FANUC Series 0*i* -MODEL D
FANUC Series 0*i* Mate-MODEL D

START-UP MANUAL

B-64304EN-3/01

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In this manual we have tried as much as possible to describe all the various matters.
However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.
Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

PREFACE

This manual describes parameter settings required to start up the FANUC Series 0*i*-MODEL D / 0*i* Mate-MODEL D.

The manual is organized into the following chapters.

Chapter 1 Parameter setting support screen
Describes the parameter setting support screen and the standard settings of parameters about an overview of each item.
Chapter 2 Initialization of the NC parameters related to axis settings
Describes how to make the minimum initialization required to start up NC axes.
Chapter 3 Initialization of servo
Describes how to make the minimum initialization required to drive the servo motor.
Chapter 4 Initialization of servo parameters
Describes how to set the standard settings of servo parameters.
Chapter 5 Initialization of the NC parameters related to high precision settings
Describes minimum initial setting required for high-precision machining.
Chapter 6 Initialization of the NC parameters related to spindle settings
Describes how to make the minimum initialization required to drive the spindle motor.
Chapter 7 Initialization of the other NC parameters
Describes how to make initialization required to start up the other NCs such as those related to DI/DO.
Chapter 8 Tuning
Describes servo adjustment, spindle adjustment, and machining parameter adjustment.
Chapter 9 Parameters recommended to be set
Describes how to set the parameters required for high-speed and high-precision machining and the servo parameters required to be adjusted.

Since "Example of setting" in the following descriptions indicates reference values for initialization, determine the best setting based on the characteristics and usage of the machine.

Related manuals

The following table lists the manuals related to Series 0*i*-MODEL D, Series 0*i* Mate-MODEL D. This manual is indicated by an asterisk(*).

Document name	Document number	Major contents	Major usage	
FANUC Series 0*i*-MODEL D/0*i* Mate-MODEL D START-UP MANUAL	B-64304EN-3	• Initial setting	• Start up the system (Software)	*
FANUC Series 0*i*-MODEL D/0*i* Mate-MODEL D PARAMETER MANUAL	B-64310EN	• Initial setting • Setting parameters • Description of parameters	• Start up the system (Software) • Turning the system (Parameters)	
FANUC Series 0*i*-MODEL D/0*i* Mate-MODEL D CONNECTION MANUAL (FUNCTION)	B-64303EN-1	• Initial setting • Setting signals	• Setting parameters (Parameter set supporting screen) • Start up the system (Software)	
FANUC AC SERVO MOTOR αis series FANUC AC SERVO MOTOR αi series FANUC AC SERVO MOTOR βis series SERVO TUNING PROCEDURE (BASIC)	B-65264EN	• Initial setting • Servo tuning	• Setting parameters (high speed and high precision) • Turning the system (Parameters)	

Document name	Document number	Major contents	Major usage	
FANUC AC SERVO MOTOR $\alpha i/\beta i$ series, FANUC LINEAR MOTOR L*i*S series FANUC SYNCHRONOUS BUILT-IN SERVO MOTOR D*i*S series PARAMETER MANUAL	B-65270EN	• Initial setting • Setting parameters • Description of parameters	• Start up the system (Software) • Turning the system (Parameters)	
FANUC AC SPINDLE MOTOR $\alpha i/\beta i$ series, BUILT-IN SPINDLE MOTOR B*i* series PARAMETER MANUAL	B-65280EN	• Initial setting • Setting parameters • Description of parameters	• Start up the system (Software) • Turning the system (Parameters)	

TABLE OF CONTENTS

1 PARAMETER SETTING SUPPORT SCREEN

Chapter 1, “PARAMETER SETTING SUPPORT SCREEN”, consists of the following sections:

1.1 OVERVIEW

The parameter setting support screen sets or adjusts parameters in order to:

- Start a machine easily by collecting and displaying the minimum parameters required to start up a machine.
- Adjust a machine smoothly by displaying the servo setting screen, spindle setting screen, and machining parameter setting screen.

Preparation

Turn on the power of the NC in the emergency stop state and, on the setting screen, set "PARAMETER ENABLE SWITCH ON" (bit 0 (PWE) of parameter No. 8900 is 1).

First of all, the number of NC axes is set to parameter No.8130(Number of controlled axes).
When parameter No.8130 is set to 0, three axes can be used in M-series and two axes can be used in T-series.

[Set procedure of parameter No.8130]
(1) Press function key [SYSTEM] to display the parameter screen.
(2) Press soft key [NO.SRH] after inputting "8130" to display parameter No.8130.
(3) Press MDI key [INPUT] after inputting the number of axes to set the number of axes.
(4) Afterwards, setting the number of axes becomes effective by cutting the power supply of NC.

Displaying the parameter setting support screen

Display the parameter setting support screen by either of the following two methods.
Method 1. Press function key [SYSTEM] several times to display the parameter setting support screen.
PARAMETER→DIAGNOSTIC→Parameter setting support screen

Method 2. Press function key [SYSTEM] and press continuous menu key [+] several times to display soft key [PRMSET]. Press soft key [PRMSET] to display the parameter setting support screen.

However, bit 2 (CPR) of parameter No. 3195 can be set to 1 to prevent the parameter setting support screen from being displayed by the function key (disabling Method 1 above). To maintain conventional operability, set this parameter. In this case, the parameter setting support screen can be displayed only by Method 2.

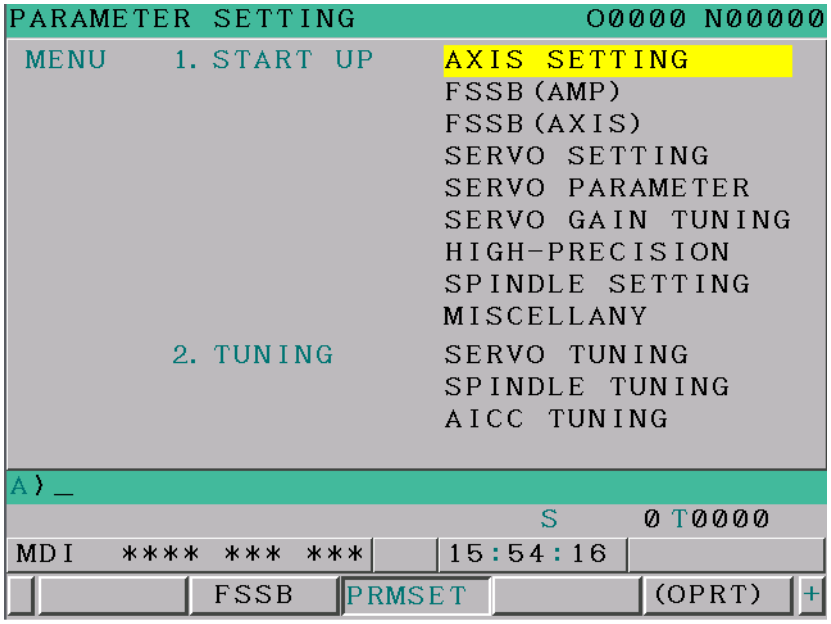


Fig. 1.1 (a) Parameter setting support screen

1.2 OVERVIEW OF ITEMS

The items displayed on the parameter setting support screen are summarized below.

START UP

The items of START UP set the minimum parameters required to start up a machine.

Startup items

Item	Description
AXIS SETTING	Sets the CNC parameters about axes, spindles, coordinates, feedrate, and acceleration/deceleration.
FSSB (AMP)	Displays the FSSB amplifier setting screen.
FSSB (AXIS)	Displays FSSB axis setting screen.
SERVO SETTING	Displays the servo setting screen.
SERVO PARAMETER	Sets the CNC parameters about servo current control, speed control, position control, and backlash acceleration.
SERVO GAIN TUNING	Tunes speed loop gain automatically.
HIGH-PRECISION	Sets the CNC parameters about servo time constants and automatic acceleration/deceleration.
SPINDLE SETTING	Displays the spindle setting screen.
MISCELLANY	Sets the CNC parameters about DI/DO and serial spindles.

TUNING

The items of TUNING display the screens for tuning servo, spindles, high-speed and high-precision machining.

Tuning items

Item	Description
SERVO TUNING	Displays the servo tuning screen.
SPINDLE TUNING	Displays the spindle tuning screen.
AICC TUNING	Displays the machining parameter tuning (advanced preview control/AI contour control) screen.

NOTE
AICC TUNING appears only when the machining condition selection function (optional) is provided.

1.3 SETTING DEFAULTS

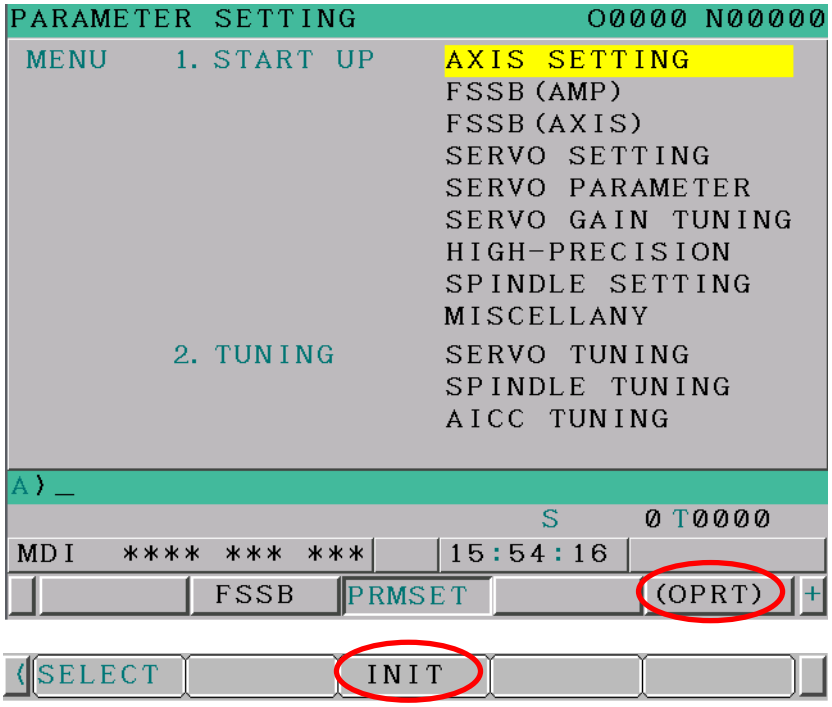
Soft key [INIT] can be used to set the defaults for all parameters of the target item.

NOTE
1 Only the following items can be initialized.
- AXIS SETTING
- SERVO PARAMETER
- HIGH-PRECISION
- MISCELLANY

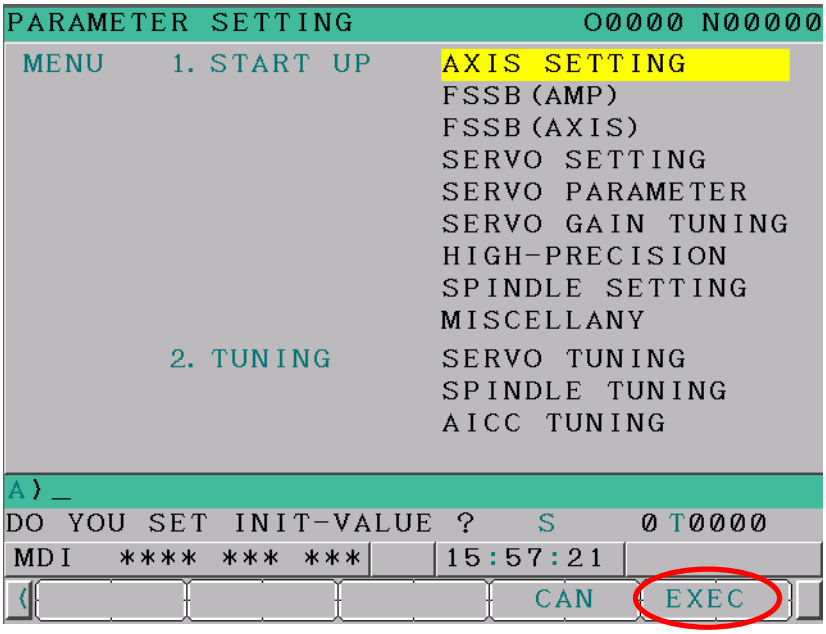
2 Before performing this operation, the emergency stop state must be entered.
3 The defaults are values recommended by FANUC and user-specific defaults cannot be set.
4 This operation sets all parameters, but it is also possible to set parameters for each group or to set parameters individually.
For details, see Chapter 2 and later in this manual.

Operation

Make sure that "PARAMETER ENABLE SWITCH ON" is set on the setting screen.
Select the MDI mode and move the cursor to the item to be initialized on the parameter setting support menu screen. Press soft key [(OPRT)] to display soft key [INIT] below.



Press soft key [INIT]. The soft keys change as shown below and a warning message saying "DO YOU SET INIT-VALUE ?" appears.



Press soft key [EXEC] to set the default value of the selected item. This operation automatically sets any selected parameters for which the default values are provided to their default values. So, be careful to set the default values.
To cancel the setting of the default values, press soft key [CAN]. However, the parameters for which the default values are not provided are not changed.

2 INITIALIZATION OF THE NC PARAMETERS RELATED TO AXIS SETTINGS

Chapter 2, “INITIALIZATION OF THE NC PARAMETERS RELATED TO AXIS SETTINGS”, consists of the following sections:

2.1 INITIALIZATION PROCEDURE

(1) Preparation

Display the parameter setting support screen. For details, refer to Section 1.1, "OVERVIEW" in this manual.

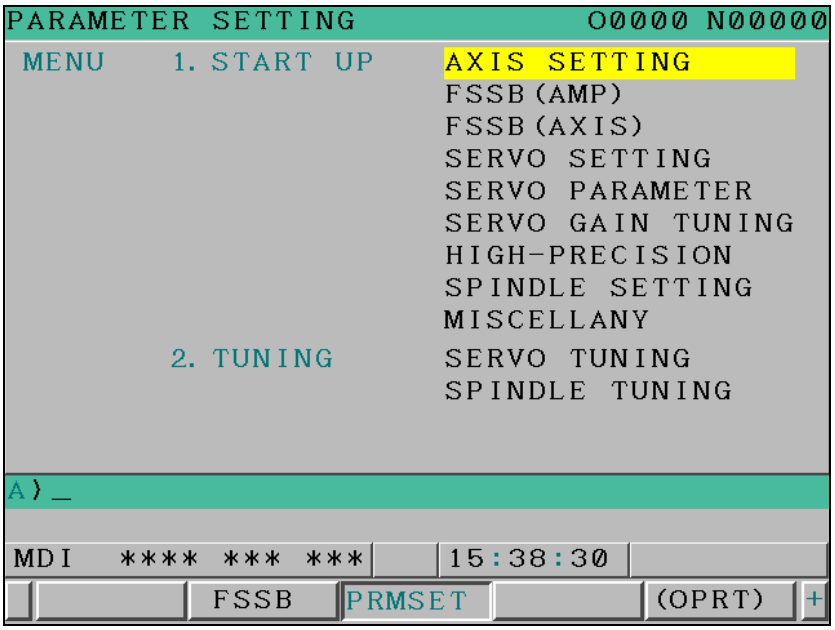


Fig. 2.1 (a) Parameter setting support screen

Press soft key [(OPRT)], move the cursor to AXIS SETTING, and press [SELECT] to display the parameter setting screen (Fig. 2.1 (b)). Use this screen to make the following parameter settings.

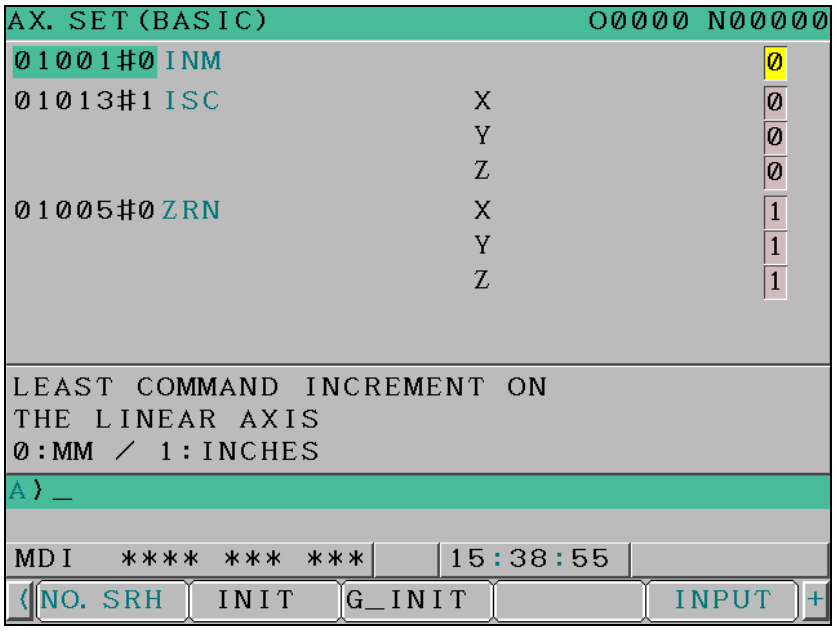


Fig. 2.1 (b) Parameter setting screen

(2) Initialization

Parameters are initialized on the START UP screen. On the START UP screen, parameters are classified into several groups, each of which is displayed on successive pages.

Initialization is made for each group. The procedure is described below.

NOTE

1 Since "Example of setting" in the following descriptions indicates reference values for initialization.
Determine the best setting based on the characteristics and usage of the machine.

2 "Example of setting" in the following descriptions assume that the setting unit for all axes is IS-B (bit 1 of parameter No. 1013 is 0) and the input unit is in millimeters (bit 2 of parameter No. 0000 is 0).

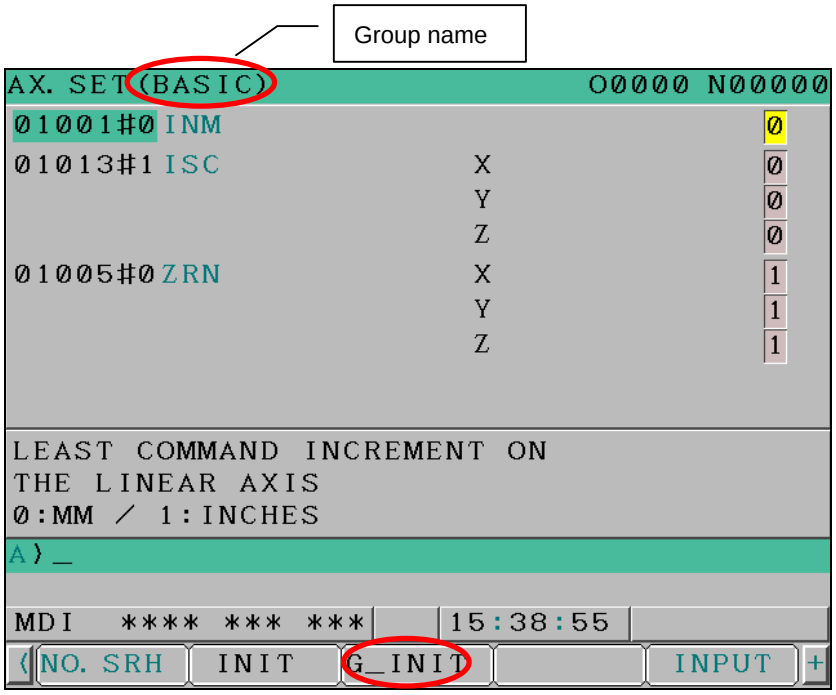
3 For details on the individual parameters, refer to the parameter manual.

<1> BASIC group

<1>-1 Setting the standard values

The standard values are set for the parameters in the BASIC group.

Press the PAGEUP or PAGEDOWN key several times until the BASIC group screen appears and then press soft key [G_INIT].



The message "DO YOU SET INIT-VALUE" appears.
Press soft key [EXEC].

This sets the standard values for the parameters in the BASIC group.

NOTE

1 The parameters on all pages in the group are set to the standard values regardless of the page on which [G_INIT] is selected.
2 Some parameters have no standard value. The values of these parameters do not change even after setting the standard values.
3 Depending on the default setting, alarm PW0000 "PLEASE TURN OFF POWER" may be issued and the alarm screen may appear, but it is not necessary to turn off the power. Display the START UP screen again as described in "(1) Preparation" and then proceed to the next procedure.

<1>-2 Setting parameters for additional axes

When no additional axes are present, proceed to Step <<1>-3 Setting parameters without the standard values>.

NOTE
1 The standard value settings made in Step <<1>-1 Setting the standard values> includes parameters for setting the standard value only for the basic axes (M series: 1st to 3rd axes, T series: 1st to 2nd axes).
In Step <<1>-2 Setting the parameters for additional axes>, the additional axis (M series: 4th and subsequent axes, T series: 3rd and subsequent axes) portions of the parameters are set manually.
2 When a parameter number is entered and then soft key [NO.SRH] is pressed, the cursor moves to the specified parameter.

Set the following parameters related to additional axes.

1020	Program axis name for each axis	Each axis

M series				T series			
Axis name	**Setting**	**Axis name**	**Setting**	**Axis name**	**Setting**	**Axis name**	**Setting**
U	85	A	65	Y	89	B	66
V	86	B	66	A	65	C	67
W	87	C	67				

1022	Setting of each axis in the basic coordinate system	Each axis

Set value	Meaning
0	Neither the basic three axes nor a parallel axis
5	Axis parallel to the X axis
6	Axis parallel to the Y axis
7	Axis parallel to the Z axis

<1>-3 Setting the parameters without the standard values

NOTE
1 Some parameters are not set to the standard value even after setting the standard value in Step <<1>-1 Setting the standard values>.
These parameters are set manually in Step <<1>-3 Setting parameters without the standard values>.
2 When a parameter number is entered and then soft key [NO.SRH] is pressed, the cursor moves to the specified parameter.

- Set the metric system or inch system as the liner axis output unit.

1001#0	Least command increment on the linear axis 0: In mm (metric system machine) 1: In inches (inch system machine)	Common to all axes

- The least input increment and least command increment are set.

1004#1	Setting least input increment and least command increment 0: IS-B 1: IS-C	Each axis

	Least input increment and least command increment
IS-B	0.001mm, 0.001deg, or 0.0001inch
IS-C	0.0001mm, 0.0001deg, or 0.00001inch

- When using reference position return without DOG, set the following parameters.

1002#1	Function setting the reference position without DOG 0: Disabled 1: Enabled (enabled for all axes)	Each axis

- Set the type of each axis, linear or rotation.

1006#0	Setting linear or rotation axis. 0: Linear axis 1: Rotation axis	Each axis

- Set the radius specification/diameter specification for each axis.

1006#3	The move command for each axis is based on: 0: Radius specification 1: Diameter specification	Each axis

- Set the direction of manual reference position return for each axis.

1006#5	The direction of manual reference position return is: 0: + direction 1: - direction	Each axis

- Set whether a separate pulse coder is used.

1815#1	Position detector 0: A separate pulse coder is not used. 1: A separate pulse coder is used.	Each axis

- Set whether the correspondence between the position of a machine and the position of an absolute position detector is completed.

1815#4	Correspondence between the position of a machine and the position of an absolute position detector 0: Not completed. 1: Completed.	Each axis

- Set whether the position detector is an absolute position detector.

1815#5	Position detector 0: Other than absolute position detector 1: Absolute position detector (absolute pulse coder)	Each axis

- Set the following parameters.

Parameter No.	Example of setting	Description	Type
1825	5000	Servo loop gain	Each axis
1826	10	In–position width	Each axis
1828	7000	Positioning deviation limit in movement	Each axis

<2> SPINDLE group

<2>-1 Setting the standard values

The standard values are set for the parameters in the SPINDLE group.
Follow a procedure similar to Step <<1>-1 Setting the standard values> in <<1> BASIC group>.

<2>-2 Setting the parameters without the standard values

Set the following parameters.

- Set the type of a spindle motor.

3716#0	Spindle motor type is : 0: Analog spindle. 1: Serial spindle.	Each spindle

<3> COORDINATE group

<2>-1 Setting the standard values

The standard values are set for the parameters in the COORDINATE group.
Follow a procedure similar to Step <<1>-1 Setting the standard values> in <<1> BASIC group>.

<2>-2 Setting the parameters without the standard values

Set the following parameters.

Parameter No.	Description	Type	Unit of data
1240	Coordinate value of the first reference position on in the machine coordinate system	Each axis	Increment system
1241	Coordinate value of the second reference position in the machine coordinate system	Each axis	Increment system
1320	Coordinate value of stored stroke check 1 in the positive direction	Each axis	Increment system
1321	Coordinate value of stored stroke check 1 in the negative direction	Each axis	Increment system

<4> FEED RATE group

<4>-1 Setting the standard values

The standard values are set for the parameters in the FEED RATE group.
Follow a procedure similar to Step <<1>-1 Setting the standard values> in <<1> BASIC group>.

<4>-2 Setting the parameters without the standard values

Set the following parameters.

Parameter No.	Example of setting	Description	Type
1410	1000	Dry run rate	All axes
1420	8000	Rapid traverse rate	Each axis
1421	1000	F0 rate of rapid traverse override	Each axis
1422	10000	Maximum cutting feedrate	All axes
1423	1000	Feedrate in jog feed	Each axis
1424	5000	Manual rapid traverse rate	Each axis
1425	150	FL rate of the reference position return	Each axis
1428	5000	Reference position return feedrate	Each axis
1430	3000	Maximum cutting feedrate	Each axis

<5> ACC./DEC. (Acceleration/Deceleration) group

Set the following parameters.

- Set the type of acceleration/deceleration in cutting feed, dray run, or jog feed.

1610#0	Acceleration/deceleration in cutting feed or dry run 0: Exponential acceleration/deceleration is applied. 1: Linear acceleration/deceleration after interpolation is applied.	Each axis
1610#4	Acceleration/deceleration in jog feed 0: Exponential acceleration/deceleration is applied. 1: The same acceleration/deceleration as for cutting feedrate is applied.	Each axis

Parameter No.	Example of setting	Description	Type
1620	100	Time constant used for linear acceleration/deceleration in rapid traverse	Each axis
1622	32	Time constant acceleration/deceleration in cutting feed	Each axis
1623	0	FL rate of exponential acceleration/deceleration in cutting feed	Each axis
1624	100	Time constant acceleration/deceleration in jog feed	Each axis
1625	0	FL rate of exponential acceleration/deceleration in jog feed	Each axis

(3) Restarting the NC

Turn off and back on the NC power. This completes the initialization of the NC parameters related to axis settings.

NOTE

1 To operate the servo axis, it is necessary to set the following signals in addition to the above parameters. For details on each signal, refer to the Connection Manual (Function).

Address	Symbol	Signal name
G008.0	*IT	Interlock signal for all axes
G008.4	*ESP	Emergency stop signal
G008.5	*SP	Feed hold signal
G010,G011	*JV	Manual feedrate override signal
G012	*FV	Feedrate override signal
G114	*+L1 to *+L5	Overtravel signals
G116	*-L1 to *-L5	Overtravel signals
G130	*IT1 to *IT5	Interlock signal for each axis

2 Manual Setting 1 is used as the FSSB setting method in this manual. When using Manual Setting 1, it is not necessary to use the FSSB (AMP) and FSSB (AXIS) items on the parameter setting aid screen.
In Manual Setting 1, restrictions are imposed on the functions and settings that can be used. The restrictions and details on FSSB settings, refer to the FSSB settings section in the Connection Manual (Function).

2.2 NC PARAMETERS RELATED TO AXIS SETTINGS

The NC parameters related to axis settings are listed below. For details on each parameter, refer to the PARAMETER MANUAL (B-64310EN).

Group	Item name	Parameter No.	Description
BASIC	INM	No.1001 #0	Least command increment on the linear axis 0: In mm (metric system machine) 1: In inches (inch system machine)
	ISCx	No.1013 #1	Least setting increment and least movement increment 0: IS-B / 1: IS-C
	ZRNx	No.1005 #0	When automatic operation (other than G28) is performed with the origin not established: 0: An alarm is issued (PS0224). 1: No alarm is issued.
	DLZ x	No.1005 #1	Reference position without dogs 0: Disabled (in each axis) / 1: Enabled (in each axis)
	ROTx	No.1006 #0	Setting linear or rotation axis 0: Linear axis / 1: Rotation axis
	DIAx	No.1006 #3	Specification of the travel amount for each axis 0: Radius specification / 1: Diameter specification
	ZMIx	No.1006 #5	Direction of reference position return for each axis 0: Positive direction / 1: Negative direction
	ROAx	No.1008 #0	Rotary axis roll-over function 0: Invalid / 1: Valid
	RRLx	No.1008 #2	Relative coordinates are 0: Not rounded by the amount of the shift per one rotation / 1: Rounded by the amount of the shift per one rotation
	AXIS NAME	No.1020	Program axis name for each axis
	AXIS ATTRIBUTE	No.1022	Setting of each axis in the basic coordinate system
	SERVO AXIS NUM	No.1023	Number of the servo axis for each axis
	OPTx	No.1815 #1	A separate pulse coder is: 0: Not used / 1: Used
	APZx	No.1815 #4	Correspondence between the position of a machine and the position of an absolute position detector 0: Not completed / 1: Completed
	APCx	No.1815 #5	Position detector 0: Other than absolute position detector / 1: Absolute position detector
	SERVO LOOP GAIN	No.1825	Servo loop gain for each axis
	IN-POS WIDTH	No.1826	In-position width for each axis
	ERR LIMIT:MOVE	No.1828	Positioning deviation limit for each axis in movement
	ERR LIMIT:STOP	No.1829	Positioning deviation limit for each axis in the stopped state

Group	Item name	Parameter No.	Description
SPINDLE	A/S	No.3716 #0	Spindle motor type is : 0: Analog spindle. 1: Serial spindle.
	SPDL INDEX NO.	No.3717	Spindle amplifier number Set 0 for unused axes.

Group	Item name	Parameter No.	Description
COORDINATE	REF. POINT #1	No.1240	Machine coordinates of the first reference position of each axis
	REF. POINT #2	No.1241	Machine coordinates of the second reference position of each axis
	AMOUNT OF 1 ROT	No.1260	Shift amount per one rotation of a rotation axis
	LIMIT 1+	No.1320	Coordinates of stored stroke check 1 in the positive direction
	LIMIT 1-	No.1321	Coordinates of stored stroke check 1 in the negative direction

Group	Item name	Parameter No.	Description
FEED RATE	RDR	No.1401 #6	Dry run for rapid traverse command 0: Disabled / 1: Enabled
	DRY RUN RATE	No.1410	Dry run rate
	RAPID FEEDRATE	No.1420	Rapid traverse rate for each axis
	RAPID OVRRIDE F0	No.1421	F0 rate of rapid traverse override for each axis
	JOG FEEDRATE	No.1423	Feedrate in jog feed for each axis
	MANUAL RAPID F	No.1424	Manual rapid traverse rate for each axis
	REF. RETURN FL	No.1425	FL rate of the reference position return for each axis
	REF FEEDRATE	No.1428	Reference position return feedrate for each axis
	MAX CUT FEEDRATE	No.1430	Maximum cutting feedrate for each axis

Group	Item name	Parameter No.	Description
ACC./DEC.	CTL	No.1610 #0	Acceleration/deceleration in cutting feed or dry run 0: Exponential acceleration/deceleration is applied. / 1: Linear acceleration/deceleration after interpolation is applied.
	JGL	No.1610 #4	Acceleration/deceleration in jog feed 0: Exponential acceleration/deceleration is applied. / 1: The same acceleration/deceleration as for cutting feedrate is applied.
	RAPID TIME CONST	No.1620	Time constant used for linear acceleration/ deceleration in rapid traverse for each axis
	CUT TIME CONST	No.1622	Time constant of acceleration/deceleration in cutting feed for each axis
	CUT FL	No.1623	FL rate of exponential acceleration/deceleration in cutting feed for each axis
	JOG TIME CONST	No.1624	Time constant of acceleration/deceleration in jog feed for each axis.
	JOG FL	No.1625	FL rate of exponential acceleration/deceleration in jog feed for each axis

2.3 DEFAULT VALUES TO BE SET DURING INITIALIZATION

The table below lists the parameters to be set during initialization of the NC parameters related to axis settings. For details on these parameters, refer to the PARAMETER MANUAL (B-64310EN).

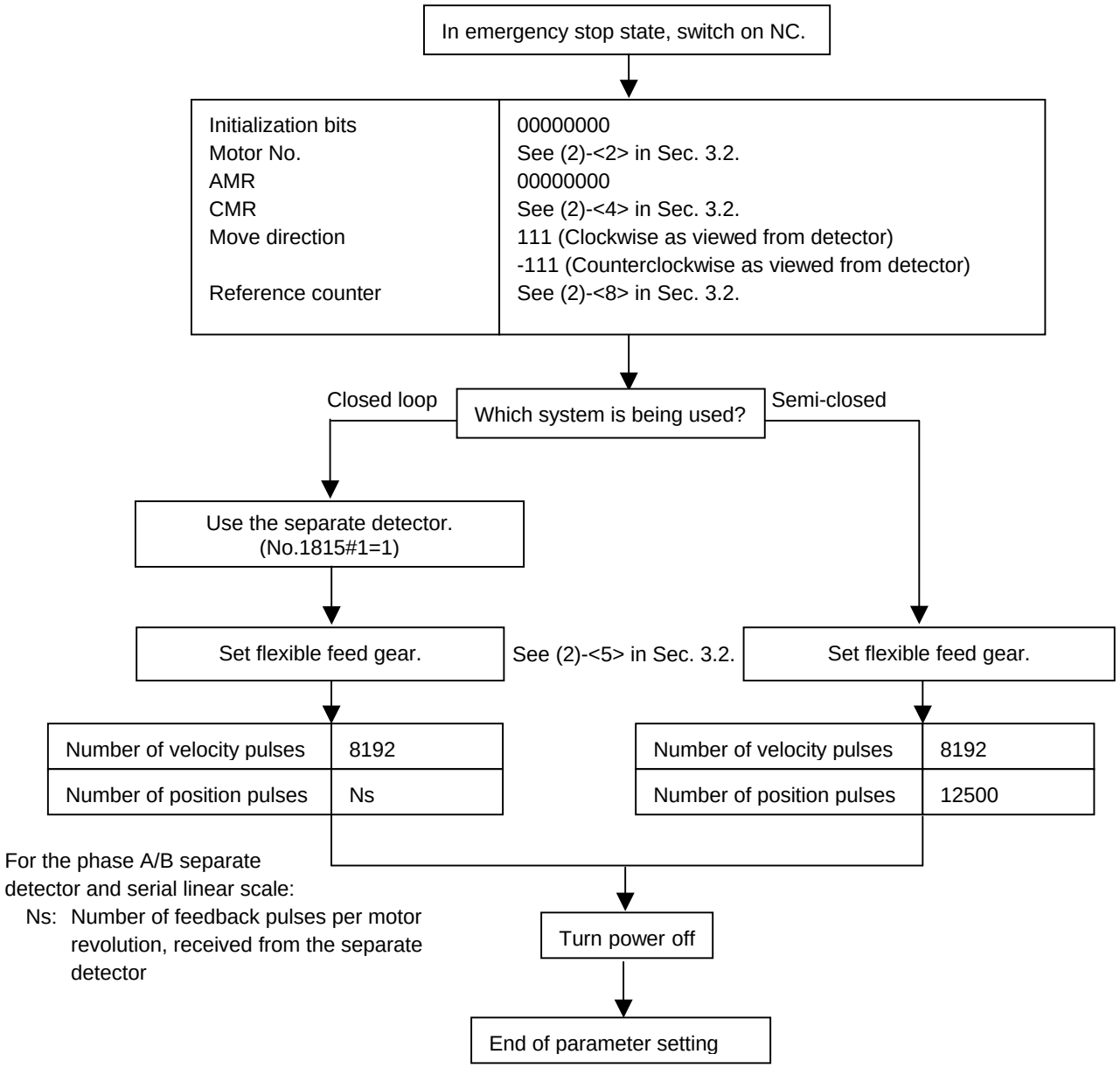
Item name	Parameter No.	Displayed data	Default value	Remark
INM	No.1001 #0	Parameter value		There is no default value.
ISCx	No.1004 #1	Parameter value		There is no default value.
ZRNx	No.1005 #0	Parameter value	0	
DLZx	No.1005 #1	Parameter value		There is no default value.
ROTx	No.1006 #0	Parameter value		There is no default value.
DIAx	No.1006 #3	Parameter value		There is no default value.
ZMIx	No.1006 #5	Parameter value		There is no default value.
ROAx	No.1008 #0	Parameter value	1	
RRLx	No.1008 #2	Parameter value	1	
AXIS NAME	No.1020	Parameter value	Value to the right	M series : X(88), Y(89), Z(90) T series : X(88), Z(90)
AXIS ATTRIBUTE	No.1022	Parameter value	Value to the right	M series : 1,2,3 T series : 1,3
SERVO AXIS NUM	No.1023	Parameter value	Value to the right	Named 1, 2, 3, ... from the first axis.
OPT	No.1815 #1	Parameter value		There is no default value.
APZ	No.1815 #4	Parameter value		There is no default value.
APC	No.1815 #5	Parameter value		There is no default value.
SERVO LOOP GAIN	No.1825	Parameter value		There is no default value.
IN-POS WIDTH	No.1826	Parameter value		There is no default value.
ERR LIMIT:MOVE	No.1828	Parameter value		There is no default value.
ERR LIMIT:STOP	No.1829	Parameter value	500	
A/S	No.3716 #0	Parameter value		There is no default value.
SPDL INDEX NO.	No.3717	Parameter value	Value to the right	Named 1, 2, 3, ... from the first spindle.
REF. POINT #1	No.1240	Parameter value		There is no default value.
REF. POINT #2	No.1241	Parameter value		There is no default value.
AMOUNT OF 1 ROT	No.1260	Parameter value	360000	
LIMIT 1+	No.1320	Parameter value		There is no default value.
LIMIT 1-	No.1321	Parameter value		There is no default value.
RDR	No.1401 #6	Parameter value	0	
DRY RUN RATE	No.1410	Parameter value		There is no default value.
RAPID FEEDRATE	No.1420	Parameter value		There is no default value.
RAPID OVRRIDE F0	No.1421	Parameter value		There is no default value.
JOG FEEDRATE	No.1423	Parameter value		There is no default value.
MANUAL RAPID F	No.1424	Parameter value		There is no default value.
REF. RETURN FL	No.1425	Parameter value		There is no default value.
REF FEEDRATE	No.1428	Parameter value		There is no default value.
MAX CUT FEEDRATE	No.1430	Parameter value		There is no default value.
CTL	No.1610 #0	Parameter value		There is no default value.
JGL	No.1610 #4	Parameter value		There is no default value.
RAPID TIME CONST	No.1620	Parameter value		There is no default value.
CUT TIME CONST	No.1622	Parameter value		There is no default value.
CUT FL	No.1623	Parameter value		There is no default value.
JOG TIME CONST	No.1624	Parameter value		There is no default value.
JOG FL	No.1625	Parameter value		There is no default value.

3 INITIALIZATION OF SERVO

Chapter 3, “INITIALIZATION OF SERVO”, consists of the following sections:

3.1 INITIALIZATION FLOW

Make the following settings on the servo setting screen and servo adjustment screen.



3.2 SERVO SETTING PROCEDURE

(1) Preparation

Display the parameter setting support screen. For details, refer to Section 1.1, "OVERVIEW" in this manual.

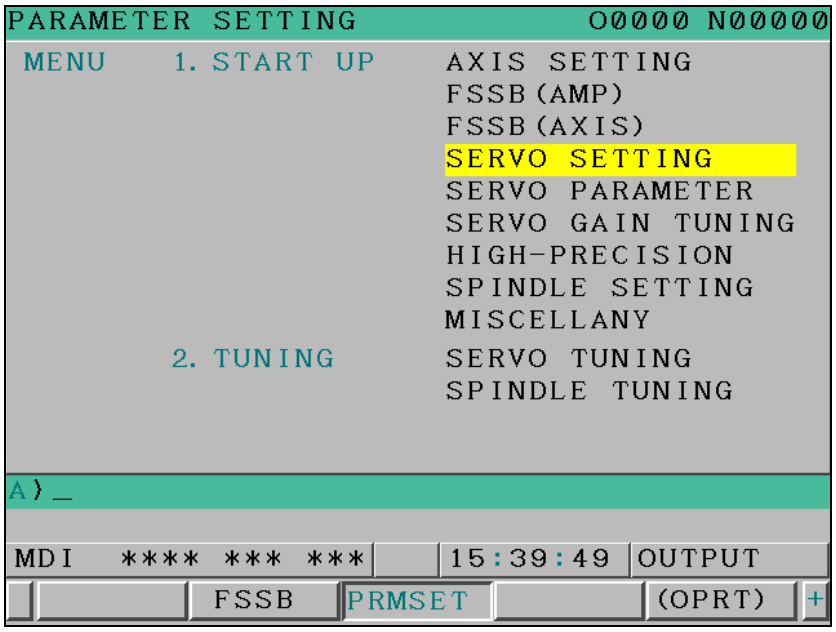


Fig. 3.2 (a) Parameter setting support screen

Press soft key [(OPRT)], move the cursor to SERVO SETTING, and press [SELECT] to display the SERVO SETTING screen (Fig. 3.2 (b)). Use this screen to make the following parameter settings.

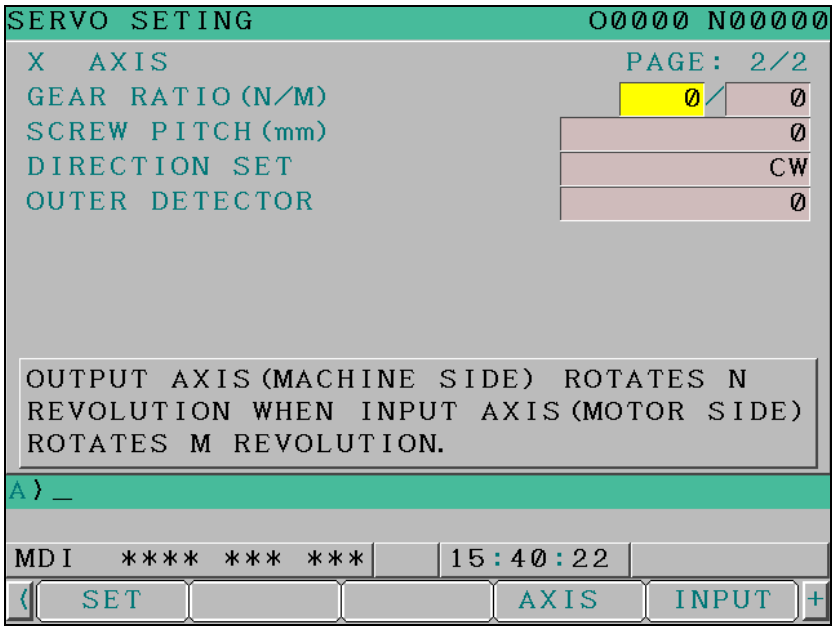


Fig. 3.2 (b) Servo setting screen for inputting machine constants

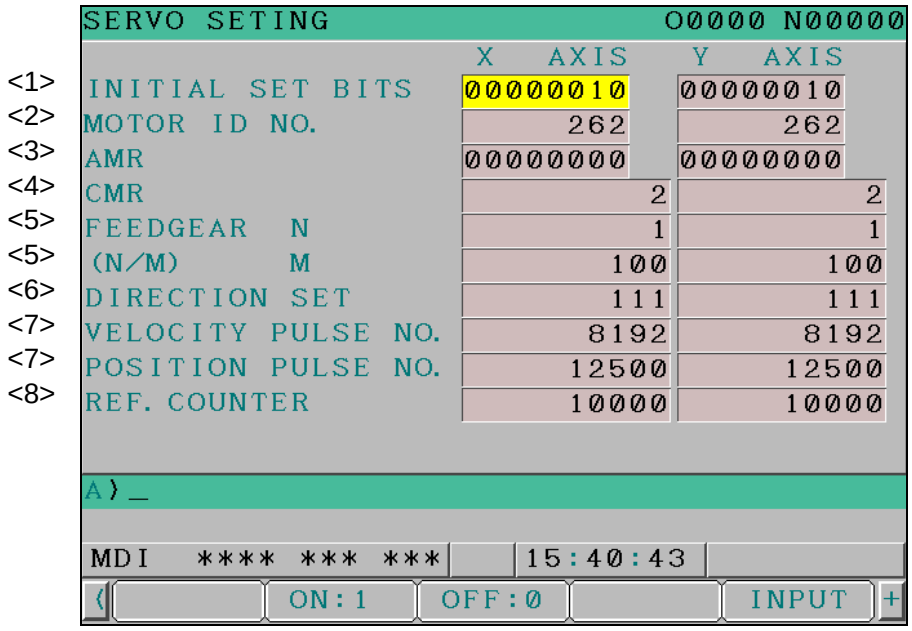


Fig. 3.2 (c) Servo setting screen for inputting parameters

(2) Initialization

Start initialization. Set <1> to <8> on the servo setting screen and turn off and back on the CNC power. For full-closed systems, set the following parameter (bit 1 (OPTx) of parameter No. 1815 is 1) first.

	#7	#6	#5	#4	#3	#2	#1	#0
1815							OPTx	

 # 1 OPTx A separate pulse coder is:

0: Not used as a position detector. ← For semi-closed systems

1: Used as a position detector. ← For full-closed systems

<1> Initialization bit

Initialization bit	00000000

When initialization is completed successfully, DGPR (#1) is set to 1 and PRMC (#3) is set to 1 automatically the next time the CNC power is turned off and back on.

<2> Motor ID No. setting

Specify the motor ID number.

Select the motor number of the α*is*/α*i*/β*is* series servo motor to be used in the following table. The motor number consists of a motor model, a motor drawing number (4-digit number in the middle of A06B-****-B***), and the maximum current value of the driving amplifier.

α*is*/α*i* series servo motor

Motor model	Motor specification	Maximum current value of the driving amplifier	Motor type No.
α2/5000*is*	0212	20A	262
α4/5000*is*	0215	40A	265
α8/4000*is*	0235	80A	285
α12/4000*is*	0238	80A	288
α22/4000*is*	0265	160A	315
α30/4000*is*	0268	160A	318
α40/4000*is*	0272	160A	322
α1/5000*i*	0202	20A	252

Motor model	Motor specification	Maximum current value of the driving amplifier	Motor type No.
α2/5000*i*	0205	20A	255
α4/4000*i*	0223	40A	273
α8/3000*i*	0227	40A	277
α12/3000*i*	0243	80A	293
α22/3000*i*	0247	80A	297
α30/3000*i*	0253	160A	303
α40/3000*i*	0257	160A	307
α40/3000*i* FAN	0258	160A	308

β*i*s series servo motor

Motor model	Motor specification	Maximum current value of the driving amplifier	Motor type No.
β0.2/5000*i*s	0210	4A	260
β0.3/5000*i*s	0211	4A	261
β0.4/5000*i*s	0114	20A	280
β0.5/5000*i*s	0115	20A	281
β1/5000*i*s	0116	20A	282
β2/4000*i*s	0061	20A	253
		40A	254
β4/4000*i*s	0063	20A	256
		40A	257
β8/3000*i*s	0075	20A	258
		40A	259
β12/3000*i*s	0078	40A	272
β22/2000*i*s	0085	40A	274

<3> AMR setting

This parameter corresponds to the number of poles of the servo motor.
For the α*i*s/α*i*/β*i*s motor, be sure to set 00000000.

α*i*/β*i* servo motor	00000000

<4> CMR setting

Set CMR with the scale of a distance the NC instructs the machine to move.

Setting value = (Command unit / Detection unit) × 2

CMR	2

Usually, set CMR with 2, because command unit = detection unit.

<5> Flexible feed gear setting

Set the parameters of the flexible field gear.

Flexible feed gear (numerator)	N
Flexible feed gear (denominator)	M

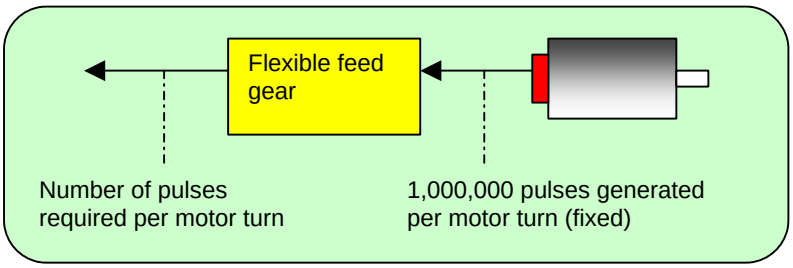
<5>-1 Semi-closed feedback loop

Examples of flexible field gear settings (gear ratio: 1 to 1)

Detection unit	Ball screw lead (N/M)					
	6mm	8mm	10mm	12mm	16mm	20mm
1μm	6/1000	8/1000	10/1000	12/1000	16/1000	20/1000
0.5 μm	12/1000	16/1000	20/1000	24/1000	32/1000	40/1000
0.1 μm	60/1000	80/1000	100/1000	120/1000	160/1000	200/1000

(Expression of calculation of parameters)

Set the pulse skipping rate assuming that the number of pulses generated per motor turn is 1000000, regardless of the type of the pulse coder.



Flexible feed gear	$\frac{\text{Necessary position feedback pulses per motor revolution}}{1{,}000{,}000}$ (as irreducible fraction)

NOTE

The maximum specifiable value (after reduction) of the flexible field gear is 32767 for both the numerator and denominator.

Example of setting (1)

If the ball screw used in direct coupling has a lead of 10 mm/rev and the detection unit is 1 μm
The number of pulses generated per motor turn (10 mm) is:
10/0.001 = 10,000 (pulses)

$$\frac{\text{Numerator of flexible field gear}}{\text{Denominator of flexible field gear}} = \frac{10{,}000}{1{,}000{,}000} = \frac{1}{100}$$

Example of setting (2)

If the gear reduction ratio between the rotation axis motor and table is 10:1 and the detection unit is 1/1000 degrees

- The table rotates through 360/10 (=36) degrees when the motor makes one turn.
- Since the detection unit is 1/1000 degrees, the number of position pulses generated per motor turn is: (36 degrees per motor turn)/(Detection unit of 1/1000 degrees) = 36000 pulses
  Therefore, the flexible gear setting is as shown below.

$$\frac{\text{Numerator of flexible field gear}}{\text{Denominator of flexible field gear}} = \frac{36{,}000}{1{,}000{,}000} = \frac{36}{100}$$

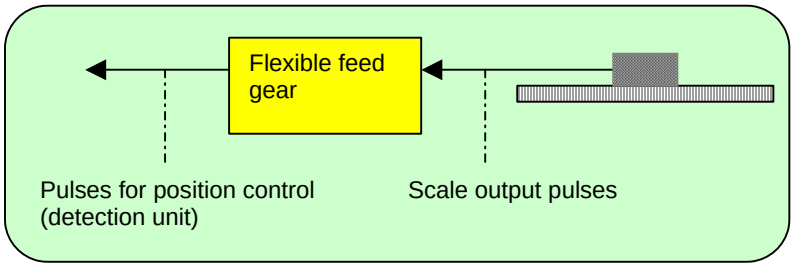
<5>-2 Full-closed feedback loop

Example of flexible field gear settings (N/M)

Detection unit	Scale resolution			
	1 μm	0.5 μm	0.1 μm	0.05 μm
1 μm	1/1	1/2	1/10	1/20
0.5 μm	-	1/1	1/5	1/10
0.1 μm	-	-	1/1	1/2

(Expression of calculation of parameters)

Set the pulse skipping rate for the number of scale output pulses



Flexible feed gear	Pulses for position control / Scale output pulses (as irreducible fraction)

Example of setting

To detect a distance of 1 μm using a 0.5 μm scale, set the following:

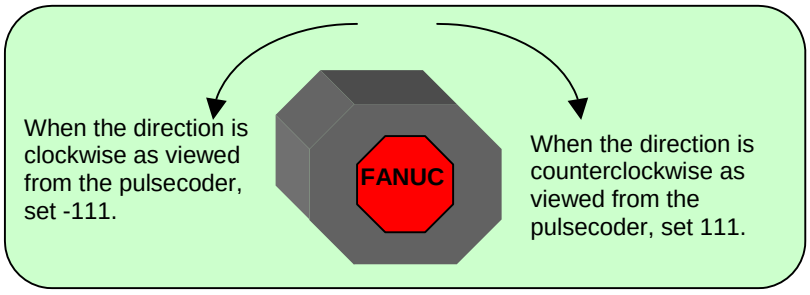
- The number of scale output pulses for movement of 1 μm is:
  1 μm/0.5 μm = 2
- Since the detection unit is 1 μm, the number of pulses used for position control is 1.

Therefore, the flexible field gear setting is:

$$\frac{\text{Numerator of flexible field gear}}{\text{Denominator of flexible field gear}} = \frac{1 \text{ pulse}}{2 \text{ pulses}} = \frac{1}{2}$$

<6> Motor rotation direction setting

111	Clockwise as viewed from the Pulsecoder
-111	Counterclockwise as viewed from the Pulsecoder



<7> Specify the number of velocity pulses and the number of position pulses.

<7>-1 Semi-closed feedback loop

Number of velocity pulses	8192 (Fixed value)

Number of position pulses	12500 (Fixed value)

<7>-2 Full-closed feedback loop (Parallel type or Serial liner scale)

Number of velocity pulses	8192 (Fixed value)

Number of position pulses	Number of feedback pulses from the scale per motor turn

Set the number of pulses fed back from the separate detector (before processing of the flexible field gear) when the motor rotates one turn.

Example 1 :

If the ball screw used in direct coupling has a lead of 10 mm and the separate detector used has a resolution of 0.5 μm (= 0.0005 mm) per pulse

$$\text{Number of feedback pulses per motor 1rev.} = \frac{\text{Ball screw lead = 10mm}}{\text{Scale resolution = 0.0005mm}} = 20000$$

Therefore, the setting of the number of position pulses is 20000.

When the calculated number of position pulses is greater than 32767, set the number of position pulses by using the position pulse conversion factor (No. 2185) to multiply the parameter of the number of position pulses by the parameter of the conversion factor.

2024	Number of position pulses
2185	Position pulse conversion factor

Example 2 :

If the ball screw used in direct coupling has a lead of 16 mm and the separate detector used has a resolution of 0.1 μm (= 0.0001 mm) per pulse

$$\text{Number of feedback pulses per motor 1rev.} = \frac{\text{Ball screw lead = 16mm}}{\text{Scale resolution = 0.0001mm}} = 160{,}000$$

Therefore, the setting of the number of position pulses is 160000. The value exceeds 32767 and cannot be entered as the number of position pulses on the servo setting screen.
In this case, make settings as shown below.

No.2024 = 16,000
No.2185 = 10

(When the value of No. 2024 multiplied by the value of No. 2185 is 160000, another setting is allowed.)

<8> Reference counter setting

Specify the reference counter.
The reference counter is used in making a return to the reference position by a grid method.

<8>-1 Semi-closed feedback loop

Count on the reference counter = Number of position pulses corresponding to a single motor revolution

Example of setting

$\alpha i/\beta i$ Pulsecoder and semi-closed loop (1-μm detection)

Ball screw lead (mm/revolution)	Necessary number of position pulses (pulse/revolution)	Reference counter	Grid width (mm)
10	10000	10000	10
20	20000	20000	20

<8>-2 Full-closed feedback loop

Reference counter setting	=	Z-phase (reference-position) interval divided by the detection unit

Example of setting

Example 1 :

When the Z-phase interval is 50 mm and the detection unit is 1 μm: Reference counter setting = 50,000/1 = 50,000

Example 2 :

When a rotation axis is used and the detection unit is 0.001°:
Reference counter setting = 360/0.001 = 360,000

Example 3 :

When a linear scale is used and a single Z phase exists:
Set the reference counter to 10000, 50000, or another round number.

Turn off and back on the NC power. This completes the initialization of the servo parameters.

4 INITIALIZATION OF SERVO PARAMETERS

Chapter 4, “PARAMETER SETTING SUPPORT SCREEN”, consists of the following sections:

4.1 INITIALIZATION FLOW

(1) Preparation

Display the parameter setting support screen. For details, refer to Section 1.1, "OVERVIEW" in this manual.

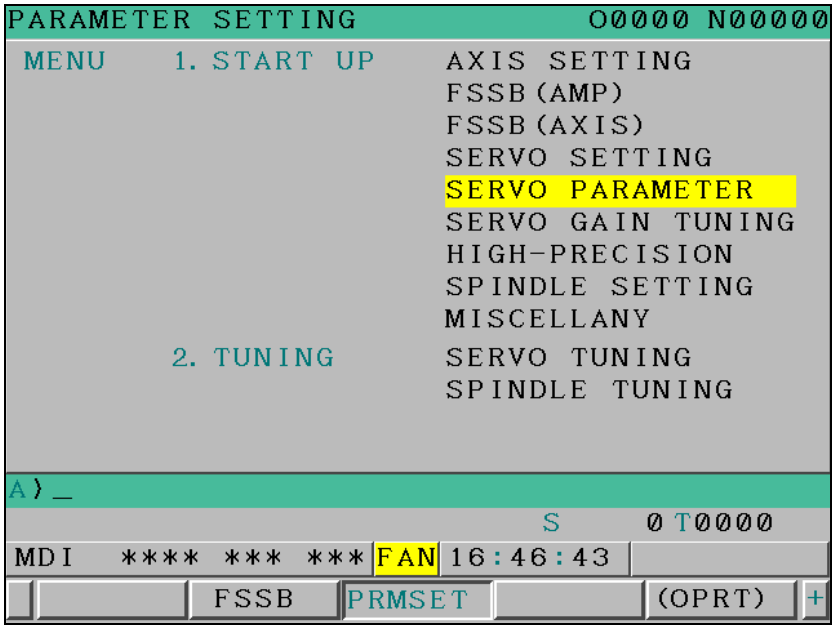


Fig. 4.1 (a) Parameter setting support screen

Press soft key [(OPRT)], move the cursor to SERVO PARAMETER, and press [SELECT] to display the servo parameter screen (Fig. 4.1 (b)). Use this screen to make the following parameter settings.

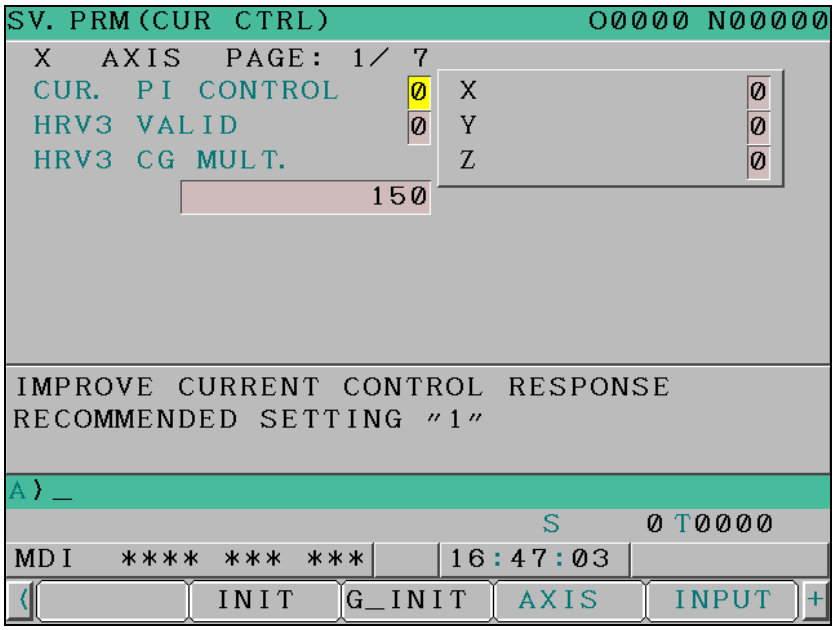


Fig. 4.1 (b) Servo parameter setting screen

(1) Setting default values

Parameters can be set to their default values. Only the parameter selected by the cursor or all parameters in a group can be set to its or their default values, as described below.

Setting each parameter to its default value

Move the cursor to the item for which to set its default value.
Press soft key [INIT].
A message saying "DO YOU SET INIT-VALUE ?" appears.
Press soft key [EXEC].

If the item selected by the cursor has no default value, pressing soft key [INIT] displays a warning message stating "NO DEFAULT VALUE".

Setting all parameters in a group to their default values

This method sets the default values for each group.
Press soft key [G_INIT].
A message saying "STANDARD PARAMETERS VALUE OF xxx GROUP (group name selected by the cursor) ARE SET" appears on the frame of the help message. A message saying "DO YOU SET INIT-VALUE ?" appears.
Press soft key [EXEC].

The default values for the selected group are set. Since all parameters in the selected group are automatically set in this case, be careful to set the default values. Parameters with no default values are not set.

4.2 SERVO PARAMETERS

The servo parameters are listed below. For details on these parameters, refer to the PARAMETER MANUAL (B-64310EN).

Group	Item name	Parameter No.	Description
CUR CTRL	CUR. PI CONTROL	No.2203 #2	Improves the responsivity for current control. Normally, set this parameter to 1.
	HRV3 VALID	No.2013 #0	0: HRV1 or HRV2, 1: HRV3 For linear motor or the like, HRV3 is recommended.
	HRV3 CG MULT.	No.2334	Gain magnification (%) in the HRV3 command. Normally, set this parameter to approx. 150.

Group	Item name	Parameter No.	Description
VEL CTRL	PI CONTROL	No.2003	Velocity PI control 0: OFF, 1: ON Normally, set this parameter to 1.
	HIGH CYCLE PROP	No.2017 #7	Velocity loop proportional high-speed processing function 0: OFF, 1: ON Normally, set this parameter to 1.
	LATEST SPEED FB	No.2006 #4	If this parameter is set to 1, the latest FB data is used. Normally, set this parameter to 1.
	VG DOWN AT STOP	No.2016#3	Gain down in the stop state 0: Disabled, 1: Enabled Normally, set this parameter to 1.
	STOP LEVEL	No.2119	Judgment level in the detection unit Normally, set this parameter to approx. 2μm.
	VEL. I GAIN	No.2043	Velocity loop integral gain Normally, use the default value.
	VEL. P GAIN	No.2044	Velocity loop proportional gain Normally, use the default value.
	VEL. GAIN	No.2021	Velocity loop gain magnification (%) Normally, set this parameter to approx. 100.
	TCMD FILTER	No.2067	Torque command filter The recommended value is 1166 (200 Hz).
	CUT/RPD VG SW	No.2202 #1	Cutting/rapid velocity gain switching function. Normally, set this parameter to 1.
	VG MULT FOR CUT	No.2107	Cutting gain magnification (%) The recommended value is approx. 150.
	HRV3 VG MULT.	No.2335	Velocity gain magnification (%) in the HRV3 command. The recommended value is approx. 200.

Group	Item name	Parameter No.	Description
POS CTRL	POSITION GAIN	No.1825	Position gain (unit: 0.01 s-1) The recommended value is approx. 5000.
	FF VALID	No.2005 #1	Feed forward 0: Disabled, 1: Enabled
	RAPID FF VALID	No.1800 #3	Rapid traverse FF 0: Disabled, 1: Enabled
	ADV. FF COEFF.	No.2092	FF coefficient (unit: 0.01%) Normally, set this parameter to 10000.
	VEL. FF COEFF.	No.2069	Velocity FF coefficient Normally, set this parameter to approx. 50.

Group	Item name	Parameter No.	Description
BACKLASH	BL COMP.	No.1851	Backlash compensation (detection unit) Set this parameter to non-zero.
	FULL BL COMP.	No.2006 #0	Backlash compensation in the full-close mode is not performed. Set this parameter to 1 in the full-close mode.
	BL ACC. VALID	No.2003 #5	Backlash acceleration 0: Disabled, 1: Enabled Normally, set this parameter to 1.
	BL ACC. STOP	No.2009 #7	Backlash acceleration stop 0: Disabled, 1: Enabled Normally, set this parameter to 1.
	BL ACC IN CUT 1	No.2009 #6	BL acceleration 1 only at cutting feed 1 0: Disabled, 1: Enabled Normally, set this parameter to 1.
	BL ACC IN CUT 2	No.2223 #7	BL acceleration 1 only at cutting feed 2 0: Disabled, 1: Enabled Normally, set this parameter to 1.
	2 STAGE BL ACC.	No.2015 #6	Two-stage backlash acceleration 0: Disabled, 1: Enabled Set this parameter to 0 for simple adjustment.
	BL ACC. VAL.	No.2048	Backlash acceleration amount Set this parameter to around 50.
	BL ACC STOP VAL	No.2082	Backlash acceleration stop distance Set this parameter to 5/(detection unit (μm)).
	BL ACC. TIME	No.2071	Backlash acceleration time Set this parameter to 20.

4.3 DEFAULT VALUES TO BE SET DURING INITIALIZATION

The servo parameters to be set during initialization are listed below. For details on these parameters, refer to the PARAMETER MANUAL (B-64310EN).

Item name	Parameter No.	Displayed data	Default value	Remark
CUR. PI CONTROL	No.2203 #2	Parameter value	1	
HRV3 VALID	No.2013 #0	Parameter value		There is no default value.
HRV3 CG MULT.	No.2334	Parameter value	150	
PI CONTROL	No.2003	Parameter value	1	
HIGH CYCLE PROP	No.2017 #7	Parameter value	1	
LATEST SPEED FB	No.2006 #4	Parameter value	1	
VG DOWN AT STOP	No.2016 #3	Parameter value	1	
STOP LEVEL	No.2119	Parameter value	Calculated value	Calculation expression: 2/detection unit (μm)
VEL. I GAIN	No.2043	Parameter value		There is no default value.
VEL. P GAIN	No.2044	Parameter value		There is no default value.
VEL. GAIN	No.2021	Value to the right	100	Calculation result of "(256+0.2021)/256 * 100"
TCMD FILTER	No.2067	Parameter value	1166	
CUT/RPD VG SW	No.2202 #1	Parameter value	1	
VG MULT FOR CUT	No.2107	Parameter value	150	
HRV3 VG MULT.	No.2335	Parameter value	200	
POSITION GAIN	No.1825	Parameter value	5000	

Item name	Parameter No.	Displayed data	Default value	Remark
FF VALID	No.2005 #1	Parameter value	Value to the right	M series : 1 T series : There is no default value.
RAPID FF VALID	No.1800 #3	Parameter value	Value to the right	M series : 1 T series : There is no default value.
ADV. FF COEFF.	No.2092	Parameter value	10000	
VEL. FF COEFF.	No.2069	Parameter value	50	
BL COMP.	No.1851	Parameter value	1	
FULL BL COMP.	No.2006#0	Parameter value	Value to the right	1: Full close mode (No.1815#1 = 1) 0: Other modes
BL ACC. VALID	No.2003 #5	Parameter value	1	
BL ACC. STOP	No.2009 #7	Parameter value	1	
BL ACC IN CUT 1	No.2009 #6	Parameter value	1	
BL ACC IN CUT 2	No.2223 #7	Parameter value	1	
2 STAGE BL ACC.	No.2015 #6	Parameter value	0	
BL ACC. VAL.	No.2048	Parameter value	50	
BL ACC STOP VAL	No.2082	Parameter value	Calculated value	Calculation expression: 5/detection unit (μm)
BL ACC. TIME	No.2071	Parameter value	20	

5 INITIALIZATION OF THE NC PARAMETERS RELATED TO HIGH PRECISION SETTINGS

Chapter 5, “INITIALIZATION OF THE NC PARAMETERS RELATED TO HIGH PRECISION SETTINGS”, consists of the following sections:

5.1 INITIALIZATION FLOW

(2) Preparation

Display the parameter setting support screen. For details, refer to Section 1.1, "OVERVIEW" in this manual.

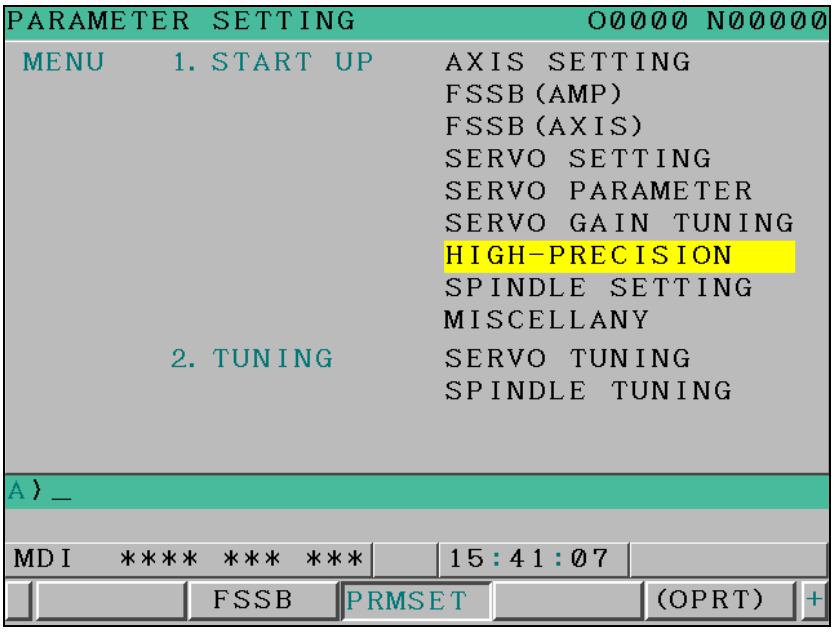


Fig. 5.1 (a) Parameter setting support screen

Press soft key [(OPRT)], move the cursor to HIGH-PRECISION, and press [SELECT] to display the high-precision setting screen (Fig. 5.1 (b)). Use this screen to make the following parameter settings.

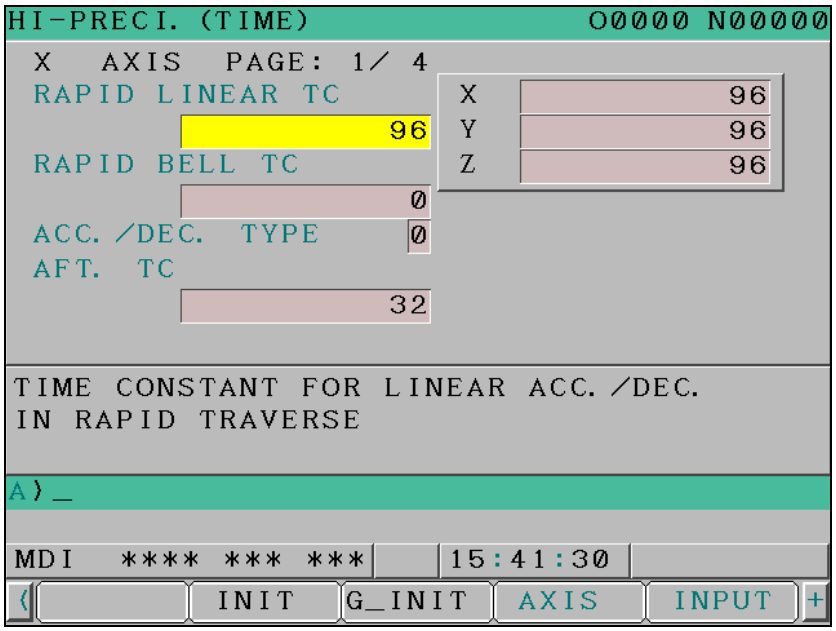


Fig. 5.1 (b) High precision setting screen

(2) Initialization

Parameters are initialized.
The procedure is described below.

<1> Time constant group

<1>-1 Setting defaults

The default values of the parameters in the time constant group are set.
Press soft key [G_INIT].
A message saying "DO YOU SET INIT-VALUE ?" appears.
Press soft key [EXEC].

The NC parameters in the time constant group have been initialized.

<2> Automatic acceleration/deceleration group

<2>-1 Setting defaults

The procedure for setting the parameters in the automatic acceleration/deceleration group to their defaults is described below.
Press soft key [G_INIT].
A message saying "DO YOU SET INIT-VALUE ?" appears.
Press soft key [EXEC].

The NC parameters in the automatic acceleration/deceleration group have been initialized.

5.2 NC PARAMETERS RELATED TO HIGH PRECISION SETTINGS

The parameters to be set during initialization of the NC parameters related to high precision settings are listed below. For details on these parameters, refer to the PARAMETER MANUAL (B-64310EN).

Group	Item name	Parameter No.	Description
Time constant	RAPID LINEAR TC	No.1620	Rapid traverse linear-shaped time constant (ms)
	RAPID BELL TC	No.1621	Rapid traverse bell-shaped time constant (ms)
	ACC./DEC. TYPE	No.1610 #0	Type of the time constant after interpolation 0: Exponential, 1: Linear Normally, set this parameter to 1.
	AFT. TC	No.1622	Time constant after interpolation in the normal mode The recommended value is 64.
	ACC. BFR IPL	No.1660	Maximum acceleration of acceleration/deceleration before interpolation (mm/sec/sec) The recommended value is 833.
	BFR. BELL TC	No.1772	Bell-shaped time constant of acceleration/deceleration before interpolation (ms) The recommended value is 57.
	AFT. BELL VALID	No.1602 #3	Acceleration/deceleration after interpolation in the acceleration/deceleration before interpolation mode is: 0: Exponential or linear, 1: Bell Normally, set this parameter to 0.
	AFT. LN-TC VALID	No.1602 #6	Acceleration/deceleration after interpolation in the acceleration/deceleration before interpolation mode is: 0: Exponential, 1: Linear Normally, set this parameter to 1.
	AFT. LINEAR TC	No.1769	Time constant after interpolation in the acceleration/deceleration before interpolation The recommended value is 32.

NOTE
The "ACC./DEC. TYPE" item and "AFT. TC" item are displayed only for the M series.

Group	Item name	Parameter No.	Description
Automatic acceleration/ deceleration	ACC. AT CIRCLE	No.1735	Arc interpolation allowable acceleration (mm/sec^2)
	CIRCLE MIN FEED	No.1732	Arc minimum velocity (mm/min) The recommended value is 100.
	CORNER DEC. FEED	No.1783	Corner deceleration (mm/min) The recommended value is 533.
	MAX CUT FEED	No.1432	Maximum cutting feedrate (mm/min) in AI contour control or AI advanced preview control For the recommended value, see *1.
	MAX ACC.	No.1737	Change in the allowable acceleration in velocity determination (mm/sec^2) For the recommended value, see *2.

*1 : The recommended value of parameter No.1432 is shown below.
When No.1430 is 0: 10000

When No.1430 is non-zero: Setting of parameter No.1430

*2 : The recommended value of parameter No.1737 is shown below.
(Setting of parameter No.1432)×(157/10000)
* The fractional portion less than the set increment is discarded.

NOTE
1 If the setting of the maximum cutting feedrate (No.1432) is changed, initialize the allowable acceleration (No.1737) item.
2 If the maximum cutting feedrate (No.1432) is not set during initialization of the allowable acceleration (No.1737), a warning saying "THERE IS NO INIT-VALUE" is issued.

6 INITIALIZATION OF THE NC PARAMETERS RELATED TO SPINDLE SETTINGS

Chapter 6, “INITIALIZATION OF THE NC PARAMETERS RELATED TO SPINDLE SETTINGS”, consists of the following sections:

6.1 INITIALIZATION PROCEDURE

(1) Preparation

Display the parameter setting support screen. For details, refer to Section 1.1, "OVERVIEW" in this manual.

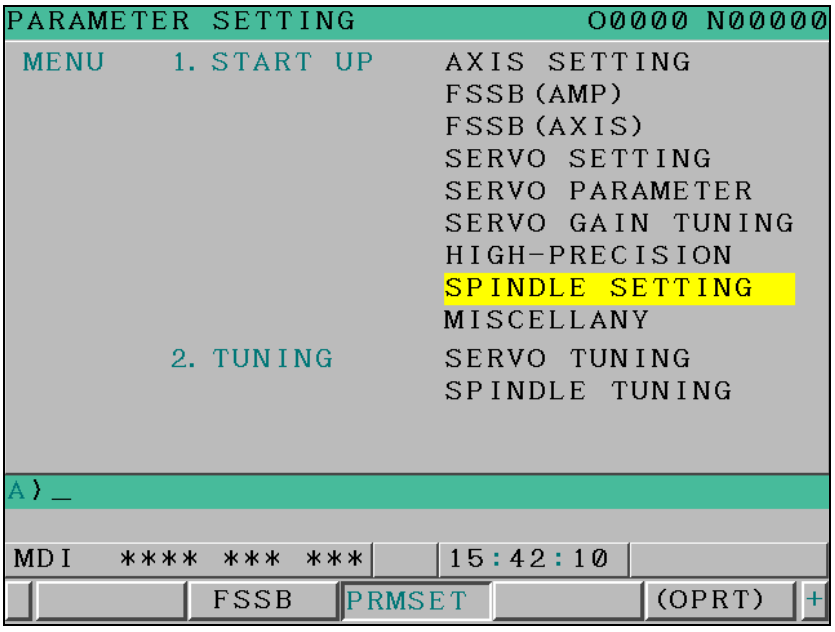


Fig. 6.1 (a) Parameter setting support screen

Displaying the spindle setting screen

There are the following two methods of displaying the spindle setting screen.

(1) On the parameter setting support menu screen, move the cursor to SPINDLE SETTING. Press soft key [OPRT] and press soft key [SELECT] to display the spindle setting screen (Fig. 6.1 (b)).

(2) Press function key [SYSTEM] and press continuous menu key [+] several times to display soft key [SP.SET]. Press soft key [SP.SET] to the spindle setting screen for spindle setting (Fig. 6.1 (b)).

NOTE
Method (2) above is valid when bit 1 (SPS) of parameter No. 3111 is 1.

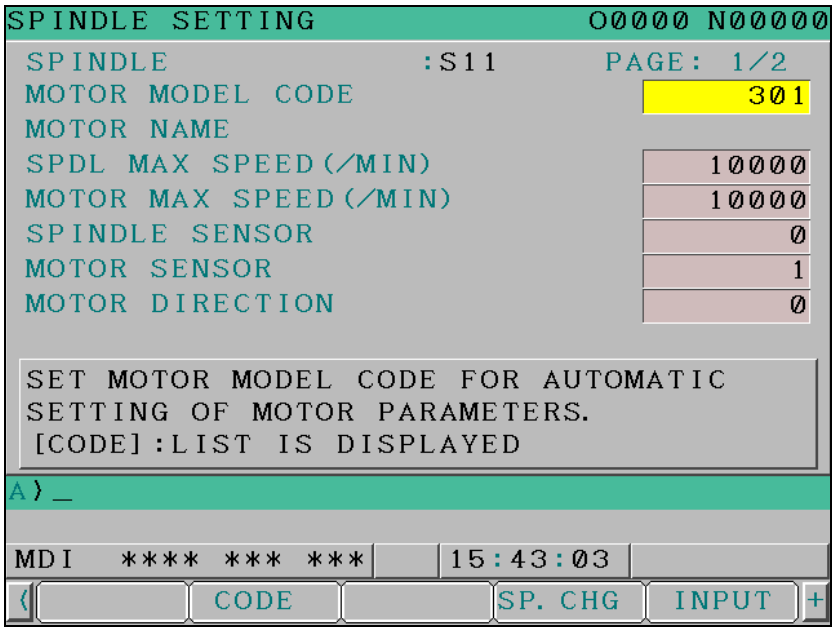


Fig. 6.1 (b) Spindle setting screen for inputting machine constants

NOTE
If no serial spindle is not connected or the spindle amplifier number (parameter No. 3717) is not set correctly, no item is displayed.

(2) Operation

Changing the spindle to be set

Press soft key [(OPRT)] to display soft key [SP. CHG]. Press soft key [SP. CHG] to change the spindle to be set.

NOTE
If multiple serial spindles are not connected, soft key [SP. CHG] is not displayed.

Inputting data

Confirm "PARAMETER ENABLE SWITCH ON" on the setting screen. Select the MDI mode and move the cursor to the item to be set.
Input data with numeric keys and press soft key [INPUT] or MDI key [INPUT].

NOTE
1 When the data of MOTOR MODEL CODE is changed, all items are set to their initial values.
2 When MOTOR MODEL CODE is blank, if another item is set, the cursor moves to MOTOR MODEL CODE and a warning saying "INPUT DATA" appears.

Input by soft keys

Soft keys are used to set data in "MOTOR SENSOR", "PROXIMITY SWITCH EDGE", "MOTOR DIRECTION", and "POS. CODER DIRECTION". Press the soft key corresponding to the item to be set and input data.
When soft key [(OPRT)] appears, press [(OPRT)] to display the soft key corresponding to the item to be set.

Soft keys displayed for MOTOR SENSOR and PROXIMITY SWITCH EDGE

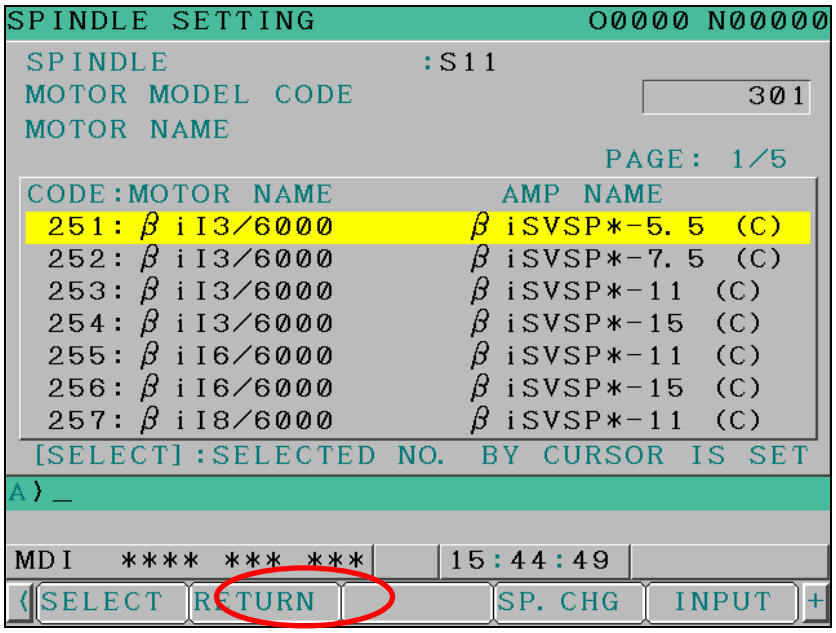
Soft keys displayed for MOTOR DIRECTION and POS. CODER DIRECTION

NOTE
It is also possible to input data with numerical keys and press soft key [INPUT] or MDI key [INPUT].
The soft keys to be displayed and their values are shown below.
- ON: 1 OFF: 0
- OPPST: 1 SAME: 0

Inputting data from a list of motor model codes

Data of MOTOR MODEL CODE can be input from a list of motor model codes. To display the motor model code list screen, press soft key [CODE]. Soft key [CODE] appears when the cursor is located on the MOTOR MODEL CODE item.
To return to the previous screen from the motor model code list screen, press soft key [RETURN].

On the motor model code list screen, motor model codes and the corresponding motor names and amplifier names are listed. Move the cursor to the code number for which data is input and press soft key [SELECT]. Upon completion of input, the previous screen is displayed.



NOTE
A motor model code not listed can be input by pressing soft key [INPUT] or MDI key [INPUT].

Displayed items

The items to be displayed depend on the settings of MOTOR MODEL CODE, SPINDLE SENSOR, and MOTOR SENSOR. The number of pages on the screen also varies.

Setting data

When soft key [SET] is pressed after all items are set, the parameter value required to start up the spindle in the CNC is calculated.
When the parameter value is successfully calculated, soft key [SET] is hidden and bit 7 (SPLD) of parameter No. 4019, which sets the spindle automatically, is set to 1. At the same time, alarm PW0000 is issued.
When data is changed, soft key [SET] appears again and bit 7 (SPLD) of parameter No. 4019, which sets the spindle automatically, is set to 0.

If soft key [SET] is pressed when an item is blank, the cursor moves to the item and a warning saying "INPUT DATA" is issued. Soft key [SET] needs to be pressed after data is input.
If the CNC parameter cannot be set to the result calculated by the CNC, the cursor moves to MOTOR MAX SPEED and a warning saying "ILLEGAL SETTING DATA" is issued. Enter an appropriate value and press soft key [SET] again.

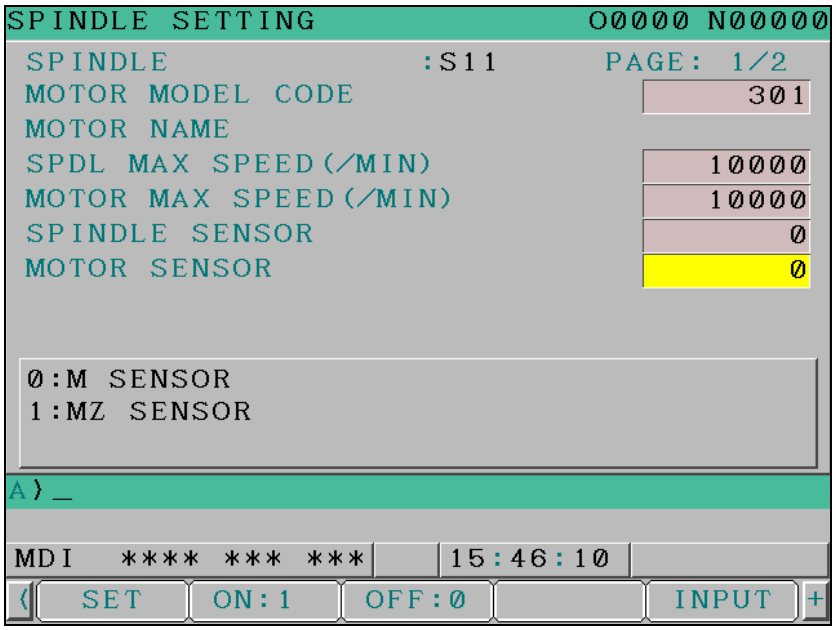
Transferring data (NC restart)

Pressing soft key [SET] does not complete the setting of the parameters required to start up the spindle.
If the CNC is restarted with soft key [SET] hidden, the parameters required to start up the spindle is calculated by the CNC and set during the restart.

NOTE
For the items other than SPINDLE SENSOR, OPTIMUM ORIENTATION, and RIGID TAPPING VOLTAGE, their parameter values are changed without soft key [SET] being pressed.

Displaying the spindle setting screen for entering parameters

Press soft key [(OPRT)] and then [+] to display soft key [CHANGE]. Press soft key [CHANGE] to display the spindle setting screen for inputting parameters. On this screen, the spindle to be set is displayed and the cursor is located at the beginning.



To display the spindle setting screen for inputting machine constants again, press soft key [CHANGE] by the same procedure. At this time, the spindle indicated on the spindle setting screen for inputting parameters becomes the setting target and the cursor is indicated at the beginning.
If bit 2 (SDO) of parameter No. 13118 is set to 1, the spindle setting screen for inputting machine constants is hidden.

6.2 ITEMS ON THE SPINDLE SETTING SCREEN

The items to be set on the spindle setting screen are listed below.

Item name	Description	Remark
MOTOR MODEL CODE	Sets a motor model code for setting motor parameters automatically.	
MOTOR NAME		Displays the name corresponding to the set motor model code.
SPDL MAX SPEED (rpm)	Sets the maximum spindle speed (rpm).	
MOTOR MAX SPEED (rpm)	Sets the motor speed (rpm) at the maximum spindle speed. This speed must be equal to or less than the maximum speed defined by the specification.	
SPINDLE SENSOR	0: NONE 2: PROXIMITY SWITCH 1: POSITION CODER	When MOTOR MODEL CODE is between 200 and 299, "2: PROXIMITY SWITCH" is not displayed.
POS. CODER DIRECTION	0: SAME REV DIRECTION AS SPINDLE 1: OPPOSITE REV DIRECTION TO SPINDLE	When SPINDLE SENSOR is POSITION CODER, this item is displayed.
MOTOR SENSOR	0: M SENSOR 1: MZ SENSOR	When MOTOR MODEL CODE is not between 200 and 299, this item is displayed.
MOTOR DIRECTION	0: SAME REV DIRECTION AS SPINDLE 1: OPPOSITE REV DIRECTION TO SPINDLE	This item is displayed when: 1. SPINDLE SENSOR is POSITION CODER or PROXIMITY SWITCH. 2. SPINDLE SENSOR is NONE and MOTOR SENSOR is MZ SENSOR.

Item name	Description	Remark
PROXIMITY SWITCH EDGE	0: RISING EDGE DETECTED 1: FALLING EDGE DETECTED	When MOTOR MODEL CODE is not between 200 and 299 and SPINDLE SENSOR is PROXIMITY SWITCH, this item is displayed.
SPINDLE GEAR TEETH	Sets the number of gear teeth on the spindle side in connection between the spindle and motor.	When MOTOR MODEL CODE is not between 200 and 299 and SPINDLE SENSOR is PROXIMITY SWITCH, this item is displayed.
MOTOR GEAR TEETH	Sets the number of gear teeth on the motor side in connection between the spindle and motor	When MOTOR MODEL CODE is not between 200 and 299 and SPINDLE SENSOR is PROXIMITY SWITCH, this item is displayed.
OPTIMUM ORIENTATION	The optimal orientation function is: 0: DISABLED, 1: ENABLED	
RIGID TAPPING VOLTAGE	During rigid tapping: 0: UNDER MOTOR BASE SPEED 1: OVER MOTOR BASE SPEED	

6.3 PARAMETERS TO BE SET ON THE SPINDLE SETTING SCREEN

The parameters to be set on the spindle setting screen are listed below. For details on these parameters, refer to the PARAMETER MANUAL (B-64310EN).

Parameter	Description
No.3741	Maximum spindle speed (rpm)
No.4000 #0	Motor rotation direction
No.4001 #4	Position coder rotation direction
No.4002 #3,2,1,0	Spindle sensor type
No.4004 #3,2	Proximity switch (other than the sensor less type)
No.4005 #0	Speed feedback method (for the sensor less type)
No.4006 #1	Gear ratio resolution
No.4010#2,1,0	Motor sensor type
No.4019 #7	Automatic setting
No.4020	Maximum motor speed (rpm)
No.4056	Motor revolutions per one spindle revolution Maximum motor speed /Maximum spindle speed × 100 (round-off)
No.4133	Motor model code
No.4171	Number of gear teeth on the spindle side
No.4172	Number of gear teeth on the motor side
No.4334	Arbitrary number of speed detector pulses
No.4018#6,3	Type of orientation by a position coder
No.4018#5,4	Velocity feed-forward setting
No.4064	Position gain change rate upon completion of spindle orientation
No.4076	Spindle orientation speed limitation ratio
No.4084	Motor voltage during spindle orientation
No.4320, No.4321	Acceleration during motor deceleration
No.4324	Acceleration during motor deceleration (for high-speed characteristic)
No.4326	Limitation start speed of acceleration during motor deceleration for the main spindle
No.4327	Limitation start speed of acceleration during motor deceleration for a sub spindle
No.4540#1	Voltage pattern during rigid tapping
No.4085	Motor voltage during servo mode/spindle synchronous control.

7 INITIALIZATION OF THE OTHER NC PARAMETERS

Chapter 7, “INITIALIZATION OF THE OTHER NC PARAMETERS”, consists of the following sections:

7.1 INITIALIZATION PROCEDURE

(1) Preparation

Display the parameter setting support screen. For details, refer to Section 1.1, "OVERVIEW" in this manual.

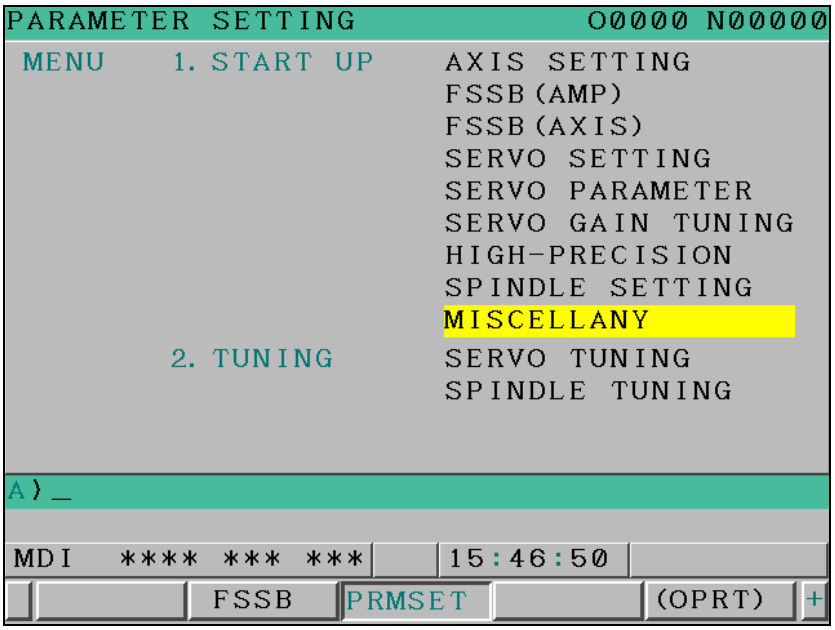


Fig. 7.1 (a) Parameter setting support screen

Press soft key [(OPRT)], move the cursor to MISCELLANY, and press [SELECT] to display the miscellany setting screen (Fig. 7.1 (b)). Use this screen to make the following parameter settings.

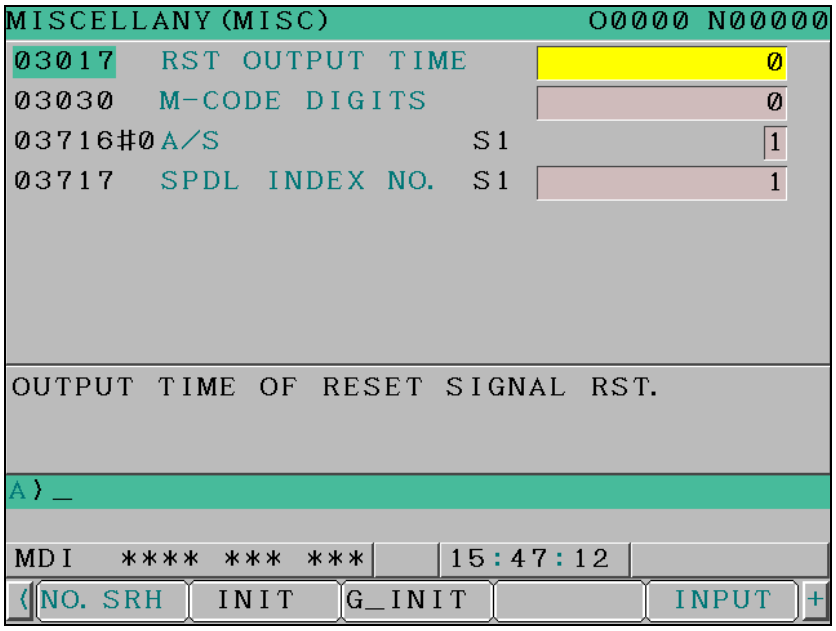


Fig. 7.1 (b) Miscellany setting screen

(2) Initialization

Parameters are initialized.
The procedure is described below.

<1> MISC group

<1>-1 Setting defaults

The procedure for setting the parameters in the MISC group to their defaults is described below.
Press soft key [G_INIT].
A message saying "DO YOU SET INIT-VALUE ?" appears.
Press soft key [EXEC].

The miscellaneous NC parameters have been initialized.

<1>-2 Setting parameters with no default

NOTE
1 Some parameters are not set to their defaults even if the procedure in "<1>-1 Setting defaults" is performed.
These parameters are set manually in the procedure in "<1>-2 Setting parameters with no default".
2 When a parameter number is entered and soft key [NO. SRH] is pressed, the cursor moves to the specified parameter.

Set the following parameters.

Parameter No.	Description	Type
3716#0	The spindle motor type is: 0: Analog spindle 1: Serial spindle	Each spindle
981	Absolute path number to which each axis belongs	Each axis

Parameter No.	Description	Type
982	Absolute path number to which each spindle belongs	Each spindle
3017	Output time of reset signal RST	-
3717	Spindle amplifier number	Each spindle

NOTE
Parameters Nos. 981 and 982 are displayed only when the 2-path control function option (T series (2-path control)) is present.

7.2 NC PARAMETERS RELATED TO MISCELLANY SETTINGS

The parameters to be set during initialization of the NC parameters related to miscellany settings are listed below. For details on these parameters, refer to the PARAMETER MANUAL (B-64310EN).

Group	Item name	Parameter No.	Description
MISC	PATH NUM OF AXIS	No.981	Sets the path to which each axis belongs.
	PATH NUM OF SPINDLE	No.982	Sets the path to which each spindle belongs.
	RST OUTPUT TIME	No.3017	Sets the output time of the reset signal.
	M-CODE DIGITS	No.3030	Sets the allowable number of digits for the M code.
	A/Ss	No.3716 #0	The spindle motor type is: 0: Analog spindle. 1: Serial spindle.
	SPDL INDEX NO.	No.3717	Sets the spindle amplifier number. Set 0 for the unused spindles.

8 TUNING

Chapter 8, “TUNING”, consists of the following sections:

8.1 TUNING ITEM

The TUNING item can be used to display the servo tuning screen, spindle tuning screen, and machining parameter tuning screen for easy tuning.
On the menu screen for parameter setting support, select an item with the cursor and press soft key [SELECT] to display each tuning screen.

SERVO TUNING : Displays the servo tuning screen.
SPINDLE TUNING : Displays the spindle tuning screen.
AICC TUNING : Displays the machining parameter tuning (advanced preview control/AI advance preview control/AI contour control) screen.

For details on the tuning screens, refer to the following manuals.

Series 0*i*-D Series 0*i* Mate-D	MAINTENANCE MANUAL (B-64305EN)	Servo tuning screen Spindle tuning screen
	CONNECTION MANUAL (FUNCTION) (B–64303EN-1)	Machining condition selection function

9 PARAMETERS RECOMMENDED TO BE SET

(1) Minimum servo parameters required to be adjusted
This section describes the minimum servo parameters required to be adjusted based on the machine characteristics.

9.1 SERVO PARAMETERS REQUIRED TO BE ADJUSTED BASED ON THE MACHINE CHARACTERISTICS

This section describes the minimum servo parameters required to be adjusted after the above parameter were set.
Make the following settings and then check the machine operation and machining. If a problem occurs, change parameters as described in the Adjustment field.

Parameters required to be adjusted to find the optimal value

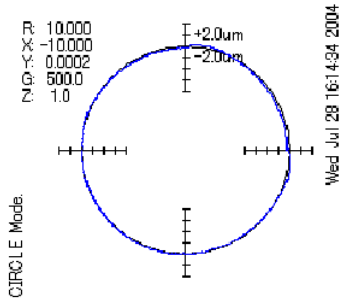
Parameter No.	Setting at tuning start	Description	Adjustment
2021	128	Load inertia ratio (LDINT) (velocity gain) (Note 1)	When vibrations occur during movement of the axis, reduce the setting to 128 → 64 → 0 in that order.
1825	5000	Position gain	If vibrations do not disappear even when the load inertia ratio is reduced to 0, reduce the position gain (No. 1825) values for all axes to 5000 → 4000 → 3000 in that order.
2048	100	Backlash acceleration	When a protrusion is found at the position where the axis movement direction is reversed, increase the setting in steps of 50. When a depression is found, decrease the setting in steps of 50.

NOTE
1 There is the following relationship between the load inertia ratio and velocity loop gain (%).
Velocity loop gain (%)
= (1 + load inertia ratio/256) × 100

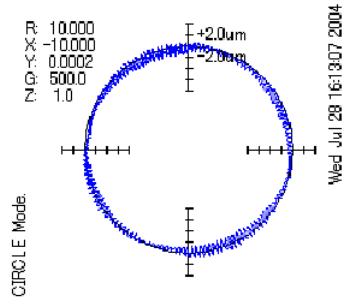
Example of conversion:
Velocity loop gain 150% -----Load inertia ratio 128
Velocity loop gain 200% -----Load inertia ratio 256
Velocity loop gain 250% -----Load inertia ratio 384
Velocity loop gain 300% -----Load inertia ratio 512

The servo guide (servo adjustment tool using PC) is useful to observe the vibration state or a protrusion/depression during reversal of the direction. Examples of observation of waveforms are shown below.

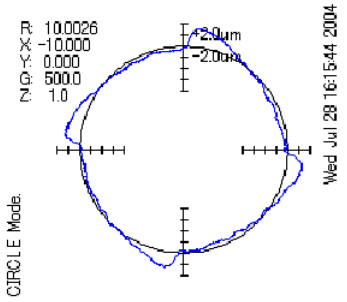
Change in the waveform depending on the load inertia ratio (velocity gain) setting and position gain setting



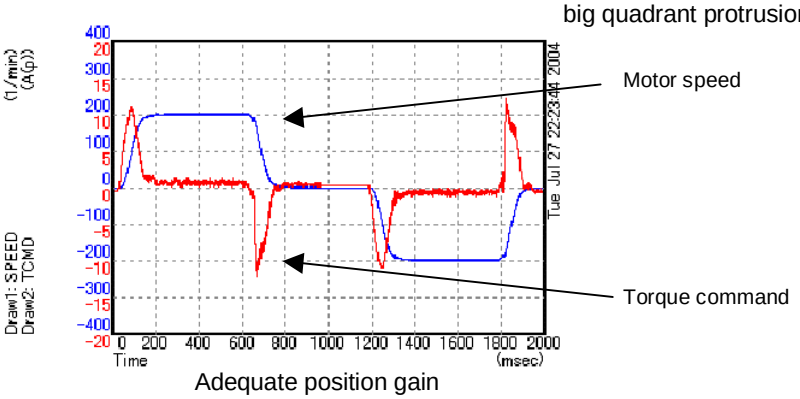
Adequate load inertia ratio (velocity gain)



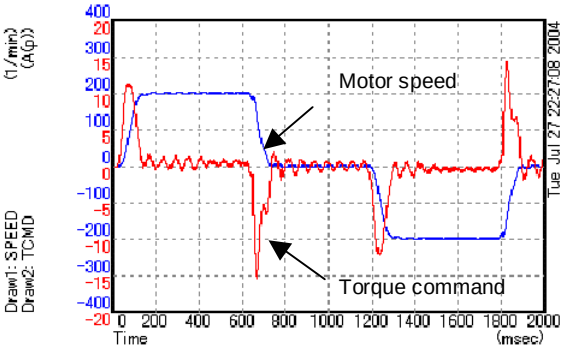
Excessive load inertia ratio (velocity gain)
High-frequency vibrations are found.



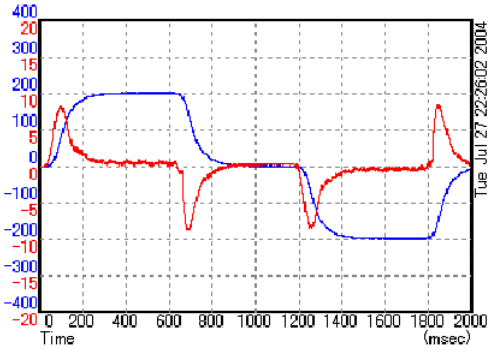
Low load inertia ratio (velocity gain)
The circle shape is not good and there are big quadrant protrusions.



Adequate position gain

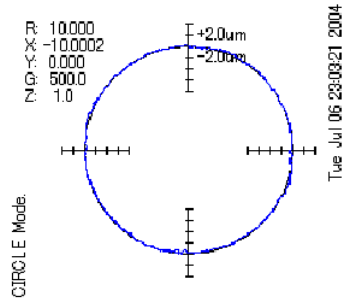


Excessively high position gain
Hunting is found during axis movement

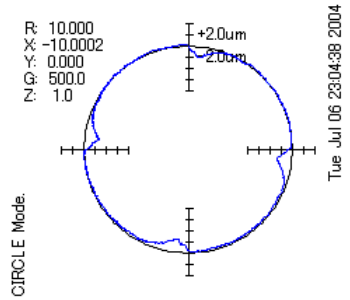


Low position gain
There is a long delay in acceleration/deceleration.

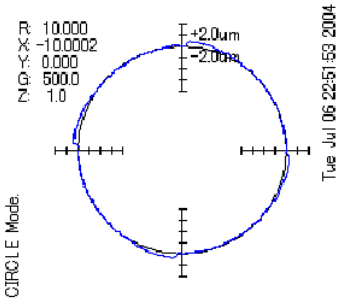
Change in the circle shape depending on the backlash acceleration setting



Adequate backlash acceleration



Excessive backlash acceleration
Depression occurs.



Small backlash acceleration
A protrusion remains.

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Revision Record

FANUC Series 0*i*-MODEL D / Series 0*i* Mate-MODEL D START-UP MANUAL (B-64304EN-3)

01	May, 2008	———————————————			
Edition	Date	Contents	Edition	Date	Contents

B-64304EN-3/01

B-64304EN-3/01.01