axes (SV+SP)		
		100	NC type		
		101	PLC device assignment type (M6/M7)		

Section No. : 3 **File system information**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Tool offset type	Character string	R
		2	Number of tool offset sets	Integer	
		3	Number of workpiece offset sets		

Section No. : 4 **Common variable (Separate for part systems #100-)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	700 + n	100 to 199 (n=100 to 199)	Integer	RW

Section No. : 5 **Common variable (Common variables #400-)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	900 + n	Common variable Variable (Common for part systems #400 to #999) (n=400 to 999)	Integer	RW
		2000 + n	Common variable Comment (Common for part systems #500 to #519) (n=500 to 519)	Character string	
		10000 + n	Common variable Variable (Common for part systems #100100 to #100199) (n=100 to 199)	Integer	
		11000 + n	Common variable Variable (Common for part systems #200100 to #200199) (n=100 to 199)		
		12000 + n	Common variable Variable (Common for part systems #300100 to #300199) (n=100 to 199)		
		13000 + n	Common variable Variable (Common for part systems #400100 to #400199) (n=100 to 199)		
		14000 + n	Common variable Variable (Common for part systems #500100 to #500199) (n=100 to 199)		
		15000 + n	Common variable Variable (Common for part systems #600100 to #600199) (n=100 to 199)		
		16000 + n	Common variable Variable (Common for part systems #700100 to #700199) (n=100 to 199)		
		17000 + n	Common variable Variable (Common for part systems #800100 to #800199) (n=100 to 199)		

Section No. : 6 **Local variables**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1000 + n	Local variables (level 0)(n=1 to 33)	Integer	R
		1100 + n	Local variables (level 1)(n=1 to 33)		
		1200 + n	Local variables (level 2)(n=1 to 33)		
		1300 + n	Local variables (level 3)(n=1 to 33)		
		1400 + n	Local variables (level 4)(n=1 to 33)		
		2000	Local variables Blank variable		

Section No. : 8 **Workpiece coordinate system offset (Workpiece coordinate)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No. in part system	n	Gn (n=54 to 59) Workpiece coordinate system offset	PLC setup unit	RW

Section No. : 9 **Workpiece coordinate system offset (The expansion workpiece coordinate)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No. in part system	n	G54.1Pn (n=1 to 96)	PLC setup unit	RW

Section No. : 10 **Workpiece coordinate system offset (A local coordinate)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No. in part system	1	Local coordinate system offset (G54)	PLC setup unit	RW
		2	Local coordinate system offset (G55)		
		3	Local coordinate system offset (G56)		
		4	Local coordinate system offset (G57)		
		5	Local coordinate system offset (G58)		
		6	Local coordinate system offset (G59)		

Section No. : 11 **Workpiece coordinate system offset (Other coordinate system)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No. in part system	1	External workpiece offset (EXT)	PLC setup unit	RW

Section No. : 12 **Tool separate for part systems offset (Type1)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	n	Compensation data (n=1 to 999)	PLC setup unit	RW

Section No. : 13 **Tool separate for part systems offset (Type2)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	n	Length dimension (n=1 to 999)	PLC setup unit	RW
		1000 + n	Radius dimension (n=1 to 999)		
		2000 + n	Length wear (n=1 to 999)		
		3000 + n	Radius wear (n=1 to 999)		

Section No. : 14 **Tool separate for part systems offset (Type3)**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	n	Nose point P (n=1 to 999)	Integer	RW
		1000 + n	Tool length X (n=1 to 999)	PLC setup unit	
		2000 + n	Tool length Y (n=1 to 999)		
		3000 + n	Tool length Z (n=1 to 999)		
		4000 + n	Nose point R (n=1 to 999)	Integer	
		5000 + n	Wear X (n=1 to 999)	PLC setup unit	
		6000 + n	Wear Y (n=1 to 999)		
		7000 + n	Wear Z (n=1 to 999)		
		8000 + n	Wear R (n=1 to 999)		

Section No. : 18 **Life management data M system only, no group No. In the order of registration.**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1000 + n	Tool No. (n=1 to 1000)	Integer	RW
		2000 + n	Status (n=1 to 1000)		
		3000 + n	Method (n=1 to 1000)		
		4000 + n	Length compensation (n=1 to 1000)	PLC setup unit	
		5000 + n	Radius compensation (n=1 to 1000)		
		6000 + n	Usage (time, times, wear amount) (n=1 to 1000)	Integer	
		7000 + n	Life (time, times, wear amount) (n=1 to 1000)		
		8000 + n	Miscellaneous (n=1 to 1000)		
		9000 + n	Group No. (n=1 to 1000)		
		10003	Group ID of the designated group No.		
		11000 + n	Group No. of the designated group ID (n=1 to 1000)		R
		12000 + n	Head record ID of the designated group ID (n=1 to 1000)		
		13000 + n	Number of tools registered in the designated group ID (n=1 to 1000)		
		16000 + n	Tool information of the designated record (n=1 to 1000)		

Section No. : 19 **Life management information**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Life management number of registered tool	Integer	R
		2	Life management number of registration groups		
		3	Life management data renewal flag		
		4	Life management maximum number of registered tools		
	Group No.	100	Life management next tool No. (for L system type II only)		

Section No. : 20 **Tool registration**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	n	Tool registration data (pot No.) (n=1 to 360)	Integer	R
		1000 + n	Tool registration data (tool No.) (n=1 to 360)		RW
		2000 + n	Tool registration data (miscellaneous: D) (n=1 to 360)		

Section No. : 21 **Spindle Alarms・Wait**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Magaz-ine No.	Not used	n	Spindle standby (tool No.) (n=0 to 4)	Integer	RW
		10 + n	Spindle standby (miscellaneous D) (n=0 to 4)		
Not used		200	Number of spindle standby displays		R
Magaz-ine No.		1000	Tool life management data for spindle tool	PLC setup unit	
		1001	Tool life management data for standby tool		

Section No. : 22 **Tool measurement mode**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	TLM switch	Integer	R
	Axis No.	2	Final movement direction		
	Not used	3	Final movement axis		
		4	Second skip contact		

Section No. : 25 **File information**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Machining program number of registrations	Integer	R
		2	Machining program number of remains		
		3	Machining program number of memory characters		
		4	Machining program number of remaining characters		
		10	melCopyFile transferred data size		

Section No. : 33 **Speed information**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	FC (composite speed)	PLC setup unit/min.	R
		2	FA: F command feedrate		
		101	Federate display FC (composite speed)		

Section No. : 34 **Spindle information**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1	Spindle rotation speed (rev/min)	Integer	R

Section No. : 35 **Running conditions**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Macro execution level	Integer	R
		2	In verification stop		RW
		10	Operation status 1 (operation status)	Character string	R
		11	Operation status 2 (operation mode)		
		20	Automatic operation is starting	Integer	
		21	In automatic operation		
		22	In automatic operation stop		
		100	Data protect key 1		
		101	Data protect key 2		
		102	Data protect key 3		
		200	External input signal 1		
		201	JOG mode (special) signal		
		202	NC status output signal 1		
		203	Alarm status signal		
		204	Operation (automatic) mode related signal		
		205	Operation (manual) mode related signal		
		206	Restart search status		
		207	Restart search type 1 valid		
		208	Extended operation search status		
		209	Current search line No. during search mode		
		210	In checking mode		
Not used		220	Parameter flag to prompt a reboot		
		221	PLC Run/Stop status		
System No.		222	MDI setting status		

Section No. : 36 **Axis status**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No.	1	Axis status (axis removal)	**Integer**	R
		2	Axis status (servo OFF)		
		3	Axis status (1st ref)		
		4	Axis status (2nd ref)		
		5	Axis status (3rd ref)		
		6	Axis status (4th ref)		
		7	Axis status (mirror image)		
		8	Axis status (restart search RP)		
	Not used	100	Axis status (servo OFF) all axes		
		101	Axis status (1st ref) all axes		
		102	Axis status (2nd ref) all axes		
		103	Axis status (3rd ref) all axes		
		104	Axis status (4th ref) all axes		
		105	Axis status (mirror image) all axes		
		106	Axis status (restart search RP) all axes		
		200	Program mirror axis (all axes)		

Section No. : 37 **Counter**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No.	1	Workpiece coordinate position counter	PLC setup unit	R
		2	Machine position counter		
		3	Current position counter		
		4	Absolute position counter		
		5	Program position counter		
		6	Remain command		
		7	Skip coordinate counter (workpiece coordinate)		
		8	Manual interrupt amount 1(ABS Off)		
		9	Manual interrupt amount 2(ABS On)		
		10	Next command		
		11	Restart position counter (workpiece coordinate)		
		12	Restart remaining distance counter		
		13	Restart position counter (machine coordinate)		
		14	Program position counter 2		
		15	TLM position counter		
		16	TLM skip position counter		
		17	TLM position counter		
		18	Skip coordinate counter (machine coordinate)		
		19	Skip remaining distance counter		
	Not used	20	Interpolation composite vector length	Interpolat-ion unit	
	Axis No.	21	Current position B counter	PLC setup unit	
		22	Skip machine value		
		23	Skip coordinate position (skip coordinate counter)		
		24	Measurement position		
		32	Machine position on the orthogonal coordinate		
		33	Feedback position		

Section No. : 38 **MSTB execute conditions**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	M Command / Manual numerical value command (M1)	Integer	RW
		2	M Command / Manual numerical value command (M2)		
		3	M Command / Manual numerical value command (M3)		
		4	M Command / Manual numerical value command (M4)		
		101	M Command / Manual numerical value command (S1)		
		102	M Command / Manual numerical value command (S2)		
		103	M Command / Manual numerical value command (S3)		
		104	M Command / Manual numerical value command (S4)		
		105	M Command / Manual numerical value command (S5)		
		106	M Command / Manual numerical value command (S6)		
		201	M Command / Manual numerical value command (T1)		
		301	M Command / Manual numerical value command (B1)		
		302	M Command / Manual numerical value command (B2)		
		303	M Command / Manual numerical value command (B3)		
		304	M Command / Manual numerical value command (B4)		
System No.		401	Restart search T command history	Character string	R
Not used		411	Restart search S1 command history		
		412	Restart search S2 command history		
		413	Restart search S3 command history		
		414	Restart search S4 command history		
		415	Restart search S5 command history		
		416	Restart search S6 command history		
System No.		421	Restart search B command history		
		431	Restart search M command history		

Section No. : 40 **Cumulative time**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Power ON time	Character string	RW
		2	Automatic operation time		
		3	Automatic start time		
		4	External cumulative time 1		
		5	External cumulative time 2		
		6	Date		
		7	Time		
System No.		8	Cycle time		R

Section No. : 41 **G modal**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	n	G code (n=group 1 to 27)	Integer	R
		51	Tool compensation No. for shape (radius) compensation modal		
		52	Compensation amount for shape (radius) compensation modal	PLC setup unit	
		53	Wear amount for shape (radius) compensation modal		
		54	Tool wear No. for radius compensation modal	Integer	
		101	Tool compensation No. for length compensation modal		
	Axis No.	102	Axis name of length compensation modal	Character string	
	Not used	103	Compensation amount of length compensation modal	PLC setup unit	
		104	Wear amount for length compensation modal		
		105	Axis information during length compensation (all axes)	Integer	
	Axis No.	106	Tool compensation No. of length compensation modal		
	Not used	201	Scaling factor (G50P_)[Grp11]	Character string	
		202	Coordinate rotation angle (G68R_)[Grp16]		
		203	High-speed machining mode (G5P_)		
		204	gmov cutting/non-cutting command	Integer	
		205	Extended workpiece coordinate selection (G54.1P_)	Character string	
		206	Information during cutting	Integer	
		207	Scaling factor (G50P_)[Grp11] (Magic compatible)	Character string	
		208	Coordinate rotation angle (G68R_)[Grp16] (Magic compatible)		
		209	3-dimensional coordinate conversion status (to display workpiece coordinate selection G68)		

Section No. : 42 **F modal**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Program command F modal (FA)	Integer	R
		2	Manual feedrate (FM)	PLC setup unit/min.	
		3	Synchronous feedrate (FS)		
		4	Thread cutting lead (FE)	Integer	
		5	Dwell remaining time		
		10 + n	Constant surface speed control (surface speed S) (n=1 to 6)		

Section No. : 43 **MSTB modal**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	n	S modal (S1 to S6) (n=1 to 6)	Integer	R
		100 + n	T modal (T1 to T2) (n=1 to 2)		
		200 + n	M modal (M1 to M4) (n=1 to 4)		
		300 + n	B modal (B1 to B4) (n=1 to 4)		

Section No. : 45 **Program execution status**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Nest level of the sub-program currently operating	Integer	R
		2	Invalid status: Single block ・MST finish		
		3	Invalid status: Feed hold ・override ・exact		
		100	Main program path during execution	Character string	
		101	Main program during execution O No.	Integer	
		102	Main program during execution N No.		
		103	Main program during execution B No.		
		201	Sub program during execution O No.		
		202	Sub program during execution N No.		
		203	Sub program during execution B No.		
		300	Last operated program path	Character string	
		301	Last operated main program O No.	Integer	
		302	Last operated main program N No.		
		303	Last operated main program B No.		
		401	Last operated sub program O No.		
		402	Last operated sub program N No.		
		403	Last operated sub program B No.		

Section No. : 46 **Program tree**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Main program during execution Device name	Character string	R
		2	Main program during execution O No.	Integer	
		3	Main program during execution N No.		
		4	Main program during execution B No.		
		100 + n	Sub 1 to 10 device name (n=1 to 10) during execution	Character string	
		200 + n	Sub program 1 to 10 during execution O No. (n=1 to 10)		
		300 + n	Sub program 1 to 10 during execution N No. (n=1 to 10)		
		400 + n	Sub program 1 to 10 during execution B No. (n=1 to 10)		
		500 + n	Sub program 1 to 10 during execution Number of repetitions (n=1 to 10)	Integer	
		1000	Program tree information (ONB, Path) during execution		

Section No. : 47 **Program tree for graphic check**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1	Execution main O No. for checking	Integer	R
		2	Execution main N No. for checking		
		3	Execution main B No. for checking		

Section No. : 59	Servo monitor

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not usedNot used	Axis No.Axis No.	1	Gain	Integer	R
		2	Droop		
		3	Rotation speed	PLC setup unit/min.	
		4	Load current (%)	Integer	
		5	MAX current 1		
		6	MAX current 2		
		7	Overload		
		8	Regenerative load		
		9	Drive unit display	Character string	
		10	Alarm 1		
		11	Alarm 2		
		12	Alarm 3		
		13	Alarm 4		
		14	Cycle counter	Integer	
		15	Grid spacing		
		16	Grid amount		
		17	Machine position	PLC setup unit	R
		18	Motor end FB		
		19	Machine end FB		
		20	FB error		
		21	DFB compensation amount		
		22	Remain command		
		23	Current value (2)		
		24	Manual interrupt amount		
		25	Detection system	Character string	
		26	Power ON position	PLC setup unit	
		27	Power OFF position		
		28	Current position		
		29	R0 (multi-rotation counter at basic point setting)	Integer	
		30	P0 (position within 1 rotation at basic point setting)		
		31	E0 (absolute position error at basic point setting)		
		32	Rn (multi-rotation counter)		
		33	Pn (position within 1 rotation)		
		34	En (absolute position error at power OFF)		
		35	ABS0 (absolute position basic counter)		
		36	ABSn (absolute position counter)		
		37	MPOS (initial offset amount)		
		38	Drive unit type	Character string	
		39	Drive unit serial No.		
		40	S/W version		
		41	Control method		
		42	Motor end detector		
		43	Machine end detector		
		44	Motor type		
		45	Work time		RW

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	46	Alarm history 1(time)	Character string	R
		47	Alarm history 2(time)		
		48	Alarm history 3(time)		
		49	Alarm history 4(time)		
		50	Alarm history 5(time)		
		51	Alarm history 6(time)		
		52	Alarm history 7(time)		
		53	Alarm history 8(time)		
		54	Alarm history 1(alarm No.)	Integer	R
		55	Alarm history 2(alarm No.)		
		56	Alarm history 3(alarm No.)		
		57	Alarm history 4(alarm No.)		
		58	Alarm history 5(alarm No.)		
		59	Alarm history 6(alarm No.)		
		60	Alarm history 7(alarm No.)		
		61	Alarm history 8(alarm No.)		
		62	Maintenance history (MNT1)		
		63	Maintenance history (MNT2)		
		64	Maintenance history (MNT3)		
		65	Maintenance history (MNT4)		
		66	/SYS		
		210	Machine end FB (for rotary axis)	PLC setup unit	

Section No. : 60 **Servo monitor(PLC axis)**

Sub-section No. is equivalent to the section No. 59.

Section No. : 62 **Synchronous error monitor**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Command error (1st set)	PLC setup unit	R
		2	Command error (2nd set)		
		3	Command error (3rd set)		
		11	FB error (1st set)		
		12	FB error (2nd set)		
		13	FB error (3rd set)		
		21	Machine position (1st set)		
		22	Machine position (2nd set)		
		23	Machine position (3rd set)		

Section No. : 63	Spindle monitor

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1	Gain	Integer	R
		2	Droop		
		3	Rotation speed	PLC setup unit/min.	
		4	Load	Integer	
		5	Drive unit display	Character string	
		6	Alarm 1		
		7	Alarm 2		
		8	Alarm 3		
		9	Alarm 4		
		10	Cycle counter	Integer	
		11	Control input 1L	Character string	
		12	Control input 1H		
		13	Control input 2L		
		14	Control input 2H		
		15	Control input 3L		
		16	Control input 3H		
		17	Control input 4L		
		18	Control input 4H		
		19	Control output 1L		
		20	Control output 1H		
		21	Control output 2L		
		22	Control output 2H		
		23	Control output 3L		
		24	Control output 3H		
		25	Control output 4L		
		26	Control output 4H		
		27	Drive unit type		
		28	Drive unit serial No.		
		29	S/W version		
		30	Work time		RW

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	31	Alarm history 1(time)	Character string	R
		32	Alarm history 2(time)		
		33	Alarm history 3(time)		
		34	Alarm history 4(time)		
		35	Alarm history 5(time)		
		36	Alarm history 6(time)		
		37	Alarm history 7(time)		
		38	Alarm history 8(time)		
		39	Alarm history 1(alarm No.)		
		40	Alarm history 2(alarm No.)		
		41	Alarm history 3(alarm No.)		
		42	Alarm history 4(alarm No.)		
		43	Alarm history 5(alarm No.)		
		44	Alarm history 6(alarm No.)		
		45	Alarm history 7(alarm No.)		
		46	Alarm history 8(alarm No.)		
		47	Maintenance history (MNT1)		
		48	Maintenance history (MNT2)		
		49	Maintenance history (MNT3)		
		50	Maintenance history (MNT4)		
		51	/SYS		
		52	Control input 1		
		53	Control input 2		
		54	Control input 3		
		55	Control input 4		
		56	Control output 1		
		57	Control output 2		
		58	Control output 3		
		59	Control output 4		
		60	Spindle angle	Integer	
		221	Spindle thermistor temperature		

Section No. : 64	Power supply monitor

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1	Unit type	Character string	R
		2	Unit No.		
		3	S/W version		
		4	Work time		
		5	Alarm history 1(time)		
		6	Alarm history 2(time)		
		7	Alarm history 3(time)		
		8	Alarm history 4(time)		
		9	Alarm history 5(time)		
		10	Alarm history 6(time)		
		11	Alarm history 7(time)		
		12	Alarm history 8(time)		
		13	Alarm history 1(alarm No.)		
		14	Alarm history 2(alarm No.)		
		15	Alarm history 3(alarm No.)		
		16	Alarm history 4(alarm No.)		
		17	Alarm history 5(alarm No.)		
		18	Alarm history 6(alarm No.)		
		19	Alarm history 7(alarm No.)		
		20	Alarm history 8(alarm No.)		
		21	Maintenance history (MNT1)		
		22	Maintenance history (MNT2)		
		23	Maintenance history (MNT3)		
		24	Maintenance history (MNT4)		
		25	/SYS		
		26	Connection drive		W

Section No. : 65 **Auxiliary axis amplifier monitor**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1	Droop	Integer	R
		2	Rotation speed	PLC setup unit/min.	
		3	Load current	Integer	
		4	MAX current 1		
		5	MAX current 2		
		6	Overload		
		7	Regenerative load		
		8	Current station No.		
		9	Current position	PLC Setup unit	
		10	Target station No.	Integer	
		11	Command position	PLC setup unit	
		12	Auxiliary axis name	Character string	
		13	Position control gain 1	Integer	
		14	Speed control gain 1		
		15	Position control gain 2		
		16	Speed control gain 2		
		17	Speed integral compensation		
		18	Load inertia ratio		
		19	Unit type	Character string	
		20	S/W version		
		21	Motor type		
		22	Alarm 1		
		23	Alarm 2		
		24	Alarm 3		
		25	Alarm 4		
		26	Unit serial No.		
		30 + n	Alarm history 1 to 6 (alarm No.) (n=1 to 6)		
		50 + n	Alarm history 1 to 6 (Detailed information of alarm) (n=1 to 6)		
		70 + n	Alarm history 1 to 6 (n=1 to 6)		

Section No. : 66 **Hardware Configuration**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	n	RIO unit 1 to 8	Character string	R
		100 + n	Terminal RIO unit 1 to 4		
		200	Control unit (NC card)		
		201	Extension unit		
		300	Terminal display unit (for M7)		
		301	Option card extension bus (OPTION CARD) (for M7)		
		302	CPUCARD external I/F (for M7)		
		400	Number of RIO units (for M7)	Integer	
		400 + n	RIO unit (for M7) (n=1 to 32)	Character string	

Section No. : 67 **Software Configuration**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	NC system version	Character string	R
		2	PLC version		
		3	PLCe version (extension external alarm message)		
		4	3rd language version		
		5	4th language version		
	Axis No.	6	Servo drive unit version		
		7	Spindle drive unit version		
	Not used	8	OS version		
		9	APLC version		
		20	NC system version (4-digit display)		

Section No. : 72 **Auxiliary Axis control**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1	Operation adjustment mode	Integer	RW
		2	Absolute position set		
		3	Position set method		R
		4	Position set status		
		5	Operation mode		RW
		6	Operation parameter group		
		7	Scale		
		8	Operation status		
		9	Auxiliary axis basic point set		
	Not used	1000	Auxiliary axis parameter SRAM backup		W

Section No. : 74 **Sampling parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Sampling trigger	Integer	RW
		2	Sampling cycle		
		3	Number of sampling data		
		4	Sampling data storing address	Character string	
		5	Sampling data storing size	Integer	
		6	Sampling address #1 (M625 conventional compatibility)	Character string	
		7	Sampling address #2 (M625 conventional compatibility)		
		8	Sampling address #3 (M625 conventional compatibility)		
		9	Sampling address #4 (M625 conventional compatibility)		
		10	Sampling address #5 (M625 conventional compatibility)		
		11	Sampling address #6 (M625 conventional compatibility)		
		12	Sampling address #7 (M625 conventional compatibility)		
		13	Sampling address #8 (M625 conventional compatibility)		
		20	Sampling address #1		
		21	Sampling address #2		
		22	Sampling address #3		
		23	Sampling address #4		
		24	Sampling address #5		
		25	Sampling address #6		
		26	Sampling address #7		
		27	Sampling address #8		
		41	Sampling address for AT #1		W
		42	Sampling address for AT #2		
		43	Sampling address for AT #3		
		44	Sampling address for AT #4		
		45	Sampling address for AT #5		
		46	Sampling address for AT #6		
		47	Sampling address for AT #7		
		48	Sampling address for AT #8		
		50	Buffer designation (0: built-in memory, 1: cassette memory)	Integer	RW
		51	Buffer capacity (1024 x (setting value +1) byte)		
		52	Starting condition		
		53	Processing format (0: 1shot, 1: repeat, 2: ring buffer)		
		54	Ending condition		
		55	Variables No. (0: #1299, other than 0: common variables)		
		56	PLC device	Character string	
		57	Condition address		
		58	Condition data	Integer	
		59	Condition data mask		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	70	Sampling status (for automatic tuning)	Integer	R
		71	Sampling delay time (for automatic tuning)		RW
		72	Cycle start request (for automatic tuning)		W
		73	Cycle start restriction (for automatic tuning)		RW
		74	Number of samplings (for automatic tuning)		R
		75	OP check information (for automatic tuning)		RW
		100	Number of sampling data		R

Section No. : 95 **Reference position return parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	2025, 2026	Refer to the Setup Manual for reference position return parameters.	PLC setup unit/min.	RW
		2027, 2028		PLC Setup unit	
		2029 to 2033		Integer	
		2037 to 2040		PLC Setup unit	

Section No. : 96 **Servo parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1 to 65, 73, 81 to 256	SVn (n= Sub-section No.) Refer to the Setup Manual for servo parameters.	Integer	RW

Section No. : 97 **Spindle specification parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1 to 31, 35, 37 to 72, 101 to 118, 120 to 138	"3000 + n" equals to parameter No. ("n": Sub-section No.) Refer to the Setup Manual for spindle parameters.	Integer	RW RW

Section No. : 98	Spindle parameters

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1001 to 1003	SPn (n=Sub-section No.-1000) Refer to the section on "Spindle parameter" in the Setup Manual for details.	Integer	RW
		1004		(Not used)	
		1005 to 1010		Integer	
		1011 to 1013		(Not used)	
		1014 to 1029		Integer	
		1030		(Not used)	
		1031 to 1050		Integer	
		1051,1052		(Not used)	
		1053		Integer	
		1054		(Not used)	
		1055 to 1057		Integer	
		1058 to 1060		(Not used)	
		1061		Integer	
		1062 to 1064		(Not used)	
		1065 to 1084		Integer	
		1085,1086		(Not used)	
		1087,1088		Integer	
		1089 to 1112		(Not used)	
		1113 to 1117		Integer	
		1118 to 1120		(Not used)	
		1121 to 1192		Integer	
		1193 to 1224		(Not used)	
		1125 to 1233		Integer	
		1234 to 1236		(Not used)	
		1237 to 1239		Integer	
		1240		(Not used)	

Appendix 1 List of PLC Window Data

Section No. : 100	Auxiliary axis・axis parameters

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1	"50000 + n" equals to parameter No. ("n": Sub-section No.) Refer to the Setup Manual for auxiliary axis parameters.	Character string	RW
		2 to 8		Integer	
		9			
		10		Integer	
		11, 12			
		13, 14		Integer	
		15			
		16		Integer	
		17, 18			
		19 to 24		Integer	
		25			
		30		Character string	
		31 to 45			
		50		Character string	
		51		Integer	
		52			
		53, 54		Integer	
		55, 56			
		100 to 103		Integer	
		104		PLC Setup unit	
		105		Character string	
		110, 111		PLC setup unit /min.	
		112 to 118		PLC setup unit	
		120		Character string	
		123		Integer	
		130		PLC setup unit	
		150, 151		PLC setup unit /min.	
		152 to 181		Integer	
		190 to 197		PLC setup unit	
		200 to 216, 220 to 223		Integer	

Section No. : 101 **Absolute position parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Axis No.	1, 2	"2048 + n" equals to parameter No. ("n": Sub-section No.) Refer to the Setup Manual for absolute position parameters.	Integer	RW
		3		PLC setup unit	
		6		Integer	
		7		PLC setup unit/min.	
		8 to 10		PLC setup unit	
		11		Integer	
		12, 13		PLC setup unit	
		14		Integer	

Section No. : 102 **Machine error compensation parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Compensation machine error compensation amount increment method	Integer	RW
		1 + n	1st to 28th axis basic axis (n=1 to 28)	Character string	
		29 + n	1st to 28th axis compensation axis (n=1 to 28)		
		57 + n	1st to 28th axis division point No. at reference position (n=1 to 28)	Integer	
		85 + n	1st to 28th axis division point No. at the most negative side (n=1 to 28)		
		113 + n	1st to 28th axis division point No. at the most positive side (n=1 to 28)		
		141 + n	1st to 28th axis compensation scale factor (n=1 to 28)		
		169 + n	1st to 28th axis division interval (n=1 to 28)	PLC setup unit	
		198 + n	Pitch error compensation amount (n=0 to 1023)	Integer	

Section No. : 104	Position switch

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	PSW selection	Integer	RW
System No.		2	1st position switch axis name	Character string	
		3	1st position switch imaginary dog position 1	PLC setup unit	
		4	1st position switch imaginary dog position 2		
		5	1st position switch PSW check method changeover	Integer	
		6	2nd position switch axis name	Character string	
		7	2nd position switch imaginary dog position 1	PLC setup unit	
		8	2nd position switch imaginary dog position 2		
		9	2nd position switch PSW check method changeover	Integer	
		10	3rd position switch axis name	Character string	
		11	3rd position switch imaginary dog position 1	PLC setup unit	
		12	3rd position switch imaginary dog position 2		
		13	3rd position switch PSW check method changeover	Integer	
		14	4th position switch axis name	Character string	
		15	4th position switch imaginary dog position 1	PLC setup unit	
		16	4th position switch imaginary dog position 2		
		17	4th position switch PSW check method changeover	Integer	
		18	5th position switch axis name	Character string	
		19	5th position switch imaginary dog position 1	PLC setup unit	
		20	5th position switch imaginary dog position 2		
		21	5th position switch PSW check method changeover	Integer	
		22	6th position switch axis name	Character string	
		23	6th position switch imaginary dog position 1	PLC setup unit	
		24	6th position switch imaginary dog position 2		
		25	6th position switch PSW check method changeover	Integer	
		26	7th position switch axis name	Character string	
		27	7th position switch imaginary dog position 1	PLC setup unit	
		28	7th position switch imaginary dog position 2		
		29	7th position switch PSW check method changeover	Integer	
		30	8th position switch axis name	Character string	
		31	8th position switch imaginary dog position 1	PLC setup unit	
		32	8th position switch imaginary dog position 2		
		33	8th position switch PSW check method changeover	Integer	
		100 + n	9th to 24th position switch axis name (n=9 ~)	Character string	
		200 + n	9th to 24th position switch imaginary dog position 1 (x=9 ~)	PLC setup unit	
		300 + n	9th to 24th position switch imaginary dog position 2 (n=9 ~)		
		400 + n	9th to 24th position switch PSW check method changeover (n=9 ~)	Integer	

Section No. : 106 **Macro List**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	M[01] Code	Integer	RW
		2	M[01] Type		
		3	M[01] Program No.		
		4	M[02] Code		
		5	M[02] Type		
		6	M[02] Program No.		
		7	M[03] Code		
		8	M[03] Type		
		9	M[03] Program No.		
		10	M[04] Code		
		11	M[04] Type		
		12	M[04] Program No.		
		13	M[05] Code		
		14	M[05] Type		
		15	M[05] Program No.		
		16	M[06] Code		
		17	M[06] Type		
		18	M[06] Program No.		
		19	M[07] Code		
		20	M[07] Type		
		21	M[07] Program No.		
		22	M[08] Code		
		23	M[08] Type		
		24	M[08] Program No.		
		25	M[09] Code		
		26	M[09] Type		
		27	M[09] Program No.		
		28	M[10] Code		
		29	M[10] Type		
		30	M[10] Program No.		
		31	M2mac Type		
		32	M2mac Program No.		
		33	G[01] Code		
		34	G[01] Type		
		35	G[01] Program No.		
		36	G[02] Code		
		37	G[02] Type		
		38	G[02] Program No.		
		39	G[03] Code		
		40	G[03] Type		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	41	G[03] Program No.	Integer	RW
		42	G[04] Code		
		43	G[04] Type		
		44	G[04] Program No.		
		45	G[05] Code		
		46	G[05] Type		
		47	G[05] Program No.		
		48	G[06] Code		
		49	G[06] Type		
		50	G[06] Program No.		
		51	G[07] Code		
		52	G[07] Type		
		53	G[07] Program No.		
		54	G[08] Code		
		55	G[08] Type		
		56	G[08] Program No.		
		57	G[09] Code		
		58	G[09] Type		
		59	G[09] Program No.		
		60	G[10] Code		
		61	G[10] Type		
		62	G[10] Program No.		
		63	Smac Type		
		64	Smac Program No.		
		65	Tmac Type		
		66	Tmac Program No.		
System No.		100 + n	ASCII[ ]ASCII code macro valid (n=1 to 2)		
		200 + n	ASCII[ ]ASCII code (n=1 to 2)	Character string	
		300 + n	ASCII[ ] call type (0:M98, 1:G65, 2:G66, 3:G66.1) (n=1 to 2)	Integer	
		400 + n	ASCII[ ] program No. (n=1 to 2)		
		500 + n	ASCII[ ] common variable No. (100 to 149) (n=1 to 2)		

Section No. : 107 **PLC constants**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1 + n	PLC constants (n=0 to 95) Refer to the Setup Manual for PLC constants.	Integer	RW

Section No. : 108 **PLC timer**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1 + n	10ms timer <10ms> (n=0 to 15 / [M7] n=0 to 703)	Integer	RW
		1000 + n	100ms timer <100ms> (n=0 to 79 / [M7] n=0 to 703)		
		2000 + n	100ms integral timer <100msINC> (n=0 to 7 / [M7] n=0 to 63)		
		3000 + n	10ms addition extension timer <10ms> (n=0 to 399 / no [M7])		
		10000	Number of PLC timers (variable) (M7 only)		R
		10001	Number of PLC integral timers (variable) (M7 only)		

Section No. : 109 **PLC counter**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1 + n	Counter (n=0 to 23 / [M7] n=0 to 255)	Integer	RW
		10000	Number of PLC counters (variable) (M7 only)		R

Section No. : 110 **Selecting the PLC Bit**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1 + n	PLC bit selection (n=0 to 195)	Integer	RW

Section No. : 118 **Anshin-net 1**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	400	Notifying party's telephone No. 1	Character string	RW
		401	Comment 1		
		402	Notifying party's telephone No. 2		
		403	Comment 2		
		404	Notifying party's telephone No. 3		
		405	Comment 3		

Section No. : 119	Anshin-net 2

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	600	Modem telephone No.	Character string	RW
		601	No. to reach call center		
		602	No. to reach machine tool builder		
		603	Incoming No. at call center 1		
		604	Incoming No. at call center 2		
		605	Incoming No. at call center 3		
		606	Incoming No. at call center 4		
		607	Incoming No. at call center 5		
		607 + n	Incoming No. at machine tool builder (n=1 to 5)		
		613	Number of retries	Integer	
		614	Anshin-net screen auto selection		
		615	Condition 1(type/registers)		
		616	Condition 1(No./status value)		
		617	Condition 2(type/registers)		
		618	Condition 2(No./status value)		
		619	Condition 3(type/registers)		
		620	Condition 3(No./status value)		
		621	Condition 4(type/registers)		
		622	Condition 4(No./status value)		
		623	Condition 5(type/registers)		
		624	Condition 5(No./status value)		
		625	Condition 6(type/registers)		
		626	Condition 6(No./status value)		
		627	Condition 7(type/registers)		
		628	Condition 7(No./status value)		
		629	Condition 8(type/registers)		
		630	Condition 8(No./status value)		
		631	Condition 9(type/registers)		
		632	Condition 9(No./status value)		
		633	Condition 10(type/registers)		
		634	Condition 10(No./status value)		
		635	Command time out time		
		636	Re-dialing interval (s)		
		637	Number of re-dialings		
		638	Modem connection port		
		639	Dialing method		
		640	Call waiting time		
		641	Machine serial No.	Character string	

Section No. : 120 **PLC Switch**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	0 + n	PLC switch X(IN) (n=1 to 64)	Integer	RW
		100 + n	PLC switch Y(OUT) (n=1 to 64)		R
		200	PLC switch X(IN)1 to 16		RW
		201	PLC switch X(IN)17 to 32		
		202	PLC switch X(IN)33 to 48		
		203	PLC switch X(IN)49 to 64		
		210	PLC switch Y(OUT)1 to 16		R
		211	PLC switch Y(OUT)17 to 32		
		212	PLC switch Y(OUT)33 to 48		
		213	PLC switch Y(OUT)49 to 64		

Section No. : 121 **Operation parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	8900 + n	Counter type 1 to 6 (n=1 to 6)	Integer	RW
		8910	Edit undo valid		
		8920	Solid drawing tool compensation selection		

Section No. : 122 **Input/Output parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1 to 32	"9000 + n" equals to parameter No. ("n": Sub-section No.) Refer to the Setup Manual for input/output parameters.	Integer	RW
		33 to 40		Character string	
		41 to 58		Integer	
		59 to 66		Character string	
		67 to 84		Integer	
		85 to 92		Character string	
		93 to 110		Integer	
		111 to 118		Character string	
		119 to 136		Integer	
		137 to 144		Character string	

Section No. : 123 **Computer link parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1 to 24	"9600 + n" equals to parameter No. ("n": Sub-section No.) Refer to the Setup Manual for computer link parameters.	Integer	RW

Section No. : 124	Ethernet parameters

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	Service start	Integer	RW
		2	IP address	Character string	
		3	Subnet mask		
		4	Gateway		
		5	Port No.	Integer	
		6	Ethernet parameter before conversion (Host IP address)	Character string	
		7	Host port No.	Integer	
		50	Automatic IP address setting		
		51	IP address (PC)	Character string	
		52	Subnet mask (PC)		
		53	Gateway (PC)		
		54	Timeout	Integer	
		55	Host No. to use		
		100 + n	User name (Host A to D)(n = 0 to 3)	Character string	
		200 + n	Password (Host A to D)(n = 0 to 3)		
		300 + n	Directory (Host A to D)(n = 0 to 3)		
		400 + n	Host address (Host A to D)(n = 0 to 3)		
		500 + n	Host type (Host 1 to 4)(n = 0 to 3)	Integer	
		600 + n	Host Word position: File (Host 1 to 4)(n = 0 to 3)		
		700 + n	Host Word position: Size (Host 1 to 4)(n = 0 to 3)		
		800 + n	Host Word position: <DIR> (Host 1 to 4)(n = 0 to 3)		
		900 + n	Host Word position: Comment (Host 1 to 4)(n = 0 to 3)		
		1000 + n	Host Word count: Comment (Host 1 to 4)(n = 0 to 3)		
		1100 + n	Host Character remain (Host 1 to 4)(n = 0 to 3)		

Section No. : 125	Barrier

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	P0 X	PLC setting unit	RW
		2	P1 X		
		3	P1 Z		
		4	P2 X		
		5	P2 Z		
		6	P3 X		
		7	P3 Z		
		8	P4 X		
		9	P4 Z		
		10	P5 X		
		11	P5 Z		
		12	P6 X		
		13	P6 Z		
System No.		20	Barrier valid	Integer	
		21	P7 X	PLC setting unit	
		22	P8 X		
		23	P8 Z		
		24	P9 X		
		25	P10 X		
		26	P10 Z		
		27	Barrier type (left)	Integer	
		28	Barrier type (right)		
		29	Delivery axis name	Character string	
		30	Tailstock angle (left)	Integer	
		31	Tailstock angle (right)		

Appendix 1 List of PLC Window Data

Section No. : 126 **Base parameters**

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.		1	System validation setup		
Not used		2	System validation setup (PLC)		
System No.		3	Number of axes		
Not used		4	Number of axes (PLC)		
System No.		5	Input setting unit	Integer	
Not used		6	PLC unit		
System No.		7	Control unit		
Not used		8	Control unit (PLC)		
		10	Initial plane selection		
		11	Base axis I		
		12	Base axis J		
System No.		13	Base axis K	Character string	
		14	Flat axis I		
		15	Flat axis J		
		16	Flat axis K		
System No.		20	Command type		
		21	Ladder selection		
		22	Number of spindles		
		23	Constant input (inch)		
Not used		24	Initial state (inch)		
		25	PLC axis command (inch)		
		26	Select language displayed		
		27	MR-J2-CT Connections		
	Not used	73	Initial absolute setting		RW
		74	Initial synchronous feed		
System No.		75	Initial G00		
		76	ABS/INC address (for L system only)		
		77	Incremental command for diameter specification axis		
		78	Decimal point type 2		
		79	Validate F1 digit		
Not used		80	Specify boring axis (for M system only)		
		81	Give priority to G code parameter	Integer	
		82	Geometric		
		84	Arc error		
		85	G00 dry run		
System No.		86	G00 non-interpolation		
		87	Constant surface speed control by rapid traverse feed command		
		88	Disable G30 soft limit		
		91	Ignore middle point		
		92	Replace tools for additional axis		
		93	Synchronization between part systems method		
Not used		94	Select life count for single block (for L system only)		
		95	TF output		
		96	Tool life management type		
		97	Tool wear compensation number 1-digit command		
		98	Tool length offset number		
		99	Cancel tool compensation amount		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	100	Tool compensation	Integer	RW
		101	Tool compensation method		
		102	Manual tool length measuring system (for L system only)		
		103	Validate life management		
		104	Tool command method 2		
		105	Tool selection method 2		
		106	Life management (for L system only)		
		107	Split life management display screen (for L system only)		
		108	Life management re-count M code (for L system only)		
System No.		109	Validate alternate M code		
		110	M96 alternate M code		
		111	M97 alternate M code		
Not used		112	Validate status trigger method		
		113	Validate interrupt method type 2		
		114	Macro argument initialization		
		115	Waiting for thread cutting		
		116	Invalidate soft limit (manual operation)		
		117	H_sens		
		118	Select how to set up the length of tools on cutter tables (opposed tables) (for L system only)		
		119	Select the mirror image of each facing turret with T command (for L system only)		
		120	Change macro variable		
		121	Edit lock C		
		122	Program display lock C		
		123	Origin set prohibit		
		124	Fix tool compensation No.		
		125	Actual feedrate display		
		126	Playback G90		
		127	DPRINT alignment		
		128	Clear variables by resetting		
		129	Clear variables by power-ON		
		130	Display selected tool number		
		132	brightness		
		135	Unit name		
		140	M code number		
		141	M code number		
		142	M code number		
		143	M code number		
		144	MDI setup lock		
		145	Manual ABS parameter		
		146	Spindle rotation speed clamp function		
		147	Minimum spindle rotation speed clamp type		
		148	Initial high precision		
		149	Arc deceleration speed change		
System No.		151	Reset initial		
Not used		153	Hole bottom deceleration check		
		159	Fixed cycle editing		
		161	Simulation test		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	162	Part system name	Integer	RW
		163	Second miscellaneous code		
		164	Tap return override		
		165	Tap return override		
		166	G04 skip condition		
		167	G31 skip speed	PLC setup unit/min.	
		168	G31.1 skip condition	Integer	
		169	G31.2 skip speed	PLC setup unit/min.	
		170	G31.2 skip condition	Integer	
		171	G31.2 skip speed	PLC setup unit/min.	
		172	G31.3 skip condition	Integer	
		173	G31.3 skip speed	PLC setup unit/min.	
		176	Constant surface speed axis	Integer	
		177	Thread cutting speed	PLC setup unit/min.	
		178	M code for clamp	Integer	
		179	Dwelling time after outputting M code for unclamp		
		180	F1 digit feedrate F1	PLC setup unit/min.	
		181	F1 digit feedrate F2		
		182	F1 digit feedrate F3		
		183	F1 digit feedrate F4		
		184	F1 digit feedrate F5		
		185	Validate inclined axis control (for L system only)	Integer	
		186	Inclination angle (for L system only)		
		187	Compensation at reference position return (for L system only)		
		188	Deceleration check method 1/ Validate in-position check		
		189	Time constant 0 for handle feed		
		190	Macro call for M command		
		191	Macro call for S command		
		192	Macro call for T command		
		193	Macro call with 2nd miscellaneous code		
		194	Select initial spindle control		
		195	Validate acceleration and deceleration with inclination angle constant G0		
		196	Validate acceleration and deceleration with inclination constant G1		
		197	Distance between facing turrets (for L system only)	PLC setup unit	
		198	Select turrets as facing turrets with T command (for L system only)	Integer	
		199	Select turrets as facing turrets with T command (for L system only)		
		200	Acceleration and deceleration before G0 interpolation		
		201	Maximum speed	PLC setup unit/min.	
		202	Time constant	Integer	
		203	Arc radius error compensation factor		
		204	Arc deceleration speed	PLC setup unit/min.	
		205	Modal G code reset	Integer	
		208	Side 1 of inclination angle (for L system only)	PLC setup unit	
		209	Side 2 of inclination angle (for L system only)		
		210	Side 3 of inclination angle (for L system only)		
		211	External deceleration level	PLC setup unit/min.	

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	300	aux01	Integer	RW
		301	aux02		
		302	aux03		
		303	aux04 (for L system only)		
		304	aux05		
		305	aux06		
		306	aux07		
		307	aux08		
		308	aux09		
		309	aux10		
		310	aux11		
		311	aux12		
		350	set01		
		351	set02		
		352	set03		
		353	set04		
		354	set05		
		355	set06		
		356	set07		
		357	set08		
		358	set09		
		359	set10		
		360	set11		
		361	set12		
		400	ext01		
		401	ext02		
		402	ext03		
		403	ext04		
		404	ext05		
		405	ext06		
		406	ext07		
		407	ext08		
		408	ext09		
		409	ext10		
		410	ext11		
		411	ext12		
		412	ext13		
		413	ext14		
		414	ext15		
		415	ext16		
		416	ext17		
		417	ext18		
		418	ext19		
		419	ext20		
		420	ext21		
		421	ext22		
		422	ext23		
		423	ext24		
		424	ext25		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	425	ext26	Integer	RW
		426	ext27		
		427	ext28		
		428	ext29		
		429	ext30		
		430	ext31		
		431	ext32		
		432	ext33		
		433	ext34		
		434	ext35		
		435	ext36		
		500	Near reference position check method		
		501	Automatic return by program restart		
		502	No. of #100 address part system common variables		
		503	No. of #500 address part system common variables		
		506	Deceleration check specification type		
		509	Switch command format		
		510	Minimum value for synchronization M code		
		511	Maximum value for synchronization M code		
		512	Tool life management standard number		
		513	Synchronous tap hole bottom wait time		
		514	Synchronous tap in-position check width (tap axis)		
		524	Chopping compensation value fixing method		
		527	Tool change method specification		
		528	Tool measurement standard positions election		
System No.		600	PLC unit		
		602	Machine error compensation unit		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	1501 to 1503, 1505	Refer to the Setup Manual for base specifications parameters.	Integer	RW
		1506		PLC setup unit/min.	
		1507, 1510 to 1513		Integer	
		1514, 1515		Character string	
		1516 to 1522		Integer	
		1523		PLC setup unit/min.	
		1524		Integer	
		1533		Character string	
		1534		Integer	
		1535		PLC setup unit	
		1537 to 1544		Character string	
		1561 to 1563		Integer	
		1564		PLC setup unit/min.	
		1568 to 1574, 1801 to 1803, 1811 to 1817, 1821 to 1827		Integer	
Not used		1901 to 1911			
System No.		8001 to 8003	Refer to the Setup Manual for user parameters.		
		8004		PLC setup unit/min.	
		8005, 8006		PLC setup unit	
		8007, 8008		Integer	
		8009 to 8013		PLC setup unit	
		8014, 8015		Integer	
		8016 to 8018		PLC setup unit	
		8019 to 8023, 8025, 8026		Integer	

Appendix 1 List of PLC Window Data

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	8027 to 8030	Refer to the Setup Manual for user parameters.	PLC setup unit	RW
		8033 to 8036		Integer	
		8037, 8041 to 8043		PLC setup unit	
Not used		8044		Integer	
System No.		8051 to 8054		PLC setup unit	
		8055		Integer	
		8056, 8057		PLC setup unit	
		8058		Integer	
		8059		PLC setup unit	
		8071, 8072		Integer	
		8075		PLC setup unit	
Not used		8078		Integer	
System No.		8083			
		8084		PLC setup unit	
		8085, 8086		PLC setup unit/min.	
		8090		Integer	
		8091		PLC setup unit	
		8092		Integer	
		8093		PLC setup unit	
		8094		Integer	
Not used		8101 to 8103, 8105 to 8114, 8116			
System No.		8621, 8622		Character string	
		8623 to 8626		PLC setup unit	
		8627		Integer	
		8701 to 8705		PLC setup unit	
		8706		PLC setup unit/min.	
		8707, 8708		PLC setup unit	
		8709, 8710		Integer	
		8711, 8712			

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	10001	G code format	Integer	RW
		10002	M2 Label O		
		10003	M2 Macro converter valid		
		10004	Coordinate rotation angle		
System No.		10005	Coordinate rotation center (Horizontal)		RW
		10006	Coordinate rotation center (Vertical)		
Not used		10007	Machine manufacturer macro password No.		
		10008	Parameter for M3/L3		
		10009	operat1		
		10010	operat2		
		10011	operat3		
		10012	operat5		
		10013	operat7		
		10035	masmac5		

Section No. : 127	Axis parameters

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No.	1	Axis name	Character string	RW
		2	Displayed axis name		
		3	Increment command axis name		
		4	Command unit	Integer	
		5	Output in inch		
		6	Rotational axis		
		7	Motor CCW		
		8	Diameter specification axis		
		9	Spindle interpolation		
		10	Drive unit I/F channel No.		
		12	Command address during cross machining	Character string	
		13	Incremental command address during cross machining		
		101	Manual ABS updating	Integer	
		102	Tool compensation function		
		103	Manual dog-type		
		104	Error correction		
		105	JOG response type		
		106	JOG start (+) Device selection	Character string	
		107	JOG start (-) Device selection		
		108	Slave axis No.	Integer	
		109	No_dsp		
		110	Axis name		
		111	Axis release		
		112	+/- JOG start signal device name		
		1010	Axis designated for chopping		
		2001, 2002	Refer to the Setup Manual for axis specifications parameters.	PLC setup unit/min.	
		2003 to 2010		Integer	
		2011, 2012		Interpolat-ion unit	
		2013 to 2016		PLC setup unit	
		2017 to 2019		Integer	
		2020		PLC setup unit	
		2021		PLC setup unit/min.	
		2022		Integer	
		2023		PLC setup unit/min.	
		2024, 2061, 2062		PLC setup unit	
		2063, 2068 to 2071		Integer	

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Axis No.	2072	Refer to the Setup Manual for axis specifications parameters.	PLC setup unit	
		2073 to 2080		Integer	
		2081		PLC setup unit/min.	
		2082, 2084, 2087		Integer	
		2088, 2089		Character string	
		2090, 2091		PLC setup unit/min.	
		2092 to 2095		Integer	
		2096		PLC setup unit/min.	
		2097, 2098		PLC Setup unit	
		2102, 2103, 2106		Integer	
		2109, 2110		PLC setup unit/min.	
		2111 to 2115, 2121 to 2129		Integer	
		2130 to 2133		PLC setup unit	
		2134 to 2137		Integer	
		2138		PLC setup unit	
		8201 to 8203		Integer	
		8204 to 8206		PLC setup unit	
		8207, 8208		Integer	
		8209		PLC setup unit	
		8210, 8211		Integer	
		10000		Character string	
		10001, 10002		PLC setup unit	
		10003, 10004		Integer	
		10101	Rapid traverse rate (for integer setting)		
		10102	Cutting feed clamp speed(for integer setting)		

Section No. : 128	Rotary Axis Configuration Parameters

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	7900 to 7902	Refer to the Setup Manual for rotary axis configuration parameters.	Character string	RW
		7903 to 7907, 7920		Integer	
		7922		Character string	
		7923		Integer	
		7924 to 7926		PLC setup unit	
		7930		Integer	
		7932		Character string	
		7933		Integer	
		7934 to 7936		PLC setup unit	
		7940		Integer	
		7942		Character string	
		7943		Integer	
		7944 to 7946		PLC setup unit	
		7950		Integer	
		7952		Character string	
		7953		Integer	
		7954 to 7956		PLC setup unit	

Section No. : 140	Ladder I/F(common)

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
System No.	Not used	n	Load meter name (n=1,2)	Character string	R
		n + 10	Load meter scale comment 1st line (n=1,2)		
		n + 20	Load meter unit comment (n=1,2)		
		n + 30	Load meter scale comment 2nd line (n=1,2)		
Not used	Not used	n + 100	Spindle standby tool comment (n=0 to 4)		
		n + 200	PLC switch message (n=1 to 64)		

Section No. : 150	User open I/F parameter

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	1	SRAM open usable amount	Integer	R
		2	SRAM open spare amount	Integer	R
		101	Device open parameter clear	Character string	W
		102	Device open parameter clear	Character string	W
		(x)	Device open parameter device allocation (x=40001 to 40100)	Character string	RW
		(10000 + (x))	Device open parameter data type (x=40001 to 40100)	Character string	RW
		(20000 + (x))	Device open parameter number of data (x=40001 to 40100)	Integer	RW
		(30000 + (x))	Device open parameter display format (x=40001 to 40100)	Character string	RW
		(x)	SRAM open parameter data type (x=41001 to 41100)	Character string	RW
		(10000 + (x))	SRAM open parameter numbef of data (x=41001 to 41100)	Integer	RW
		(20000 + (x))	SRAM open parameter display format (x=41001 to 41100)	Character string	RW

Section No. : 151	User open I/F data

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	(x)	#41001 SRAM open data(x=1-9999999)	Integer	RW
		(10000000 +(x))	#41002 SRAM open data(x=1-9999999)		
		(20000000 +(x))	#41003 SRAM open data(x=1-9999999)		
		(30000000 +(x))	#41004 SRAM open data(x=1-9999999)		
		(40000000 +(x))	#41005 SRAM open data(x=1-9999999)		
		(50000000 +(x))	#41006 SRAM open data(x=1-9999999)		
		(60000000 +(x))	#41007 SRAM open data(x=1-9999999)		
		(70000000 +(x))	#41008 SRAM open data(x=1-9999999)		
		(80000000 +(x))	#41009 SRAM open data(x=1-9999999)		
		(90000000 +(x))	#41010 SRAM open data(x=1-9999999)		
		(100000000 +(x))	#41011 SRAM open data(x=1-9999999)		
		(110000000 +(x))	#41012 SRAM open data(x=1-9999999)		
		(120000000 +(x))	#41013 SRAM open data(x=1-9999999)		
		(130000000 +(x))	#41014 SRAM open data(x=1-9999999)		
		(140000000 +(x))	#41015 SRAM open data(x=1-9999999)		
		(150000000 +(x))	#41016 SRAM open data(x=1-9999999)		
		(160000000 +(x))	#41017 SRAM open data(x=1-9999999)		
		(170000000 +(x))	#41018 SRAM open data(x=1-9999999)		
		(180000000 +(x))	#41019 SRAM open data(x=1-9999999)		
		(190000000 +(x))	#41020 SRAM open data(x=1-9999999)		
		(200000000 +(x))	#41021 SRAM open data(x=1-9999999)		
		(210000000 +(x))	#41022 SRAM open data(x=1-9999999)		
		(220000000 +(x))	#41023 SRAM open data(x=1-9999999)		
		(230000000 +(x))	#41024 SRAM open data(x=1-9999999)		
		(240000000 +(x))	#41025 SRAM open data(x=1-9999999)		
		(250000000 +(x))	#41026 SRAM open data(x=1-9999999)		
		(260000000 +(x))	#41027 SRAM open data(x=1-9999999)		
		(270000000 +(x))	#41028 SRAM open data(x=1-9999999)		
		(280000000 +(x))	#41029 SRAM open data(x=1-9999999)		
		(290000000 +(x))	#41030 SRAM open data(x=1-9999999)		
		(300000000 +(x))	#41031 SRAM open data(x=1-9999999)		
		(310000000 +(x))	#41032 SRAM open data(x=1-9999999)		
		(320000000 +(x))	#41033 SRAM open data(x=1-9999999)		
		(330000000 +(x))	#41034 SRAM open data(x=1-9999999)		
		(340000000 +(x))	#41035 SRAM open data(x=1-9999999)		
		(350000000 +(x))	#41036 SRAM open data(x=1-9999999)		
		(360000000 +(x))	#41037 SRAM open data(x=1-9999999)		
		(370000000 +(x))	#41038 SRAM open data(x=1-9999999)		
		(380000000 +(x))	#41039 SRAM open data(x=1-9999999)		
		(390000000 +(x))	#41040 SRAM open data(x=1-9999999)		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	(400000000 +(x))	#41041 SRAM open data(x=1-9999999)	Integer	RW
		(410000000 +(x))	#41042 SRAM open data(x=1-9999999)		
		(420000000 +(x))	#41043 SRAM open data(x=1-9999999)		
		(430000000 +(x))	#41044 SRAM open data(x=1-9999999)		
		(440000000 +(x))	#41045 SRAM open data(x=1-9999999)		
		(450000000 +(x))	#41046 SRAM open data(x=1-9999999)		
		(460000000 +(x))	#41047 SRAM open data(x=1-9999999)		
		(470000000 +(x))	#41048 SRAM open data(x=1-9999999)		
		(480000000 +(x))	#41049 SRAM open data(x=1-9999999)		
		(490000000 +(x))	#41050 SRAM open data(x=1-9999999)		
		(500000000 +(x))	#41051 SRAM open data(x=1-9999999)		
		(510000000 +(x))	#41052 SRAM open data(x=1-9999999)		
		(520000000 +(x))	#41053 SRAM open data(x=1-9999999)		
		(530000000 +(x))	#41054 SRAM open data(x=1-9999999)		
		(540000000 +(x))	#41055 SRAM open data(x=1-9999999)		
		(550000000 +(x))	#41056 SRAM open data(x=1-9999999)		
		(560000000 +(x))	#41057 SRAM open data(x=1-9999999)		
		(570000000 +(x))	#41058 SRAM open data(x=1-9999999)		
		(580000000 +(x))	#41059 SRAM open data(x=1-9999999)		
		(590000000 +(x))	#41060 SRAM open data(x=1-9999999)		
		(600000000 +(x))	#41061 SRAM open data(x=1-9999999)		
		(610000000 +(x))	#41062 SRAM open data(x=1-9999999)		
		(620000000 +(x))	#41063 SRAM open data(x=1-9999999)		
		(630000000 +(x))	#41064 SRAM open data(x=1-9999999)		
		(640000000 +(x))	#41065 SRAM open data(x=1-9999999)		
		(650000000 +(x))	#41066 SRAM open data(x=1-9999999)6		
		(660000000 +(x))	#41067 SRAM open data(x=1-9999999)		
		(670000000 +(x))	#41068 SRAM open data(x=1-9999999)		
		(680000000 +(x))	#41069 SRAM open data(x=1-9999999)		
		(690000000 +(x))	#41070 SRAM open data(x=1-9999999)		
		(700000000 +(x))	#41071 SRAM open data(x=1-9999999)		
		(710000000 +(x))	#41072 SRAM open data(x=1-9999999)		
		(720000000 +(x))	#41073 SRAM open data(x=1-9999999)		
		(730000000 +(x))	#41074 SRAM open data(x=1-9999999)		
		(740000000 +(x))	#41075 SRAM open data(x=1-9999999)		
		(750000000 +(x))	#41076 SRAM open data(x=1-9999999)		
		(760000000 +(x))	#41077 SRAM open data(x=1-9999999)		
		(770000000 +(x))	#41078 SRAM open data(x=1-9999999)		
		(780000000 +(x))	#41079 SRAM open data(x=1-9999999)		
		(790000000 +(x))	#41080 SRAM open data(x=1-9999999)		

Sub-ID	Significance of data No.	Sub-section No.	Details described Sub-section No.	Data type	R/W
Not used	Not used	(800000000 +(x))	#41081 SRAM open data(x=1-9999999)	Integer	RW
		(810000000 +(x))	#41082 SRAM open data(x=1-9999999)		
		(820000000 +(x))	#41083 SRAM open data(x=1-9999999)		
		(830000000 +(x))	#41084 SRAM open data(x=1-9999999)		
		(840000000 +(x))	#41085 SRAM open data(x=1-9999999)		
		(850000000 +(x))	#41086 SRAM open data(x=1-9999999)		
		(860000000 +(x))	#41087 SRAM open data(x=1-9999999)		
		(870000000 +(x))	#41088 SRAM open data(x=1-9999999)		
		(880000000 +(x))	#41089 SRAM open data(x=1-9999999)		
		(890000000 +(x))	#41090 SRAM open data(x=1-9999999)		
		(900000000 +(x))	#41091 SRAM open data(x=1-9999999)		
		(910000000 +(x))	#41092 SRAM open data(x=1-9999999)		
		(920000000 +(x))	#41093 SRAM open data(x=1-9999999)		
		(930000000 +(x))	#41094 SRAM open data(x=1-9999999)		
		(940000000 +(x))	#41095 SRAM open data(x=1-9999999)		
		(950000000 +(x))	#41096 SRAM open data(x=1-9999999)		
		(960000000 +(x))	#41097 SRAM open data(x=1-9999999)		
		(970000000 +(x))	#41098 SRAM open data(x=1-9999999)		
		(980000000 +(x))	#41099 SRAM open data(x=1-9999999)		
		(990000000 +(x))	#41100 SRAM open data(x=1-9999999)		

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Revision History

Date of revision	Manual No.	Revision details
Nov. 2008	IB(NA)1500920-A	First edition created.
Jan. 2009	IB(NA)1500920-B	Mistakes were corrected.
Mar. 2010	IB(NA)1500920-C	Mistakes were corrected.
June. 2011	IB(NA)1500920-D	Corrections and additions were made corresponding to S/W version G5. - SB and SW were added to "2.9 List of Devices Used". (Special relay and special register for CC-Link) - R13312 to R32767 were added to "2.10 File Register General Map". - Following signals were added to "4. Input/Output Signals with Controller". 4.1 PLC Input Signals (Bit type: X***) X711 Optimum acceleration/deceleration switching parameter completion [spindle] ▲ X728 Modbus/TCP communicating ▲ X729 Modbus time-out 1 ▲ X72A Modbus time-out 2 ▲ X753 In multi-step speed monitor ▲ XB00 to XB1F Clamp command 1st axis to 8th axis ▲ XC7F Chopping compensation update prevented XC9C NC warning (Servo warning) XCAA Optimum acceleration/deceleration parameter switch completion [axis] ▲ XCCA Tool length measurement completion ▲ XCCB Tool length measurement error ▲ XCCE Tool length measurement sub-side selected ▲ XCCF Tool retract position reached ▲ XCD0 With tool retract amount command ▲ XCD1 In tool repositioning ▲ XCED Optimum machining diagnosis in progress ▲ XCEE Cutting torque estimation in progress ▲ XCEF Cutting torque estimation completed ▲ 4.2 PLC Input Signals (Data type: R***) R83 Modbus/RTU received packet monitor ▲ R84 Modbus/RTU communication error monitor ▲ R90 Modbus/TCP connection request monitor ▲ R91 Modbus/TCP number of connections monitor ▲ R92 Modbus/TCP received packet monitor ▲ R93 Modbus/TCP communication error monitor ▲ R94 Modbus/TCP protocol error packet monitor ▲ R98 Multi-step speed monitor selected speed output ▲ R168 to R173 PLC axis alarm/warning No. 1st axis to 6th axis R578 Measurement tool tip point No. ▲ R646 Machining mode state ▲ R652 Censor ON Tool length compensation No. (BCD output) ▲ R653 Censor ON Tool wear compensation No. (BCD output) ▲ R654 Compensation data update Tool length compensation No. (BCD output) ▲ R655 Compensation data update Tool wear compensation No. (BCD output) ▲ R684 Specific user NC status 1 ▲ R688 Specific user Manual skip Axis in skip motion ▲ R689 Specific user Manual skip Skip motion direction ▲ R690 Specific user Error/Warning detail ▲ (Continue to the next page)

Date of revision	Manual No.	Revision details
		(Continued from the previous page) R5140 to R5171 Optimum acceleration/deceleration parameter group currently selected [axis] 1st axis to 8th axis ▲ R5332 to R5363 Servo alarm/warning No. 1st axis to 8th axis R5364,R5365/R5368,R5369/R5372,R5373/R5376,R5377/R5380, R5381/R5384,R5385/R5388,R5389/R5392,R5393 Skip coordinate position feature coordinate 1st axis to 8th axis R5492 to R5523 Cutting torque output value 1st axis to 8th axis ▲ R5524 to R5555 Actual machining time 1st axis to 8th axis ▲ R6514 Optimum acceleration/deceleration estimated inertia ratio [spindle] ▲ R6515 Optimum acceleration/deceleration parameter group currently selected [spindle] ▲ R6527 Spindle actual machining time ▲ R6528 Spindle cutting torque output value ▲ R6529 Spindle alarm/warning No. R20516 Appropriate machining diagnosis error axis ▲ 4.3 PLC Output Signals (Bit type: Y***) Y706 Modbus Time-out 1 cancel ▲ Y707 Modbus Time-out 2 cancel ▲ Y711 Optimum acceleration/deceleration parameter switch request [spindle] ▲ YB00 to YB1F Clamp completion 1st axis to 8th axis ▲ YC8E Manual tool length measurement interlock temporarily canceled ▲ YCCF Tool retract start ▲ YCD5 Optimum acceleration/deceleration parameter switching request [axis] ▲ YCD7 Chopping compensation update prevention request YCEF Cutting torque estimation in progress ▲ YCFE Appropriate machining diagnosis in progress ▲ YCFF Appropriate machining diagnosis error reset ▲ 4.4 PLC Output Signals (Data type: R***) R255 PLC axis OT ignored R279 PLC axis near-point dog ignored R377 Load meter comment designation R391 Optimum acceleration/deceleration parameter switching axis (spindle and bit selection) ▲ R470 Modbus block 1 transfer position ▲ R471 Modbus block 1 number of transfer ▲ R472 Modbus block 2 transfer position ▲ R473 Modbus block 2 number of transfer ▲ R474 Modbus block 3 transfer position ▲ R475 Modbus block 3 number of transfer ▲ R476 Modbus block 4 transfer position ▲ R477 Modbus block 4 number of transfer ▲ R478 Modbus transfer cycle ▲ R479 Modbus time-out period ▲ R2599 Workpiece coordinate selection ▲ R2617 Optimum acceleration/deceleration parameter switching axis (axis and bit selection) ▲ R2684 For specific users NC control signal 1 ▲ R2688 Specific users Manual skip motion direction (-) ▲ R2689 Specific users Manual skip motion direction (+) ▲ R6052 to R6083 External deceleration speed selection 1st axis to 8th axis ▲ R6084 to R6115 Optimum acceleratin/deceleration parameter group selection 1st axis to 8th axis ▲ (Continue to the next page)

Date of revision	Manual No.	Revision details
		(Continued from the previous page) R6116 to R6147 Target machining time 1st axis to 8th axis ▲ R7003 Optimum acceleration/deceleration parameter group selection [spindle] ▲ R7004 Spindle target machining time ▲ R20200/R20204/R20208/R20212/R20216/R20220/R20224/R20228 Skip coordinate (PLC axis 1st axis to 8th axis) ▲ R22692 Cutting torque estimation target axis ▲ (▲…For specific manufacturer) 4.5 Special Relay/Register SB and SW were added - Explanation for the following signals were added to "6. Explanation of Interface Signals". 6.1 PLC Input Signals (Bit Type: X***) X728 Modbus/TCP communicating ▲ X729 Modbus time-out 1 ▲ X72A Modbus time-out 2 ▲ XC7F Chopping compensation update prevented XC9C NC warning (Servo warning) 6.2 PLC Input Signals (Data Type: R***) R83 Modbus/RTU received packet monitor ▲ R84 Modbus/RTU communication error monitor ▲ R90 Modbus/TCP connection request monitor ▲ R91 Modbus/TCP number of connections monitor ▲ R92 Modbus/TCP received packet monitor ▲ R93 Modbus/TCP communication error monitor ▲ R94 Modbus/TCP protocol error packet monitor ▲ R168 PLC axis alarm/warning R5332 Servo alarm/warning No. R5364 Skip coordinate position feature coordinate R6529 Spindle alarm/warning No. R8290 Optimum acceleration/deceleration estimated inertia level ▲ 6.3 PLC Output Signals (Bit Type: Y***) Y706 Modbus Time-out 1 cancel ▲ Y707 Modbus Time-out 2 cancel ▲ YCD7 Chopping compensation update prevention request 6.4 PLC Output Signals (Data Type: R***) R377 Load meter comment designation R470 Modbus block 1 transfer position ▲ R471 Modbus block 1 number of transfer ▲ R472 Modbus block 2 transfer position ▲ R473 Modbus block 2 number of transfer ▲ R474 Modbus block 3 transfer position ▲ R475 Modbus block 3 number of transfer ▲ R476 Modbus block 4 transfer position ▲ R477 Modbus block 4 number of transfer ▲ R478 Modbus transfer cycle ▲ R479 Modbus time-out period ▲ R7003 Optimum acceleration/deceleration parameter group selection [spindle] ▲ - "6.6.15 CC-Link" was added. - "Appendix 1 List of PLC Window Data" was updated. - Mistakes were corrected.

Date of revision	Manual No.	Revision details
Dec. 2011	IB(NA)1500920-E	Additions and changes were made corresponding to S/W version H0. - "How to handle this product" was added. - Configuration diagrams of M700V and M70V were added to "2. System Configuration". - "2.1.4 Relationship between MITSUBISHI CNC Operation Panel and the Device" was added. - The following signals were added to "4. Input/Output Signals with Controller". 4.1 PLC Input Signals (Bit type:X***) XD18 Tool axis coordinate system in manual feed for 5-axis machining (JOG, INC) XD19 Table coordinate system in manual feed for 5-axis machining (JOG, INC) XD1A Feature coordinate system in manual feed for 5-axis machining (JOG, INC) XD1B Tool axis coordinate system in manual feed for 5-axis machining (1st handle) XD1C Table coordinate system in manual feed for 5-axis machining (1st handle) XD1D Feature coordinate system in manual feed for 5-axis machining (1st handle) XD1E Tool axis coordinate system in manual feed for 5-axis machining (2nd handle) XD1F Table coordinate system in manual feed for 5-axis machining (2nd handle) XD20 Feature coordinate system in manual feed for 5-axis machining (2nd handle) XD21 Tool axis coordinate system in manual feed for 5-axis machining (3rd handle) XD22 Table coordinate system in manual feed for 5-axis machining (3rd handle) XD23 Feature coordinate system in manual feed for 5-axis machining (3rd handle) XD27 In tool center point rotation 4.3 PLC Output Signals (Bit type: Y***) YD18 Manual feed for 5-axis machining (JOG, INC) in tool axis coordinate system YD19 Manual feed for 5-axis machining (JOG, INC) in table coordinate system YD1A Manual feed for 5-axis machining (JOG, INC) in feature coordinate system YD1B Manual feed for 5-axis machining (1st handle) in tool axis coordinate system YD1C Manual feed for 5-axis machining (1st handle) in table coordinate system YD1D Manual feed for 5-axis machining (1st handle) in feature coordinate system YD1E Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system YD1F Manual feed for 5-axis machining (2nd handle) in table coordinate system YD20 Manual feed for 5-axis machining (2nd handle) in feature coordinate system YD21 Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system YD22 Manual feed for 5-axis machining (3rd handle) in table coordinate system YD23 Manual feed for 5-axis machining (3rd handle) in feature coordinate system YD27 Tool center point rotation (Continue to the next page)

Date of revision	Manual No.	Revision details
		(Continued from the previous page) - The following signal explanations were added to "6 Explanation of Interface Signals". 6.1 PLC Input Signals (Bit Type: X***) XCC1 In small diameter deep hole cycle XD18 Tool axis coordinate system in manual feed for 5-axis machining (JOG, INC) XD19 Table coordinate system in manual feed for 5-axis machining (JOG, INC) XD1A Feature coordinate system in manual feed for 5-axis machining (JOG, INC) XD1B Tool axis coordinate system in manual feed for 5-axis machining (1st handle) XD1C Table coordinate system in manual feed for 5-axis machining (1st handle) XD1D Feature coordinate system in manual feed for 5-axis machining (1st handle) XD1E Tool axis coordinate system in manual feed for 5-axis machining (2nd handle) XD1F Table coordinate system in manual feed for 5-axis machining (2nd handle) XD20 Feature coordinate system in manual feed for 5-axis machining (2nd handle) XD21 Tool axis coordinate system in manual feed for 5-axis machining (3rd handle) XD22 Table coordinate system in manual feed for 5-axis machining (3rd handle) XD23 Feature coordinate system in manual feed for 5-axis machining (3rd handle) XD27 In tool center point rotation 6.3 PLC Output Signals (Bit Type: Y***) YCCA Small diameter deep hole drilling cycle YD18 Manual feed for 5-axis machining (JOG, INC) in tool axis coordinate system YD19 Manual feed for 5-axis machining (JOG, INC) in table coordinate system YD1A Manual feed for 5-axis machining (JOG, INC) in feature coordinate system YD1B Manual feed for 5-axis machining (1st handle) in tool axis coordinate system YD1C Manual feed for 5-axis machining (1st handle) in table coordinate system YD1D Manual feed for 5-axis machining (1st handle) in feature coordinate system YD1E Manual feed for 5-axis machining (2nd handle) in tool axis coordinate system YD1F Manual feed for 5-axis machining (2nd handle) in table coordinate system YD20 Manual feed for 5-axis machining (2nd handle) in feature coordinate system YD21 Manual feed for 5-axis machining (3rd handle) in tool axis coordinate system YD22 Manual feed for 5-axis machining (3rd handle) in table coordinate system YD23 Manual feed for 5-axis machining (3rd handle) in feature coordinate system YD27 Tool center point rotation - Description of the manual speed command 2 was added to "6.6.12 Manual Speed Command". - "6.6.16 Manual Feed for 5-axis Machining" was added. - "Section No.: 126 Base parameters" in "Appendix 1.2 Sub-section No. List" was updated. - Mistakes were corrected.

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Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible. Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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MODEL CODE	100-210
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