FANUC

GE Fanuc Automation

Computer Numerical Control Products

I/O Unit – Model A

Connection / Maintenance Manual

GFZ-61813E/03 *February 2000*

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warning and Caution according to their bearing on safety. Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

WARNING
Applied when there is a danger of the user being injured or when there is a damage of both the user being injured and the equipment being damaged if the approved procedure is not observed.

CAUTION
Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE
The Note is used to indicate supplementary information other than Warning and Caution.

- Read this manual carefully, and store it in a safe place.

PREFACE

This manual describe the following products:

Applicable models

Name of products	Abbreviation
FANUC I/O Unit-MODEL A	I/O Unit-A
FANUC I/O Unit-MODEL B	I/O Unit-B

Applicable CNCs

Name of products	Abbreviation
FANUC Power Mate-MODEL A	Power Mate-A
FANUC Power Mate-MODEL B	Power Mate-B
FANUC Power Mate-MODEL C	Power Mate-C
FANUC Series 0(MODEL C)	Series 0-C
FANUC Series 15	Series 15
FANUC Series 16	Series 16
FANUC Series 18	Series 18
FANUC SYSTEM F-MODEL D Mate	F-D Mate

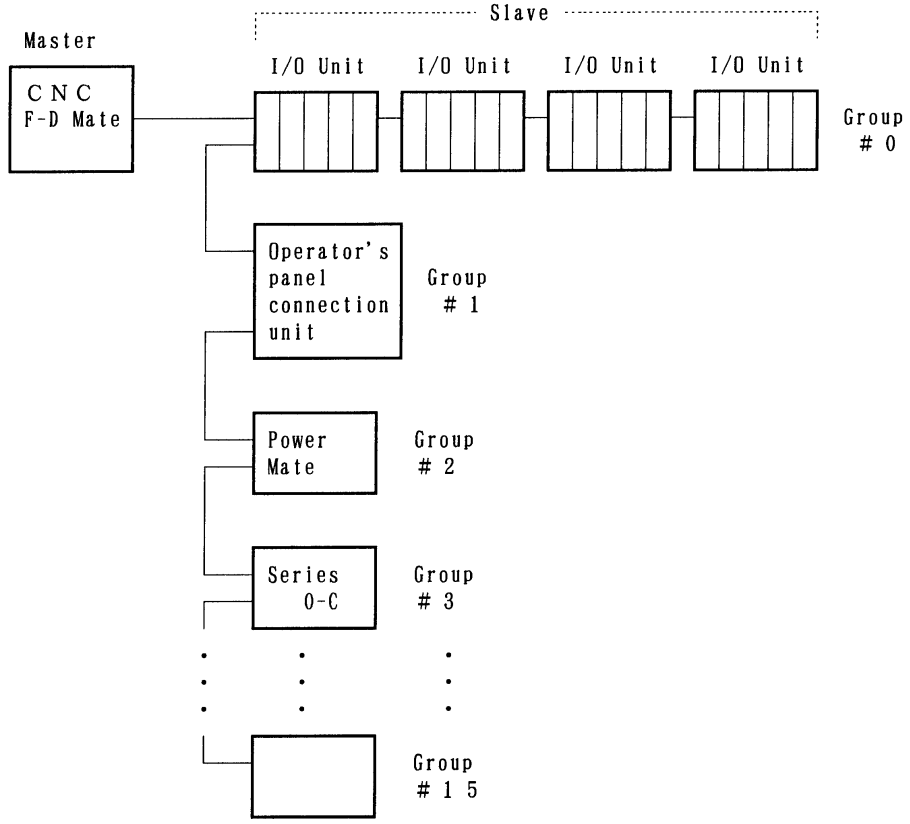
Contents

I. CONNECTIONS

1 FANUC I/O Link

I/O Link is a serial interface with a purpose to transfer I/O signals (bit data) betweenCNC, cell controller, the I/O Unit-A, the Power Mate-A, etc. at high speed.

1.1 CONFIGURATION



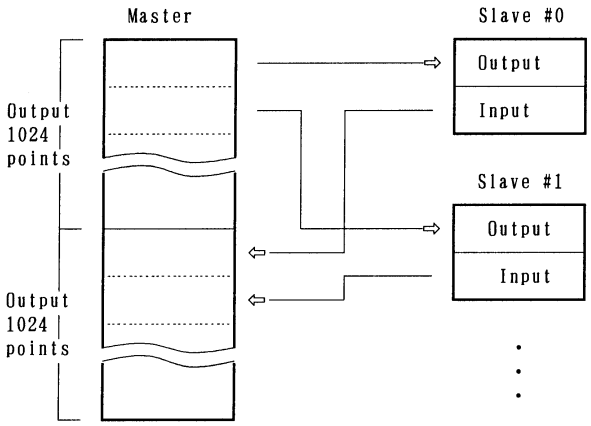
1) The FANUC I/O Link is made up of one master and a number of slaves.
   Master : Series 0-C, Series 15/16/18/20/21, Series 15*i*/16*i*/18*i*/20*i*/21*i*, Power Mate-D/H, Power Mate *i*-D/H, F-D Mate
   Slave : I/O Unit-A, Power Mate operator's panel connection unit, Series 0-C

2) Up to 16 groups of slaves can be connected with a single I/O Link. Number of slaves per one group is as follows.
   I/O Unit-A : Up to 4 units (i.e.4 bases) but when Master is CNC and Pwer Mate up to 2 units.
   Power Mate : 1
   Operator's panel connection unit : 1
   Series 0-C, : 1

3) Any slave can be connected with any group. However, different types of slaves can not be connected with a single group.

1.2 ALLOCATION OF I/O POINTS

I/O Link has 1024 input points and 1024 output points as viewed from the master.
I/O data is periodically transferred between the master and slaves by allotting these I/O points to each slave.



Each slave occupies specified number of I/O points. Sum of I/O points occupied by all slaves in an I/O Link is restricted as follows:

Number of input points $\leqq$ 1024
Number of output points $\leqq$ 1024

Number of actual I/O points may differ from that of the occupied ones. How to determine the number of I/O points to be allotted to each slave and restrictions for allocation are shown in the followings.
(For the allocation method for I/O points, refer to the PMC PROGRAMMING MANUAL.)
Number of actual and occupied I/O points are shown in Table 1.2.

Table 1.2

Kind of slave		Actual I/O points		Occupied I/O point		Remarks
		Input points	Output points	Input points	Output points	
I/O Unit-A		Each input moudle points	Each output module points	Refer 3 of next page		
Operator's panel connection unit	A	96	64	128	64	
	B	64	32			
Power Mate		32	32	32	32	Either I/O point can be allocated.
		64	64	64	64	
Series 0-C		32	32	32	32	Either I/O point can be allocated.
		64	64	64	64	

1) Sum the numbers of the occupied I/O points in Table 1 for all slaves connected with a single I/O Link. The sum must satisfy the following restriction :
   Number of input points $\leqq$ 1024 (per one I/O Link)
   Number of output points $\leqq$ 1024 (per one I/O Link)
2) Number of the occupied I/O points per one group must satisfy the following restriction :
   Number of input points $\leqq$ 256 (per one group)
   Number of output points $\leqq$ 256 (per one group)
3) Determine the number of I/O points for the I/O Unit-A using the following.
   [Output points]

Sum of the actual output points in a group		Occupied output points
0 to 32	⇒	32 points
40 to 64	⇒	64 points
72 to 128	⇒	128 points
136 to 256	⇒	256 points

NOTE
Count AOA05E as 8 points AOA12F as 16 points.

[Input points]

Sum of the actual output points in a group		Occupied output points
0 to 32	⇒	32 points
40 to 64	⇒	64 points
72 to 128	⇒	128 points
136 to 256	⇒	256 points

However, as result of the calculation above, when the number of input points is not larger than that of the output points in a single group, the number of input points is assumed to be equal to that of the output points.

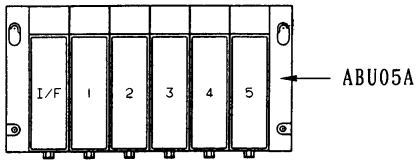
Example 1 : When the following modules are used in the group No. 0.
AOD32C 3 AID32A 5
AOA12F 2 AIA16G 3
[Output points]
32 × 3 + 16 × 2 = 128 ⇒ 128 points
[Input points]
32 × 5 + 16 × 3 = 208 ⇒ 256 points

Example 2: When the following modules are used in the group No.2
AOD16C 7 AID16C 4
AOA05E 9 AIA16G 3
[Output points]
16 ×7 + 8 ×9 = 184 ⇒ 256 points
[Input points]
16 ×4 + 16×3 = 112 ⇒ 128 points

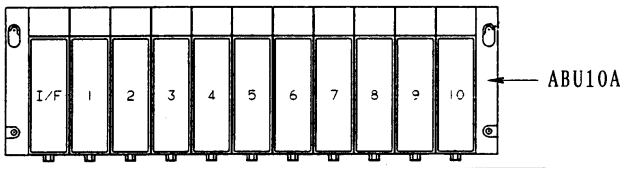
In this case, as the number of input points is not larger than that of the output points, the number of input points is assumed to be equal to that of the output points, in other words, 256 points.

2 I/O UNIT CONFIGURATION

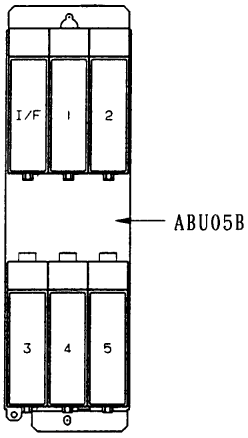
5-slot horizontal base unit (ABU05A)



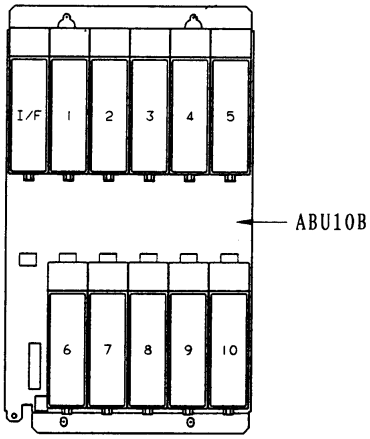
10-slot horizontal base unit (ABU10A)



5-slot vertical base unit (ABU05B)



10-slot vertical base unit (ABU10B)



NOTE
I/F :Interface module (AIF01A, AIF01B, or AIF02C)
1 to 10: I/O modules

3 INSTALLATION

3.1 ENVIRONMENTAL CONDITIONS

Install the cabinet containing the I/O Unit-A where the following conditions are satisfied.

1) Surrounding temperature
   During operation: 0 to 45°C
   During preservation and transportation: -20 to 60°C

2) Temperature changing rate: Max. 1.1°C/min

3) Humidity
   Normal condition: 75% or less (relative humidity)
   Short period (one month or shorter): Max.95%

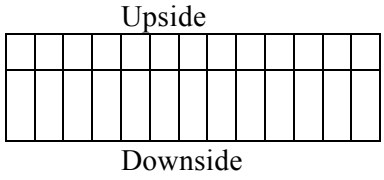
4) Vibration
   During operation: 0.5G or less

5) Atmosphere
   When the unit is used in areas with high density of dust, cutting fluid ororganic solvent,the user should consult FANUC.

3.2 DESIGNING CONDITION FOR A CABINET

When designing a cabinet to contain the I/O Unit-A, take the same care as taken for the cabinet containing the CNC control unit and other units. For details, refer to the CNC CONNECTING MANUAL.
In addition, when mounting the I/O unit,conform to the followings in view of maintenance, environmental durability, noise resistance and the like.

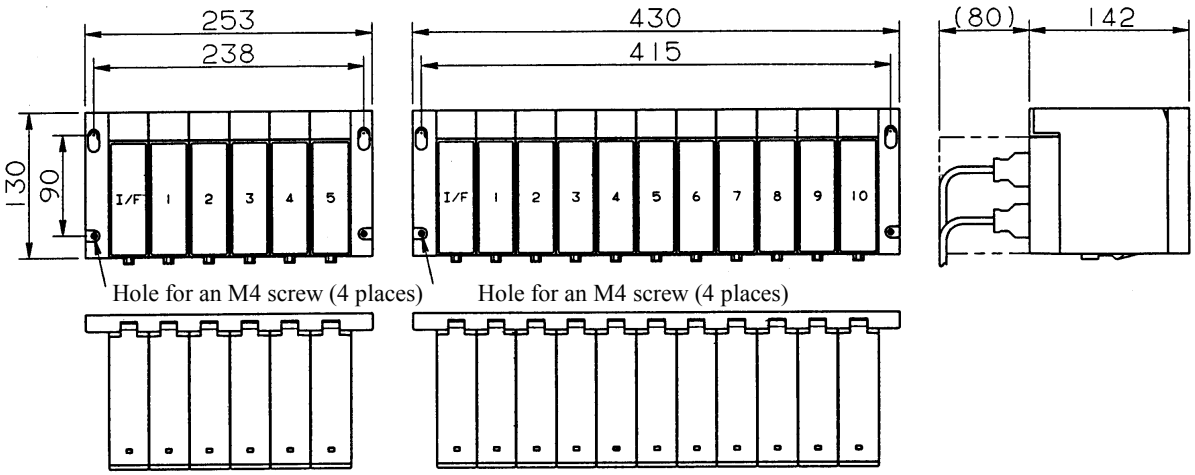
1) In order to ventilate inside the module well, mount the I/O unit in the direction shown in the figure below.



2) Mount the I/O unit vertically apart from other units by 100 mm or more taking ventilation and wiring into consideration.
3) Do not put equipments which generate a large amount of heat under the I/O unit.
4) Low-level signals are transferred through the signal cables K1X and K2X.(For these cables,see the general connection diagram.) Lay out these cables apart from the wires for AC power source and the I/O wires of the I/O module by 100 mm or more.
5) Make sure that there is no protruding portion such as a screw on the mounting surface of the I/O unit.
6) Heat values of I/O unit are listed in Table 3.3

3.3 OUTER DIMENSION OF I/O Unit

Horizontal base units (ABU05A and ABU10A)



Vertical base units (ABU05B and ABU10B)

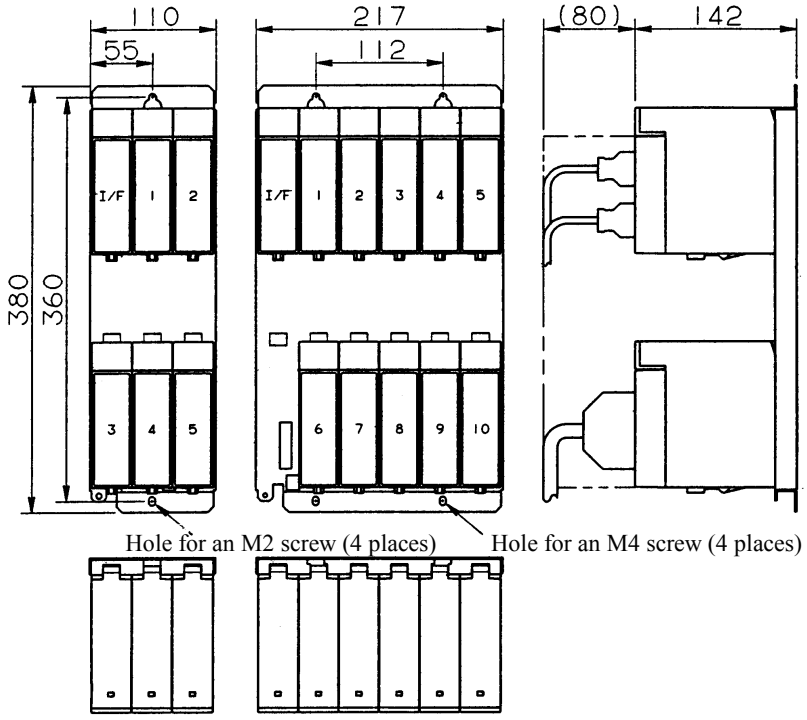


Table 3.3 Heat value of each module

	Module name	Basic heat value (W)	Heat value per 1 I/O point (W)
	AIF01A	1.2	-
	AIF01B	1.2	-
*1	AID32A1	1.2	0.23
*2	AID32B1	1.2	0.23
	AID32H1	1.2	0.23
	AID16C	0.1	0.21
	AID16K	0.1	0.21
	AID16D	0.1	0.21
	AID16L	0.1	0.21
*3	AID32E1	0.1	0.23
	AID32E2	0.1	0.23
*4	AID32F1	0.1	0.23
	AID32F2	0.1	0.23
	AIA16G	0.1	0.21
*5	AOD32A1	0.3	-
	AOD08C	0.1	$0.04+0.4\times IL^2$
	AOD08D	0.1	$0.04+0.6\times IL^2$
	AOD16C	0.1	$0.04+1.4\times IL^2$
	AOD16D	0.1	$0.04+1.4\times IL^2$
*6	AOD32C1	0.1	$0.01+0.8\times IL^2$
	AOD32C2	0.1	$0.01+0.8\times IL^2$
*7	AOD32D1	0.1	$0.01+0.8\times IL^2$
	AOD32D2	0.1	$0.01+0.8\times IL^2$
	AOA05E	0.1	$0.13+1.5\times IL$
	AOA08E	0.1	$0.13+1.5\times IL$
	AOA12F	0.1	$0.11+1.5\times IL$
	AOR08G	0.1	$0.3+0.1\times IL^2$
	AOR16G	0.1	$0.3+0.1\times IL^2$
	AOR16H2	0.1	$0.3+0.1\times IL^2$
	AAD04A	3.1	-
	ADA02A	3.1	-
	ADA02B	3.1	-
	ACT01A	4.1	-
	ATI04A	4.0	-
	ATI04B	4.0	-

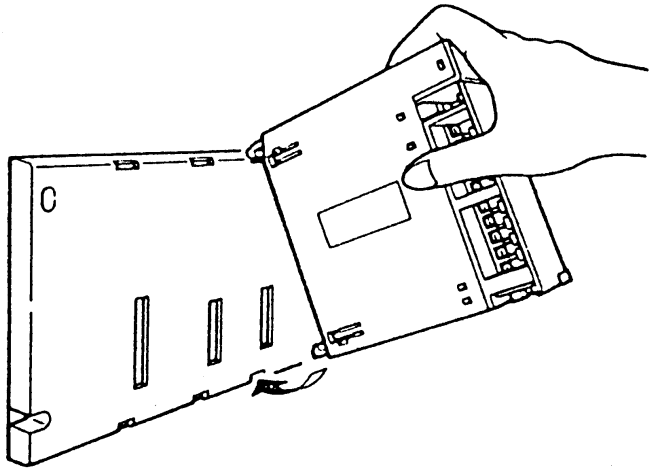
- Total `Heat value per 1 I/O point' for simultaneous ON points plus `Basic heat value' is the heat value of the module.
- IL : Load current of output
- A□D32□1 of " *1 to *7" is the same module as former A□D32□.
  (Example : AID32E1 is equal to former AID32E.)

3.4 MOUNTING AND DISMOUNTING MODULES

Interface modules and various types of I/O modules can be mounted to and dismounted from the base unit easily as shown below.

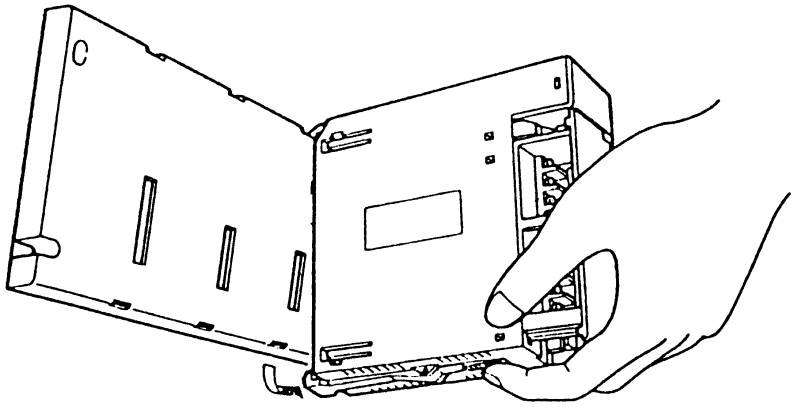
Mounting

Hang the hook at the top of the module on the groove in the upper side of the base unit, and make the connector of the module engage with that of the base unit. Push the module in the lower groove of the base unit till the stopper in the lower side of the module stops.



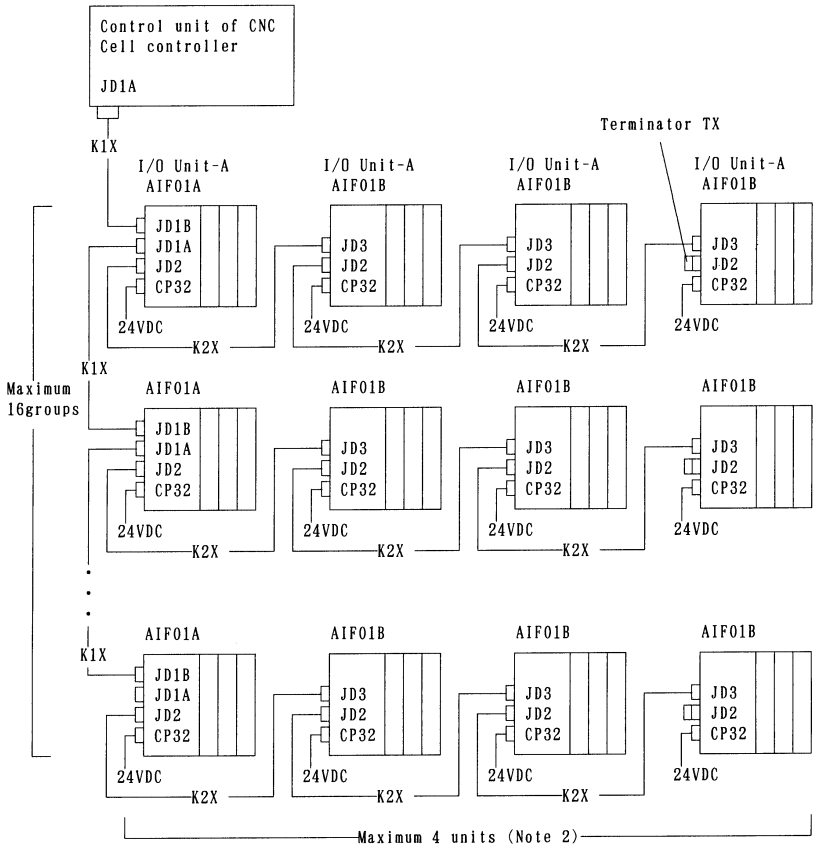
Dismounting

Release the stopper by pushing the lever at the bottom of the module, and then push the module upwards.



4 CONNECTION

4.1 GENERAL CONNECTION DIAGRAM



NOTE

1 Number of I/O Units and connecting method are restricted depending on the allocation of the I/O points. Refer to the section 1.2,"Allocation of I/O points."

2 The number of I/O units per group is limited to 2 when the master equipment is the CNC.

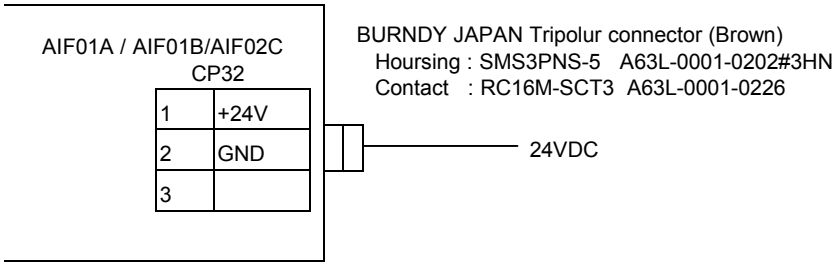
3 Cable K1X can be an optical fiber cable by using the optical I/O link adapter.
See chapter 10.

4 Terminator TX is required for connector JD2 of the AIF01B that is the last unit to be connected in the group. The terminator is not required when the AIF01B is not used.

4.2 CONNECTING INPUT POWER SOURCE

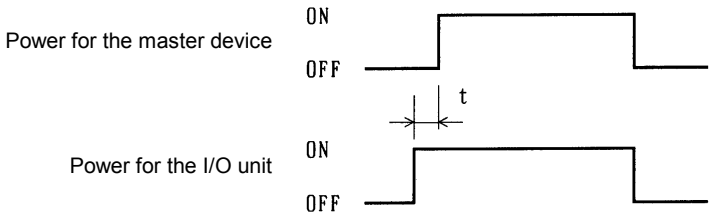
Connect the following power source with the connector CP32 of the interface module (AIF01A, AIF01B, or AIF02C).

- Voltage: 24VDC ±10%
- Current: Determine from Table 4.4



NOTE

Turn ON the power for the I/O unit just when or before the power for the CNC or the cell controller is turned ON. When the CNC or cell controller power is turned OFF,make sure to turn the power to the I/O unit OFF as well. If the power is not turned on and off according to the above procedure, an error occurs in the CNC or the controller, or the I/O unit is not normally connected to the power.

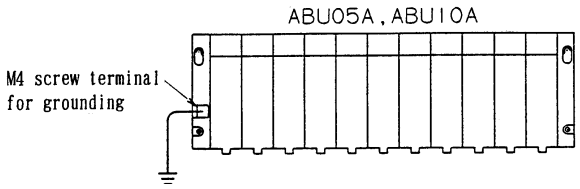


t ≧ 500 ms (Turn ON of the power for I/O unit can be late 500 ms or less.)

4.3 GROUNDING

Connect the grounding terminal of the base unit (ABU05A, ABU05B, ABU10A, or ABU10B) to ground.

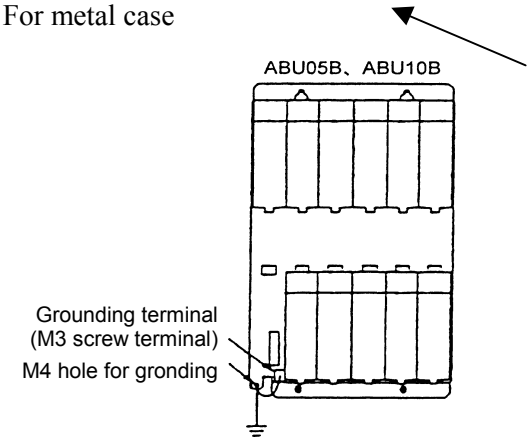
(1) Horizontal type base unit



Use a wire of 2 mm^2 or more for grounding.

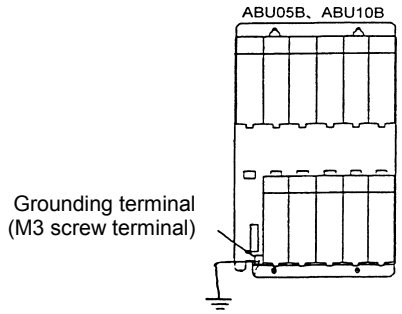
(2) Vertical type base unit

(a) For metal case



NOTE
Connect the grounding terminal to the grounding hole portion.

(b) For plastic case



(2) When the cable K1X (See overall connection figure in section 4.1) runs between different cabinets, make sure to connect the cabinets with a wire more than 5.5 mm^2.

4.4 REQUIRED CURRENT

Table 4.4 Required current of each module

Module name	Required current (mA) of+24V	
	A	B
AIF01A	50	
AIF01B	50	
AIF0K	50	
AID32A1	20+0.5×n	3.0+7.5×n
AID32B1	20+0.5×n	3.0+7.5×n
AID32H1	20+0.5×n	3.0+7.5×n
AID16C	5	
AID16K	5	
AID16D	5	
AID16L	5	
AID32E1	5	
AID32E2	5	
AID32F1	5	
AID32F2	5	
AIA16G	5+1.5×n	
AOD32A1	14	
AOD08C	5+2×n	
AOD08D	5+2×n	
AOD16C	5+2×n	
AOD16D	5+2×n	
AOD32C1	5+0.5×n	
AOD32C2	5+0.5×n	
AOD32D1	5+0.5×n	
AOD32D2	5+0.5×n	
AOA05E	5+5.5×n	
AOA08E	5+5.5×n	
AOA12F	5+4.5×n	
AOR08G	5	10×n
AOR16G	5	10×n
AOR16H2	5	10×n
AAD04A	5	130
ADA02A	6	120
ADA04B	5	130
ACT01A	170+0.3×α	
ATI04A	62.5	100
ATI04B	62.5	100

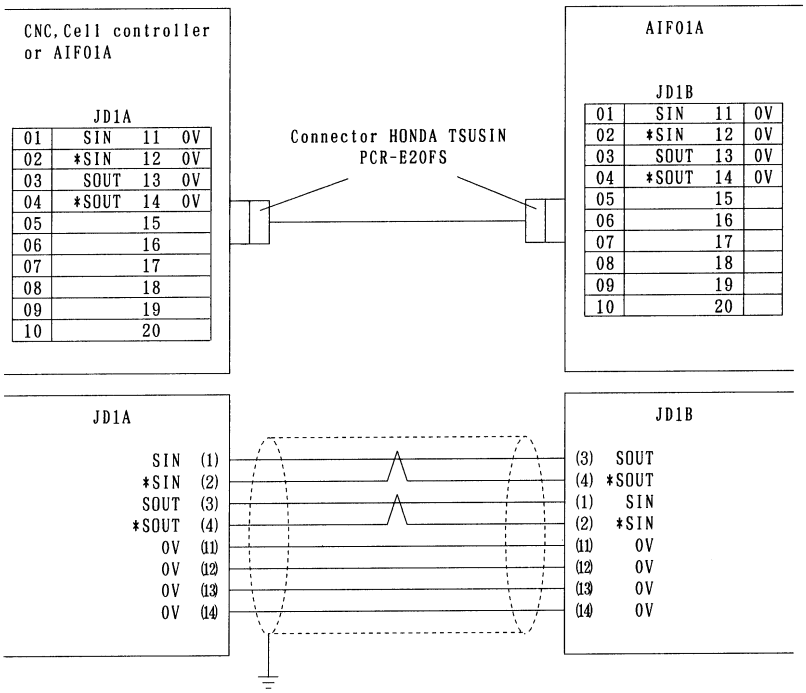
n: Number of the input and output points (for each module) which turn ON simultaneously
α: +5-V current (mA) output to the outside

- Add the sums of the columns A and B for the modules to be used. The sum is the required current.(Unit:mA)
- For each base unit, keep the sum of column A and the sum of column B to within 500 mA and 1,500 mA, respectively.

4.5 INTERFACE MODULE (AIF01A, AIF01B)

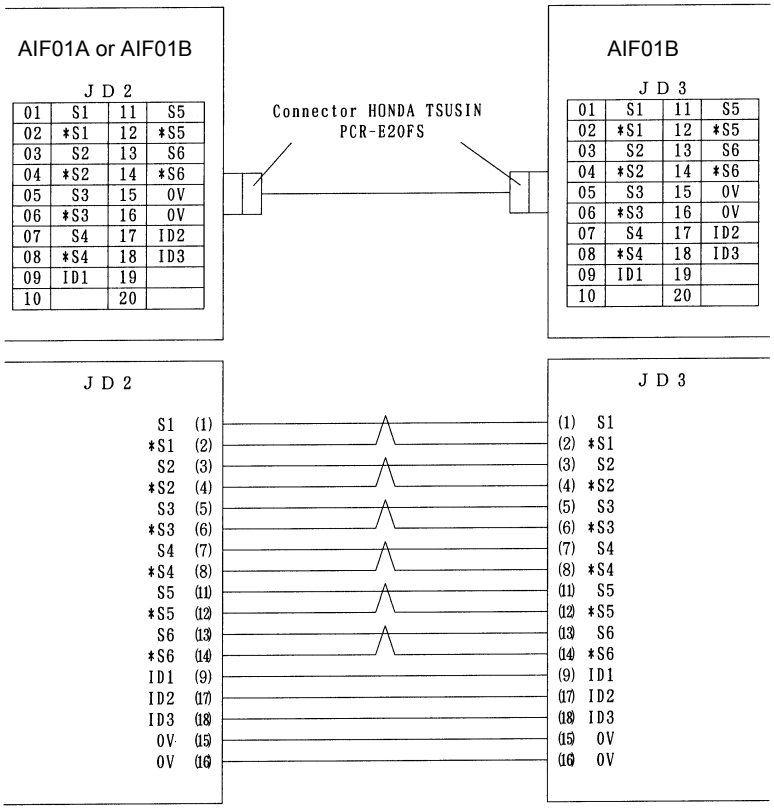
Details of the cables K1X,K2X and the terminator shown in the general connection diagram are as follows.

1) Cable K1X



a) Make sure to use twisted pair wires for signal SIN and *SIN, and signals SOUT and *SOUT.
   i) Reconnecnded cable material: A66L-0001-0284#10P (twisted pair/shielded)
   ii) Shielding wires should be connected with the grounding plate of the cabinet at the JD1A side using a cable clamp. (Refer to the CONNECTING MANUAL for the CNC and the cell controller.)
   iii) Maximum cable length: 10 m
   iv) Make sure not to connect to the connector spare pins.
   v) In the following cases, make sure to use an optical I/O link adapter and an optical fiber cable.(See chapter 10)
      - When the cable is more than 10 meters long.
      - When the cable runs between different cabinets and there is no appropriate ground wire between the cabinets.
      - When there is concern that the cable is influenced by strong noise.
   vi) When an optical I/O link adapter is used: Cable to be used between the interface module (AIF01A) and the optical I/O link adapter is dissimilar to this cable. (See chapter 10.)

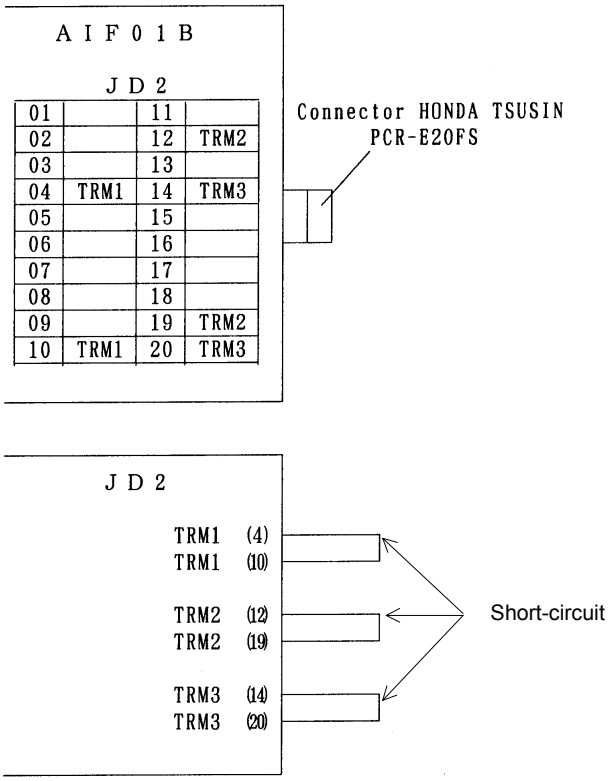
2) Cable K2X



- Connect the signals with a same name.
- Make sure to use twisted pair wires for the following signals:
  S1 and * S1, S2 and *S2, S3 and *S3
  S4 and * S4, S5 and *S5, S6 and *S6

- Do not connect the pins No.10, No.19 and No.20 as they are used internally.
- Recommended cable material: A66L - 0001 - 0284#10P (twisted pair/shielded)
- Maximum cable length: 2m

3) Terminator TX



- Terminate the connector JD2 of the last AIF01B in a single group with the terminator. The connector need not be terminated when the AIF01B is not used.
- Short-circuit the TRM1s, the TRM2s and the TRM 3s one another respectively in a manner that a TRM1 is with another TRM1 and so on.

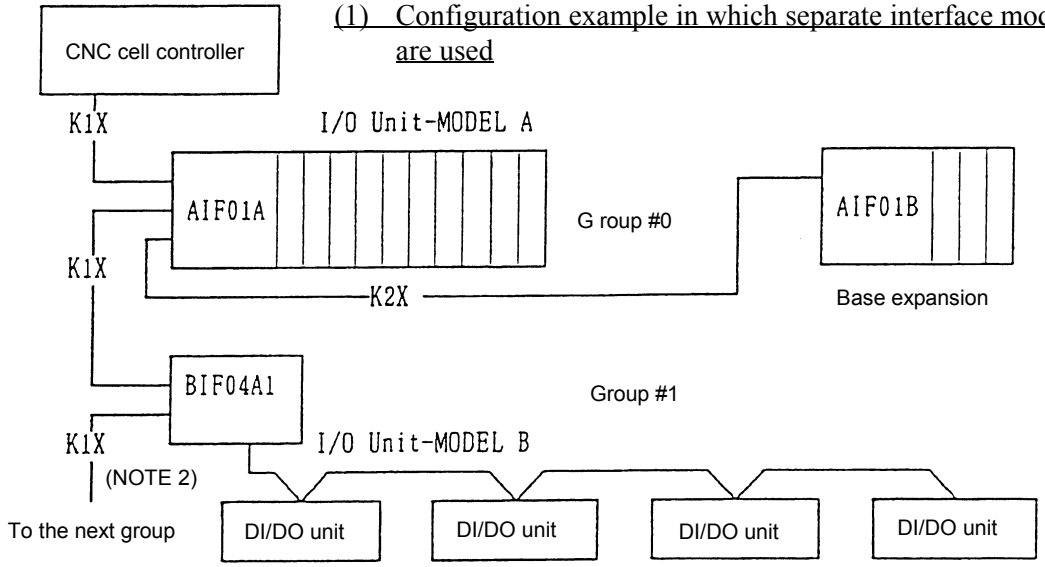
4.6 INTERFACE MODULE (AIF02C) CONNECTION

4.6.1 Overview

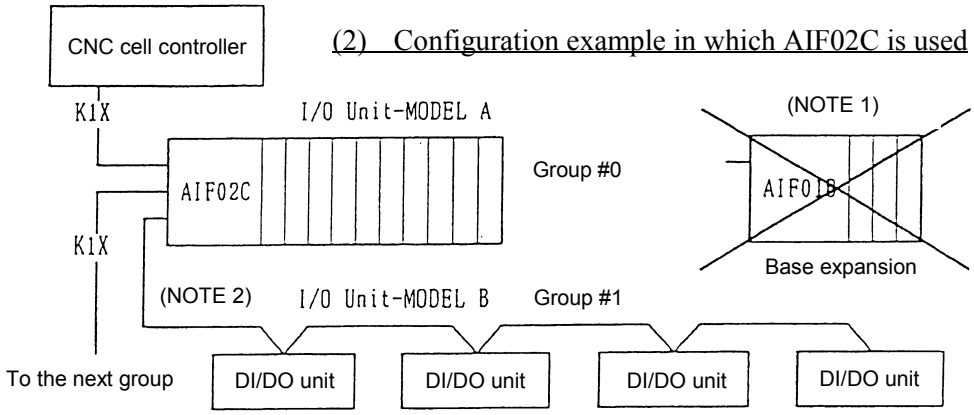
One interface module (AIF02C) can control communication with both I/O Unit-A and Unit-B, when it is connected to the FANUC I/O Link.

The following examples show a configuration in which two conventional separate interface modules, I/O Unit-A and I/O Unit-B, are used and a configuration in which the AIF02C is used.

(1) Configuration example in which separate interface modules are used



(2) Configuration example in which AIF02C is used

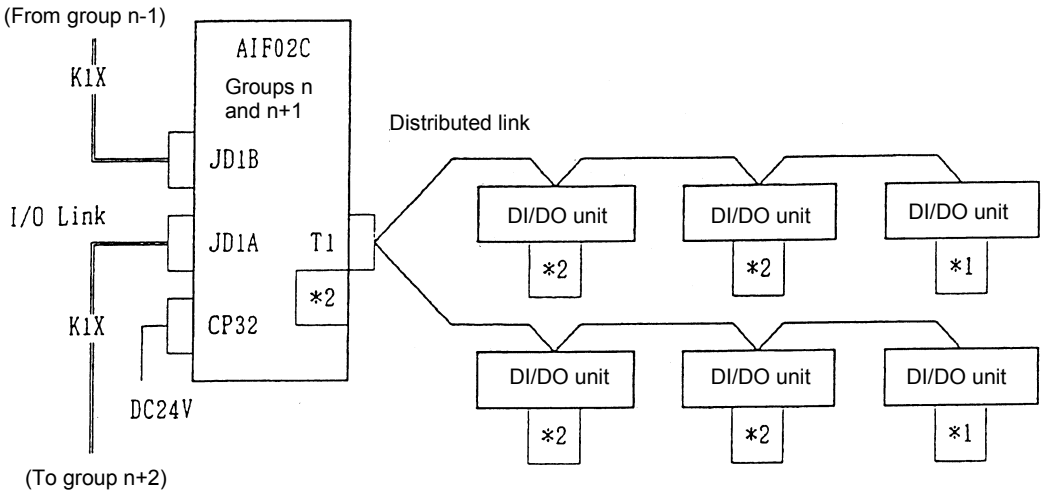


In this way, using the AIF02C eliminates the necessity for the interface unit (BIF04A1) for I/O Unit-B, which has conventionally been used separately; this configuration is suitable for a small I/O Unit-B system. Note the following points.

NOTES
1 The AIF02C cannot be used for base expansion.
2 The BIF04A1 can branch to a maximum of eight communication lines.
The AIF02C can branch only to a maximum of two distributed link cables.

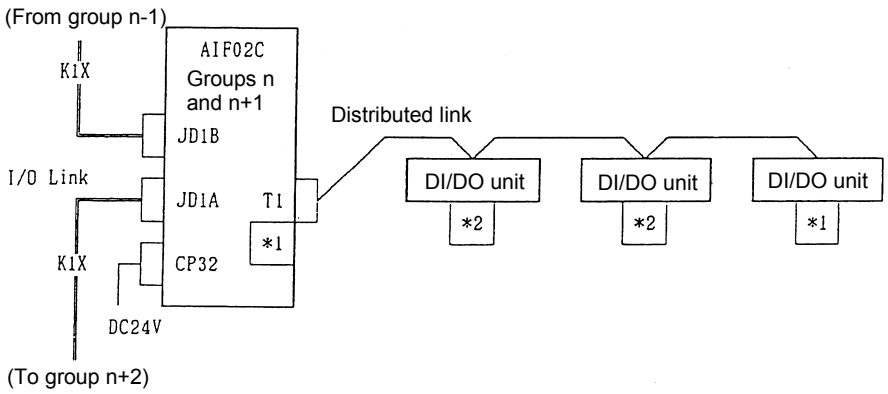
4.6.2 Connection

(1) Connection diagram
[a] Configuration with two distributed link cables (note the setting of the terminating resistor.)



CAUTIONS
1 Set the terminating resistor DIP switch to ON
2 Set the terminating resistor DIP switch to OFF.

[b] Connection with one Distributed Link cable (note the setting



CAUTIONS
1 Set the terminating resistor DIP switch to ON.
2 Set the terminating resistor DIP switch to OFF.

(2) Connection with the I/O link
The AIF02C occupies two groups on the I/O link.
When groups #n and #n+1 are used, for example, the smaller-numbered group, #n, is assigned to the I/O Unit-A, and the larger-numbered group, #n+1, is assigned to the I/O Unit-B.

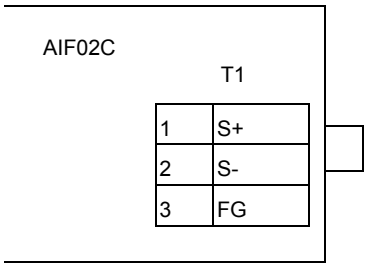
[a] Connection of the I/O link cable
Connect the I/O link cable from the previous group to JD1B.
Connect JD1A to the I/O link cable leading to the next group.
Use the K1X I/O link signal cable, the same I/O link signal cable type as that for the AIF01A.

[b] Number of occupied I/O points on the I/O link
The nominal number of occupied I/O points may differ from the actual number of I/O points. For the details of the number of I/O points occupied by the I/O Unit-B, refer to Section 4.2.1, "Number of points occupied on the interface unit I/O link," of the FANUC I/O Unit-B MODEL Connection Manual (B-62163E).

(3) Connection with the distributed link (I/O Unit-B)

[a] Number of distributed communication lines (I/O Unit-B)
"T1" can connect to two communication lines (twisted-pair wires).
So, it is possible to branch to up to two lines.
To branch to more lines, you should use the I/O Unit-B interface unit (BIF04A1), which enables branching to up to eight communication lines.

[b] Terminal board "T1," used for connection with the distributed link cable
The distributed link cable is connected to "T1."



① Use twisted-pair wires as the distributed link cable.
② The distributed link cable is polarity-sensitive. Match the signal polarity of the AIF02C with that of the basic unit.
③ The terminal board has M3 screws with a terminal cover.

Refer to Section 4.3, "Connecting a Distributed Link," and Section 4.5.2, "Connecting the communications cable," of the FANUC I/O Unit-MODEL B Connection Manual (B-62163E) for details.

4.6.3 Setting with the DIP switch

In the AIF02C, distributed link settings can be made with the DIP switch on the back of the module.
The settings and corresponding signals are shown below.

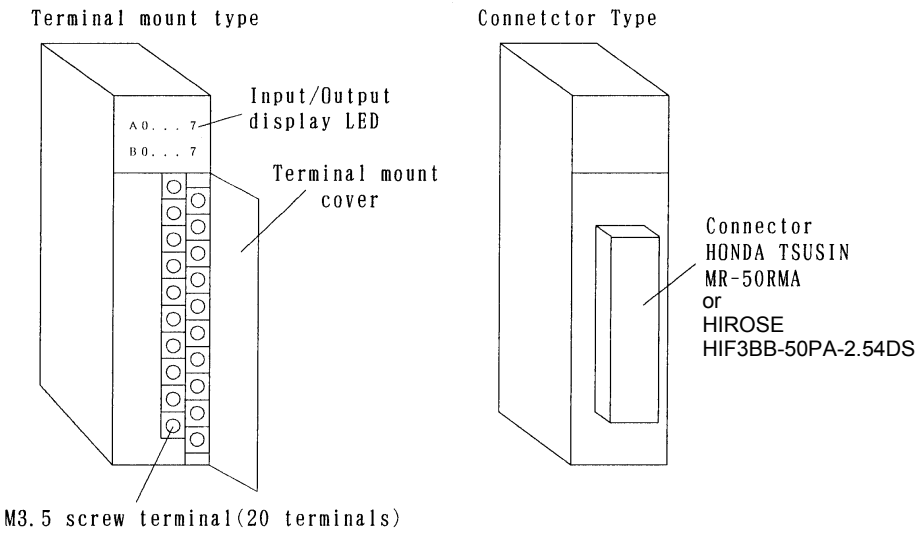
1		Unused
2		
3		
4	EDSP	
5	Q	
6	H	
7	URDY	
8	R	

(1) EDSP (error display method selection)
Normally, set EDSP to the ON position.
(2) Q and H (communication speed setting)
Normally, set both Q and H to the OFF positions.
(3) URDY (setting of the power on/off information for the unit)
Normally, set URDY to the OFF position.
(4) R (terminating resistor setting)
The ON position means that a terminating resistor must be installed. The OFF position means that no terminating resistor need be installed.
When only one communication cable is connected to the AIF02C, terminate it and the basic unit at the end of the communication cable with a resistor.
When two communication cables are connected to the AIF02C, terminate the basic unit connected to the end of each communication cable with a resistor. Do not connect a terminating resistor to the AIF02C. (Refer to Section 4.6.2, "Connection.")

Refer to Section 5.1.1, "DIP switch setting," of the FANUC I/O Unit-MODEL B Connection Manual (B-62163E).

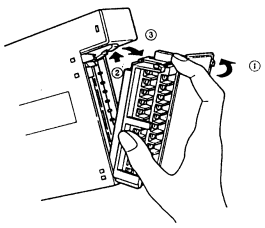
4.7 CONNECTING WITH I/O MODULES

From the point of view of an external connecting method, there are two types of I/O modules such as one with a terminal block and one with a connector.



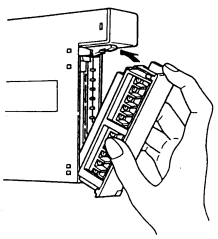
1) Connect with each module following the connection diagrams of sections 4.2 and 5.3.
2) The terminal block is a removable type.

[Dismounting the terminal block]



① Open the cover of the terminal block.
② Push up the latch at the top of the terminal block.
③ Drag out the tab at the top of the terminal block and pull it out. The terminal block will be removed from the module.

[Mounting the terminal block]

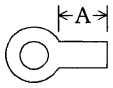


① Insert the protruding portion at the bottom of the terminal block in the groove of the module side.
② Push the terminal block using the engaging point of the protruding portion and the groove as an axis and mount it in the module firmly.
③ Open the cover of the terminal block and check to make sure the latch at the top of the terminal block is firmly set.

3) Cautionary points when wiring terminal block type

- Wiring material : AWG22 to 18 (0.3 to 0.75 mm^2)
  A wire as this as possible is recommended.

- Crimp style terminal : M3.5
  Crimp style terminal with no insulation sleeve and a short distance "A", as illustrated in the drawing below, is recommended.



DAIDO TANSHI 1.25-S3.5
NICHIFU TANSHI 1.25-3.5S etc.

- Mark tube : Use a short mark tube as possible and cover crimped part with the mark tube.

5 DIGITAL INPUT/OUTPUT MODULES

5.1 LIST OF MODULES

Digital input modules

Input type	module name	Rated voltage	Rated current	Polarity	Response time	Points	External connection	LED display
Non-insulation type DC input	AID32A1	24VDC	7.5 mA	Both	Maximum 20 ms	32	Connector A	not provided
	AID32B1	24VDC	7.5 mA	Both	Maximum 2 ms	32	Connector A	not provided
	AID32H1	24VDC	7.5 mA	Both	Maximum 2 ms Maximum 20 ms	8 24	Connector A	not provided
Insulation type DC input	AID16C	24VDC	7.5 mA	NEG	Maximum 20 ms	16	Terminal block	provided
	AID16K	24VDC	7.5 mA	NEG	Maximum 2 ms	16	Terminal block	provided
	AID16D	24VDC	7.5 mA	POS	Maximum 20 ms	16	Terminal block	provided
	AID16L	24VDC	7.5 mA	POS	Maximum 2 ms	16	Terminal block	provided
	AID32E1	24VDC	7.5 mA	Both	Maximum 20 ms	32	Connector A	not provided
	AID32E2	24VDC	7.5 mA	Both	Maximum 20 ms	32	Connector B	not provided
	AID32F1	24VDC	7.5 mA	Both	Maximum 2 ms	32	Connector A	not provided
	AID32F2	24VDC	7.5 mA	Both	Maximum 2 ms	32	Connector B	not provided
AC input	AIA16G	100 to 120VAC	10.5 mA (120VAC)		ON Max 35ms OFF Max 45ms	16	Terminal block	provided

NOTE
1 Polarity
Negative : 0 V common (current source type) Regard to be ON when input is at Low level.
Positive : 24 V common (current sink type) Regard to be ON when input is High level.
2 Connector A : HONDA MR Connector
Connector B : Flat Cable Connector
3 For the details of the specifications for each module, refer to the section 5.3.

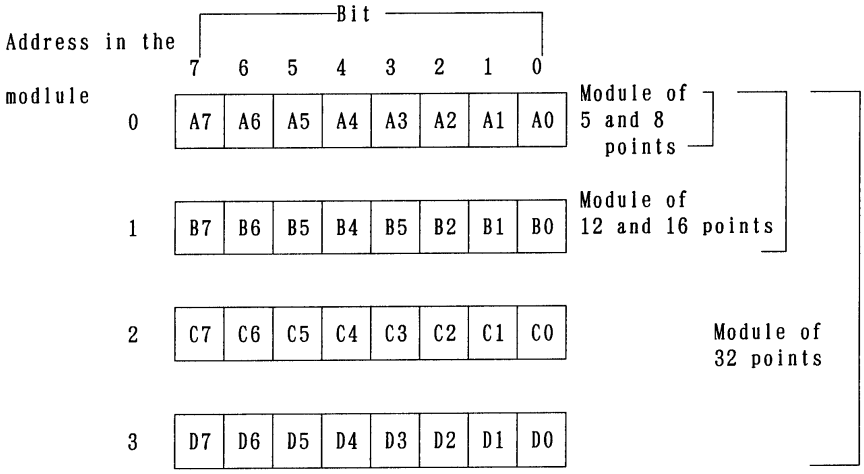
Digital output modules

Output type	Module name	Rated voltage	Maximum current	Polarity	Points	Points/ common	Externa connection	LED display	Fuse
Non-insulation type DC output	AOD32A1	5 to 24VDC	0.3A	NEG	32	8	Connector A	not provided	not provided
Insulation type DC output	AOD08C	12 to 24VDC	2A	NEG	8	8	Terminal block	provided	provided
	AOD08D		2A	POS	8	8	Terminal block	provided	provided
	AOD16C		0.5A	NEG	16	8	Terminal block	provided	not provided
	AOD16D		0.5A	POS	16	8	Terminal block	provided	not provided
	AOD32C1		0.3A	NEG	32	8	Connector A	not provided	not provided
	AOD32C2		0.3A	NEG	32	8	Connector B	not provided	not provided
	AOD32D1		0.3A	POS	32	8	Connector A	not provided	not provided
	AOD32D2		0.3A	POS	32	8	Connector B	not provided	not provided
AC output	AOA05E	100 to 240VAC	2A	-	5	1	Terminal block	provided	provided
	AOA08E		1A	-	8	4	Terminal block	provided	provided
	AOA12F	100 to 120VAC	0.5A	-	12	6	Terminal block	provided	provided
RELAY output	AOR08G	Maximum 250VAC/ 30VDC	4A	-	8	1	Terminal block	provided	not provided
	AOR16G		2A	-	16	4	Terminal block	provided	not provided
	AOR16H2	30VDC	2A	-	16	4	Connector B	provided	not provided

NOTE

1 Polarity
  Negative : 0 V common (current sink type) Output is at Low level when ON.
  Positive : 24 V common (current source type) Output is at High level when ON.
2 Connector A : HONDA MR Connector
  Connector B : Flat Cable Connector
3 For the details of the specifications for each module, refer to the section 5.3.
4 The maximum current of the DC output module includes the permissible rush current.

5.2 CORRESPONDENCE BETWEEN I/O SIGNALS AND ADDRESSES IN A MODULE



Addresses in a module are addresses defined for each module. They are relative addresses in a module with the beginning address in the module as 0. Real addresses viewed from the sequence program of the PMC are set by the programmer.

For input modules, an input signal becomes "1" when the contact point connected with the input is turned ON. On the other hand, for output modules, an output contact point (or transistor) is turned ON when the output signal is "1."

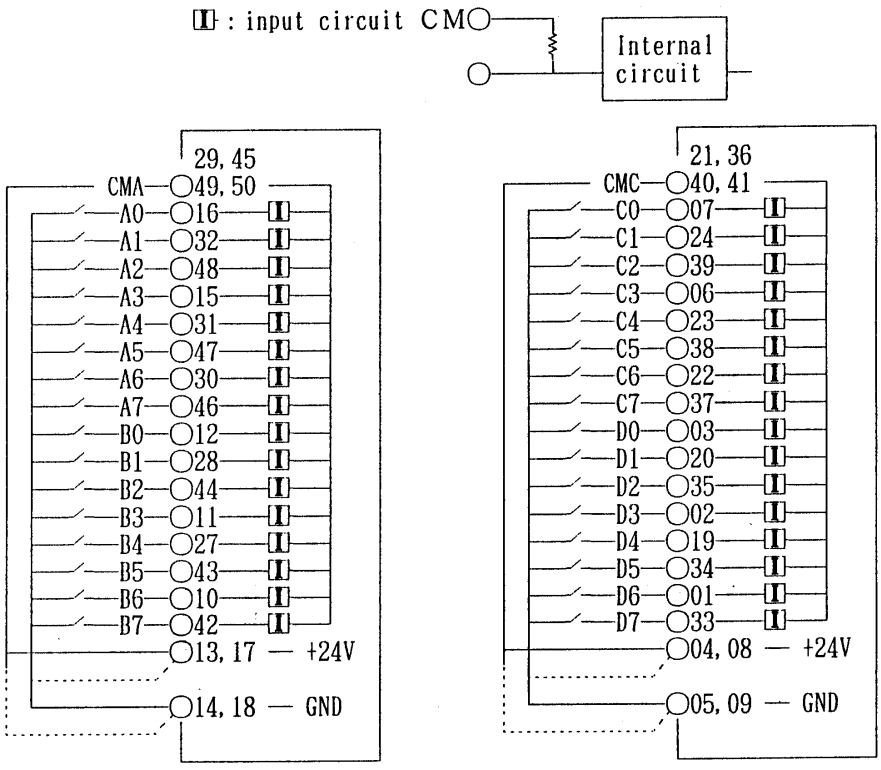
5.3 SPECIFICATION FOR EACH MODULE

Specifications for each I/O module are shown in the following pages.

(1) Input module AID32A1
(2) Input module AID32B1
(3) Input module AID32H1
(4) Input module AID16C
(5) Input module AID16K
(6) Input module AID16D
(7) Input module AID16L
(8) Input module AID32E1
(9) Input module AID32E2
(10) Input module AID32F1
(11) Input module AID32F2
(12) Input module AIA16G
(13) Output module AOD32A1
(14) Output module AOD08C
(15) Output module AOD08D
(16) Output module AOD16C
(17) Output module AOD16D
(18) Output module AOD32C1
(19) Output module AOD32C2
(20) Output module AOD32D1
(21) Output module AOD32D2
(22) Output module AOA05E
(23) Output module AOA08E
(24) Output module AOA12F
(25) Output module AOR08G
(26) Output module AOR16G
(27) Output module AOR16H2

(1) Input module AID32A1 (Non-insulation type)

Item		Specifications	
Points/module		32 points	
Points/common		16 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 18VDC, min. 6mA	
OFF voltage, current		Max. 6VDC, max. 1.5mA	
Response time	OFF→ON	Max.20ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.20ms	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			

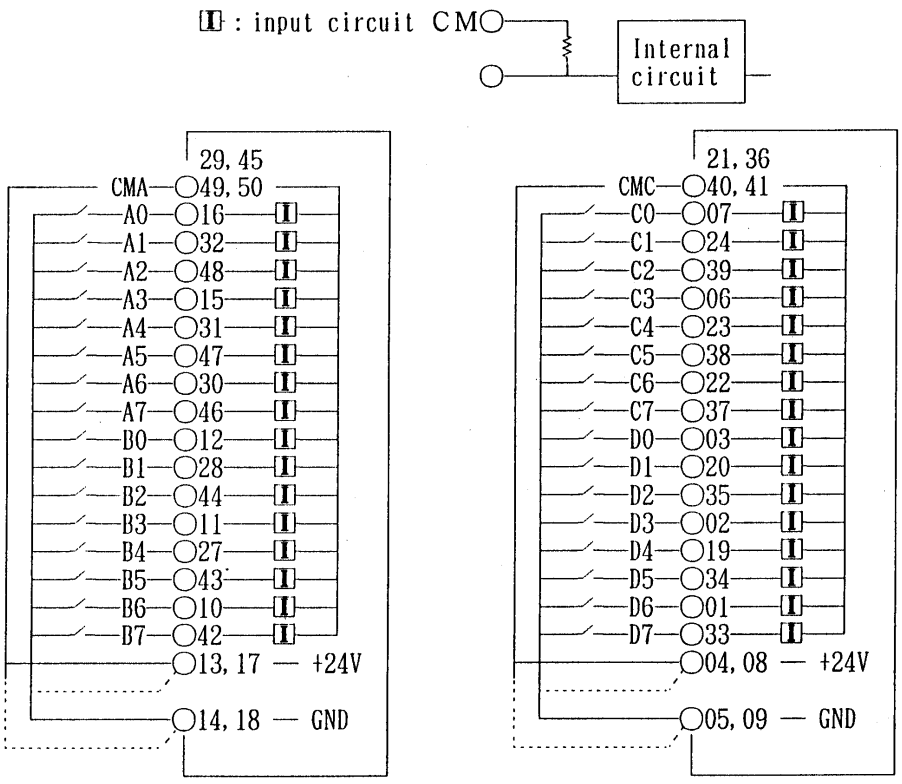


+24V or GND can be selected for input common as above fig.

NOTE
1 Make sure to connect all common (CMA, CMC) pins.
2 This module outputs +24 V on pins 13, 17, 04, and 08.

(2) Input module AID32B1 (Non-insulation type)

Item		Specifications	
Points/module		32 points	
Points/common		16 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, –20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 18VDC, min. 6mA	
OFF voltage, current		Max. 6VDC, max. 1.5mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			

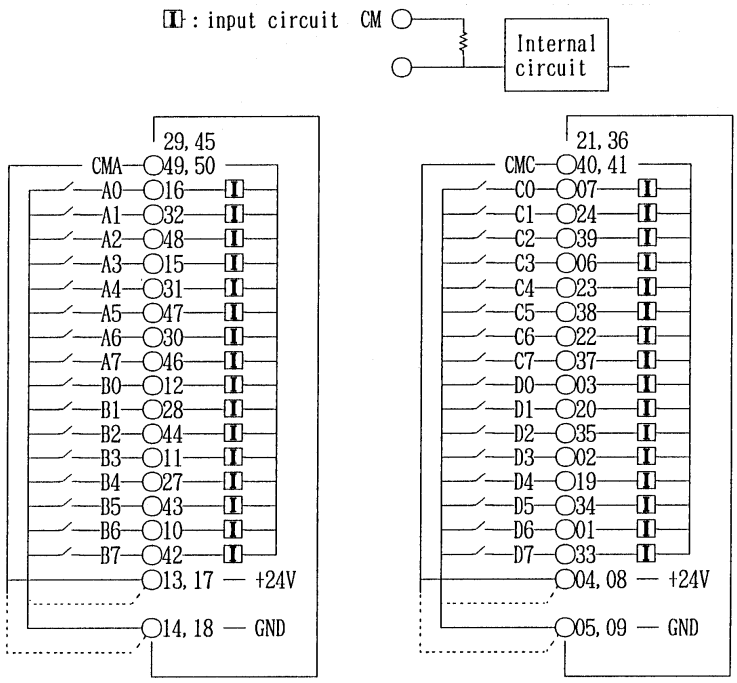


+24V or GND can be selected for input common as above fig.

NOTE
1 Make sure to connect all common (CMA, CMC) pins.
2 This module outputs +24 V on pins 13, 17, 04, and 08.

(3) Input module AID32H1

Item		Specifications	
Points/module		32 points	
Points/common		16 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 18VDC, min. 6mA	
OFF voltage, current		Max. 6VDC, max. 1.5mA	
Response time	OFF→ON	Max.2ms (A0 to A7) Max.20ms (B0 to D7)	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms (A0 to A7) Max.20ms (B0 to D7)	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			

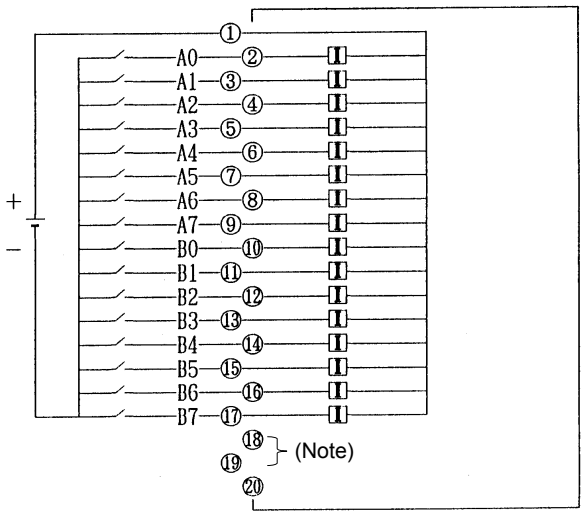


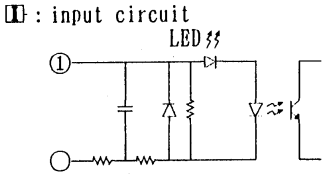
+24V or GND can be selected for input common as above fig.

NOTE
1 Make sure to connect all common (CMA, CMC) pins.
2 This module outputs +24 V on pins 13, 17, 04, and 08.

(4) Input module AID16C

Item		Specifications	
Points/module		16 points	
Points/common		16 points/common	
Sink/source current		Source current type	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4mA	
OFF voltage, current		Max. 5VDC, max. 1.5mA	
Response time	OFF→ON	Max.20ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.20ms	
Input display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			

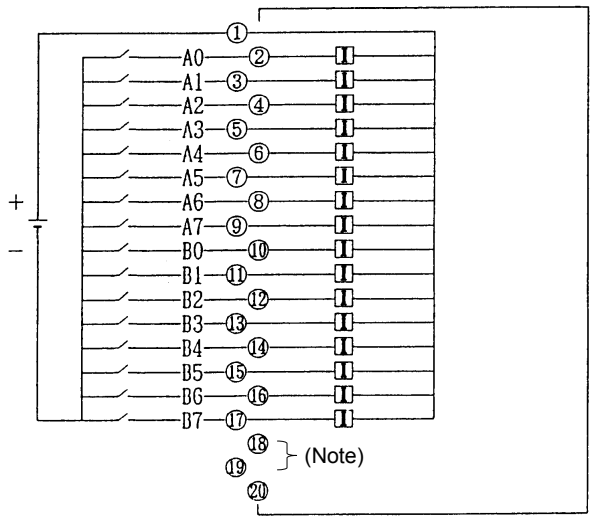


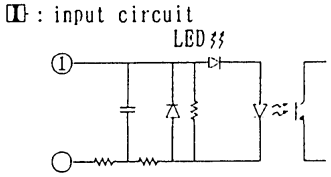


NOTE
Pins 18 and 19 are for factory use only.
Do not connect any wire to them

(5) Input module AID16K

Item		Specifications	
Points/module		16 points	
Points/common		16 points/common	
Sink/source current		Source current type	
Input voltage		24VDC +10%, –20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4mA	
OFF voltage, current		Max. 5VDC, max. 1.5mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Input display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			

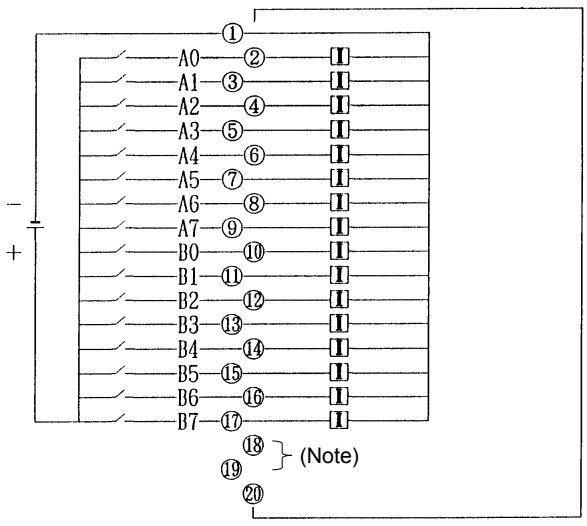


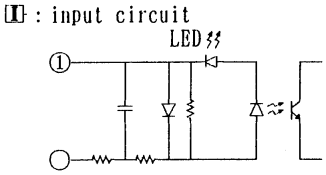


NOTE
Pins 18 and 19 are for factory use only.
Do not connect any wire to them

(6) Input module AID16D

Item		Specifications	
Points/module		32 points	
Points/common		16 points/common	
Sink/source current		Sink current type	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4mA	
OFF voltage, current		Max. 5VDC, max. 1.5mA	
Response time	OFF→ON	Max.20ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.20ms	
Input display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			

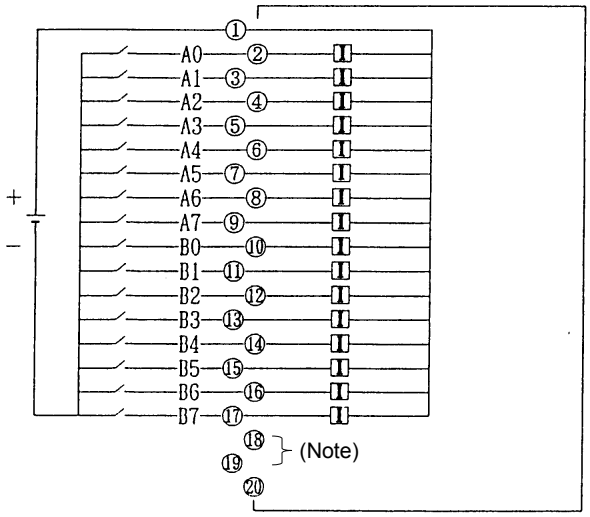


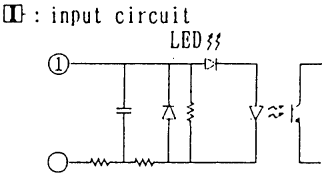


NOTE
Pins 18 and 19 are for factory use only.
Do not connect any wire to them

(7) Input module AID16L

Item		Specifications	
Points/module		16 points	
Points/common		16 points/common	
Sink/source current		Source current type	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4mA	
OFF voltage, current		Max. 5VDC, max. 1.5mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Input display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			

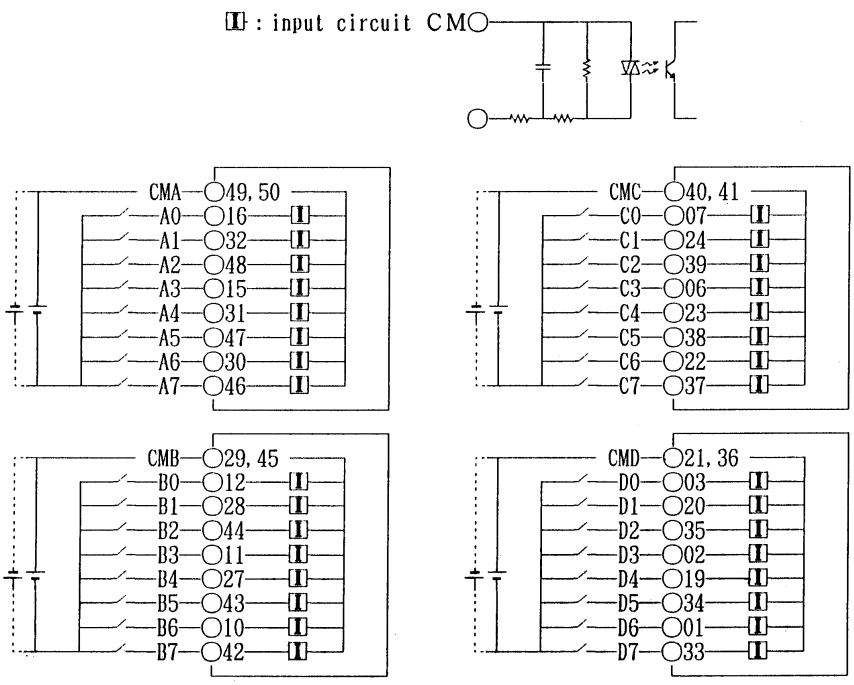




NOTE
Pins 18 and 19 are for factory use only.
Do not connect any wire to them

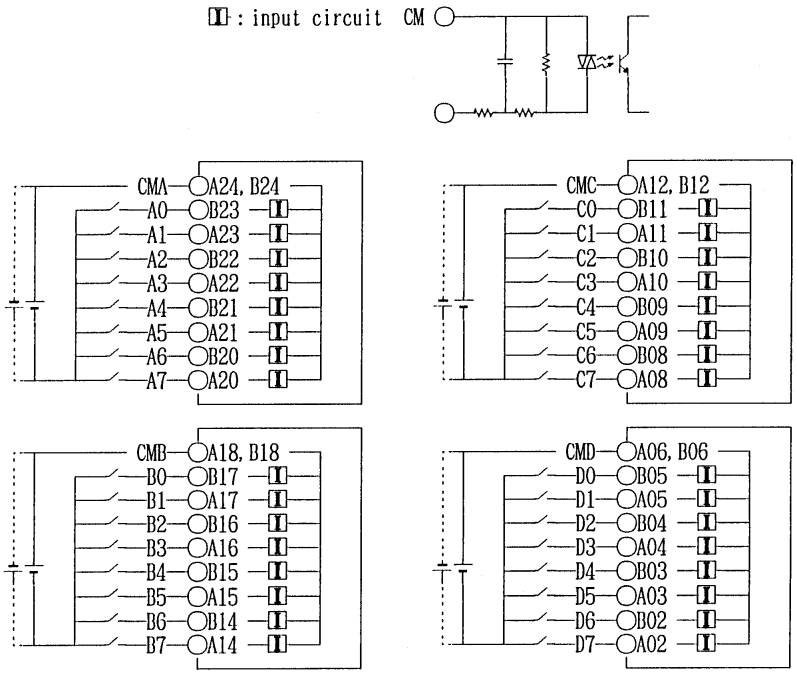
(8) Input module AID32E1

Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF→ON	Max.20ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.20ms	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			



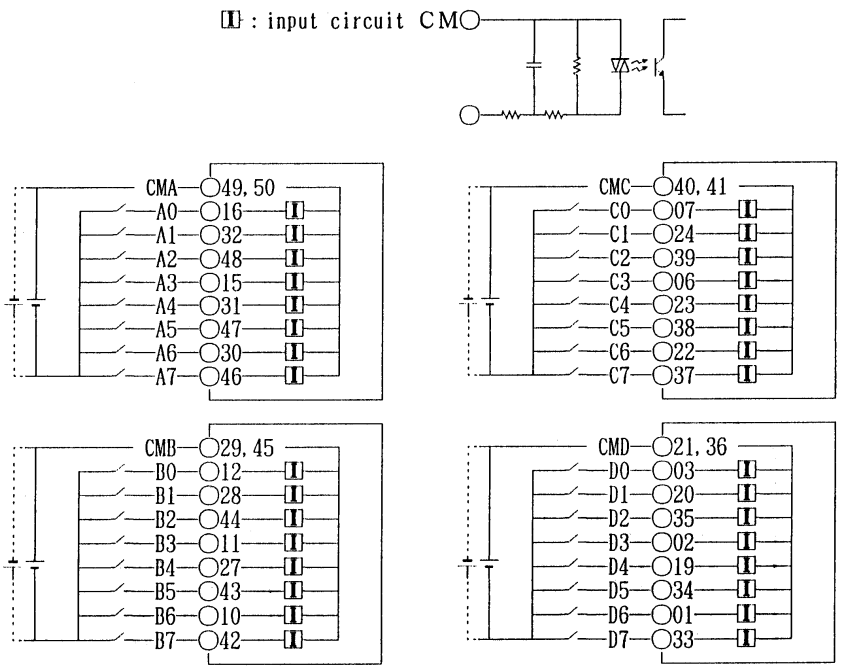
(9) Input module AID32E2

Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF→ON	Max.20ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.20ms	
Input display		Not provided	
External connection		Connector (HIROSE ELECTRIC HIF3BB-50PA-2.54DS in accordance with MIL standard)	
Terminal connection and circuitry			



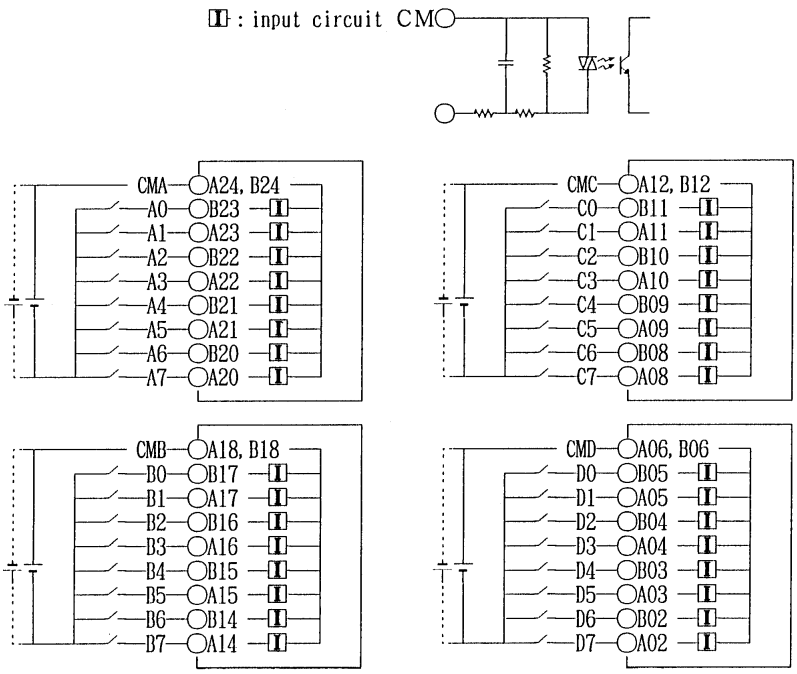
(10) Input module AID32F1

Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			



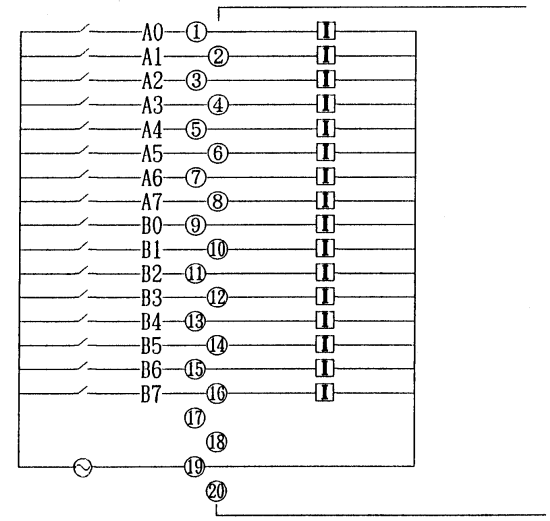
(11) Input module AID32F2

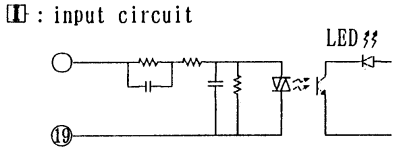
Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Input display		Not provided	
External connection		Connector (HIROSE ELECTRIC HIF3BB-50PA-2.54DS in accordance with MIL standard)	
Terminal connection and circuitry			



(12) Input module AIA16G

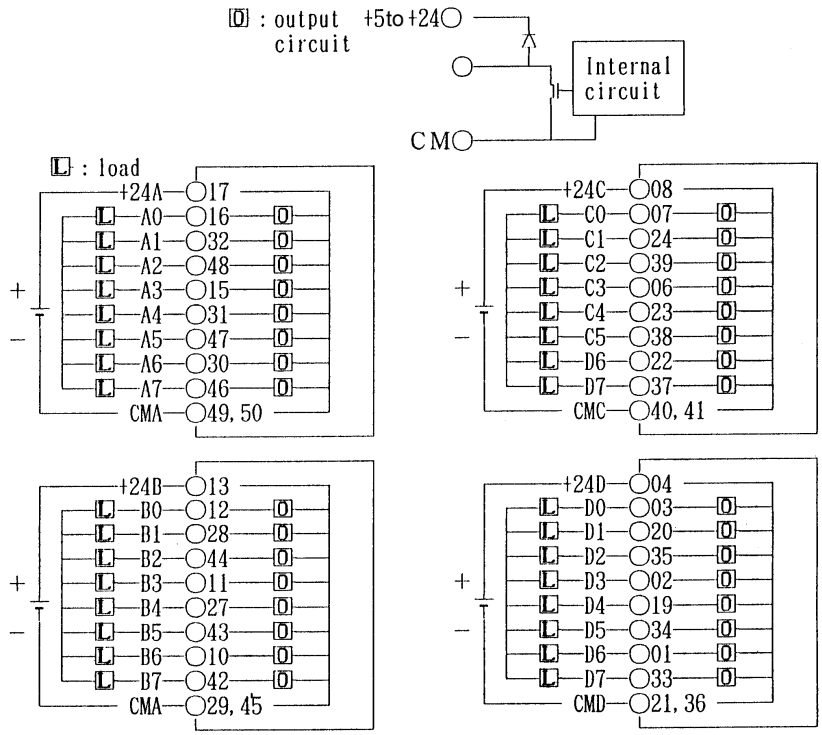
Item		Specifications	
Points/module		16 points	
Points/common		16 points/common	
Sink/source current		100 to 115VAC ±15%	
Input voltage		132Vrms, 50/60 Hz	
Input current		10.55mArms (120VAC, 50Hz)	
ON voltage, current		Min. 74Vrms, min. 6mArms	
OFF voltage, current		Max. 20Vrms, max. 2.2mArms	
Response time	OFF→ON	Max.35ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.45ms	
Input display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Common		16 points/common	
Terminal connection and circuitry			





(13) Output module AOD32A1 (Non-insulation type)

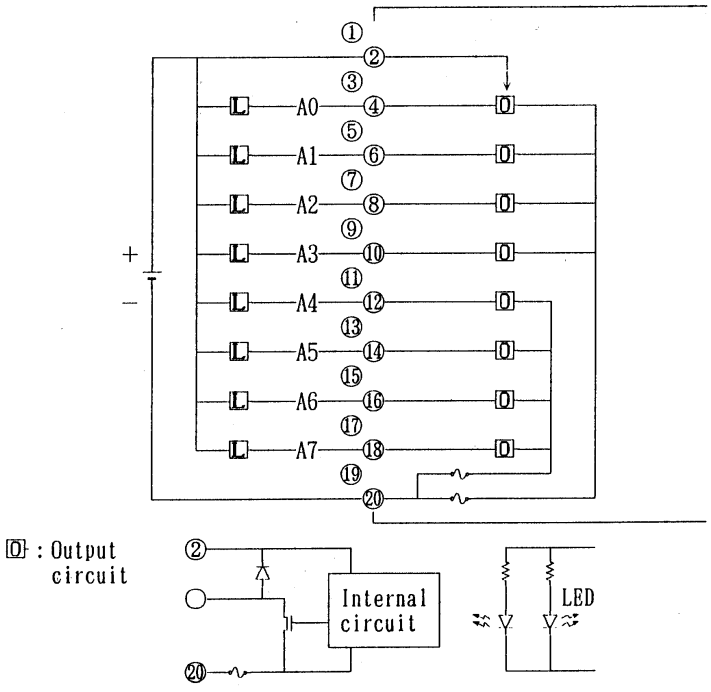
Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Sink current type	
Rated load voltage		5 to 24VDC +20%, −15%	
Maximum load current		0.3A (however 2A/common)	
Maximum voltage drop when ON		0.24V (load current ×0.8Ω)	
Maximum leak current when OFF		0.1mA	
Response time	OFF→ON	Max.1ms	
	ON→OFF	Max.1ms	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			



NOTE
For the common (CMA, CMB, CMC, CMD) , make sure to use both of them.

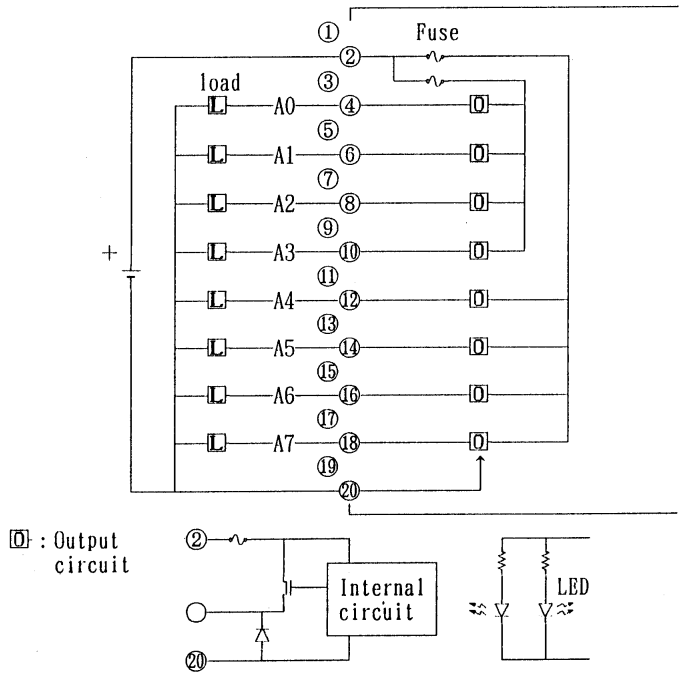
(14) Output module AOD08C

Item		Specifications	
Points/module		8 points	
Points/common		8 points/common	
Sink/source current		Sink current type	
Rated load voltage		12 to 24VDC +20%, −15%	
Maximum load current		2A (however 4A/fuse)	
Maximum voltage drop when ON		0.8V (load current ×0.4Ω)	
Maximum leak current when OFF		0.1mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Input display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Fuse		5A, 1 piece for each output A0-A3 and A4-A7.	
Terminal connection and circuitry			



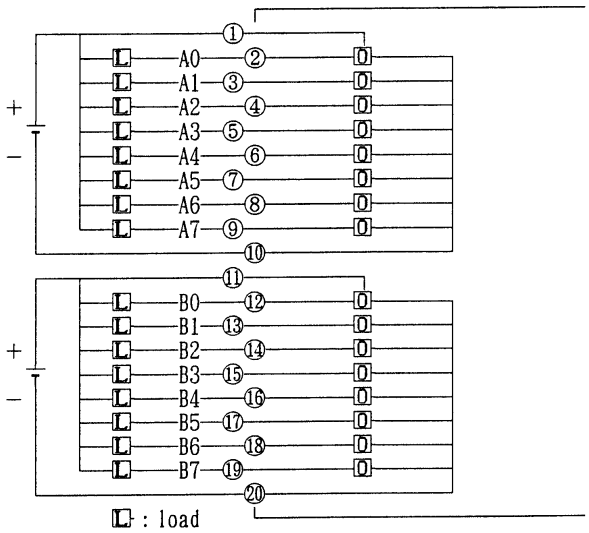
(15) Output module AOD08D

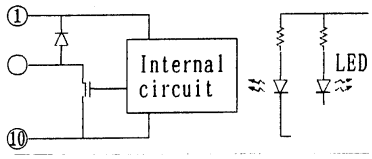
Item		Specifications	
Points/module		8 points	
Points/common		8 points/common	
Sink/source current		Source current type	
Rated load voltage		12 to 24VDC +20%, −15%	
Maximum load current		2A (however 4A/fuse)	
Limit of load		Refer to load derating curve (Fig. 5.3(a))	
Maximum voltage drop when ON		1.2V (load current ×0.6Ω)	
Maximum leak current when OFF		0.1mA	
Response Time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Fuse		5A, 1 piece for each output A0-A3 and A4-A7.	
Terminal connection and circuitry			



(16) Output module AOD16C

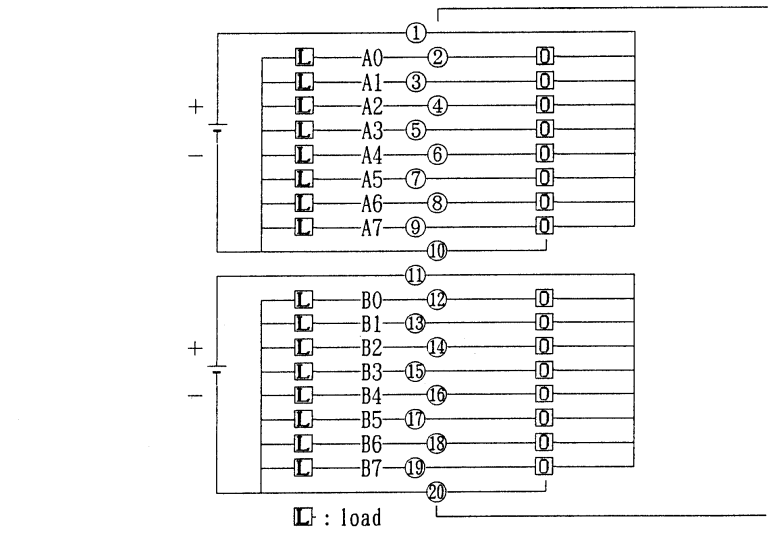
Item		Specifications	
Points/module		16 points	
Points/common		8 points/common	
Sink/source current		Sink current type	
Rated load voltage		12 to 24VDC +20%, −15%	
Maximum load current		0.5A (however 2A/common)	
Maximum voltage drop when ON		0.7V (load current ×1.4Ω)	
Maximum leak current when OFF		0.1Ma	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			





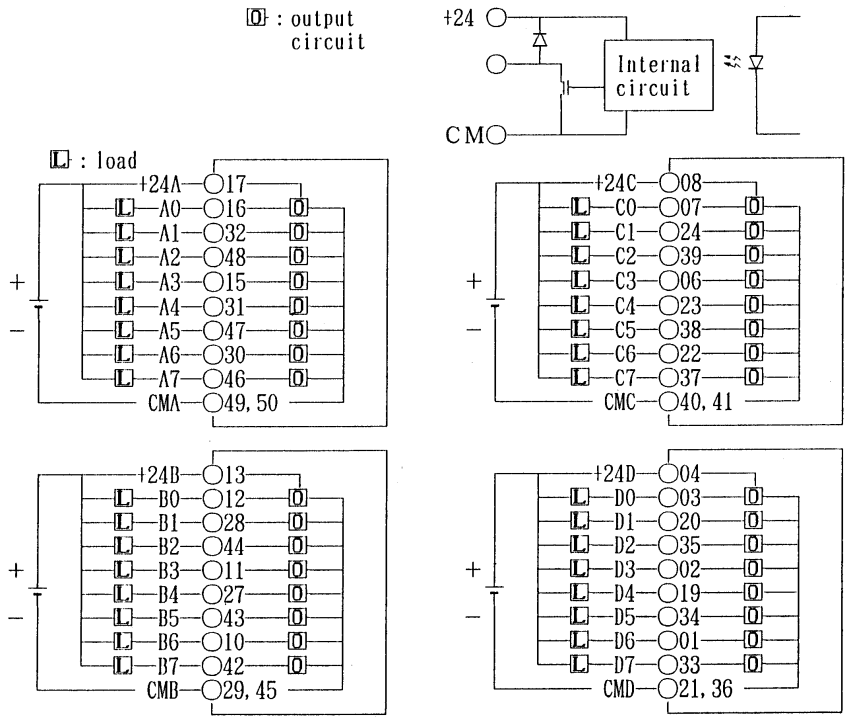
(17) Output module AOD16D

Item		Specifications	
Points/module		16 points	
Points/common		8 points/common	
Sink/source current		Source current type	
Rated load voltage		12 to 24VDC +20%, −15%	
Maximum load current		0.5A (however 2A/common)	
Maximum voltage drop when ON		0.7V (load current ×1.4Ω)	
Maximum leak current when OFF		0.1mA	
Response time	OFF→ON	Max.2ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.2ms	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			



(18) Output module AOD32C1

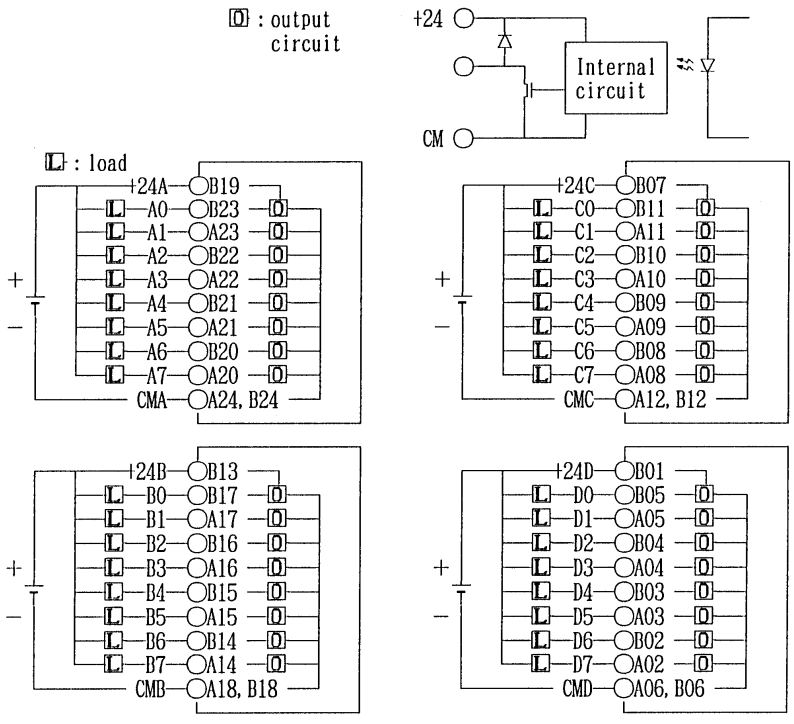
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Sink current type
Rated load voltage		12 to 24VDC +20%, −15%
Maximum load current		0.3A (however 2A/common)
Maximum voltage drop when ON		0.24V (load current ×0.8Ω)
Maximum leak current when OFF		0.1mA
Response time	OFF→ON	Max.2ms
	ON→OFF	Max.2ms
Output display		Not provided
External connection		Connector (HONDA TSUSIN MR-50RMA)
Terminal connection and circuitry		



NOTE
For the common (CMA, CMB, CMC, CMD) , make sure to use both of them.

(19) Output module AOD32C2

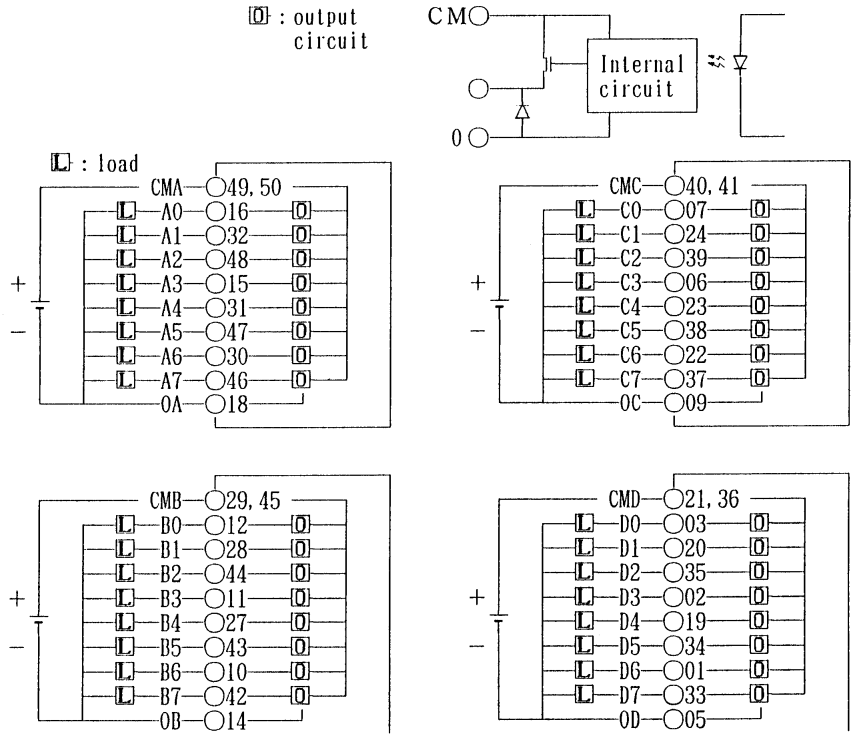
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Sink current type
Rated load voltage		12 to 24VDC +20%, −15%
Maximum load current		0.3A (however 2A/common)
Maximum voltage drop when ON		0.24V (load current ×0.8Ω)
Maximum leak current when OFF		0.1mA
Response time	OFF→ON	Max.2ms
	ON→OFF	Max.2ms
Output display		Not provided
External connection		Connector (HIROSE ELECTRIC HIF3BB-50PA-2.54DS in accordance with MIL standard)
Terminal connection and circuitry		



NOTE
For the common (CMA, CMB, CMC, CMD), make sure to use both of them.

(20) Output module AOD32D1

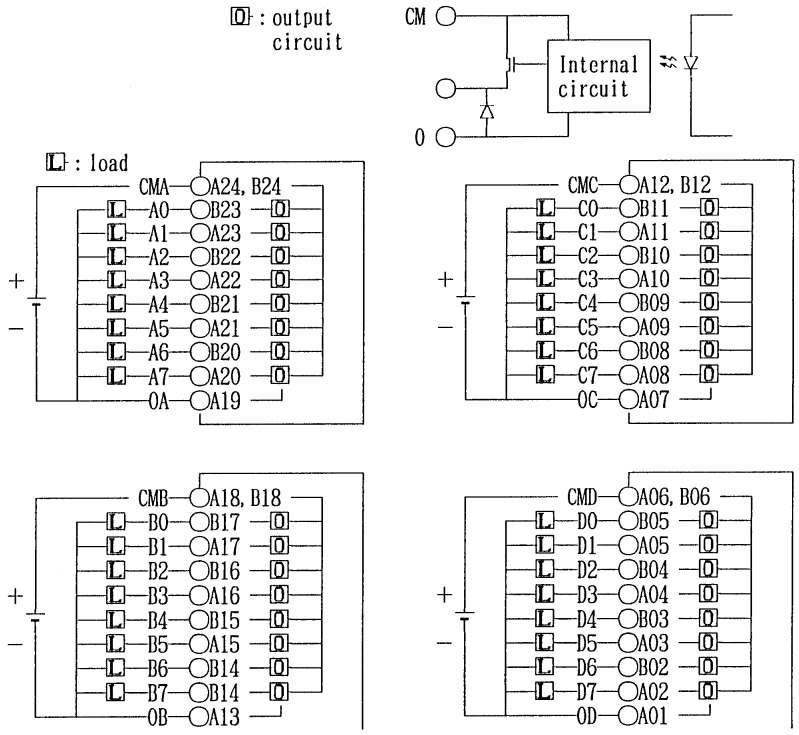
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Source current type
Rated load voltage		12 to 24VDC +20%, −15%
Maximum load current		0.3A (however 2A/common)
Maximum voltage drop when ON		0.24V (load current ×0.8Ω)
Maximum leak current when OFF		0.1mA
Response Time	OFF→ON	Max.2ms
	ON→OFF	Max.2ms
Output display		Not provided
External connection		Connector (HONDA TSUSIN MR-50RMA)
Terminal connection and circuitry		



NOTE
For the common (CMA, CMB, CMC, CMD), make sure to use both of them.

(21) Output module AOD32D2

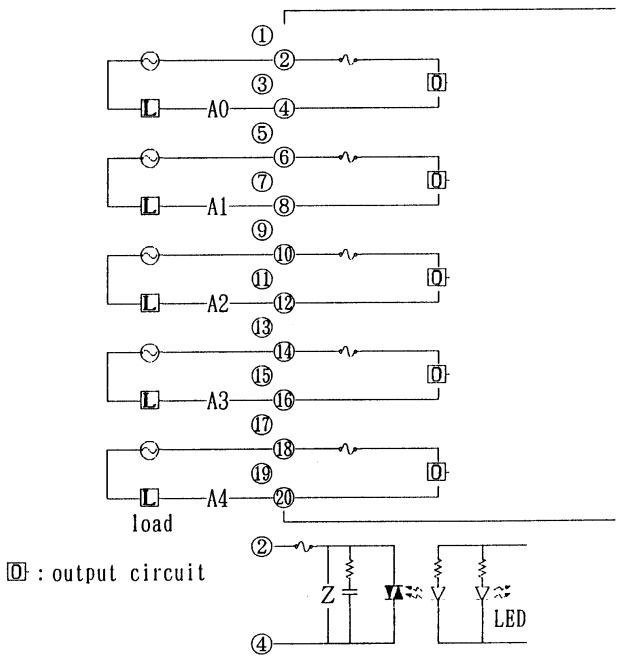
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Source current type
Rated load voltage		12 to 24VDC +20%, −15%
Maximum load current		0.3A (however 2A/common)
Maximum voltage drop when ON		0.24V (load current ×0.8Ω)
Maximum leak current when OFF		0.1mA
Response time	OFF→ON	Max.2ms
	ON→OFF	Max.2ms
Output display		Not provided
External connection		Connector (HIROSE ELECTRIC HIF3BB-50PA-2.54DS in accordance with MIL standard)
Terminal connection and circuitry		



NOTE
For the common (CMA, CMB, CMC, CMD), make sure to use both of them.

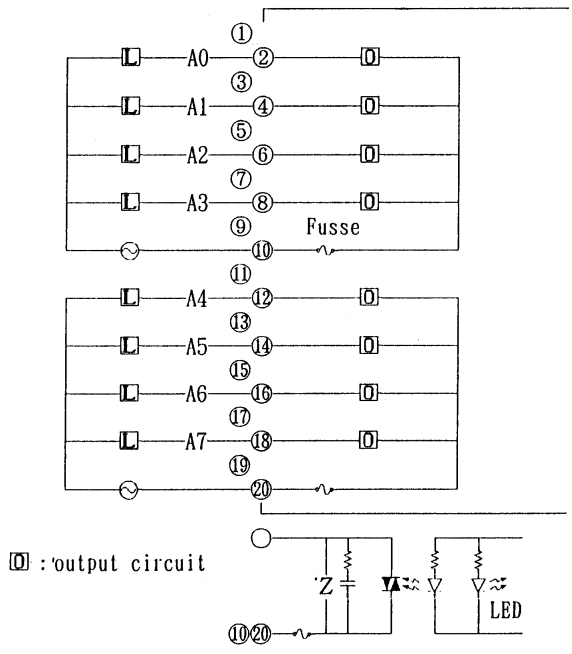
(22) Output module AOA05E

Item		Specifications	
Points/module		5 points	
Points/common		1 points/common	
Rated load voltage		100 to 230VAC ±15%, 47 to 63Hz	
Maximum load current		2A/point (howerver 5A/module)	
Maximum rush current		25A (1 period)	
Limit of load		Refer to load derating curve (Fig. 5.3 (b))	
Maximum voltage drop when ON		1.5Vrms	
Maximum leak current when OFF		3.0mA (115VAC), 6.0mA (230VAC)	
Response time	OFF→ON	Max.1ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Half of the load ferquency or less	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Fuse		3.2A, 1 piece for each output A0 to A4	
Terminal connection and circuitry			



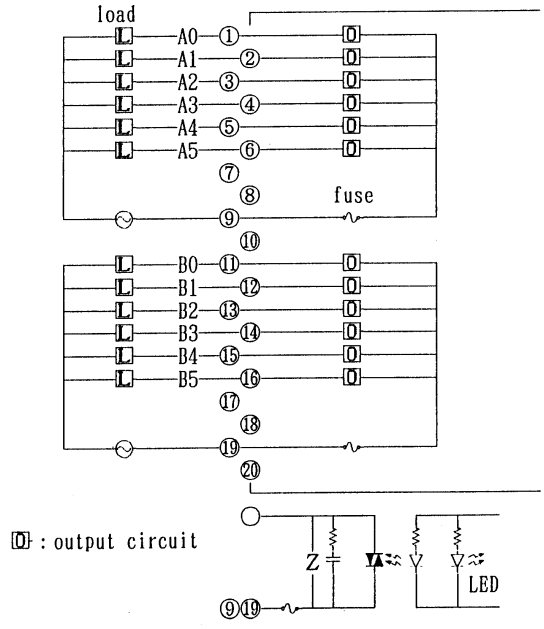
(23) Output module AOA08E

Item		Specifications	
Points/module		8 points	
Points/common		4 points/common	
Rated load voltage		100 to 230VAC ±15%, 47 to 63Hz	
Maximum load current		1A/point (howerver 2A/common)	
Maximum in rush current		10A (1 period)	
Maximum voltage drop when ON		1.5Vrms	
Maximum leak current when OFF		3.0mA (115VAC), 6.0mA (230VAC)	
Response time	OFF→ON	Max.1ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Half of the load ferquency or less	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Fuse		3.2A, 1 piece for each output A0 to A3 and A4 to A7	
Terminal connection and circuitry			



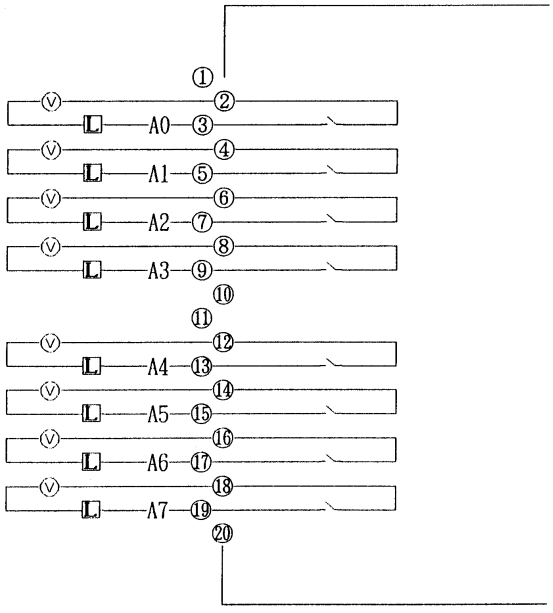
(24) Output module AOA12F

Item		Specifications	
Points/module		12 points	
Points/common		6 points/common	
Rated load voltage		100 to 115VAC ±15%, 47 to 63Hz	
Maximum load current		0.5A/point (howerver, 2A/common)	
Maximum in rush current		5A (1 period)	
Limit of load		Refer to load derating curve (Fig. 5.3 (c))	
Maximum voltage drop when ON		1.5Vrms	
Maximum leak current when OFF		1.5mA (115VAC)	
Response time	OFF→ON	Max.1ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Half of the load ferquency or less	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Fuse		3.2A, 1 piece for each output A0 to A5 and B0 to B5	
Terminal connection and circuitry			



(25) Output module AOR08G

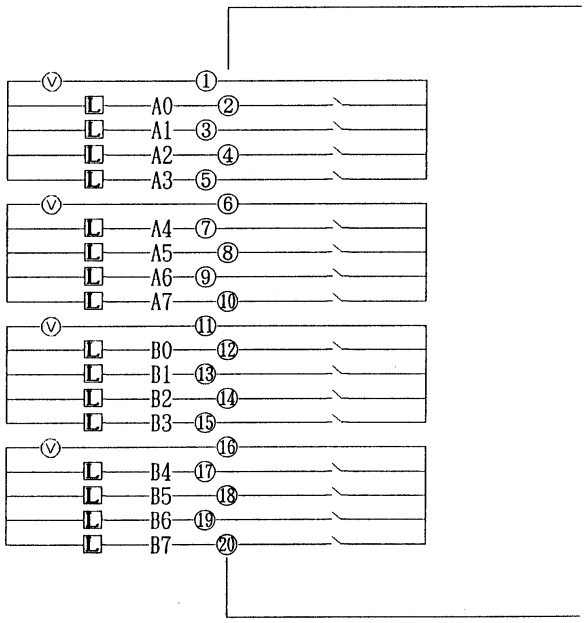
Item		Specifications	
Points/module		8 points	
Points/common		1 points/common	
Maximum load		30VDC/250VAC, 4A (resistance load)	
Minimum load		5VDC, 10mA	
Limit of load		Refer to load derating curve (Fig. 5.3 (d))	
Maximum voltage drop when ON		1.5Vrms	
Maximum leak current when OFF		1.5mA (115VAC)	
Response time	OFF→ON	Max.15ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.15ms	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Fuse		3.2A, 1 piece for each output A0 to A5 and B0 to B5	
Relay life	Mechanical	Min. 20,000,000 times	
	Electrical	Min. 100,000 times (resistance load)	
Terminal connection and circuitry			



Ⓥ : Direct current power or alternating current power

(26) Output module AOR16G

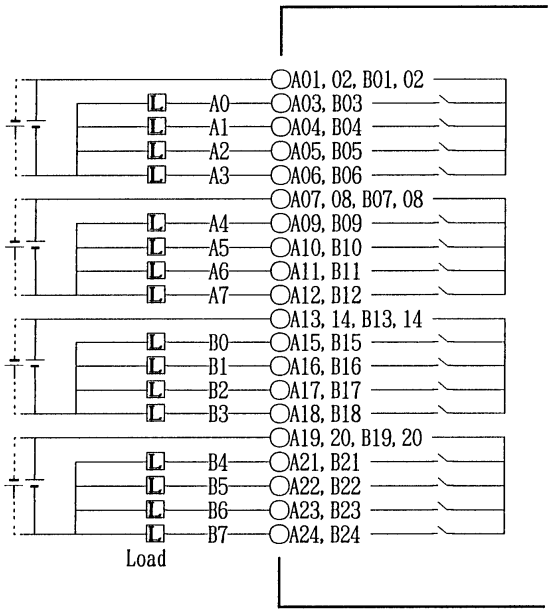
Item		Specifications	
Points/module		16 points	
Points/common		4 points/common	
Maximum load		30VDC/250VAC, 2A (resistance load)	
Minimum load		5VDC, 10mA	
Maximum current		4A/common	
Limit of load		Refer to load derating curve (Fig. 5.3 (e))	
Response time	OFF→ON	Max.15ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.15ms	
Output display		LED display	
External connection		Terminal block connector (20 terminals, M3.5 screw terminal)	
Relay life	Mechanical	Min. 20,000,000 times	
	Electrical	Min. 100,000 times (resistance load)	
Terminal connection and circuitry			



Ⓥ: Direct current power or alternating current power

(27) Output module AOR16H2

Item		Specifications	
Points/module		16 points	
Points/common		4 points/common	
Maximum load		30VDC, 2A (resistance load)	
Minimum load		5VDC, 10mA	
Maximum current		4A/common	
Limit of load		Refer to load derating curve (Fig. 5.3 (e))	
Response time	OFF→ON	Max.15ms	This is the value from input to output in the module. The actual value is determined by adding it to the scanning time depending on each system.
	ON→OFF	Max.15ms	
Output display		LED display	
External connection		Connector (HIROSE ELECTRIC HIF3BB-50PA-2.54DS in accordance with MIL standard)	
Relay life	Mechanical	Min. 20,000,000 times	
	Electrical	Min. 100,000 times (resistance load)	
Terminal connection and circuitry			



⏚ : Direct current power

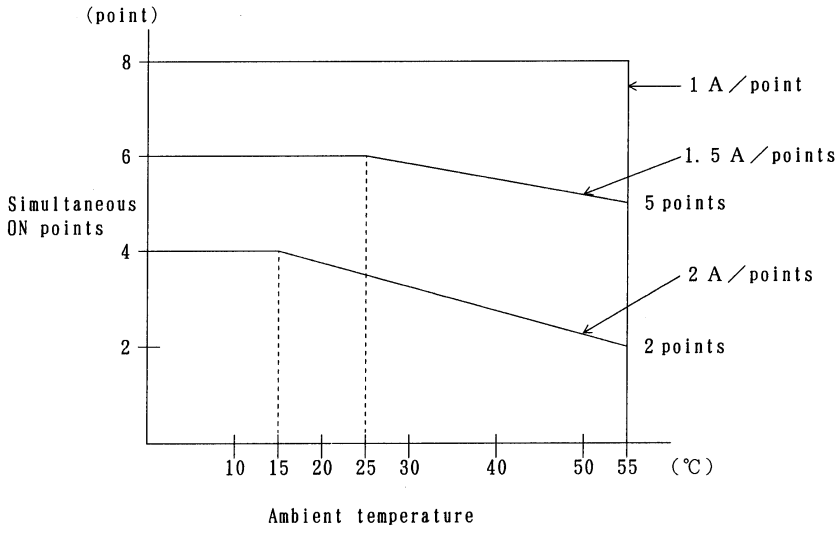


Fig.5.3 (a) AOD08D Load reduction curve

NOTE
Ambient temperature means the temperature surrounding the I/O unit and not that surrounding the cabinet containing the I/O unit.

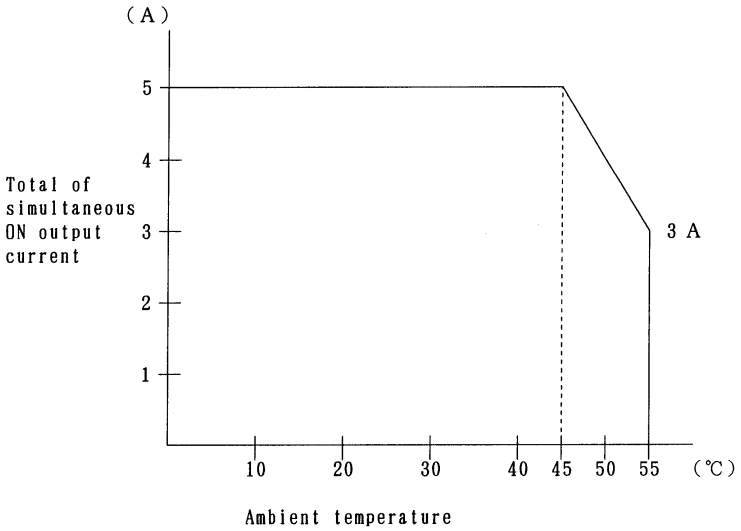


Fig.5.3 (b) AOA05E Load reduction curve

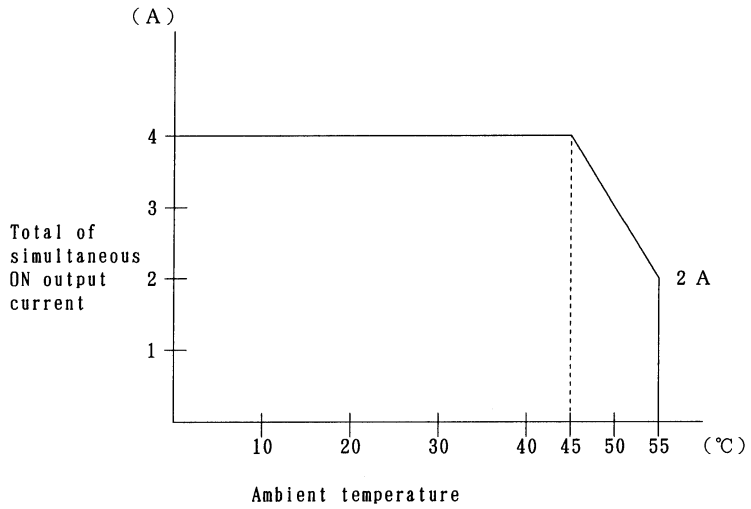


Fig.5.3 (c) AOA12F Load reduction curve

NOTE
Ambient temperature means the temperature surrounding the I/O unit and not that surrounding the cabinet containing the I/O unit.

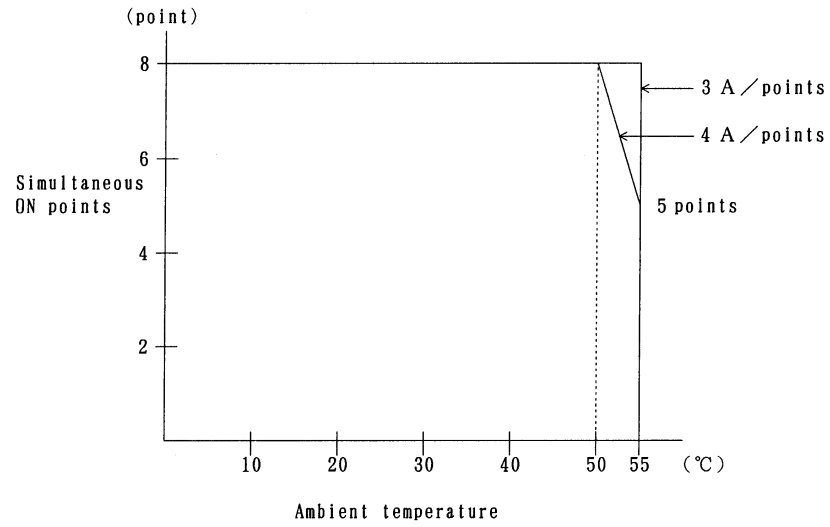


Fig.5.3 (d) AOR08G Load reduction curve

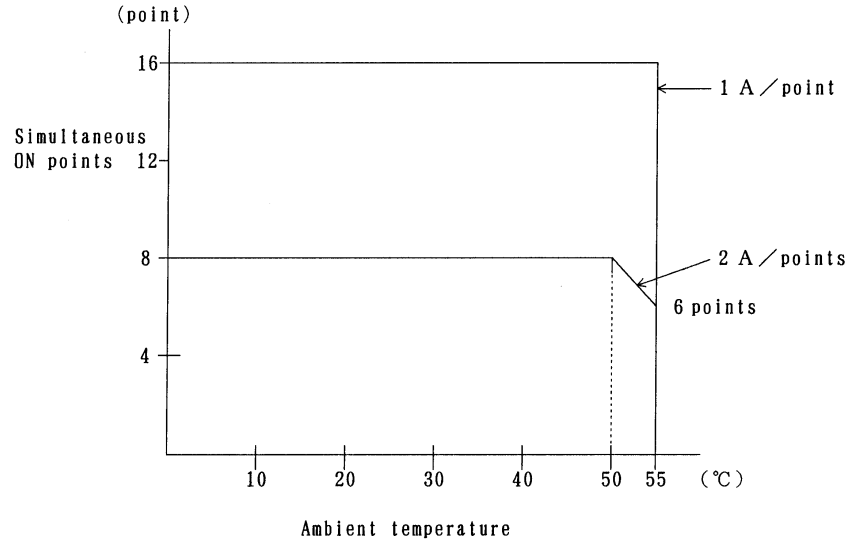


Fig.5.3 (e) AOR16G, AOR16H2 Load reduction curve

NOTE
Ambient temperature means the temperature surrounding the I/O unit and not that surrounding the cabinet containing the I/O unit.

6 ANALOG INPUT MODULE (AAD04A)

6.1 SPECIFICATIONS FOR ANALOG INPUT MODULE

Item	Specifications
Number of input channel	4 channel/module
Analog input	-10VDC to+10VDC(input resistance 4.7MΩ) -20mADC to+20mADC(input resistance 250Ω) Selectable
Digital output	12 bit binary (complementary representation of "2".)
Input/output correspondence	<table><tr><th>Analog input</th><th>Digital output</th></tr><tr><td>+10V</td><td>+2000</td></tr><tr><td>+5V or + 20mA</td><td>+1000</td></tr><tr><td>0V or 0mA</td><td>0</td></tr><tr><td>-5V or -20mA</td><td>-1000</td></tr><tr><td>-10V</td><td>-2000</td></tr></table>
Resolution	5mV or 20μA
Total precision	Voltage input ±0.5%(For full scale) Current input ±1%(For full scale)
Conversionary time	Max.2ms(note)
Maximum input voltage/current	±15V, ±30mA
Isolation	Photocoupler isolated(between the input signal and the base) However, not isolated between input channels
Output connecting	Removable terminal block(20 terminals, M3.5 screw terminal)
Required input points	64 points

NOTE
Conversion time means that only in a module. Actual response speed is ditermined by adding the scanning time depending on each system to this conversion time.

6.2 CORRESPONDENCE BETWEEN INPUT SIGNALS AND ADDRESSES IN A MODULE

In the analog input module AAD04A, the 4-channel analog input signals are cyclically A-D converted in order, and the converted digital data are written in the following addresses. Therefore, in the PMC program, it is possible at any time to know the values for the analog input signals by referring to the following addresses.

(1) PMC-N, Q (PMC for Series 15 AND F-D Mate)

Address in module	Bits 7	6	5	4	3	2	1	0	
0	X-0	X-0	X-0	X-0	D11-0	D10-0	D09-0	D08-0	Channel 0
1	D07-0	D06-0	D05-0	D04-0	D03-0	D02-0	D01-0	D00-0	
2	X-1	X-1	X-1	X-1	D11-1	D10-1	D09-1	D08-1	Channel 1
3	D07-1	D06-1	D05-1	D04-1	D03-1	D02-1	D01-1	D00-1	
4	X-2	X-2	X-2	X-2	D11-2	D10-2	D09-2	D08-2	Channel 2
5	D07-2	D06-2	D05-2	D04-2	D03-2	D02-2	D01-2	D00-2	
6	X-3	X-3	X-3	X-3	D11-3	D10-3	D09-3	D08-3	Channel 3
7	D07-3	D06-3	D05-3	D04-3	D03-3	D02-3	D01-3	D00-3	

D00-n and D11-n correspond to the weights of 2^0 and 2^{11} respectively. Here, D11-n corresponds to the sign bit in the complementary representation of "2."
In addition, in X-n is written the same value as that in D11-n.

NOTE
When addressing I/O modules, the beginning address for this module should be assigned to an even one. Moreover, when an A-D converted value is referred to in a PMC program, make sure to read the data in unit of a word (16 bits).

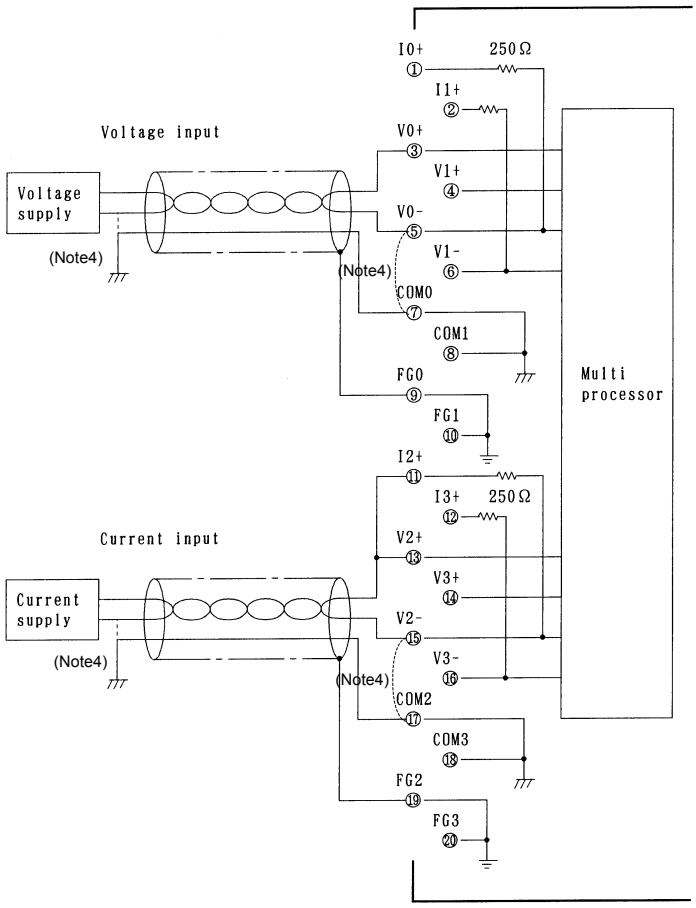
(2) PMC-M, R (PMC for Series 0, Series 16, Series 18)

Address in module	Bits 7	6	5	4	3	2	1	0	
0	D07-0	D06-0	D05-0	D04-0	D03-0	D02-0	D01-0	D00-0	Channel 0
1	X-0	X-0	X-0	X-0	D11-0	D10-0	D09-0	D08-0	
2	D07-1	D06-1	D05-1	D04-1	D03-1	D02-1	D01-1	D00-1	Channel 1
3	X-1	X-1	X-1	X-1	D11-1	D10-1	D09-1	D08-1	
4	D07-2	D06-2	D05-2	D04-2	D03-2	D02-2	D01-2	D00-2	Channel 2
5	X-2	X-2	X-2	X-2	D11-2	D10-2	D09-2	D08-2	
6	D07-3	D06-3	D05-3	D04-3	D03-3	D02-3	D01-3	D00-3	Channel 3
7	X-3	X-3	X-3	X-3	D11-3	D10-3	D09-3	D08-3	

D00-n and D11-n correspond to the weights of 2^0 and 2^{11} respectively. Here, D11-n corresponds to the sign bit in the complementary representation of "2."
In addition, in X-n is written the same value as that in D11-n.

NOTE
When addressing I/O modules, the beginning address for this module should be assigned to an even one. Moreover, when an A-D converted value is referred to in a PMC program, make sure to read the data in unit of a word (16 bits).

6.3 CONNECTING WITH ANALOG INPUT MODULE



NOTE

1 Though the example above shows the connection of channels 0 and 2, it is just the same with the cahnnel 1 (I1+, V1+, V1-, COM1 and FG1) and the channel 3 (I3+, V3+, V3-, COM3 and FG3).

2 Either voltage input or current input can be specified for each channel. When current input is specified, make sure to short-circuit in + and Vn+.

3 Use shielded cables of twisted pair for connecting.

4 Connect the COMX (X: 0 to 3) terminals to the input voltage and current source common (GND) points to fix the ground potential of the conversion section in the module at the ground potential of the input power sources.

The VX- (X: 0 to 3) and COMX (X: 0 to 3) terminals may have to be strapped depending on the specifications of the input voltage and current sources (if the voltage source external outputs, OUT- and GND, are common).

7 ANALOG OUTPUT MODULE

7.1 12-BIT ANALOG OUTPUT MODULE (ADA02A)

7.1.1 Specification

Item	Specification
Number of output channels	2 channels/module
Digital input	12-bit binary (2's complement representation)
Analog output	-10VDC to +10VDC(external load resistance: 10KΩ or more) (Note 1) 0mADC to +20mADC(external load resistance: 400Ω or less)
Input/output correspondence	<table><tr><th>Digital input</th><th>Analog output</th></tr><tr><td>+2000</td><td>+10V</td></tr><tr><td>+1000</td><td>+5V or +20mA</td></tr><tr><td>0</td><td>0V or 0mA</td></tr><tr><td>-1000</td><td>-5V</td></tr><tr><td>-2000</td><td>-10V</td></tr></table>
Resolution	5mV or 20μ A
Comprehensive accuracy	Voltage output ±0.5% (For the full scale) Current output ±1% (For the full scale)
Converting time	1ms or less (Note 2)
Insulation	Photocoupler insulation (between output signal and base). However, non-insulation between output channels.
External connection	At removable terminal block (20 terminals, M3.5 screw terminals)
Number of occupied output points	32

NOTE
1 It is possible to select whether the analog output module is to be used with voltage or current output.
2 The converting time is the one only inside the module. The actual response time is added a scan time that is determined by the system.

7.1.2 Correspondence between Output Signals and Addresses in a Module

In the analog output module ADA02A, a 12-bit digital value is written into each of the following addresses to output the desired voltage/current to its corresponding analog output.

(1) For PMC-N/Q (PMC for Series 15/F-D Mate)

Address in module	Bits 7	6	5	4	3	2	1	0	
0	-	-	-	-	D11-0	D10-0	D09-0	D08-0	Channel 0
1	D07-0	D06-0	D05-0	D04-0	D03-0	D02-0	D01-0	D00-0	
2	-	-	-	-	D11-1	D10-1	D09-1	D08-1	Channel 1
3	D07-1	D06-1	D05-1	D04-1	D03-1	D02-1	D01-1	D00-1	

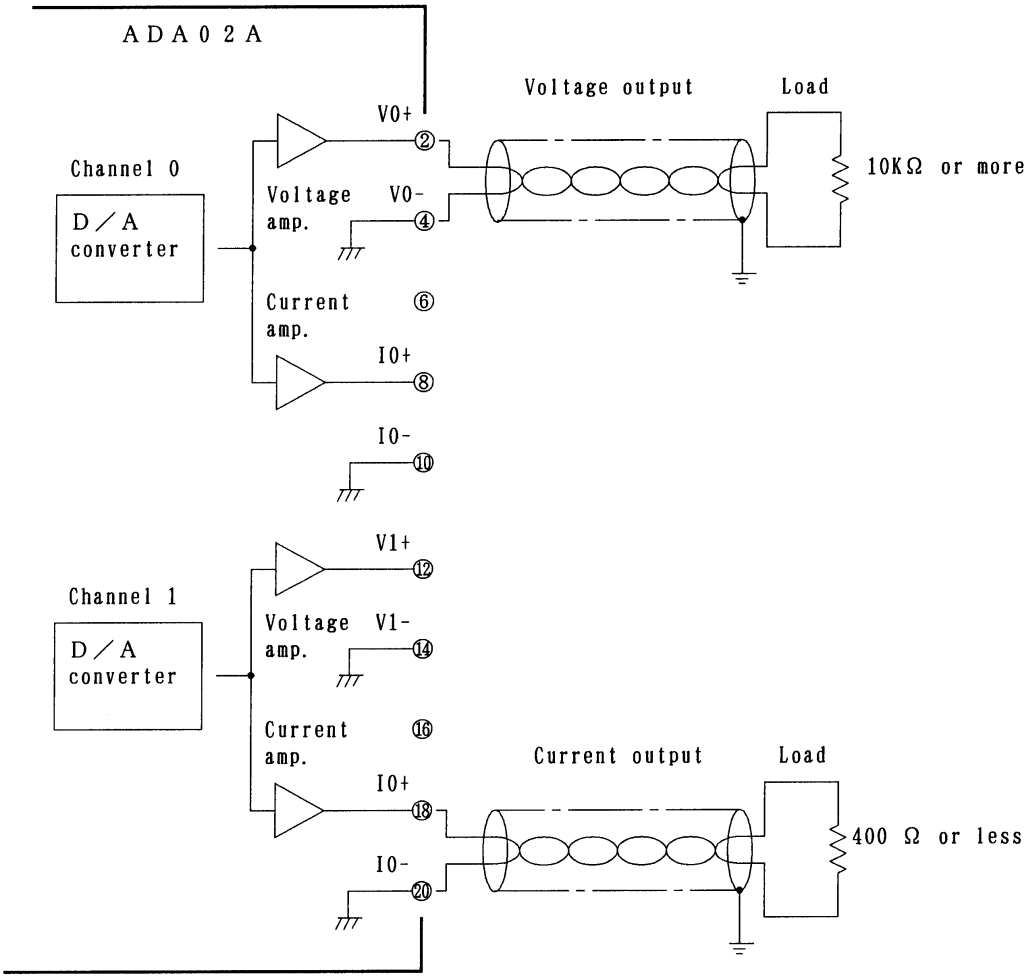
(2) For PMC-M/R (PMC for Series 0/Series 16)

Address in module	Bits 7	6	5	4	3	2	1	0	
0	D07-0	D06-0	D05-0	D04-0	D03-0	D02-0	D01-0	D00-0	Channel 0
1	-	-	-	-	D11-0	D10-0	D09-0	D08-0	
2	D07-1	D06-1	D05-1	D04-1	D03-1	D02-1	D01-1	D00-1	Channel 1
3	-	-	-	-	D11-1	D10-1	D09-1	D08-1	

D00-n corresponds to the 2^0 weight, while D11-n corresponds to the 2^{11} weight.
However, D11-n corresponds to the code bit 2's complement representation.

NOTE
When setting an I/O module address, this module initial adress must be assigned to an even address. To write a value that is to be converted from digital to analog into a PMC program, be sure to write it in words (16 bits).

7.1.3 Connection to Analog Output Module



NOTE
1 Use a 2-core twisted shielded cable as the connection cable
2 Ground the cable shield on the load side.

7.2 FOURTEEN-BIT ANALOG OUTPUT MODULE (ADA02B)

7.2.1 Specification

Item	Specification
Number of output channels	2 channels/module
Digital input	14-bit binary (2's complement representation)
Analog output	•Voltage output -10 VDC to +10 VDC (external load resistance of 10 kΩ or higher) (NOTE 1) •Current output 0 mADC to +20 mADC (external load resistance of 400Ω or lower)
Input/output correspondence	<table><tr><td rowspan="2">Digital input</td><td colspan="2">Analog output</td></tr><tr><td>Voltage output</td><td>Current output</td></tr><tr><td>+8000</td><td>+10V</td><td>+20mA</td></tr><tr><td>+4000</td><td>+5V</td><td>+10mA</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>-4000</td><td>-5V</td><td>-</td></tr><tr><td>-8000</td><td>-10V</td><td>-</td></tr></table>
Resolution	Voltage output: 1.25 mV Current output: 2.5 μA
Overall precision	Voltage output: ±0.5% (of the full scale) Current output: ±1% (of the full scale)
Converting time	1 ms or shorter (NOTE 2)
Insulation	Photocoupler-based insulation between output signal and base, but no insulation between output channels
External connection	At removable terminal block (with twenty M3.5 screw terminals)
Number of occupied output points	32

NOTE
1 It is possible to select whether the analog output module is to be used with voltage output or current output.
2 The converting time is that inside the module. The actual response time is added the scan time that is determined by the system.

7.2.2 Correspondence between Output Signals and Addresses in the Module

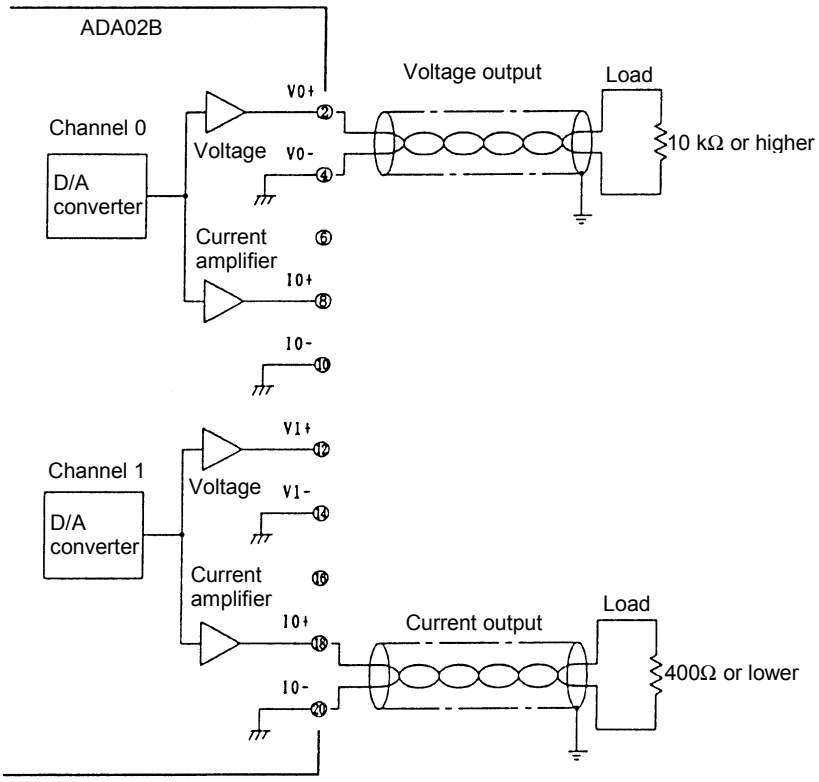
In the ADA02B analog output module, a 14-bit digital value is written to each of the following address to output the desired voltage/current from its corresponding analog output.

- For PMC-M/R (PMC for Series 0/Series 16)

Address in module	Bits 7	6	5	4	3	2	1	0	
0	D07-0	D06-0	D05-0	D04-0	D03-0	D02-0	D01-0	D00-0	Channel 0
1	-	-	D13-0	D12-0	D11-0	D10-0	D9-0	D8-0	
2	D07-1	D06-1	D05-1	D04-1	D03-1	D02-1	D01-1	D00-1	Channel 1
3	-	-	D13-1	D12-1	D11-1	D10-1	D9-1	D8-1	

D00-n (where n is 0 or 1) corresponds to a weight of 2^0, and D13-n to a weight of 2^{13}. However, D13-n corresponds to the sign bit of a two's complement representation.

7.2.3 Connection between the Analog Output Module and Load



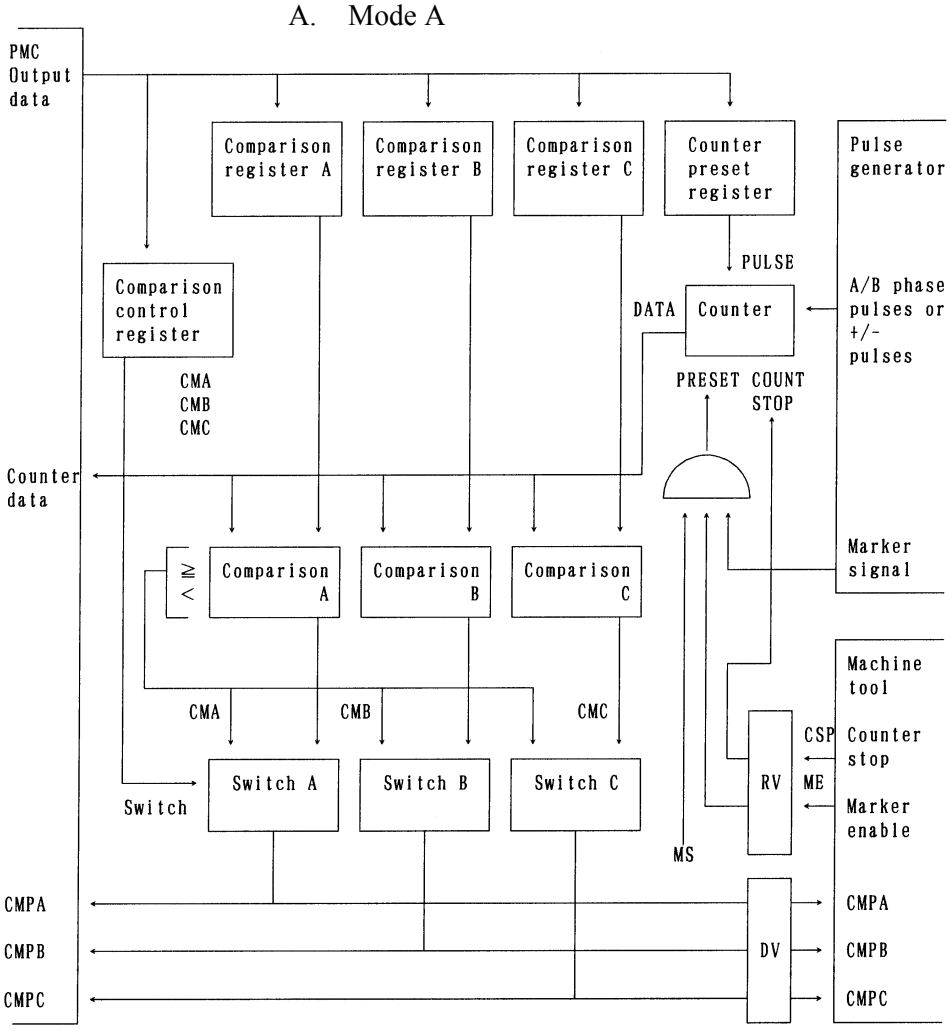
NOTE
1 Use a shielded 2-conductor twisted pair cable for the connection between the analog output module and load.
2 Ground the cable shielding on the load side.

8 HIGH SPEED COUNTER MODULE

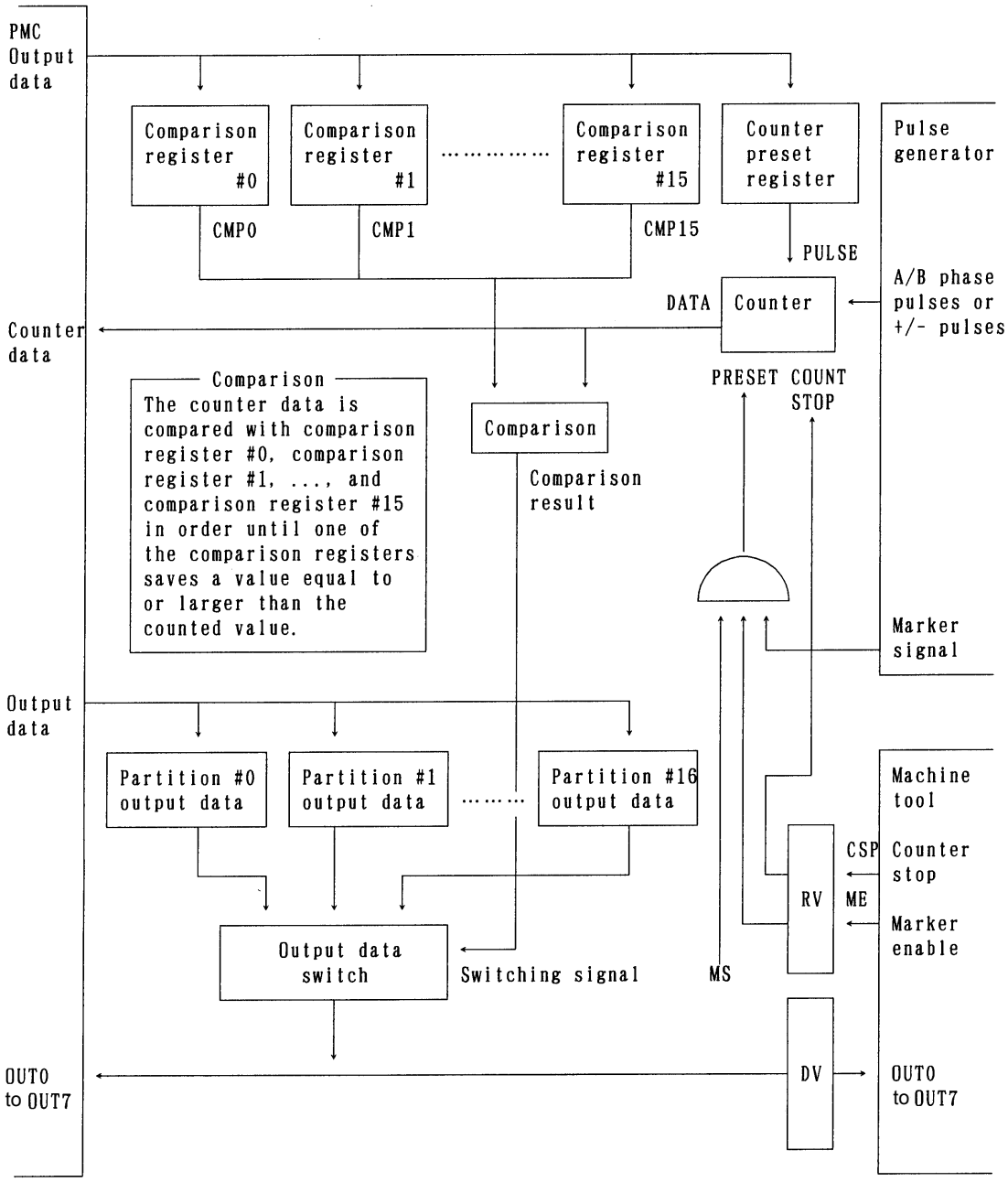
8.1 OUTLINE OF HIGH SPEED COUNTER MODULE

The high speed counter module consists of a counter which counts the pulses sent from a pulse generator such as a position detector in the machine tool and comparison registersfor comparing preset values with counter data. The module can read the counter data andoutput the results of comparison to the machine.
The pulse counter module has two operation modes, A and B.
Simplified configuration diagrams in modes A and B are shown below.

A. Mode A



B. Mode B


PMC
Output
data
Comparison
register
#0
Comparison
register
#1
Comparison
register
#15
Counter
preset
register
Pulse
generator
CMP0
CMP1
CMP15
PULSE
A/B phase
pulses or
+/- pulses
DATA
Counter
Counter
data
PRESET
COUNT
STOP
Comparison
The counter data is compared with comparison register #0, comparison register #1, ..., and comparison register #15 in order until one of the comparison registers saves a value equal to or larger than the counted value.
Comparison
Comparison
result
Marker
signal
Output
data
Partition #0
output data
Partition #1
output data
Partition #16
output data
Machine
tool
CSP
Counter
stop
RV
ME
Marker
enable
Output data
switch
Switching signal
MS
DV
OUT0
to OUT7
OUT0
to OUT7

8.2 SPECIFICATIONS OF HIGH SPEED COUNTER MODULE

8.2.1 Pulse counter

(1) Binary up/down counter (1)

(2) Counter capacity
0 to 8, 388, 607

(3) Counter data
The pulse counter can preset data and read count data.

8.2.2 Comparison function

(1) Mode A

A. Comparison register (23 bits)
Comparison registers A, B, and C are provided. The values to be compared are preset in the comparison registers.

B. Comparison output
The results (CMPA, CMPB, and CMPC) of comparing the count data in the pulse counter with the data set in the comparison registers are output.

C. Comparison output values
The comparison output values are set as listed in the table below. The valuesdepend on the states of CMA, CMB, and CMC, the comparison mode signals from the PMC.

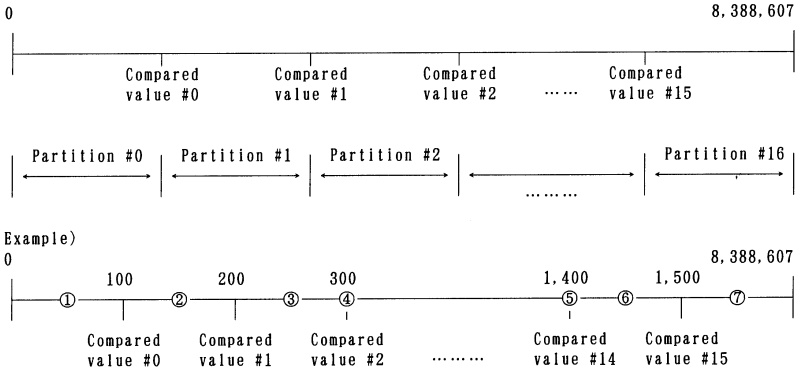
	Counter value ≦ comparison register value	**Counter value > comparison register value**
CMA=0 CMB=0 CMC=0	CMPA=0 CMPB=0 CMPC=0	CMPA=1 CMPB=1 CMPC=1
CMA=1 CMB=1 CMC=1	CMPA=1 CMPB=1 CMPC=1	CMPA=0 CMPB=0 CMPC=0

(2) Mode B

A. Comparison register (23 bits)
There are 16 comparison registers #0,#1, ...,#15. The values to be compared are preset in the comparison registers. The preset value in a comparison register having a larger register number should be larger than that in a comparison register having a smaller register number, as follows:
Value in register #0 < value in register #1< ... < value in register #14 < valuein register 15

B. Comparison output
The results (OUT0 to OUT7) of comparing the count data in the pulse counter with the data set in the comparison registers are output.

C. Comparison output values
The count data in the pulse counter is compared with the values in the comparison registers in sequential order from register 0 until the count data is equal to or less than the value in a comparison register. This enables a partition to be madewhich includes the count data. Then the output data for the partition (which is previously preset) is output. Eight output points (OUT0 to OUT7) are provided.
If the count data is equal to the value in a comparison register, the data in the partition having the same number as the register number is output.



Output data from partition #0 = 0H
Output data from partition #1 = 1H
Output data from partition #2 = 2H
Output data from partition #3 = 3H
Output data from partition #4 = 4H
Output data from partition #5 = 5H
Output data from partition #6 = 6H
Output data from partition #7 = 7H
Output data from partition #8 = 8H
Output data from partition #9 = 9H
Output data from partition #10 = 10H
Output data from partition #11 = 11H
Output data from partition #12 = 12H
Output data from partition #13 = 13H
Output data from partition #14 = 20H
Output data from partition #15 = 21H
Output data from partition #16 = FFH

The output data is set as listed in the table below, depending on the counter values in ① to ⑦ above.

	OUT							
	7	6	5	4	3	2	1	0
①	0	0	0	0	0	0	0	0
②	0	0	0	0	0	0	0	1
③	0	0	0	0	0	0	1	0
④	0	0	0	0	0	0	1	0
⑤	0	0	1	0	0	0	0	0
⑥	0	0	1	0	0	0	0	1
⑦	1	1	1	1	1	1	1	1

8.2.3 Pulse Interface

The following three types of pulses are entered in the high speed counter module.

A. Phase A/B pulses: The phase difference between these detection pulses is 90°

B. +/- pulses: These detection pulses are separated in the positive and negative directions.

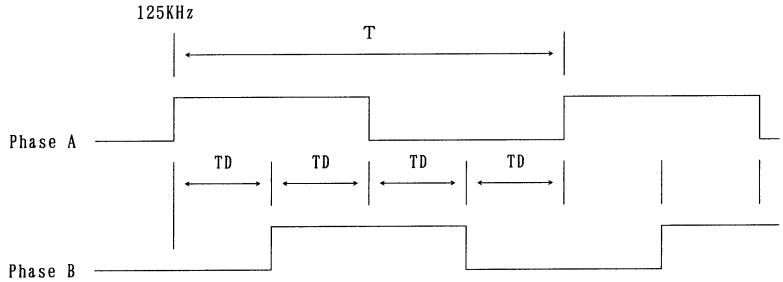
Select either type of the detection pulse.

C. Marker signal: Used to preset data in the pulse counter.

(1) Phase A/B pulse interface
The phase A/B pulses are selected when the PSEL signal is open.

A. Interface IC
Use differential drivers (SN75113 or equivalent) at the output ports of the pulse generator.

B. Maximum frequency



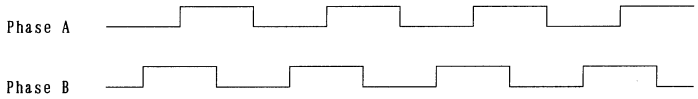
Tmin. =8μS (minimum period)
TDmin. =1.2μS (minimum time between edges)

C. Count and direction

A counter multiplied by four compared to phase A and B pulses is provided. It counts positive when phase A advances before phase B and it counts negative when phase B advances before phase A.

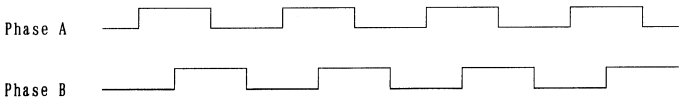
Positive count

Advance of phase A before phase B



Negative count

Advance of phase B before phase A



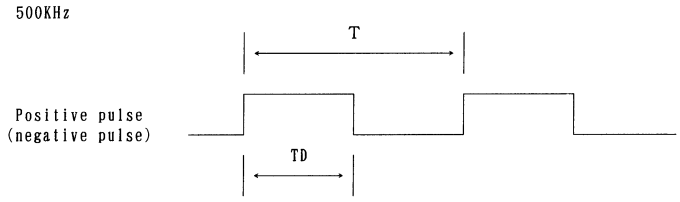
(2) Positive/negative pulse interface

Positive and negative pulses are selected when the PSEL signal is connected to 0 VDC.

A. Interface IC

Use differential drivers (SN75113 or equivalent) at the output ports of the pulse generator.

B. Maximum frequency

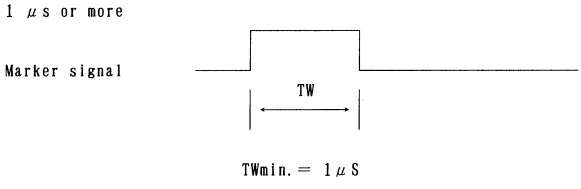


(3) Marker signal

A. Interface IC

Use differential drivers (SN75113 or equivalent) at the output ports of the pulse generator.

B. Minimum pulse width



8.2.4 External contact input

The pulse counter module uses insulating receivers (having a voltage rating of 24 VDC) at the input ports. The following two types of signal inputs are provided.

(1) Marker enable signal input (ME)
The contact of the marker enable signal is closed to make the marker signal valid.
This enables data to be preset in the counter.

(2) Count stop signal input (CSP)
The contact of the count stop signal is closed to stop the count operation.

8.2.5 External contact output

Solid state relays are used for the contacts.

(1) Mode A
The comparison mode signal outputs A, B, C (CMPA, CMPB, and CMPC) are provided in mode A. These outputs indicate the results of comparing the comparison registers A, B, and C with the pulse counter. The comparison output values are determined depending on whether the control mode signals (CMA, CMB, and CMC) from the PMC are set to 1 or 0.

(2) Mode B
The results of comparing comparison register #0, comparison register #1, ..., comparison register #15 with the pulse counter are provided in mode B. The comparison output indicates the values in the output data registers for the partitions in which the count data is located. Eight output points are provided. (See Section 8.2.2 (2))

8.2.6 Marker processing

(1) Mode A

A. Synchronization with marker
The counter value is set to the data in the counter preset register at the rising edge of the first marker signal with the MS signal output from the PMC set to 1 and the contact of the marker enable signal input (ME) from the machine closed.

B. Marker hold
The MH signal is set to 1 at the rising edge of the first marker signal with the MS signal output from the PMC set to 1 and the contact of the marker enable signalinput (ME) from the machine closed. The MH signal is reset when the marker

hold reset (MHR), an output signal from the PMC, is set to 1 or the MS signal output from the PMC is set to 0.

(2) Mode B

A. Synchronization with marker
When the MS signal output from the PMC is 1 and the contact of the marker enable (ME) signal input from the machine is closed, the counter is set to the data in the counter preset register at the rising edge of the first marker signal.

B. Maker hold
When the MS signal output from the PMC is 1 and the contact of the marker enable (ME) signal input from the machine is closed, the MH signal is set to 1 at the rising edge of the marker signal. The MH signal is reset when the MS signal output from the PMC is set to 0.

8.2.7 LED indicators

The high speed counter module has the following indicators.

(1) OK indicator
See below Table.

(2) ALM0 and ALM1 indicators
See below Table.

(3) Phase A and B pulses (positive and negative pulses) input signal indicators (A and B)
The phase A pulse input signal indicator is on when the phase A pulse input is active.
The phase B pulse input signal indicator is on when the phase B pulse input is active.

(4) Marker signal indicator (M)
The marker signal indicator is on while the marker signal (MP) from the pulse generator is active.

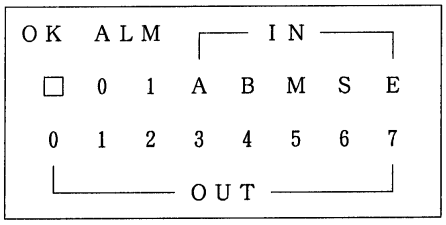
(5) Count stop signal indicator (S)
The count stop signal indicator is on when the contact of the count stop signal input sent from the machine is closed.

(6) Marker enable signal indicator (E)
The marker enable signal indicator is on when the contact of the marker enable signal input sent from the machine is closed.

(7) Comparison result output indicators (OUT0, OUT1, OUT2, OUT3, OUT4, OUT5, OUT6, and OUT7)

A. Mode A
The indicators OUT0, OUT1, and OUT2 correspond to the signals CMPA, CMPB, and CMPC. OUT1 goes on when CMPA goes on, OUT2 goes on when CMPB goes on, and OUT3 goes on when CMPC goes on.

B. Mode B
The indicators OUT0 - OUT7 go on corresponding to when the output data OUT0 - OUT7resulting from the comparisons between the count data and comparison resisters areset TO 1.



LED indicator panel

OK	ALM0	ALM1	Explanation of alarm
●	●	○	Disconnection alarm
○	●	○	Self-diagnosis alarm, RAM error
○	○	●	Self-diagnosis alarm, ROM error
○	●	●	Watch dog alarm
●	○	○	Normal operation

● : On
○ : Off

8.3 PMC INTERFACE

8.3.1 Mode A

(1) PMC I/O area
In mode A, four input bytes and four output bytes are used as the I/O area. The bytes in the I/O area have the following names. The input and output directions arespecified on the basis of the PMC. The operation mode is set to mode A at power-on.

1) Output data (sent from PMC to high speed counter module)

0	CTRL (control)
+1	DTOH (higher 8-bit data)
+2	DTOM (middle 8-bit data)
+3	DTOL (lower 8-bit data)

2) Input data (entered from high speed counter module to PMC)

0	CNTS (counter H and status)
+1	CNTM (middle 8 bits of counter)
+2	CNTL (lower 8 bits of counter)
+3	STTS (status)

(2) PMC outputs (outputs from PMC)
The PMC outputs are separated into control output CTRL and data outputs DTOH, DTOM, and DTOL. As with normal DOs, the control outputs of bit 3 to bit 7 are controlled independently. The cotrol outputs of bit0 to bit2 constitute the SELECT indicating the target data specified by DTOH, DTOM, and DTOL.

1) Control output

CTRL

7	6	5	4	3	2	1	0
MHR	MS		CE	PRS	SELECT		

PRS : Preset
CE : Count enable
MS : Marker synchronization
MHR : Marker hold reset

2) Details of DTOH, DTOM, and DTOL
The SELECT bits indicate the target data.

SELECT	
0	CCTR (comparison control)
1	Counter preset data
2	Comparison register A
3	Comparison register B
4	Comparison register C
7	Change to mode B

NOTE
1 Change to mode B: See Section 8.3.2, "Mode B".
2 Detail of CCTR

DTOH

7	6	5	4	3	2	1	0
					CMC	CMB	CMA

The DTOM and DTOL are ignored.

(3) PMC inputs (inputs to PMC)
The inputs to the PMC include the status and counter data. The data is shown below.

0	CNTS (counter H and status)
+1	CNTM (middle 8 bits of counter)
+2	CNTL (lower 8 bits of counter)
+3	STTS (status)

NOTE
1 Details of CNTS

7	6	5	4	3	2	1	0
TRA	Counter H (most significant 7 bits)						

TRA : Transfer A

NOTE
2 Details of STTS

7	6	5	4	3	2	1	0
TRB	ALM	CSP	ME	MH	CMPC	CMPB	CMPA

CMPA : Comparison output A
CMPB : Comparison output B
CMPC : Comparison output C
MH : Marker hold
ME : Marker enable

CSP : Count stop
ALM : Alarm (disconnection or watch dog alarm)
TRB : Transfer B

8.3.2 Mode B

Change to mode B
The operation mode is set to mode A at power-on. The following data is output to the counter module and the mode changes from A to B. The mode cannot change from B to A.

0	CTRL	:	0FH (SELECT = 7, PRS = 1)
+1	DTOH	:	01H
+2	DTOM	:	00H
+3	DTOL	:	00H

(1) PMC I/O area
In mode B, eight input bytes and four output bytes are used as the I/O area. The bytes in the I/O area have the following names. The input and output directions arespecified on the basis of the PMC.

1) Output data (sent from PMC to high speed counter module)

0	CTRL (control)
+1	DTOH (higher 8-bit data)
+2	DTOM (middle 8-bit data)
+3	DTOL (lower 8-bit data)

2) Input data (entered from high speed counter module to PMC)

0	CNTS (counter H and status)
+1	CNTM (middle 8 bits of counter)
+2	CNTL (lower 8 bits of counter)
+3	STTS (status)
+4	OUTD
+5	MODD
+6	Unused
+7	Unused

(2) PMC outputs (outputs from PMC)
The PMC outputs are separated into control output CTRL and data outputs DTOH, DTOM, and DTOL. As with normal DOs, the control outputs of bit 5 to bit 7 are controlled independently. The control outputs of bit 0 to bit 4 constitute SELECT indicating the target data specified by DTOH, DTOM, and DTOL.

1) Control outputs

CTRL

7	6	5	4	3	2	1	0
MS	CE	PRS	SELECT				

PRS : Preset
CE : Count enable
MS : Marker synchronization

2) Details of DTOH, DTOM, and DTOL
The SELECT bits indicate the target data.

SELECT	Target data
0 ~ 15	Comparison data 0 to comparison data 15
16	Output data for partition #0 to partition #2 DTOH:#0, M:#1, L:#2
17	Output data for partition #3 to partition #5 DTOH:#3, M:#4, L:#5
18	Output data for partition #6 to partition #8 DTOH:#6, M:#7, L:#8
19	Output data for partition #9 to partition #11 DTOH:#9, M:#10, L:#11
20	Output data for partition #12 to partition #14 DTOH:#12, M:#13, L:#14
21	Output data for partition #15 and partition #16 DTOH:#15, M:#16
22	Counter preset data

(The numbers of DTOH, DTOM, and DTOL indicate the output data for the partitions specified by the numbers.)

3) PMC inputs (inputs to PMC)
The inputs to the PMC include the status and counter data. The data is shown below.

0	CNTS (counter H and status)
+1	CNTM (middle 8 bits of counter)
+2	CNTL (lower 8 bits of counter)
+3	STTS (status)
+4	OUTD
+5	MODD
+6	Not used
+7	Not used

NOTE
1 Detail of CNTS

7	6	5	4	3	2	1	0
TRA		Counter H (most significant 7 bits)					

TRA : Transfer A

NOTE
2 Details of STTS

7	6	5	4	3	2	1	0
TRB	ALM	CSP	ME	MH	OUT2	OUT1	OUT0

OUT0 : Bit 0 of comparison output
OUT1 : Bit 1 of comparison output
OUT2 : Bit 2 of comparison output
MH : Marker hold
ME : Marker enable
CSP : Count stop
ALM : Alarm (disconnection or watch dog alarm)
TRB : Transfer B

NOTE
3 Detail of OUTD

7	6	5	4	3	2	1	0
OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0

OUT0 : Bit 0 of comparison output
OUT1 : Bit 1 of comparison output
OUT2 : Bit 2 of comparison output
OUT3 : Bit 3 of comparison output
OUT4 : Bit 4 of comparison output
OUT5 : Bit 5 of comparison output
OUT6 : Bit 6 of comparison output
OUT7 : Bit 7 of comparison output

NOTE
4 Detail of MODD

7	6	5	4	3	2	1	0
							MOD0

MOD0 : Set to 1 after the mode changes to B.

8.3.3 Details of PMC interface signals

(1) PMC inputs (inputs from PMC)

1) TRA and TRB
The counter data is valid when TRA is equal to TRB and invalid when TRA is not equal to TRB.

2) CMPA, CMPB, and CMPC (comparison output signals A, B, and C, only in mode A)
The CMPA, CMPB, and CMPC signals are output signals resulting from the comparison between the comparison registers A, B, and C and the counter data, respectively. The output levels of CMPA, CMPB, and CMPC are determined by the comparison mode signals CMA, CMB, and CMC.
When CMA, CMB, and CMC are 0, and the counter data is larger than the values in comparison registers A, B, and C, CMPA, CMPB, and CMPC are set to 1.
When CMA, CMB, and CMC are 1, and the counter data is equal to or less than the values in comparison registers A, B, and C, CMPA, CMPB, and CMPC are set to 1.

3) OUT0 to OUT 7 (comparison output signal 0 to comparison output signal 7, only in mode B)
OUT0 - OUT7 correspond to bit 0 to bit 7 in the comparison result output of a single byte.

4) MH (marker hold signal)
The marker hold signal MH is set to 1 at the rising edge of the marker signal whenthe marker enable signal is 1. The marker hold signal is reset when MHR=1 or MS=0. (In mode B, the marker hold signal MH is reset only when MS=0.)

5) ME (marker enable signal)
The marker enable signal ME enables the marker signal as follows:
ME=1: Marker signal enabled
ME=0: Marker signal disabled

6) CSP (count stop signal)
The counter stops counting when the contact for the external input signal CSP is closed.

7) ALM (alarm signal)
The alarm signal ALM is set to 1 if the signal line for the count pulse or the marker signal is disconnected or short-circuited.
ALM is also set to 1 when the watch dog alarm is activated.

(2) PMC outputs (outputs from PMC)

1) SELECT (selection signal)
The SELECT signal selects the register in which data will be set. That is, the signal specifies the register for presetting data. The SELECT signal should be set when or before the PRS signal is reversed.

2) PRS (preset signal)
The PRS signal presets data in registers. If data is set in DTOH, DTOM, and DTOL and then PRS is reversed, the data is set in the register specified by SELECT. Reversing the PRS signal means that PRS changes from level 0 to level 1 or vise versa.
DTOH, DTOM, DTOL, and SELECT should not be changed within two scans after the PRS is reversed. Also, the PRS must not reversed again within this period.
When SELECT=1, data is set in both the counter preset register and the counter.
Data is set by setting the first PRS to 1 after power-on or after the mode changesto B.

3) CE (count enable signal)
The CE signal determines whether the counter counts. When the CE is set to 1 and the external input signal CSP closes the contact, the counter retains its value, instead of counting.
When CE = 1 and the CSP external input contact is open, the counter counts input pulses. Presetting the counter requires maintaining CE = 0.

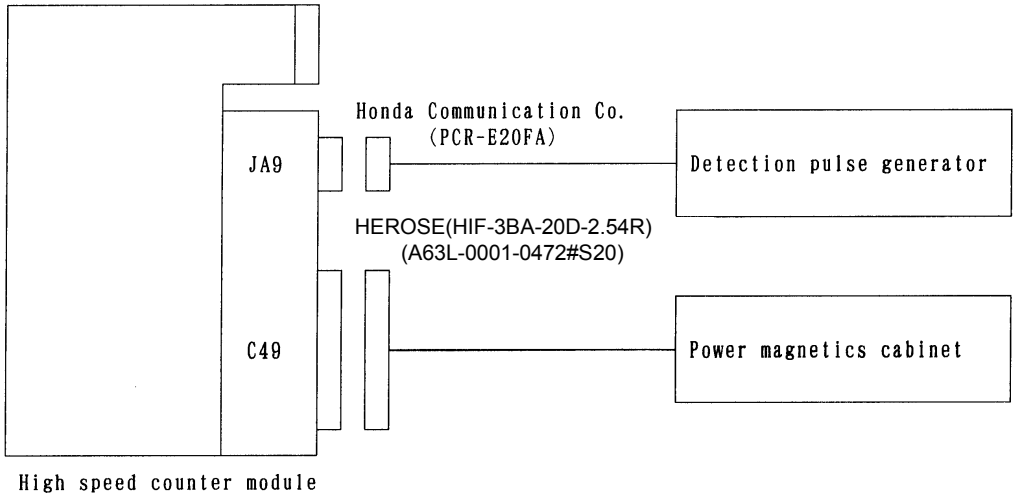
4) MS (marker synchronization signal)
The MS signal determines whether marker synchronization is provided. When the MS is 1 and the the contact of external input signal ME is closed, the counter is preset to the value in the counter preset register at the rising edge of the firstmarker signal. If the MS is set to 0 then set to 1 or the MHR is set to 1 then setto 0, marker synchronization is provided again.
(The MHR signal is not included in mode B.)

5) MHR (marker hold reset signal, only in mode A)
The MHR signal resets the marker hold (MH) signal which is output to the PMC. TheMHR is set to 1 to reset the marker hold signal.

6) CMA, CMB, and CMC (comparison mode signals A, B, and C, only in mode A)
The CMA, CMB, and CMC signals specify the levels of the comparison outputs A, B, and C (CMPA, CMPB, and CMPC), respectively.
When CMA, CMB, and CMC are 0, and the value of the counter is larger than the values in comparison registers A, B, and C, CMPA, CMPB, and CMPC are set to 0.
When CMA, CMB, and CMC are 1, and the value of the counter is equal to or less than the values in comparison registers A, B, and C, CMPA, CMPB, and CMPC are set to 1.

8.4 TOTAL CONNECTION OF HIGH SPEED COUNTER MODULE

8.4.1 Connection diagram



8.4.2 Connector signal list

JA9

9	+5V	10		19		20	+5V
7	LGND	8	PSEL	17		18	+5V
5	MKS	6	*MKS	18		16	LGND
3	PBS	4	*PBS	13		14	LGND
1	PAS	2	*PAS	11		12	LGND

PAS : Phase A pulse input signal (Negative pulse input signal)(positive)
*PAS : Phase A pulse input signal (Negative pulse input signal)(negative)
PBS : Phase B pulse input signal (Positive pulse input signal)(positive)
*PBS : Phase B pulse input signal (Positive pulse input signal)(negative)
MKS : Marker signal (positive)
*MKS : Marker signal (negative)
PSEL : Pulse select signal
+5V : 5V (output from this module)
LGND : 0V

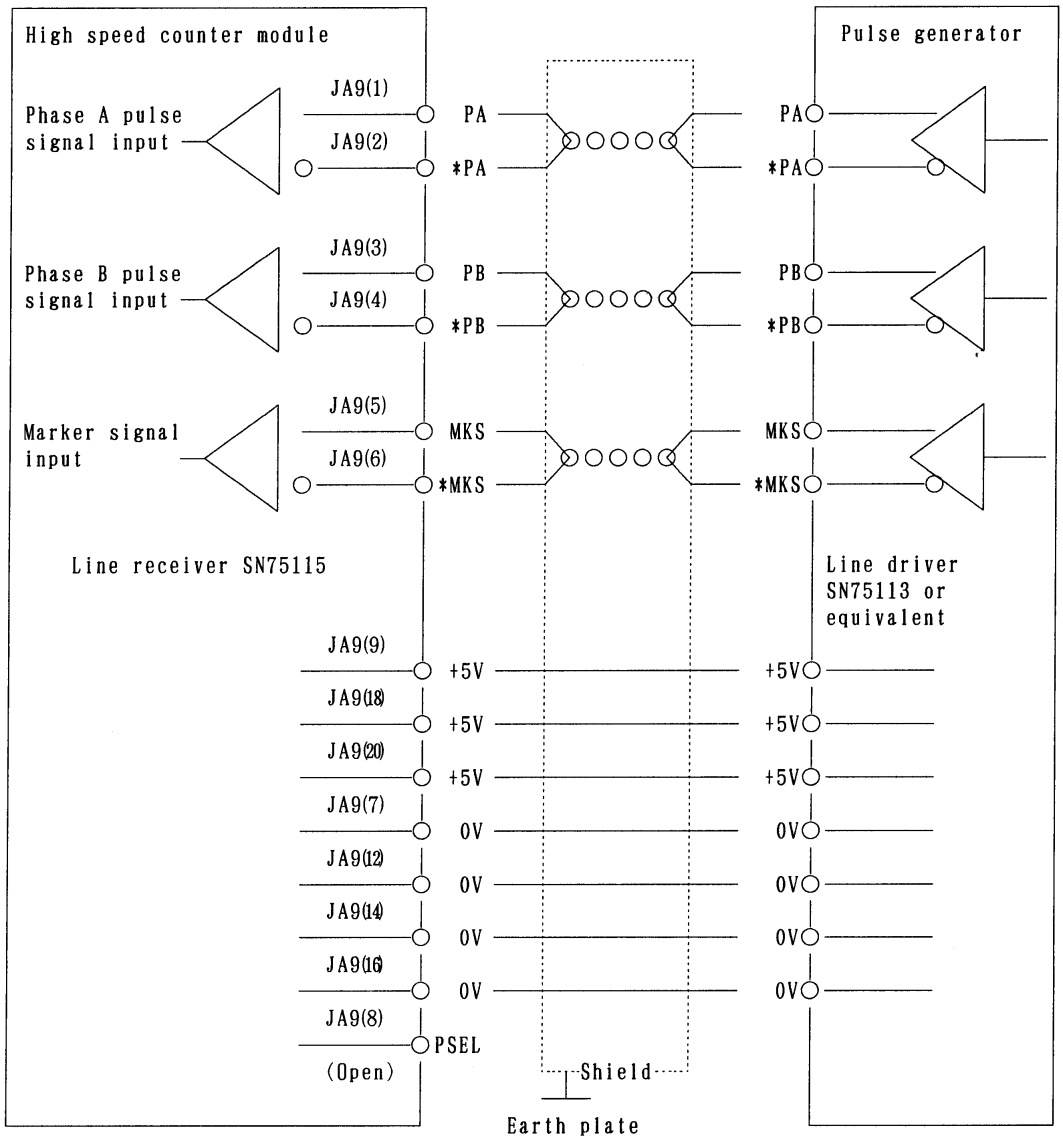
C49

	A	B
01	ME	
02	CSP	
03	COM1	
04		
05		
06	OUT0	OUT4
07	OUT1	OUT5
08	OUT2	OUT6
09	OUT3	OUT7
10	COM2	COM3

ME : Marker enable signal input
CSP : Counter stop signal input
OUT0 : Comparison result output
OUT1 : Comparison result output
OUT2 : Comparison result output
OUT3 : Comparison result output
OUT4 : Comparison result output
OUT5 : Comparison result output
OUT6 : Comparison result output
OUT7 : Comparison result output
COM1 : Common signal for ME and CSP
COM2 : Common signal for comparison result output 0 to comparison result output 3
COM3 : Common signal for comparison result output 4 to comparison result output 7

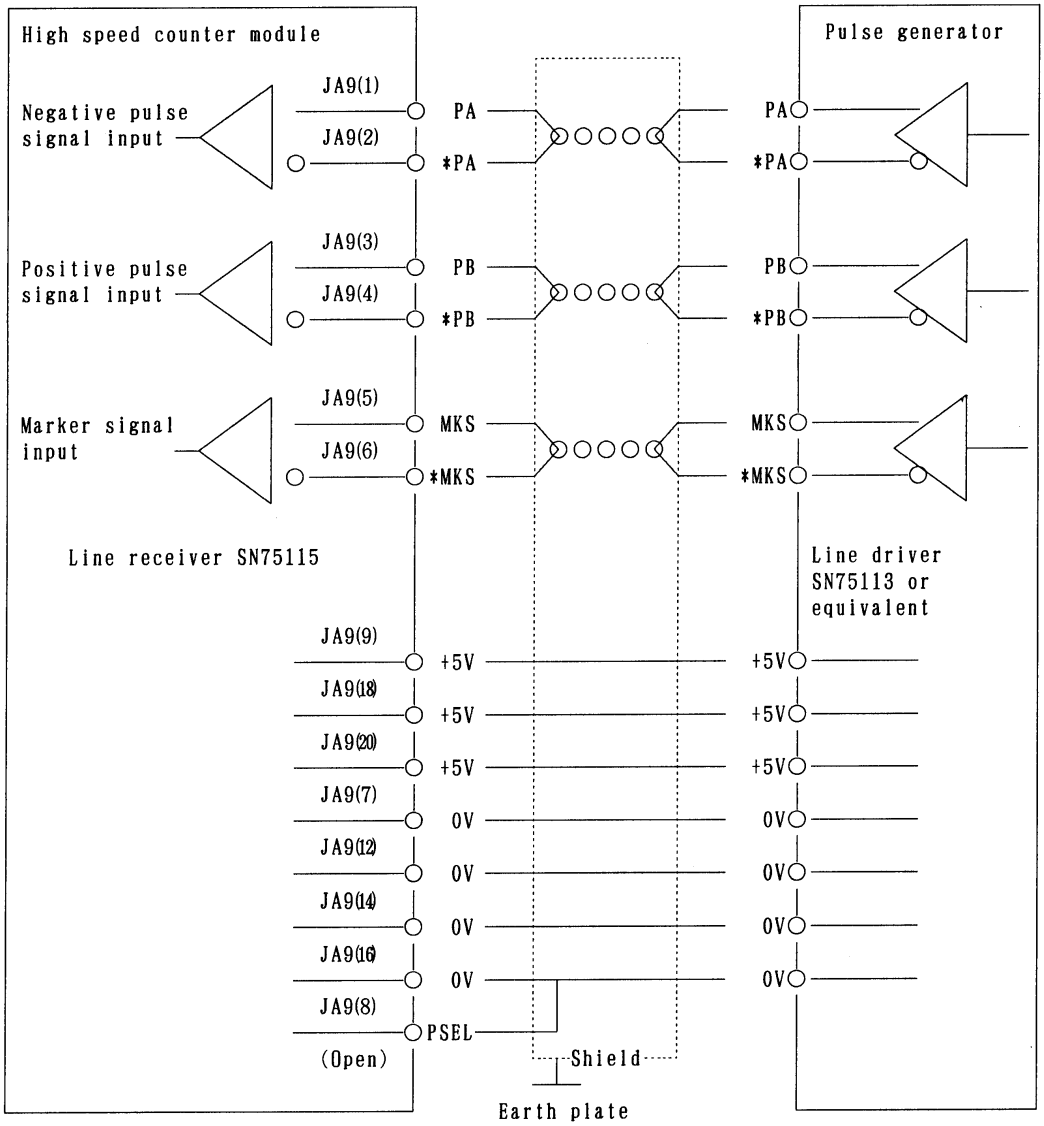
8.5 CONNECTION WITH PULSE GENERATOR

8.5.1 Use of phase A and B pulses



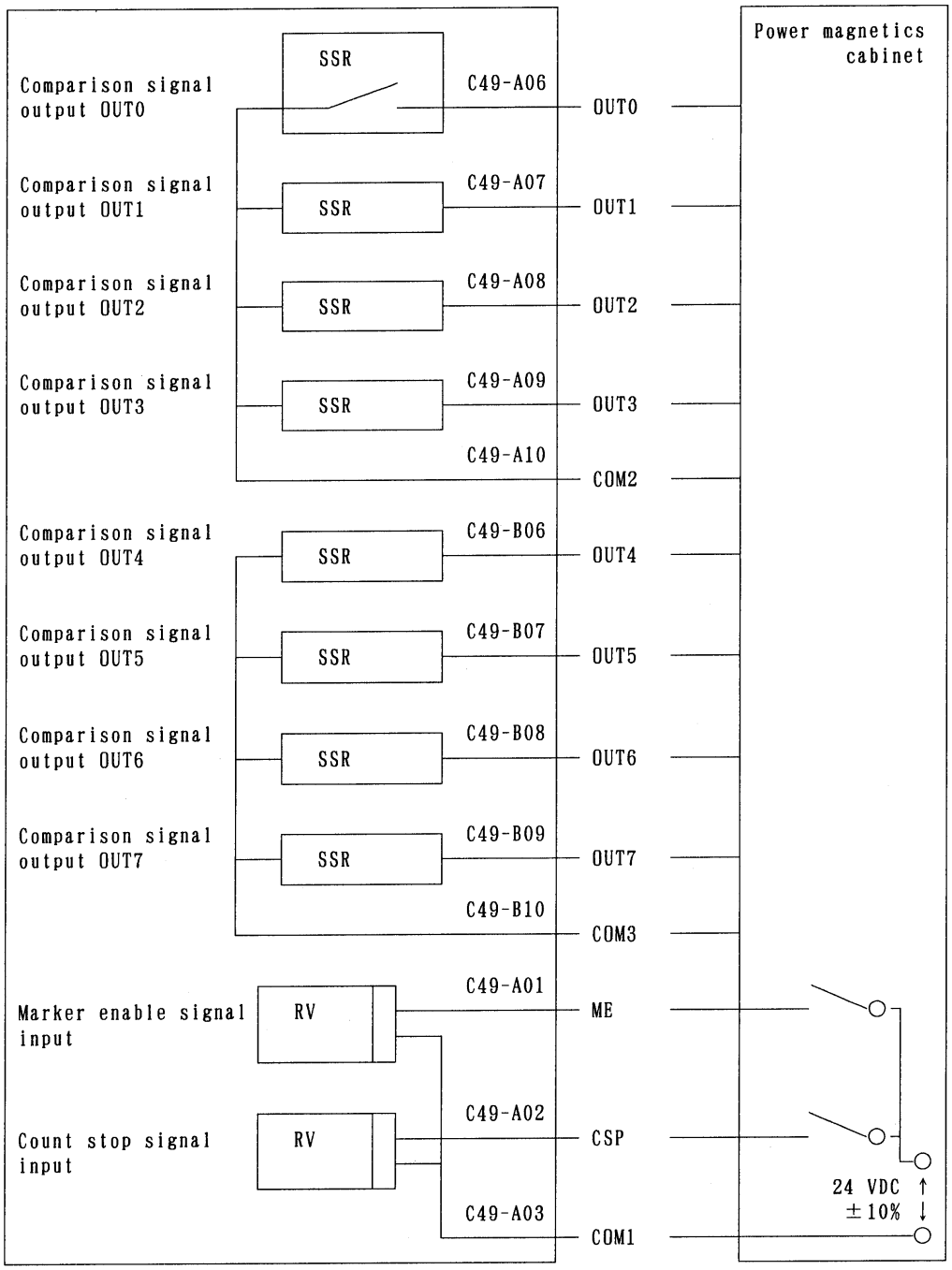
Recommended cable
A66L-0001-0286 (#20AWG×7, #24AWG×3 Pairs)

8.5.2 Use of positive/negative pulses



Recommended cable
A66L-0001-0286 (#20AWG×8, #24AWG×3 Pairs)

8.6 CONNECTION WITH POWER MAGNETICS CABINET



8.7 I/O SIGNALS CONVENTIONS

8.7.1 Solid state relay output signals (OUT0 to OUT7)

The solid state relay output signals drive relays in the power magnetics cabinet and indicator LEDs.

(1) Solid state relays

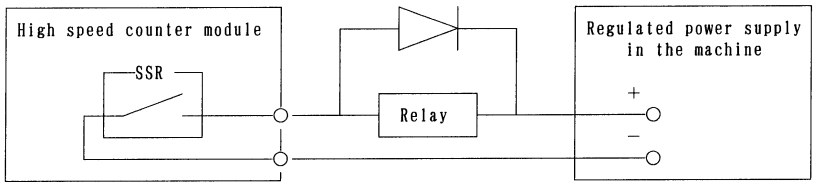
i) Maximum load current at output-on
250 mA: Up to three outputs set to on
125 mA: Eight outputs set to on

ii) Saturation voltage at output-on
Not more than 6xIL V (IL: load current)

iii) Withstand voltage at output-off
30 VDC max. even for instantaneous voltage

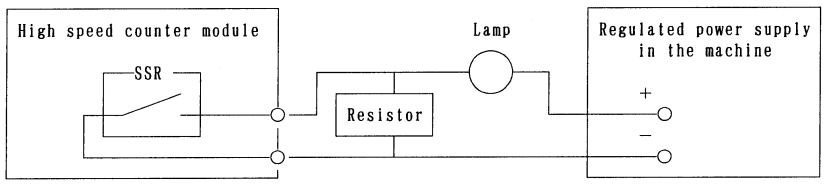
iv) Leak current at output-off
Not more than 100μA

(2) Output circuit



(3) Always install spark arresters when inductive loads such as relays are connected in the machine. Insert the spark arresters as near the load as possible (less than 20 cm). When capacitive loads are used in the machine, insert current limiting resistors in series with the loads to prevent the instantaneous current and voltage from exceeding the rated values.

(4) If a lamp is turned on by a solid state relay output, the resulting surge current may damage the solid state relay. Thus, as shown in the figure below, provide a protective resistor to prevent the instantaneous current and voltage from exceeding the rated values.



8.7.2 DC input signals (ME and CSP)

The DC input signals (such as relay contact signal) are sent from the machine (control circuit) to the pulse counter module.

(1) Input conditions
On voltage and current: 15 VDC or more, 4.5 mA or more
Off voltage and current: 6 VDC or less, 2 mA or less
Response time: 20 mA or less

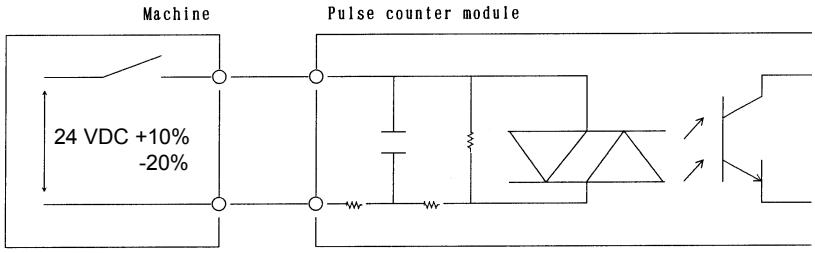
(2) Voltage and polarity
Voltage : 24 VDC +10%, -20%
Polarity : Positive or negative polarity available (The power is not supplied from the pulse counter module.)

(3) Logical correspondence

Contact	Logic
Open	0
Closed	1

(4) Receiver circuit of DC input signal

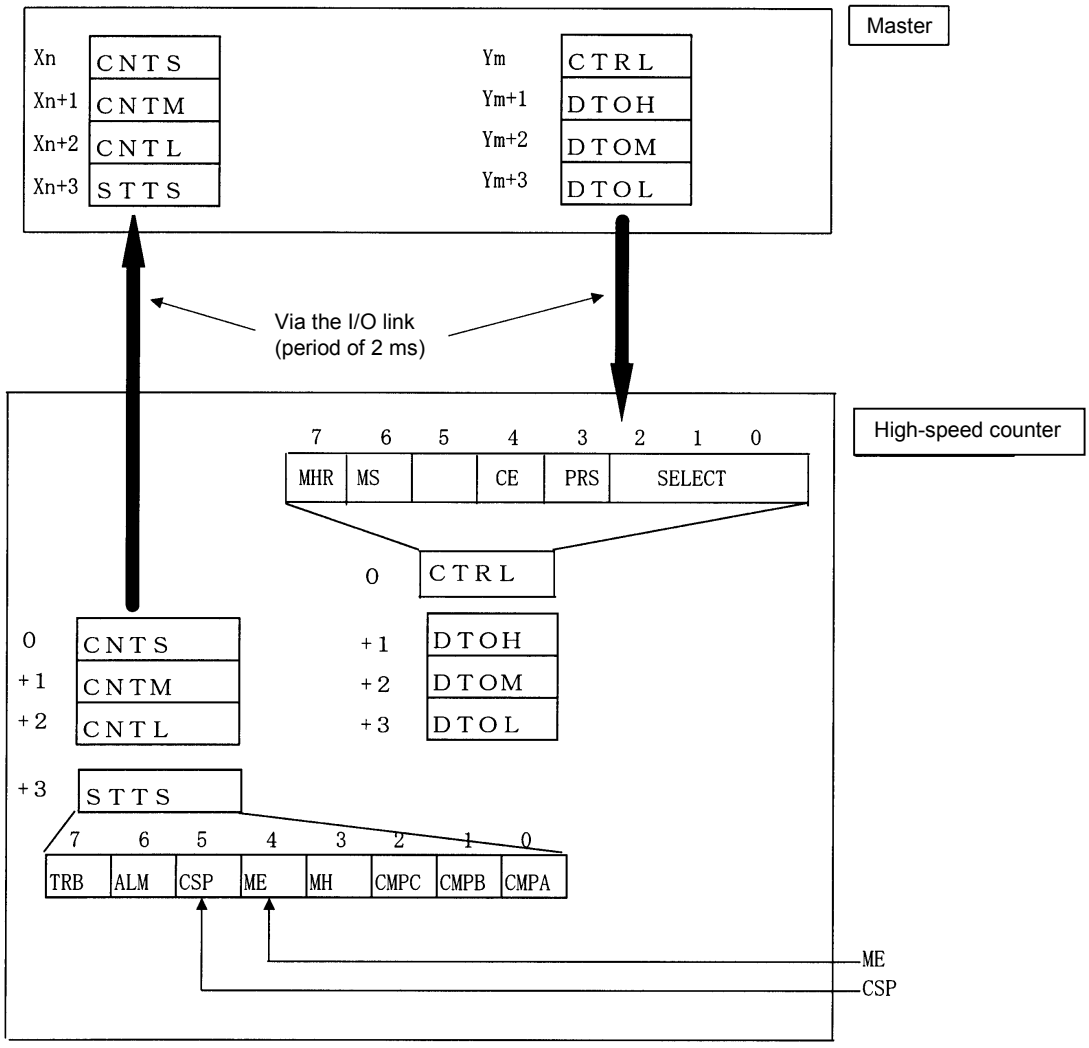
Machine Pulse counter module



8.8 SUPPLEMENT

8.8.1 Configuration of mode A

How mode A is configured is shown below. The contents of the CNTS, CNTM, CNTL, and STTS on a high-speed counter module are sent to the X area assigned on the master via the I/O link. The contents of the Y area assigned on the master are sent to CTRL, DTOH, DTOM, and DTOL on the high-speed counter module, via the I/O link.



8.8.2 Counter presetting and counting

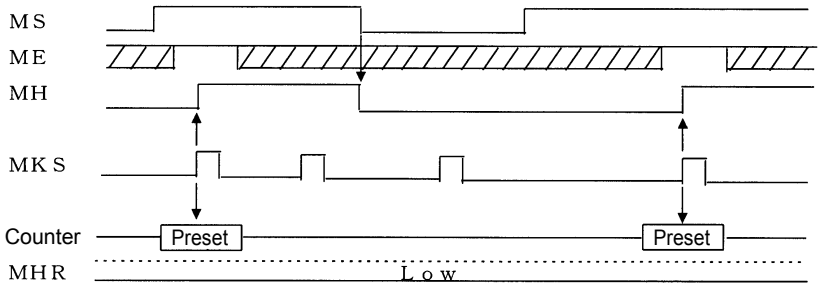
(1) The following table lists the information related to counter presetting. The MH signal can be reset either by setting the MHR (bit 7) of the CTRL (control) to 1 or by resetting the MS (bit 6) of the CTRL to 0. See control examples 1 and 2.

	Condition				Status	
	MHR of CTRL	**MS of CTRL**	**ME of external signal**	**MKS of external signal**	**ME of STTS**	**MH of STTS**
Counter presetting	0	1	Contact "Closed	Initial ↑	1	1
MH signal resetting (1)	×	0	×	×	×	0
MH signal resetting (2)	1	×	×	×	×	0

- Contact "Closed" means that 24 V is applied to the ME terminal.
- × means that the bit can be either 0 or 1. (× for the ME bit of the STTS means that the bit corresponds to the status of the ME bit of the external signal.)

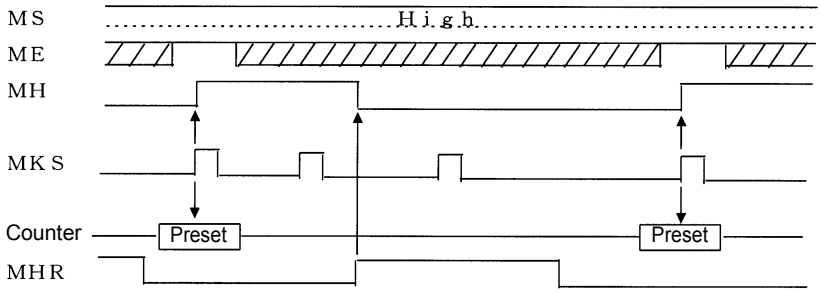
Control example 1:

(Hatching ▨ means that the bit can be either 0 or 1.)



Control example 2:

(Hatching ▨ means that the bit can be either 0 or 1.)



(2) Information related to counting
Counting starts and stops under the conditions listed below.

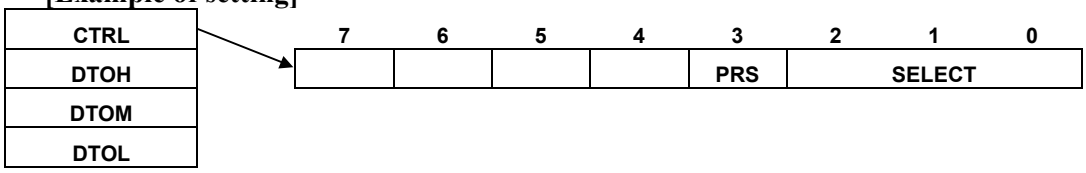
	CE of CTRL	CSP of external signal	PSEL of external signal	CSP of STTS
Count (A/B phase pulse)	1	Contact "Open"	Open	0
Count (+/- pulse)	1	Contact "Open"	Connected to 0 V	0
Counting stop (1)	0	×	×	×
Counting stop (2)	×	Contact "Closed"	×	1

- Contact "Closed" means that 24 V is applied to the CSP terminal. (1 or POS)
- Contact "Open" means that the CSP terminal is open. (0 or NEG)
- × means that the bit can be either 0 or 1. (× for the CSP bit of the STTS means that the bit corresponds to the status of the CSP bit of the external signal.)

8.8.3 Setting data

Data for some models (such as the FS15 and FS18) is in the opposite order to that of the NC data. In this case, convert (rearrange) the data in byte units.

[Example of setting]



Example 1 : To preset the counter preset register with a specific value (the counter is also set to this value), follow the steps below.

(1) Preset the DTOH, DTOM, and DTOL with a desired value.
(2) Set SELECT to 001.
(3) Reverse the setting of the PRS (from 0 to 1 or from 1 to 0).
(4) Wait for two scanning periods.

- Another method for presetting the counter is to use the MKS external signal (see Section 3.1). It takes a maximum of 5 ms to preset using the first method, while it takes only a maximum of 100 μs to preset using the MKS external signal.

Example 2 : To set the comparison control register with the setting (0 or 1) of CMA, CMB, and CMC, follow the steps below.

(1) Set DTOH bits 0, 1, and 2 to the desired data.
(2) Set SELECT to 000.
(3) Reverse the setting of the PRS (from 0 to 1 or from 1 to 0).
(4) Wait for two scanning periods.

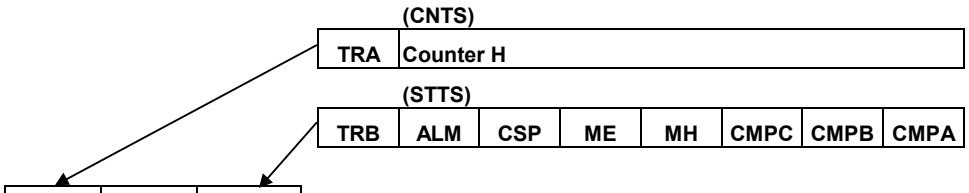
Example 3 : To set comparison register B to a desired comparison value, follow the steps below.

(1) Set DTOH, DTOM, and DTOL to the desired comparison value.
(2) Set SELECT to 011.
(3) Reverse the setting of the PRS (from 0 to 1 or from 1 to 0).
(4) Wait for two scanning periods.

The result of comparing comparison registers A, B, and C with the pulse counter is output via OUT0 to OUT2 of connector C49 of this counter module (A → OUT0, B → OUT1, and C → OUT2).
Their output status is output via OUT0 to OUT2 of the LED indication panel (A → OUT0, B → OUT1, and C → OUT2).
The result of comparison can be confirmed by checking STTS bits 0, 1, and 2 (CMPA, CMPB, and CMPC) with the PMC.

8.8.4 Reading data

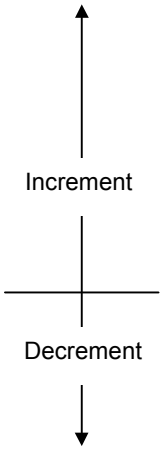
The CNTS and STTS are two of the four input bytes. The most significant bit, TRA, of the CNTS and the most significant bit, TRB, of the STTS can be used to determine whether the count data is correct. If both TRA and TRB are 0 or 1, the count data is correct.
In almost all cases, both TRA and TRB will be 0 or 1 when you view the diagnostic display. (Do not determine that the data has not changed because of the fact that the TRA and TRB do not become 0 or 1 alternately.) Note that the count data does not take a negative value.



TRA	TRB	Validity
0	0	Correct
0	1	Incorrect
1	0	Incorrect
1	1	Correct

The counter assumes the following data when it is incremented or decremented.

□0000000 00000000 00000010
□0000000 00000000 00000001
□0000000 00000000 00000000
□1111111 11111111 11111111
to
□0000000 00000000 00000011
□0000000 00000000 00000010
□0000000 00000000 00000001
□0000000 00000000 00000000
□1111111 11111111 11111111
□1111111 11111111 11111110
□1111111 11111111 11111101
□1111111 11111111 11111100



The square □represents the TRA. (The most significant bit is the TRA. It is not a sign bit.)

8.8.5 Miscellaneous information

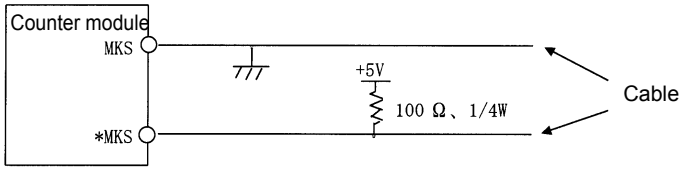
(1) +5 V for connector JA9

- +5 V on connector JA9 of this high-speed counter module is output from the counter module (with a maximum current of 300 mA).
  It is necessary to satisfy Table 4.4 in Section 4.4, "Required Current."
  Example : When 100 mA is drawn from +5 V on connector JA9, 170 + 0.3 × 100 = 200. So, use 200 instead of 170.

(2) Rotary encoder output

- Use a line driver output to drive the rotary encoder. Note that a voltage output or an open-collector output cannot be used for the rotary encoder. In addition, use a differential driver (SN75113 or equivalent) at the line driver output. Note that the AM26LS31 is equivalent to the SN75113.

(3) Marker signal treatment
When not using a marker signal (when not presetting), treat it as shown below. Otherwise, a disconnection alarm will occur. A disconnection alarm does not suspend counting.



If this treatment does not prevent the disconnection alarm, check whether the GND point of the pulse generator is connected to the LGND (0 V) pin of connector JA9 on this high-speed counter module.

(4) LED
A/B phase pulse (+/- pulse) input signal indicators, A and B, correspond to pulse inputs A and B. When the pulse input is "1" (high), the indicator lights. If the pulse input has a very short period for "1" (high), it may difficult to recognize the indicator as being on.

9 TEMPERATURE INPUT MODULE

9.1 OVERVIEW

A temperature input module is used to measure the temperature of machine tools and similar equipment. The temperature input module can be either of the following, depending on the type of the sensor used.

- Thermoresistance-type temperature input module: ATI04A
- Thermocouple-type temperature input module: ATI04B

These modules can measure temperature on up to four channels. For the thermoresistance-type temperature input module, either JPt100Ω or Pt100Ω can be selected. For the thermocouple-type temperature input module, either K or J thermocouple input can be selected. This selection is made using the PMC user program (ladder).

9.2 TEMPERATURE INPUT MODULE SPECIFICATION

Input signal types and number of input channels	• Types ATI04A Three-wire thermoresistance (JPt100Ω) Three-wire thermoresistance (Pt100Ω) ATI04B J thermocouple (can also be used with the tip grounded) K thermocouple (can also be used with the tip grounded) • Number of input channels 2/4, for all for which the input is the same
Input signal switching method	• User program (ladder)
Temperature measurement range and precision	• Thermoresistance type (ATI04A) -50 to 300.0°C Resolution 0.1°C Overall precision ±1%FS • Thermocouple type (ATI04B) 0 to 600.0°C Resolution 0.1°C Overall precision ±1%FS
Data sampling period setting (NOTE)	• 0.3 s per two channels • 0.5 s per four channels to 10 s per four channels (4 s per four channels is assumed if no specification is made)
System failure check	• Self-diagnosis A watchdog timer is used. • Abnormal temperature (including sensor input disconnection) Failure information about each abnormal channel is sent to the PMC.
Interface with the PMC	• PMC → temperature module Information format: Binary or bit Signals: 32 points • Temperature module → PMC Information format: Binary or bit Signals: 32 points
External connection	Connector (Hirose Electric Co., Ltd.: HIF3BA-34PA-2.54DS)

NOTE
The actual response time is the sum of the time required for the signal to pass the filter and the scan time that is determined depending on the system1

9.3 PMC INTERFACE

9.3.1 PMC I/O area

This temperature module uses an input/output area consisting of four bytes for input and the same number of bytes for output. Each byte of the input/output area has the following meanings. The terms "input" and "output" are used in reference to the PMC. When input/output addresses are assigned to the module, "/4" is used as the module name.

1) Output (PMC → temperature module)

Addresses in the module		
0	DO07 to DO00	Period for 4-channel automatic measurement mode (lower 8 bits)
+1	DO15 to DO08	Period for 4-channel automatic measurement mode (higher 8 bits)
+2	DO23 to DO16	Module setting data and timing data
+3	DO31 to DO24	Module setting data and timing data

2) Input (temperature module → PMC)

Addresses in the module		
0	DI07 to DI00	CH1 temperature data, CH3 temperature data, or abnormality data (lower 8 bits)
+1	DI12 to DI08	CH1 temperature data, CH3 temperature data, or abnormality data (higher 5 bits)
	DI15 to DI13	Status signal
+2	DI23 to DI16	CH2 temperature data, CH4 temperature data, or abnormality data (lower 8 bits)
+3	DI28 to DI24	CH2 temperature data, CH4 temperature data, or abnormality data (higher 5 bits)
	DI31 to DI29	Status signal

NOTE
If you are using the PMC-N, NA, or QA (the PMC for Series 15 or F-D Mate), all addresses up to those listed above can be used without modifying them if the data is manipulated in byte (8-bit) units. When manipulating data in word (16-bit) units, note that the byte addresses are transposed as shown below.

Addresses for word-unit operation in the PMC-N, NA, and QA

PMC → Temperature module
High-order bits Low-order bits
Addresses in the module

0	DO07 to DO00	DO07 to DO00
+2	DO23 to DO16	DO31 to DO24

Temperature module → PMC
High-order bits Low-order bits
Addresses in the module

0	DI07 to DI00	DI15 to DI08
+2	DI23 to DI16	DI31 to DI24

9.3.2 Measurement mode

This temperature module can operate in any of the following three measurement modes. The mode to use can be selected using a user program (ladder).

③ 2-channel measurement mode
This mode uses two channels, CH1 and CH2, for measurement. Data on each channel is updated every 0.3 s.

③ 4-channel automatic measurement mode
This mode uses four channels, CH1 to CH4, for measurement. Input switching from CH1 and CH2 data to CH3 and CH4 data and vice versa is performed automatically. Data on each channel is updated at a specified interval, say, every 0.5 to 10 s.

③ 4-channel manual measurement mode
This mode uses four channels, CH1 to CH4, for measurement. The PMC can reference CH1 and CH2 data or CH3 and CH4 data at the desired timing.

9.3.3 Details of output signals (PMC → temperature module)

DO07	**DO06**	**DO05**	**DO04**	**DO03**	**DO02**	**DO01**	**DO00**
DO15	**DO14**	**DO13**	**DO12**	**DO11**	**DO10**	**DO09**	**DO08**
	DO22			**DO19**	**DO18**	**DO17**	**DO16**
					DO26	**DO25**	**DO24**

1) Before setting the module setting data bit (NC READY (DO16)) to "1", set the following bits.

DO00 (LSB) to DO15 (MSB):
Channel switching period for 4-channel automatic measurement mode
These bits are set with a binary number representing the channel switching period for the 4-channel automatic

measurement mode. They need not be set for the 2-channel mode.
The period can be varied in a range between 0.5 s and 10 s. When setting the bits, use a value ten times the desired period.
(Example) 2 s → 20 (14h)
The valid data range is between 5 and 100 (64h). Any value out of this range is regarded as being 40 (28h), that is, 4 s. If nothing is specified, a period of 4 s is again assumed.

DO17 : Module type
This bit is set according to the type of the temperature module being used.
0 : Thermocouple-type module (ATI04B)
1 : Thermoresistance-type module (ATI04A)

DO18 : Sensor type
This bit is set according to the type of the temperature sensor being used.
- ATI04A

0 : Pt
1 : JPt

- ATI04B

0 : K
1 : J

DO19 : Reserved for future use
This bit must always be set to "0".

DO24 : Number of channels
This bit is used to specify the number of channels to be measured.
0 : 2 channels
1 : 4 channels (if 1 is selected, DO25 must also be used.)

DO25 : 4-channel mode specification
This bit is used to select the 4-channel mode to be used.
0 : Automatic measurement (the period is specified using DO00 to DO15.)
1 : Manual measurement (a request is issued using DO22 and DO26 at every data read.)

2) Timing data

DO16 : NC READY

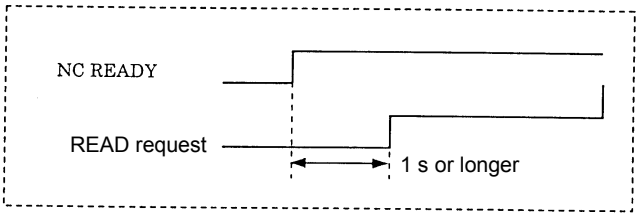
When the power is switched on, this bit is set to "1" to cause the module setting data to be set in the temperature module.

The NC READY bit is enabled only once after the power is switched on. To rewrite the module setting data, switch the power off and then on again.

DO22 : READ request

This bit serves as the timing signal used in 4-channel manual measurement mode. Setting the bit to "1" issues a request for temperature data. When the input signal data READY signal becomes "1", read the temperature data.

This bit need not be set for 2-channel mode.



NOTE
After setting the NC READY bit to "1", wait for one second, and then set the READ request to "1".

DO26 : Channel select

This bit is used to specify channel switching for 4-channel manual measurement mode.

0: Channels 1 and 2
1: Channels 3 and 4

NOTE
See Section 9.5, "Timing Charts," for concrete explanations about how to handle the timing data.

9.3.4 Details of input signals (temperature module → PMC)

1) Status signals and CH1 temperature data, CH3 temperature data, or abnormality data

DI07	DI06	DI05	DI04	DI03	DI02	DI01	DI00

DI15	DI14	DI13	DI12	DI11	DI10	DI09	DI08

- Status signals
  DI13 : Abnormality sign bit
  1 : This bit is set to "1" when the temperature input is abnormal. DI00 to DI12 are used to describe the abnormality.
  0 : DI00 to DI12 are used to indicate the temperature data.

  DI14 : CH1 data READY
  1 : Read the CH1 temperature data from DI00 to DI12 when this bit is set to "1".

  DI15 : CH3 data READY
  1 : Read the CH3 temperature data from DI00 to DI12 when this bit is set to "1".

- CH1 temperature data, CH3 temperature data, or abnormality data
  DI00 (LSB) to DI12 (MSB):
  These bits indicate temperature input data (CH1/CH3) or abnormality data.

Temperature input data

The temperature input data is in binary. It is ten times the actual temperature.
Example
(83EDh → 1005 → 100.5℃)
The highest three bits are status signals.

For the thermoresistance-type module (ATI04A), the DI12 bit is a sign bit. (Negative data is represented in two's complement.)
Example
(9F9Ch → -10.0℃)
The highest three bits are status signals.

Abnormality data

If an abnormality occurs in the input data or in the module, the DI13 bit (status signal) becomes "1", resulting in the display changing from temperature input data to abnormality data. Abnormality data is assigned to these bits as listed below:

DI00 : CH1 input out of scale--the current temperature falls outside the measurable range.
DI01 : CH1 input burn-out--the cable or connector has been detached.
DI02 : CH3 input out of scale--the current temperature falls outside the measurable range.
DI03 : CH3 input burn-out--the cable or connector has been detached.
DI04 : Cold-junction abnormality (only for thermocouple-type input module)--the temperature of the terminal board unit falls outside the measurable range.

DI05 : System error--the internal circuit is abnormal.
DI06 : Wrong module--other than the correct module has been installed.

2) Status signals, CH2 temperature data, CH4 temperature data, or abnormality data

DI23	DI22	DI21	DI20	DI19	DI18	DI17	DI16

DI31	DI30	DI29	DI28	DI27	DI26	DI25	DI24

- Status signals
  DI129 : Abnormality sign bit
  1 : This bit becomes "1" when the temperature input becomes abnormal. DI16 to DI28 are used to describe the abnormality.
  0 : DI16 to DI28 are used to indicate the temperature data.

  DI30 : CH2 data READY
  1 : Read the CH2 temperature data from DI16 to DI28 when this bit is set to "1".

  DI31 : CH4 data READY
  1 : Read the CH4 temperature data from DI16 to DI28 when this bit is set to "1".
- CH2 temperature data, CH4 temperature data, or abnormality data
  DI16 (LSB) to DI28 (MSB):
  These bits indicate temperature input data (CH2/CH4) or abnormality data.

Temperature input data

The temperature input data is in binary. It is ten times the actual temperature.
Example
(41F3h → 0499 → 49.9℃)
The highest three bits are status signals.

For a thermoresistance-type module (ATI04A), the DI28 bit is a sign bit. (Negative data is represented in two's complement.)
Example
(5FFBh → -0.5℃)
The highest three bits are status signals.

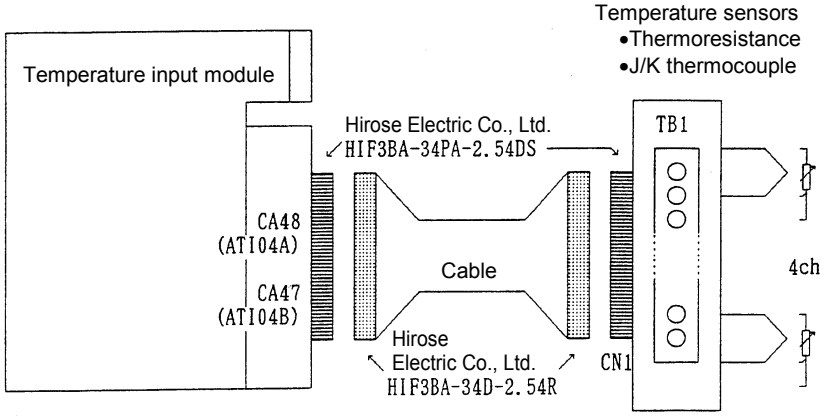
Abnormality data

If an abnormality occurs in the input data or the module, the DI29 bit (status signal) is set to "1", resulting in the display changing from temperature input data to abnormality data. Abnormality data is assigned to these bits as listed below:

DI16 : CH2 input out of scale--the current temperature falls outside the measurable range.
DI17 : CH2 input burn-out--the cable or connector has been detached.
DI18 : CH4 input out of scale--the current temperature falls outside the measurable range.
DI19 : CH4 input burn-out--the cable or connector has been detached.
DI20 : Cold-junction abnormality (only for thermocouple-type input module)--the temperature of the terminal board unit falls outside the measurable range.
DI21 : System error--the internal circuit is abnormal.
DI22 : Wrong module--other than the correct module has been installed.

9.4 COMPLETE CONNECTION OF TEMPERATURE INPUT MODULE

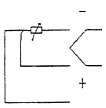
9.4.1 Temperature input module connection diagram



Terminal board unit
(There are two types of terminal board units, the first for a thermoresistance-type module and the second for a thermocouple-type module.)
See Section 9.7 for explanations about the dimensions of the terminal board.

9.4.2 Connector signal lists

1) Thermoresistance input module
ATI04A

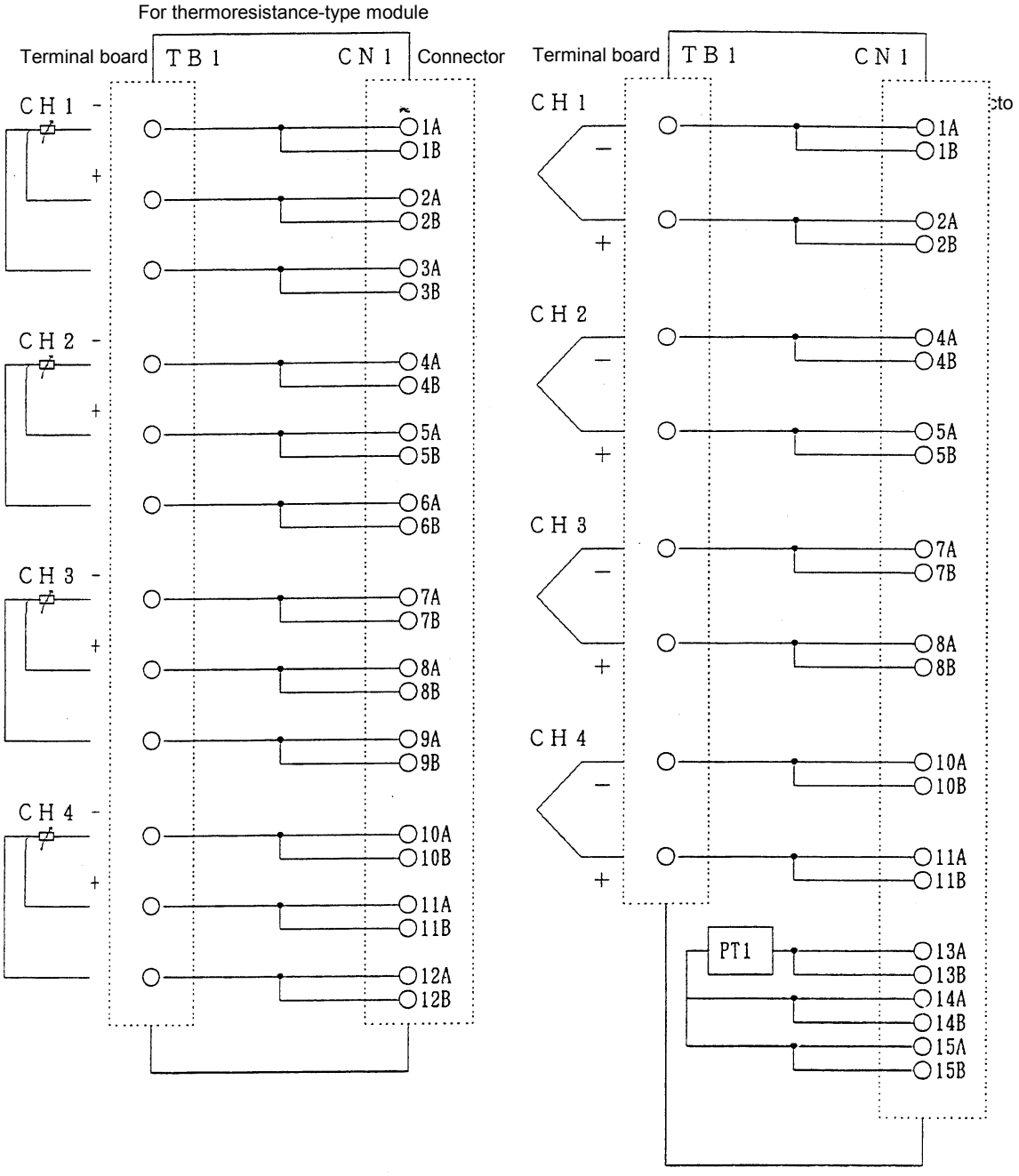


Channel	Pin No.	Pin No.
Channel 1 -	1A	1B
Channel 1 +	2A	2B
Channel 1 +	3A	3B
Channel 2 -	4A	4B
Channel 2 +	5A	5B
Channel 2 +	6A	6B
Channel 3 -	7A	7B
Channel 3 +	8A	8B
Channel 3 +	9A	9B
Channel 4 -	10A	10B
Channel 4 +	11A	11B
Channel 4 +	12A	12B
Unusable	13A	13B
Unusable	14A	14B
Unusable	15A	15B
Unusable	16A	16B
Unusable	17A	17B

2) Thermocouple input module
ATI04B

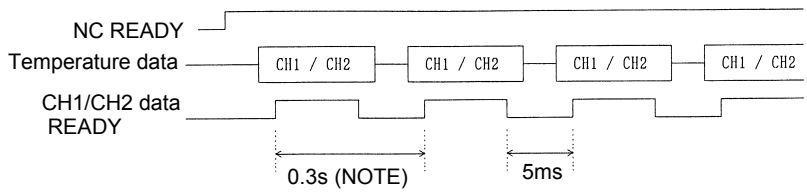
Channel	Pin No.	Pin No.
Channel 1 -	1A	1B
Channel 1 +	2A	2B
Unusable	3A	3B
Channel 2 -	4A	4B
Channel 2 +	5A	5B
Unusable	6A	6B
Channel 3 -	7A	7B
Channel 3 +	8A	8B
Unusable	9A	9B
Channel 4 -	10A	10B
Channel 4 +	11A	11B
Unusable	12A	12B
Cold-junction compensation element A	13A	13B
Cold-junction compensation element B1	14A	14B
Cold-junction compensation element B2	15A	15B
Unusable	16A	16B
Unusable	17A	17B

9.4.3 Terminal board unit connection diagram



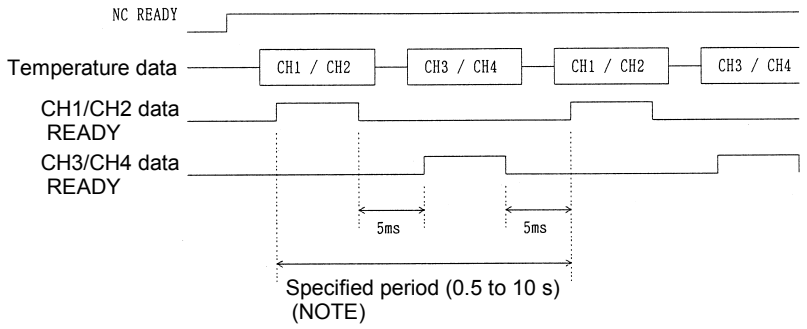
9.5 TIMING CHARTS

(1) 2-channel mode



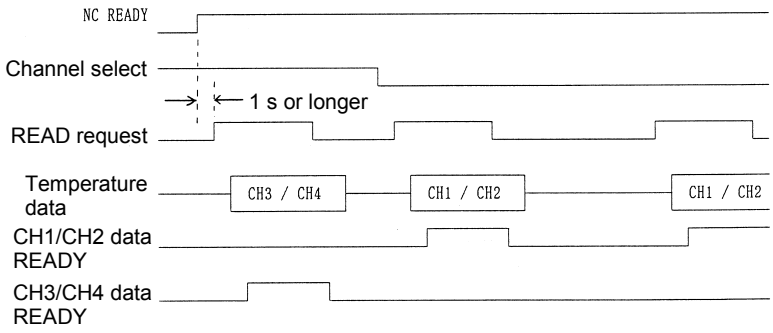
NOTE
The actual response time is the sum of the time required to pass the filter and the scan time that is determined depending on the system.

(2) 4-channel automatic measurement mode



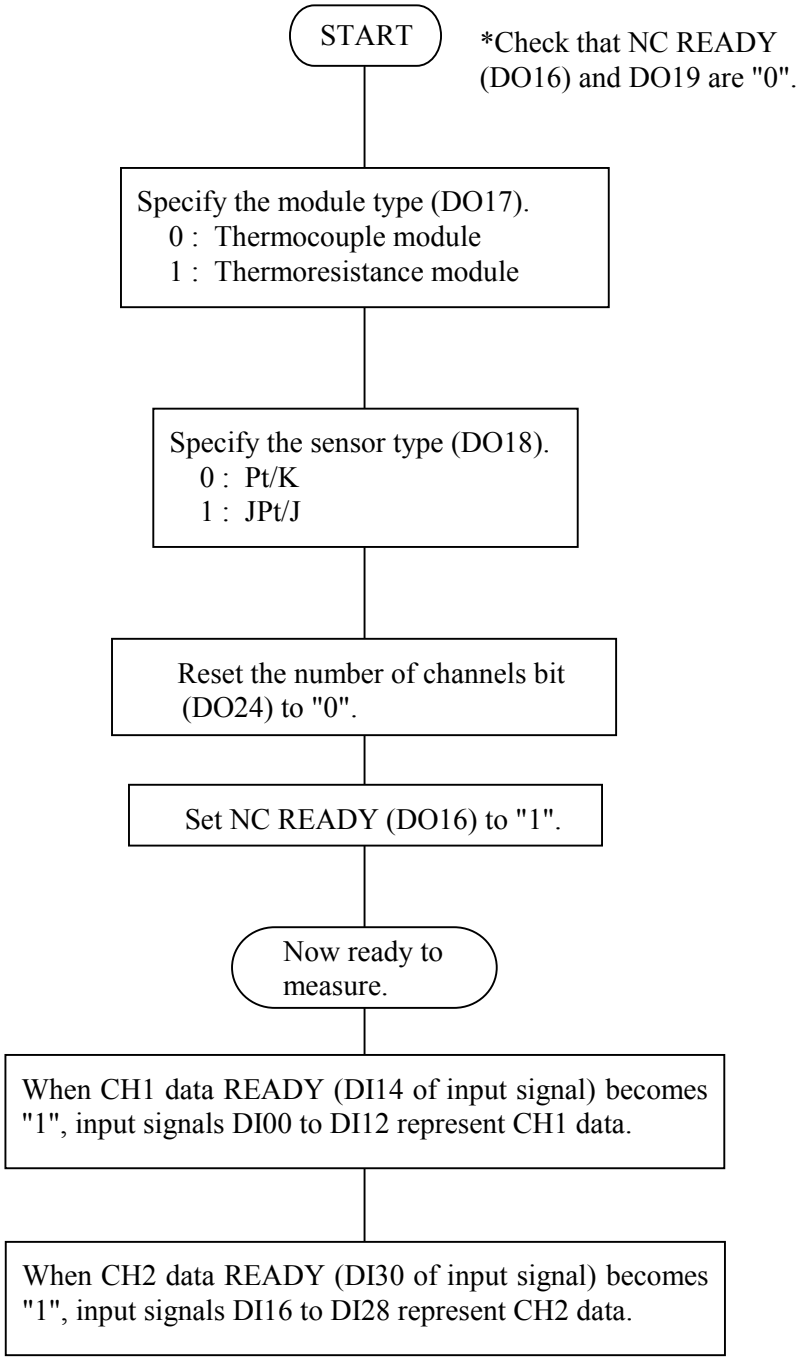
NOTE
The actual response time is the sum of the time required to pass the filter and the scan time that is determined depending on the system.

(3) 4-channel manual measurement mode



9.6 MEASUREMENT EXAMPLES

(1) 2-channel mode
(a) Flowchart



(b) Ladder example

The following measurement and ladder examples apply when a thermoresistance module with Pt is used for measurement.

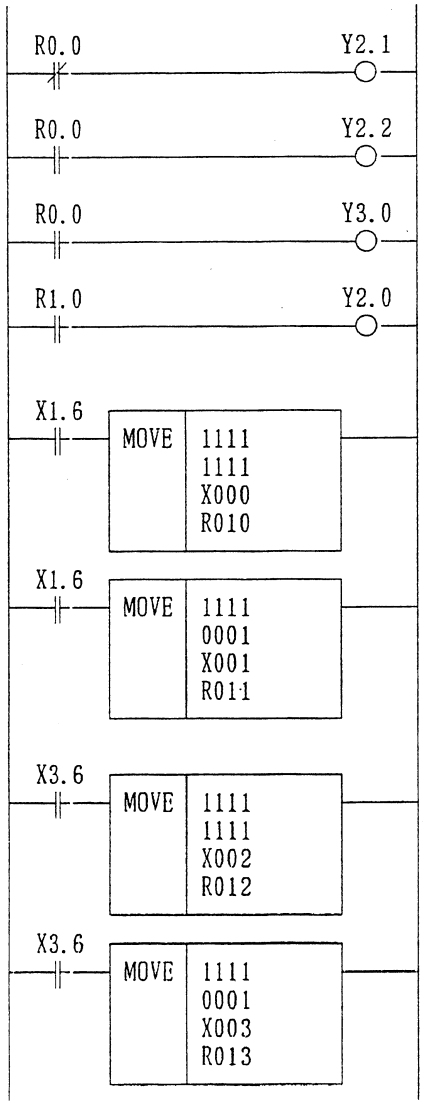
PMC measurement

	GROUP	BASE	SLOT	NAME		GROUP	BASE	SLOT	NAME
X000	0	0	1	/4	Y000	0	0	1	/4
X001	0	0	1	/4	Y001	0	0	1	/4
X002	0	0	1	/4	Y002	0	0	1	/4
X003	0	0	1	/4	Y003	0	0	1	/4

NOTE

Set the ladder scan time to 0.25 s or less.
This example of ladder use is for the second level.
R0.0 is used as a normally open relay.

Ladder



Specify the module.

(thermoresistance-type module)
Specify the sensor (Pt).

Specify the number of channels (two channels).

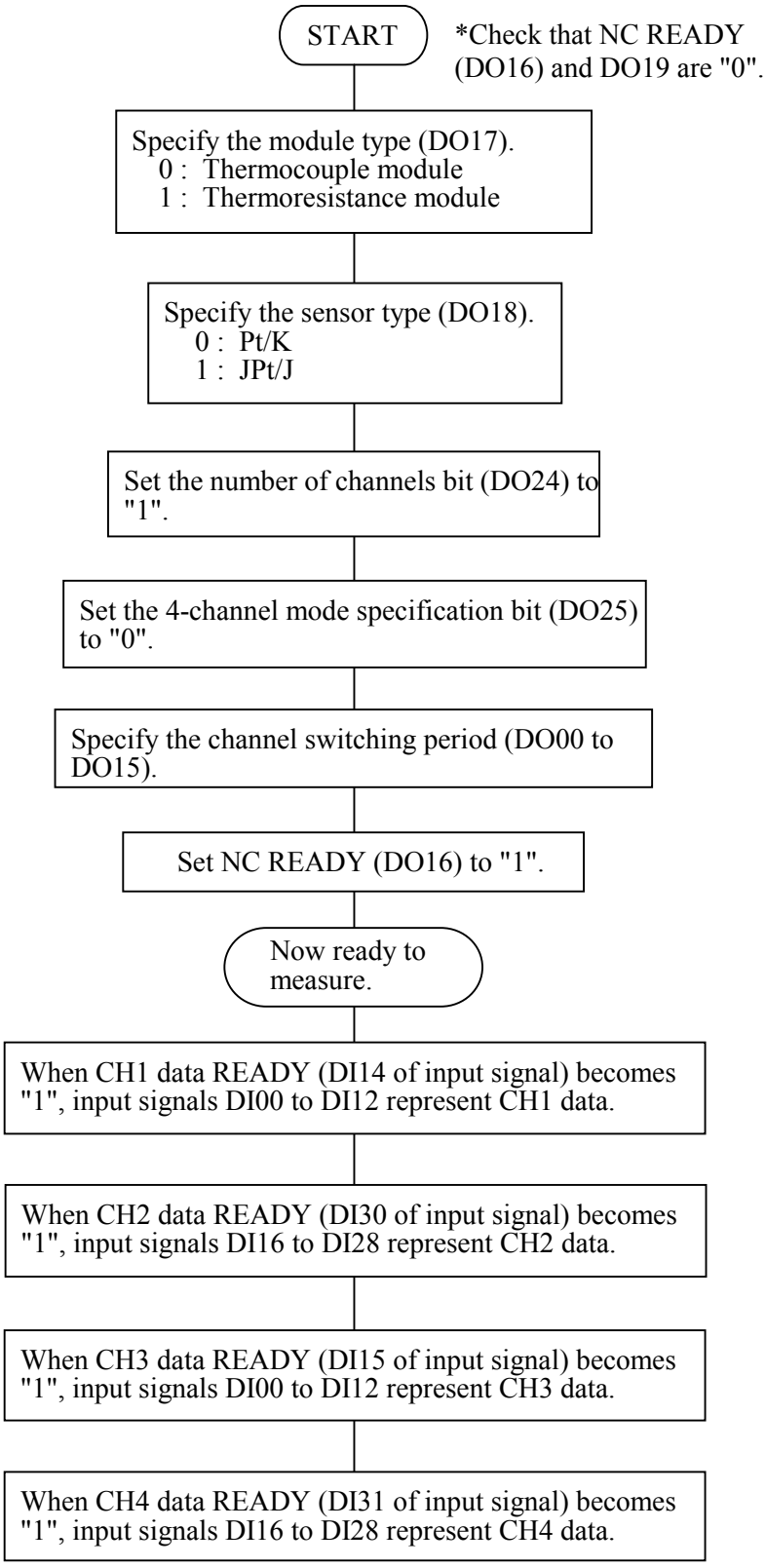
NC READY (When R1.0 becomes "1", NC READY becomes "1" to start measurement.)

When CH1 data READY is "1", CH1 temperature data is sent to R010 to R011.

When CH2 data READY is "1", CH2 temperature data is sent to R012 to R013.

(2) 4-channel automatic measurement mode

(a) Flowchart



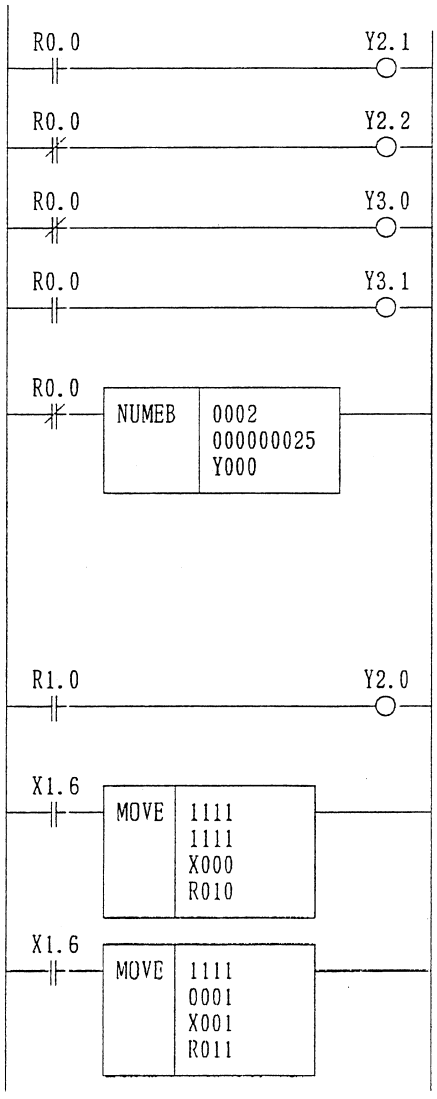
(b) Ladder example

The following measurement and ladder examples apply when a J thermocouple module is used for measurement.
PMC assignment

	GROUP	BASE	SLOT	NAME		GROUP	BASE	SLOT	NAME
X000	0	0	1	/4	Y000	0	0	1	/4
X001	0	0	1	/4	Y001	0	0	1	/4
X002	0	0	1	/4	Y002	0	0	1	/4
X003	0	0	1	/4	Y003	0	0	1	/4

NOTE
This example of ladder use is for the second level.
R0.0 is used as a normally open relay.

Ladder



Specify the module.

(thermocouple-type module)
Specify the sensor
(J thermocouple).

Specify the number of channels (four channels).

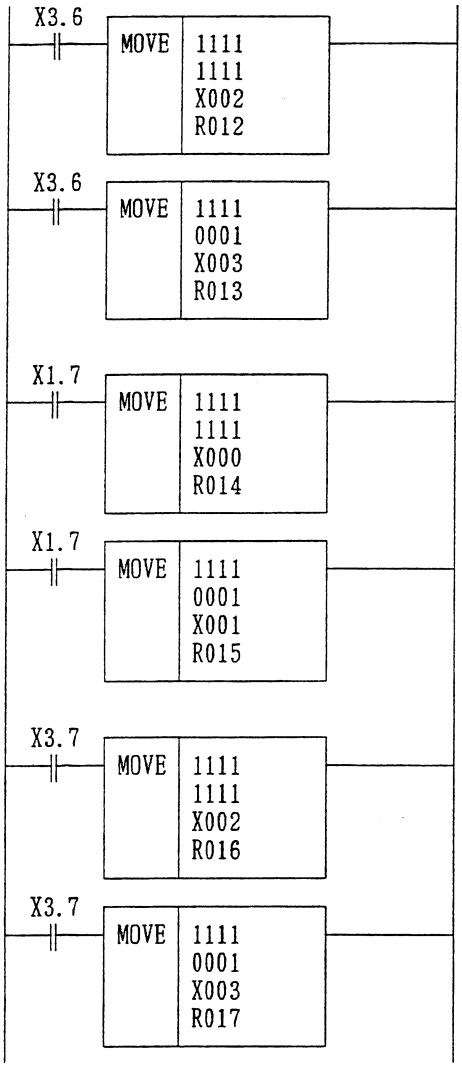
Specify a 4-channel mode (automatic measurement).

Specify the channel switching period for 4-channel automatic measurement.
Specify 0025 to provide a period of 2.5 s.(NOTE)

NC READY (When R1.0 is set to "1", NC READY becomes "1" to start measurement.)

When CH1 data READY is set to "1", CH1 temperature data is sent to R010 to R011.

NOTE
If your machine is the PMC-N, NA, or QA, specify 6400.
0025 ⇒ 0019h. Because the upper byte is exchanged with the lower byte, 1900h ⇒ 6400.



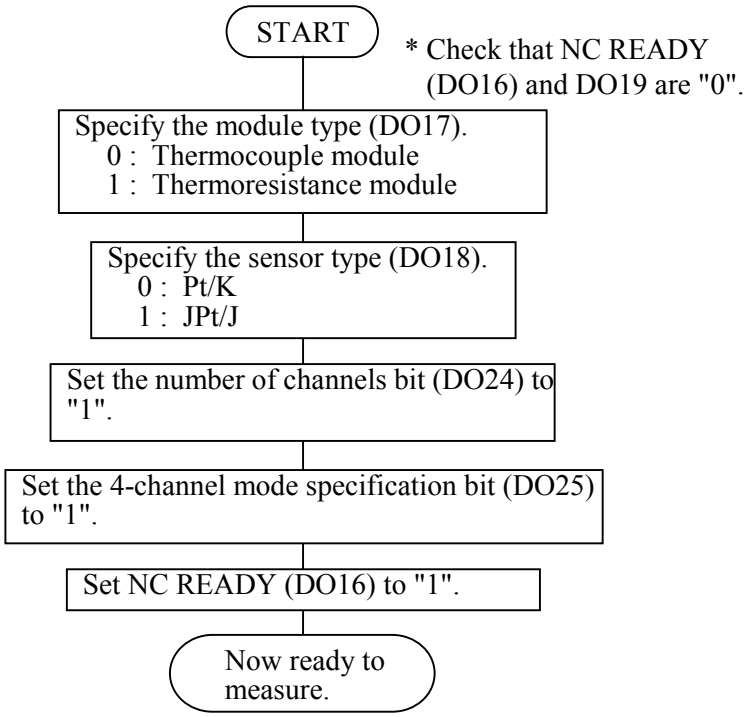
When CH2 data READY is "1", CH2 temperature data is sent to R012 to R013.

When CH3 data READY is "1", CH3 temperature data is sent to R014 to R015.

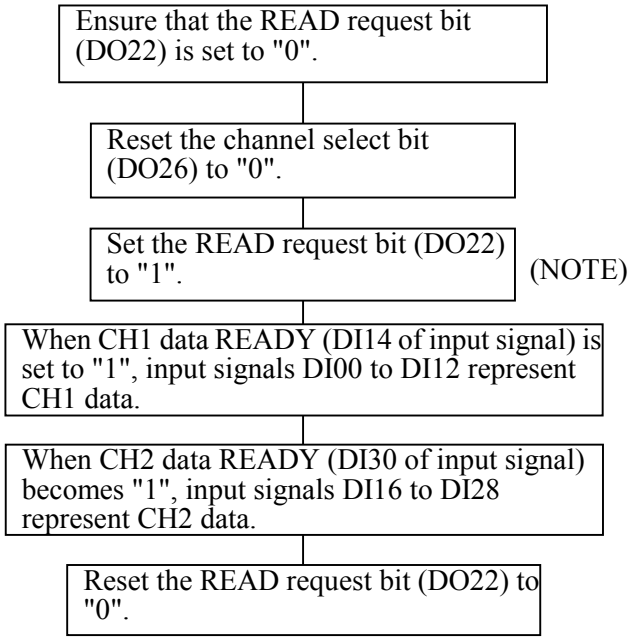
When CH4 data READY is "1", CH4 temperature data is sent to R016 to R017.

(3) 4-channel manual measurement mode

(a) Flowchart

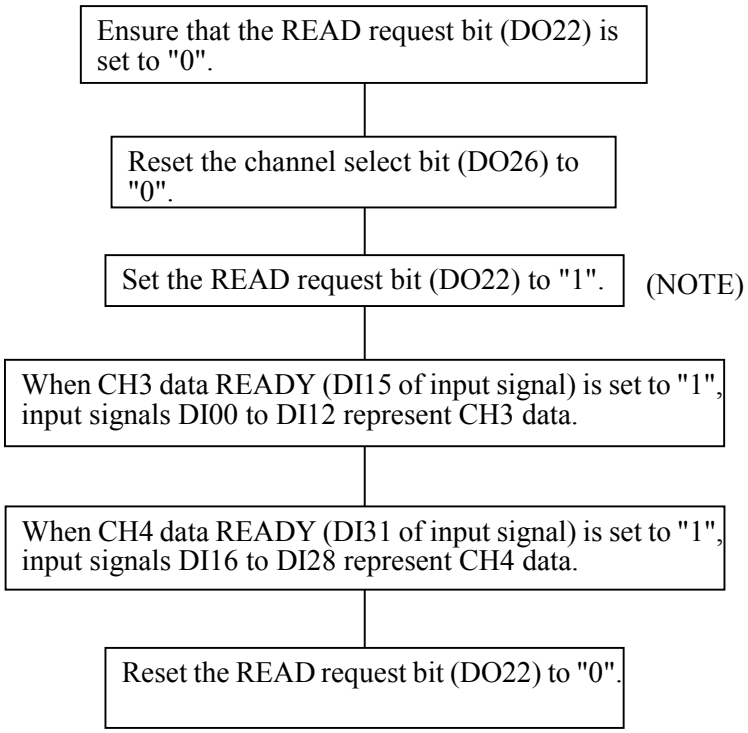


* Reading CH3 and CH4 data



NOTE
After setting NC READY to "1", wait for one second, and then set the READ request to "1".

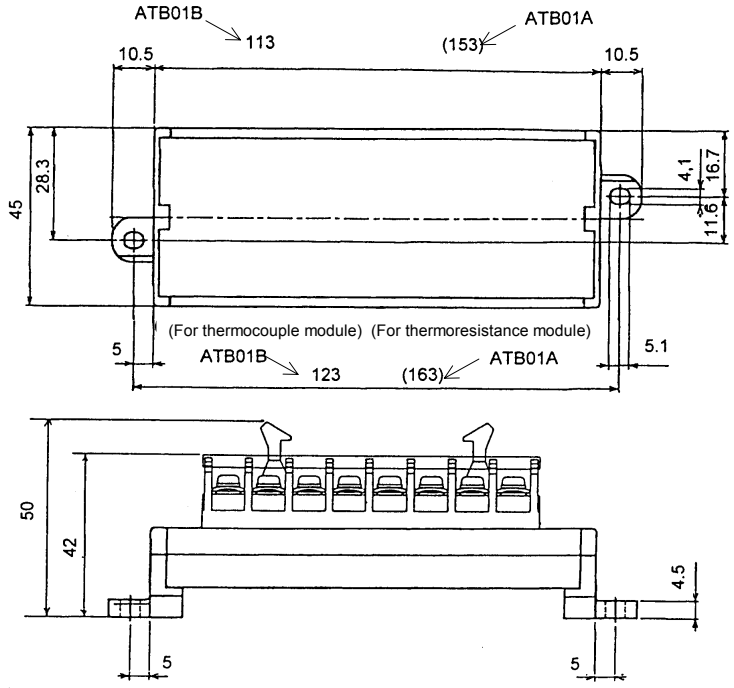
* Reading CH3 and CH4 data



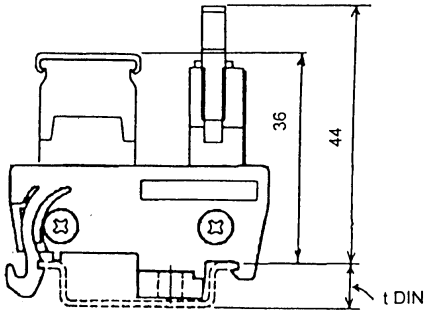
NOTE
After setting the NC READY bit to "1", wait for one second, and then set the READ request bit to "1".

To create the ladder for 4-channel manual measurement, refer to the above flowchart or timing chart.

9.7 TERMINAL BOARD UNIT DIMENSIONS



To use a DIN rail, add its height (tDIN) to the dimension shown below.



10 OPTICAL I/O LINK ADAPTER

The signal cable K1X shown in the general connection deagram (in section 4.1) can be extended to the maximum length of 200 m with optical fiber cables using an optical I/O link adapter.

NOTE

1 For the cable K2X, the optical I/O link adapter can not be applied to.

2 In the following cases, make sure to use an optical fiber cable for K1X.

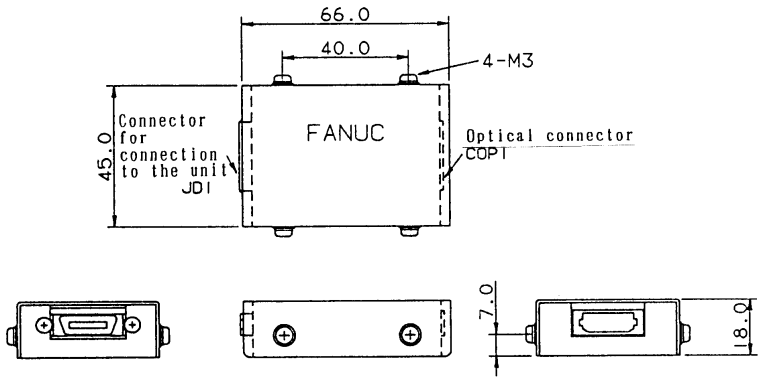
- When the cable is more than 10 meters long.
- When the cable K1X runs between different cabinets and it is impossible to connect the cabinets with a wire of 5.5 mm2 or thicker.
- When there is concern that the cable K1X is influenced by strong noise.

For example;

When there is a strong electromagnetic noise source beside the cable K1X such as a welding machine and the like.

When a noise generating cable such as a power cable and the like runs for a long distance in parallel with the cable K1X.

10.1 EXTERNAL DIMENSION OF OPTICAL I/O LINK

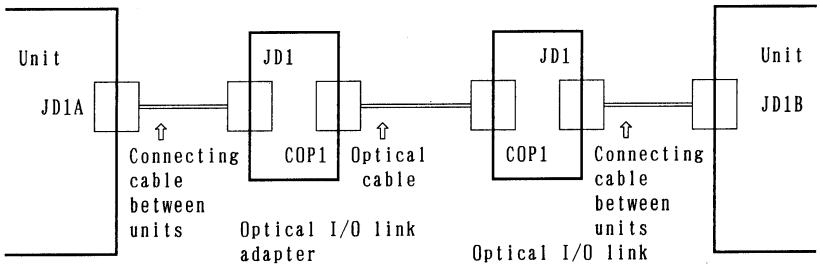


10.2 WEIGHT OF OPTICAL I/O LINK

1) Main body: Approx. 100g

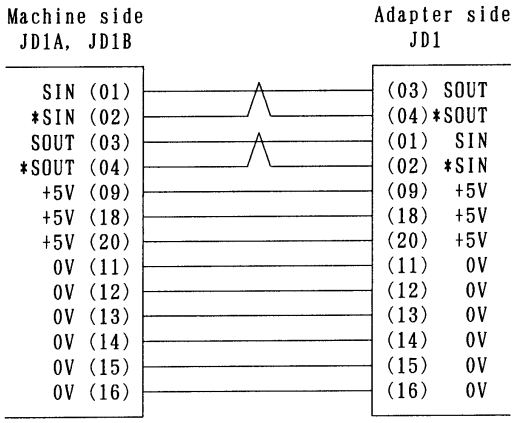
10.3 CONNECTION OF OPTICAL I/O LINK

1) Connection diagram



2) Interunit connecting cables

01	SIN	11	0V
02	*SIN	12	0V
03	SOUT	13	0V
04	*SOUT	14	0V
05		15	0V
06		16	0V
07		17	
08		18	+5V
09	+5V	19	
10		20	+5V



① Recommended connector for cable side:
PCR - E20FS (made by HONDA TSUSHIN Co.,Ltd.)
② Recommended cable (with material):
A66L-0001-0284#10P
③ Cable length:
Max.2m (when the recommended cable is used)

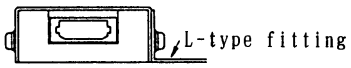
3) Optical cable
① Specification:
A66L-6001-0009(Make sure to use one with this specification)
② Cable length: Max.200m

10.4 POWER SOURCE OF OPTICAL I/O LINK ADAPTER

1) Power voltage: 4.75 V to 5.25 V (at the receiving end)
2) Consumption current: 200mA

10.5 INSTALLATION CONDITIONS OF OPTICAL I/O LINK ADAPTER

1) As this adapter is not a closed type, install it in the same closed type cabinet as used for the NC control unit.
2) Make sure to ground the case using the case fixing screw of the adapter.
3) As the adapter is light, it is not necessary to fix it with screws. However, keep it from getting contact with other circuits lest it should be short-circuited. In addition, when fixing the adapter in a cabinet and the like, fix it with a L-type fitting using the case fixing screws (M3) of the adapter.

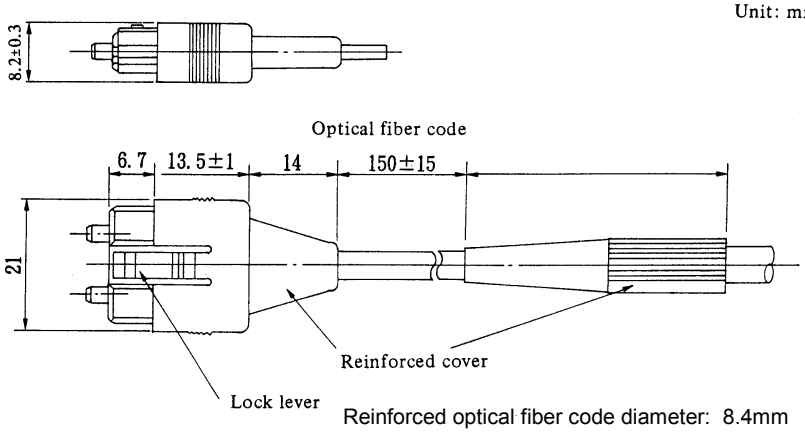


10.6 OPTICAL FIBER CABLE

This CNC uses optical cables for connections between the control unit and the I/O unit. Unlike the conventional power cables, optical fiber cables need special care in installation and handling.

10.6.1 External view of optical fiber cable

Unit: mm



Reinforced optical fiber code diameter: 8.4mm
Tensile strength: Optical fiber code: 25kg
Optical fiber code-connector: 2kg
Reinforcing cover: 150kg
Bending radious of optical fiber code with reinforcing cover: 50mm

(1) Standard length of an optical fiber cable is 5, 10, and 15 meters.

(2) An optical fiber cable cannot be cut and joined at machine manufacturers side.

(3) If it needs to relay on cabling, use optical fiber adapter. Up to the relay points are allowed on a transmission line.

10.6.2 Notice of optical fiber cable handling

(1) Even though reinforcing cover used on the optical fiber code has enough mechanical strength, be sure not to be damaged by heavy materials drop.

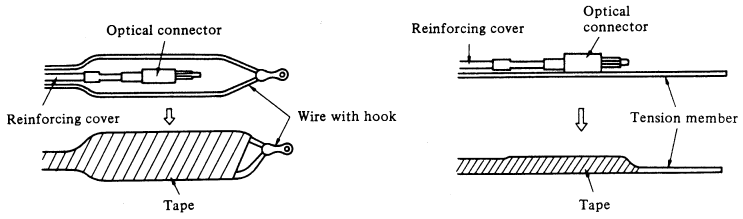
(2) Detaching and attaching of optical connector should always be made by touching connector. Optical fiber code should not be touched when replacement.

(3) Optical connector is automatically locked with upper side lock levels after being connected. It is impossible to pull out the connector without releasing the lock levers.

(4) Optical connector can not be connected oppositely. Be sure the connector direction when connection is done.

(5) Optical connector should be processed as follows before laying of optical fiber cable.

- Fix a reinforcing cover to a wire with hook or tension member by a tape.
  At laying hook the wire or pull the tension member taking enough care that opticalconnector does not receive pulling strength.

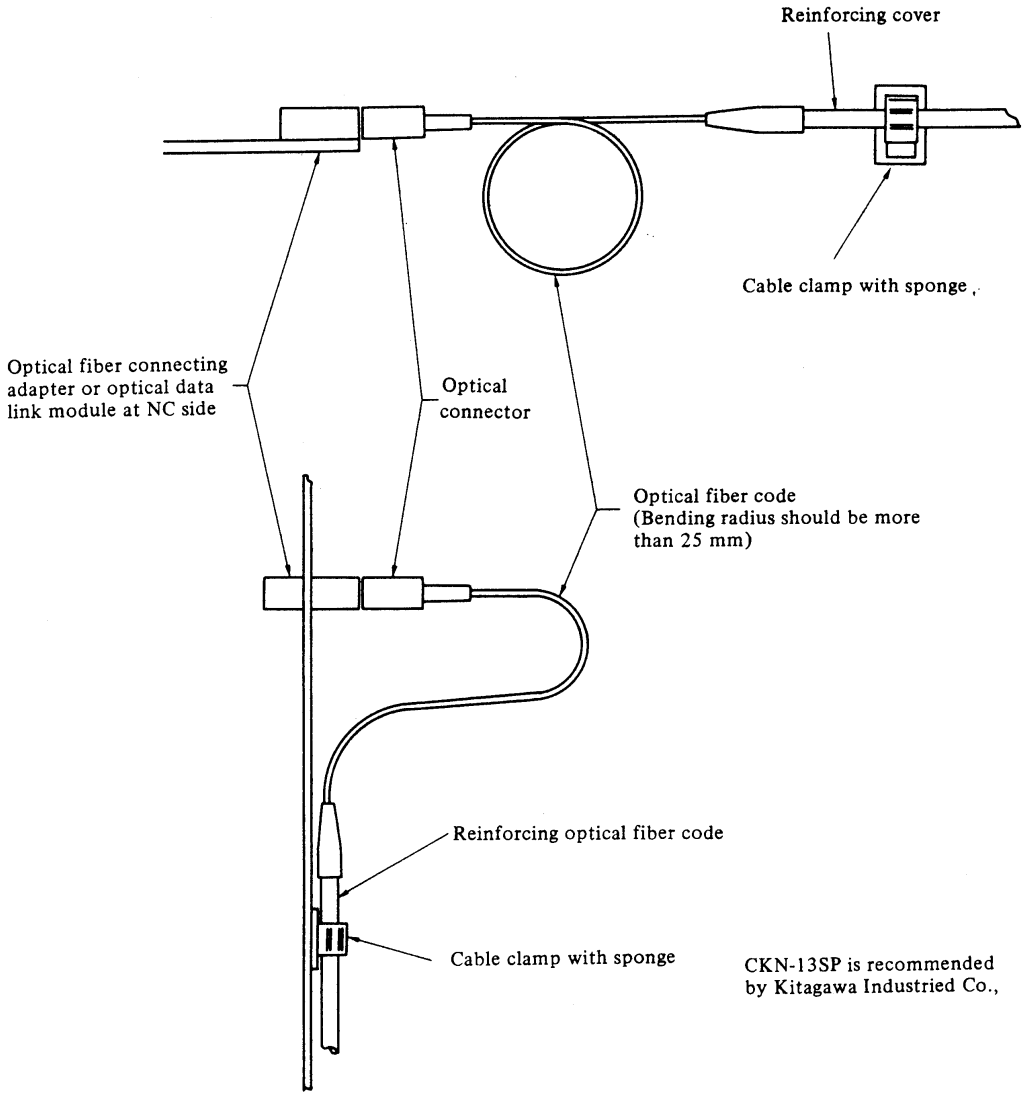


(6) Reinforcing cover is fixed to cable lamp so that optical fiber cable could not weigh directly the connecting part of connector.

(7) Notice that optical connector's chip is clear.
The attached protect cap must be always put on when optical connector is not used.
Remove dirty with a clear tissue or absorbent cotton (cotton with ethyl alcohol is applicable). No other organic solvent than ethyl alcohol can not be used.

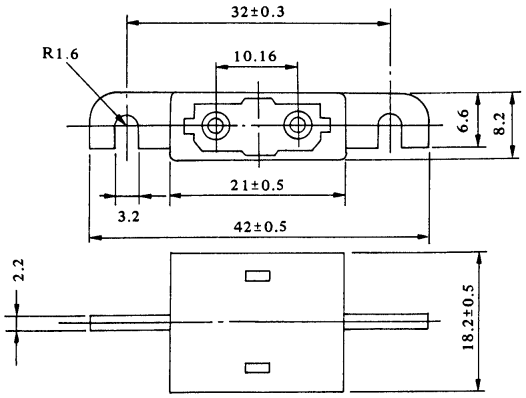
10.6.3 Optical fiber cable clamping method

When reinforcing cover is fixed at cable clamp with sponge, enough sag at optical fiber code as shown below is necessary so that connecting part of optical should not be weighed directly by optical fiber cable.

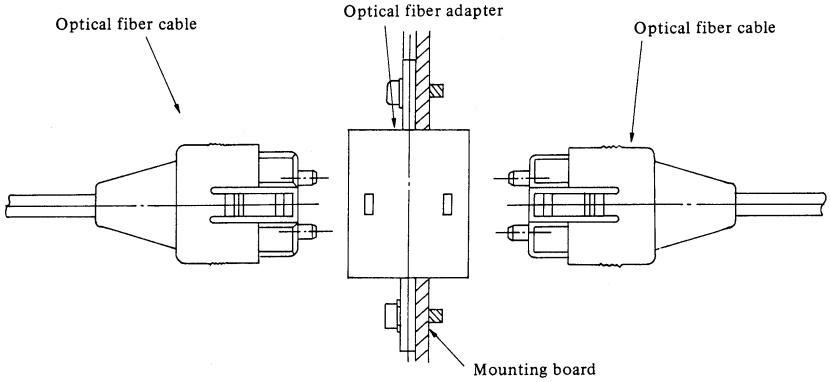


10.6.4 Relay using an optical fiber adapter

(1) External view of an optical fiber adapter



(2) Example of the use of an optical fiber adapter



NOTE
Up to one relay points are permitted.

10.6.5 Maximum transmission distance by optical fiber cable

Maximum transmission distance by optical fiber cable is shown below: Maximum transmission distance varies depend on numbers of relay points by optical fiber adapter.

Relay points	Max. trans. distance (total)
0	200m
1	100m

11 I/O LINK DUMMY UNIT

11.1 OVERVIEW

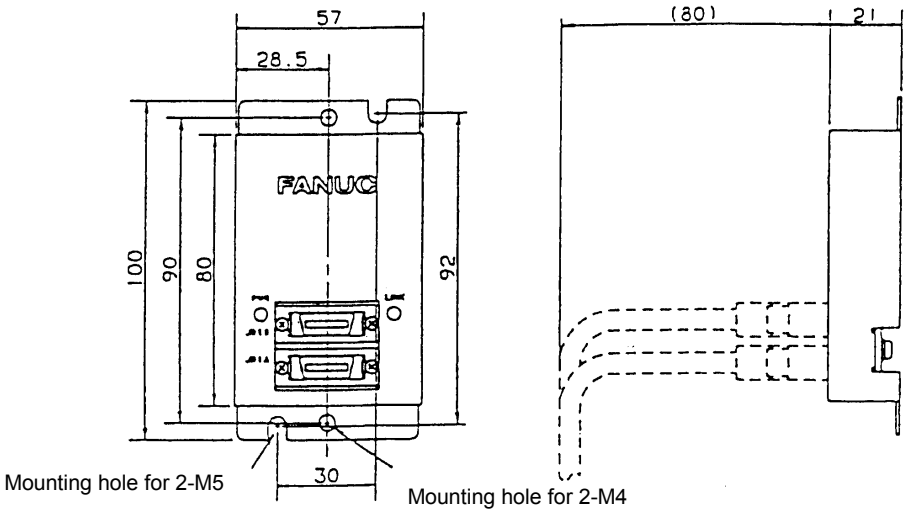
If a slave unit (such as the FS0, Power Mate, I/O Unit-MODEL A, or connection unit) is removed from the FANUC I/O Link (NOTE), the group number for those that followed the removed slave unit changes. So, it becomes necessary to change the PMC assignment. However, connecting a FANUC I/O Link dummy unit in place of the removed slave unit makes it unnecessary to change PMC assignment.

This document describes the electrical and structural specifications that apply to the FANUC I/O Link dummy unit when it is connected to the FANUC I/O Link.

NOTE
The FANUC I/O Link is a serial interface for connecting the CNC or cell controller to the I/O Unit-MODEL A, Power Mate, or other units for high-speed transfer of I/O signals (bit data).

11.2 EXTERNAL DIMENSIONS

Units: mm



11.3 LED INDICATORS

(1) PWR: Lights when the FANUC I/O Link dummy unit is supplied with power.

(2) LINK: Lights when the FANUC I/O Link is performing communication.

11.4 WEIGHT

(1) Main unit: Approximately 120 g

11.5 POWER REQUIREMENTS

(1) Supply voltage: 4.75 to 5.25 V (at reception terminal)

(2) Required current: 180 mA (maximum)

(3) Power dissipation: 0.9 W

(4) Supply method: Via the I/O link cable

11.6 INSTALLATION CONDITIONS

This unit is not hermetically sealed. So, it must be installed in a cabinet that is hermetically sealed to the same level as that for the NC. The cabinet must be installed in a location where the following environmental requirements are satisfied.

(1) Ambient temperature
Operating: 0 to 45°C
Storage and transportation: -20 to 60°C

(2) Humidity
Normal: 75% or less (relative)
Short-period (within one month): 95% (maximum)

(3) Vibration
Operating: 0.5 G or less

11.7 CONNECTION DIAGRAMS

11.7.1 When not connecting FANUC I/O Link dummy units in series

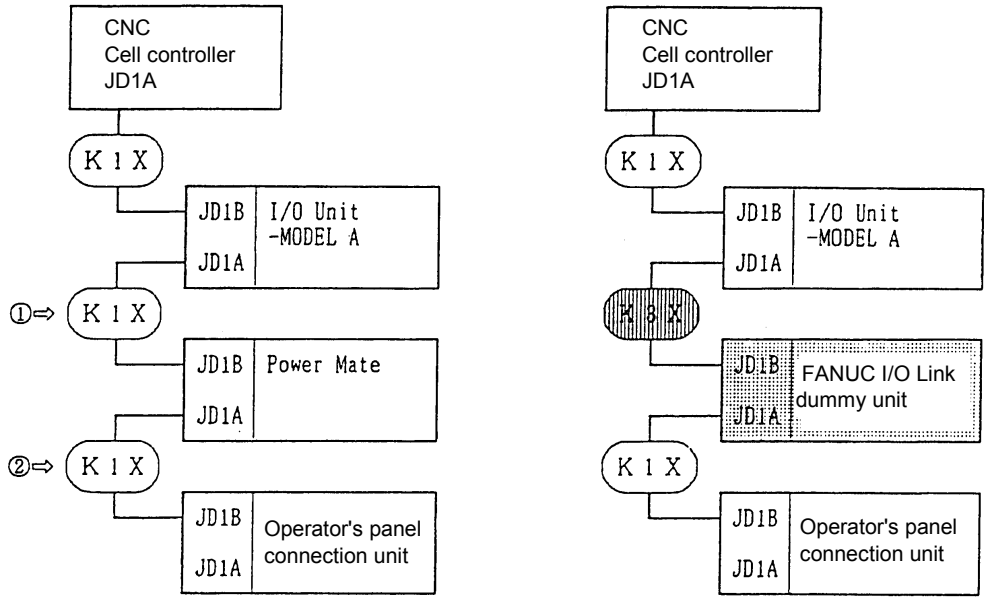


Fig. 11.7.1 Example of Using the FANUC I/O Link Dummy Unit (in Place of the Power Mate)

(1) Replacing a cable
The FANUC I/O Link dummy unit is supplied with power from the preceding or following group via a K3X cable. So, the K1X cable at either JD1A or JD1B of the dummy unit must be replaced with the K3X cable (① or ② in Fig. 11.7.1).

CAUTION
Do not attach a K3X cable to JD1A and JD1B simultaneously.

(2) Cable length
K1X cable: 10 m (maximum)
K3X cable: 2 m (maximum)

11.7.2 Connecting FANUC I/O Link dummy units in series

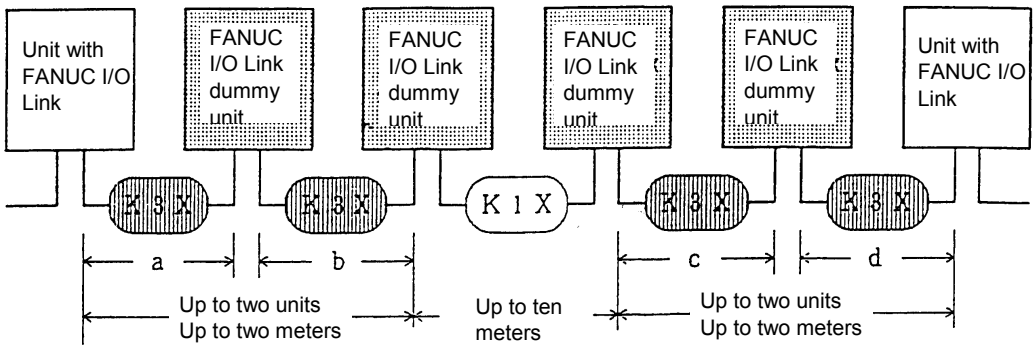


Fig. 11.7.2

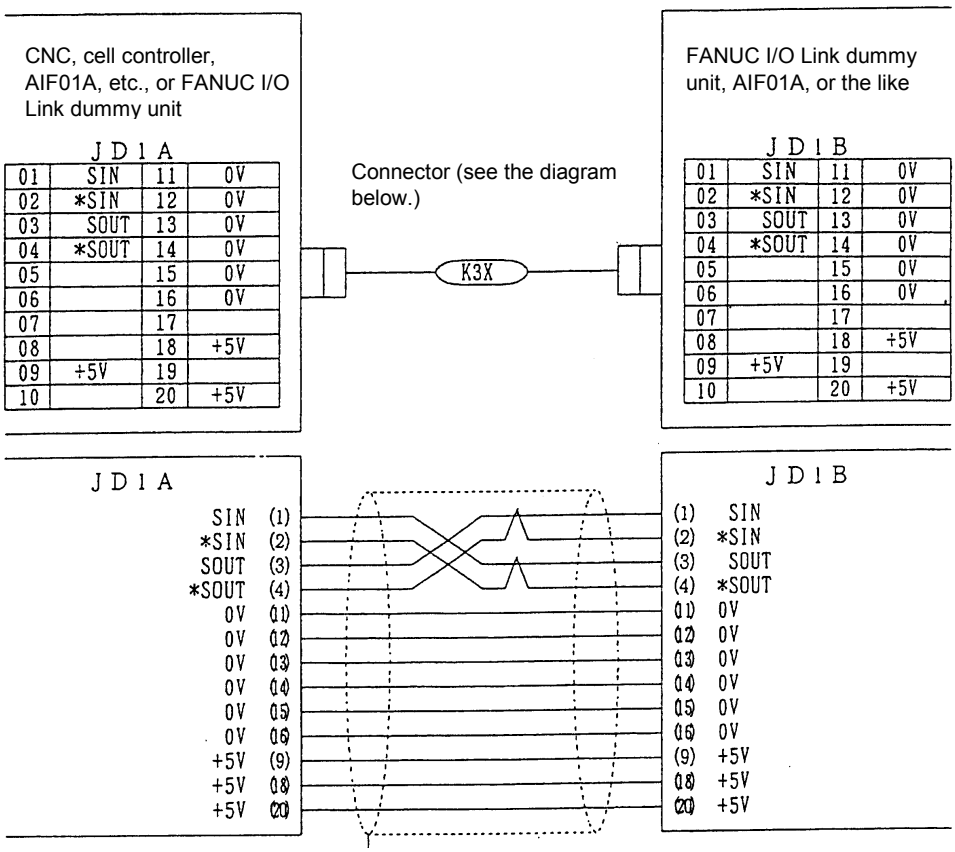
(1) Number of FANUC I/O Link dummy units that can be used in succession
Up to two FANUC I/O Link dummy units can be connected via a K3X cable to a unit that supplies power to them. (See Fig. 11.7.2.)

(2) Cable length
K1X cable: 10 m (maximum)
K3X cable: 2 m (maximum) in total ($a + b \leq 2$ m and $c + d \leq 2$ m)

11.7.3 Grounding

Ground the case of the FANUC I/O Link dummy unit.

11.7.4 K3X cable



- Cable connector

Manufacturer	Pin		Housing
	Soldering type	Crimping type	
Honda Tsushin	PCR-E20FS	PCR-E20FA	PCR-V20LA
Hirose Electric	FI-40-20S	FI-30-20S	FI-20-CV2
Fujitsu	-	FCN-247J020-G/E	FCN-240C020-Y/S

- Use twisted-pair wires for the SIN, *SIN, SOUT, and *SOUT signals.
- Recommended wires : A66L-0001-0284#10P (twisted-pair wires with common shielding)
- Maximum cable length : 2 m (when recommended wires are used)
- Do not connect a wire to an idle pin.
- Connect the cable shielding to the grounding plate of the cabinet via a metal cable clamp at JD1A. (See the applicable CNC or cell controller connection manual.)

12 SAFETY FOR USING AC

IF AC output module or AC input module is used, 12.1 is recommended for safety. IF 12.1 must be observed for Europe. [conforming to EN50178]

12.1 INSTALLATION ENVIRONMENT

12.1.1 Installation Category (Overvoltage Category)

The available impulse surge level to the ground that appears in the power source is 2.5kV maximum.
(100VAC system power source is needed in AC input module
According to the standard, the available impulse surge level to the ground is 1.5kV for this power source (voltage of which is 150VAC or less) However, for this module, the available impulse surge level to the ground thet apperars in the power source is 2.5 kV.)
Generally, an isolation transformer used for the main power source is regardrd as an effective surge filter.

The class of the 16-point relay output module (AOR16G) is set to installation category (overvoltage category) I.
(Keep any impulse voltage to ground that may appear on the AC power to within 1.5 kV.)
The class for the 8-point relay output module (AOR08G), AC output module, and AC input module is set to installation category (overvoltage category) II.

12.1.2 Pollution Degree

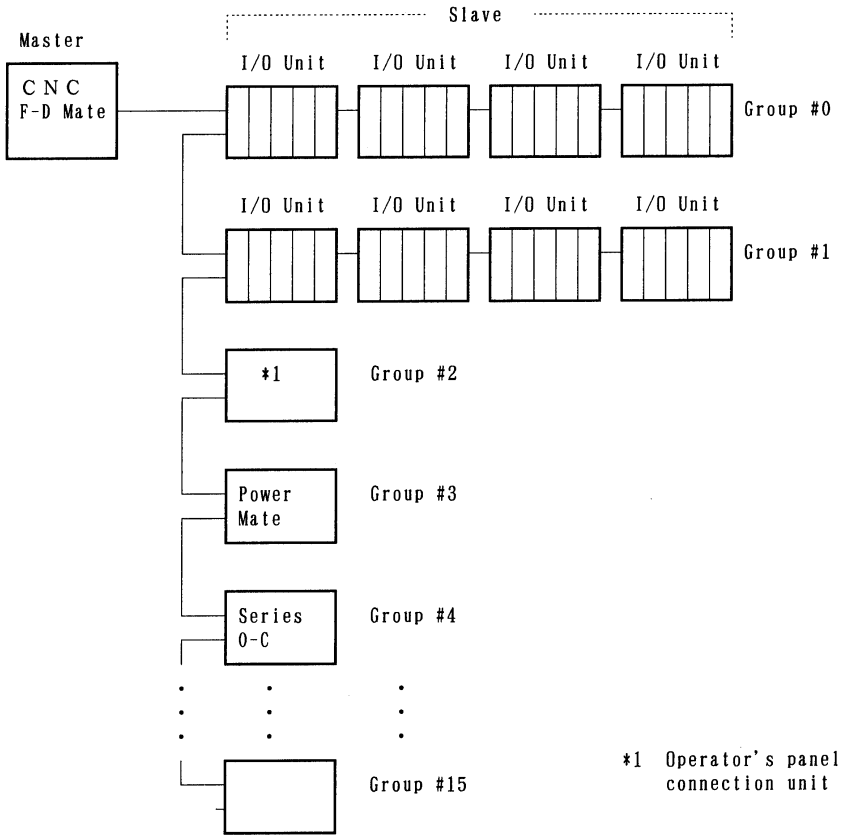
Install the unit in the environment of pollution degree 2 or better.[EN50178]
In cabinet of IP-54 or better (described in 3.1), it can be considered as pollution degree 2 or better usually. The IP degree required is dependend on the circumstances of machine tool, so please chooce the adequate degree in accordance with such environment.

II. MAINTENANCE

1 OVERVIEW

1.1 SYSTEM CONFIGURATION

I/O Unit-A is connected to a CNC and cell controller through a high-speed serial interface, I/O Link.

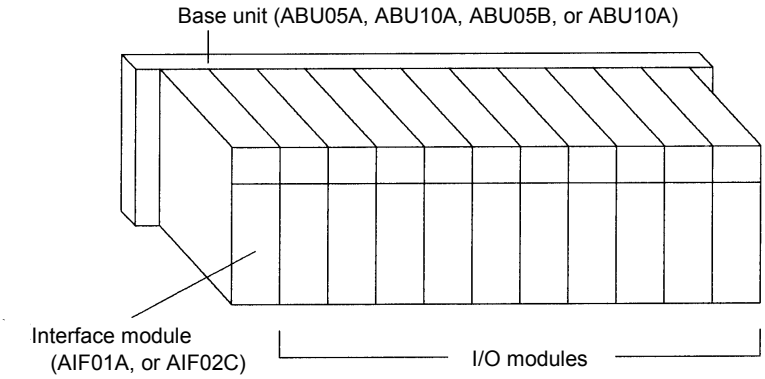


1) The I/O Link consists of a master and slaves.
   Master: Series 0-C, Series 15/16/18/20/21, Series 15*i*/16*i*/18*i*/20*i*/21*i*, Power Mate-D/H, Power Mate *i*-D/H and F-D Mate
   Slave: I/O Unit-A, Power Mate, operator's panel connection unit, and Series 0-C

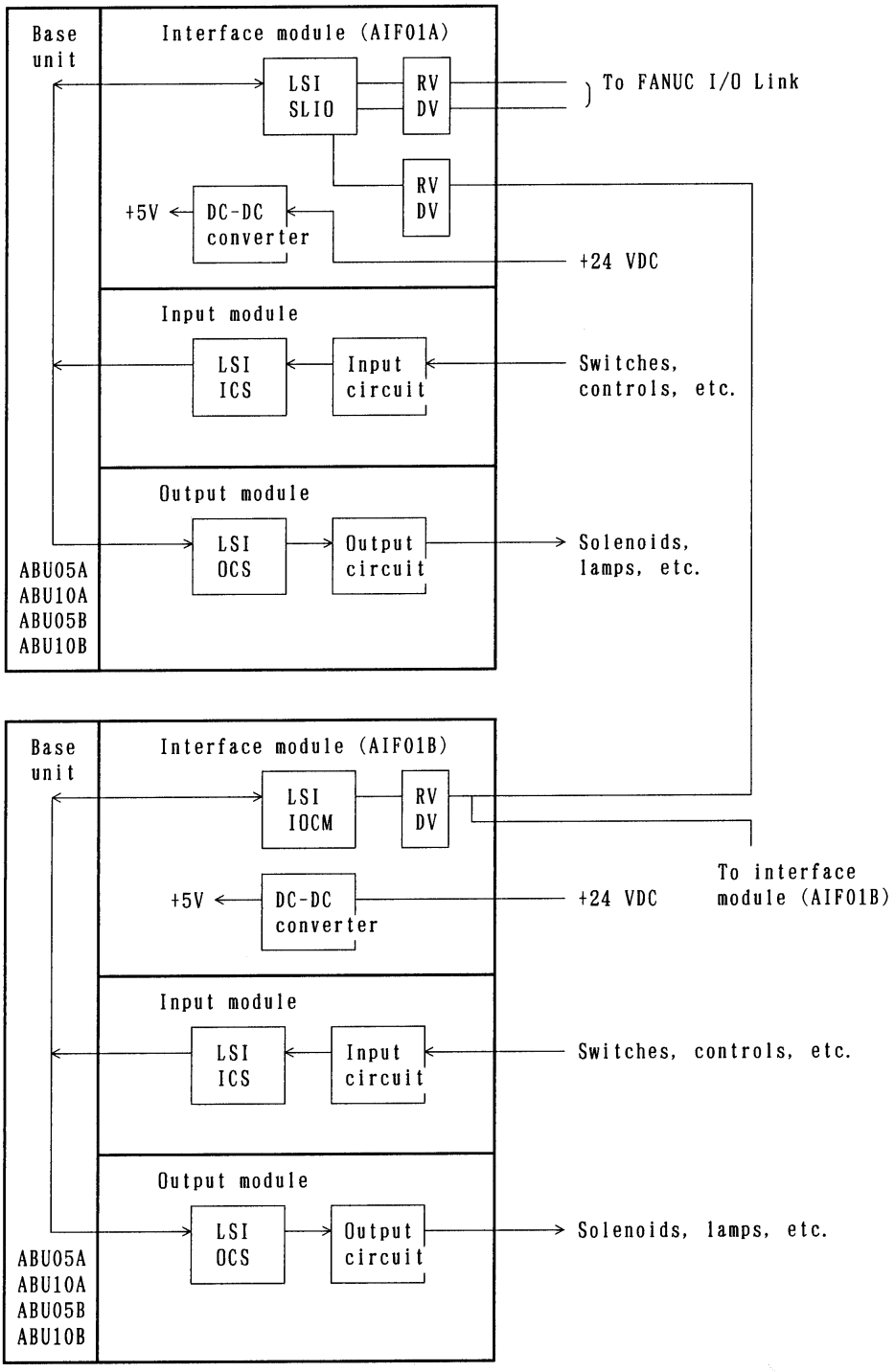
2) One I/O Link can connect to up 16 groups of slaves. If the master is not a CNC, one slave group can contain up to 4 of I/O Unit A (4 base units). If the master is a CNC or Power Mate the number of units per slave group is limited to within 2.

1.2 I/O UNIT-A CONFIGURATION

An I/O unit-A consists of a base unit, interface module, and I/O modules.



1.3 BLOCK DIAGRAM



1.4 LIST OF UNITS

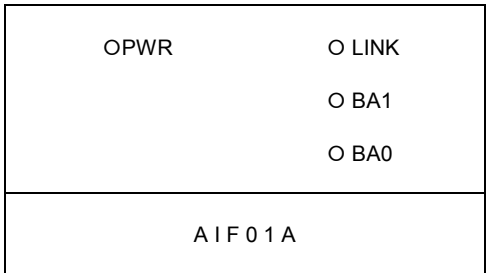
Name				Arrangement drawing No.	Unit drawing No.	PCB drawing No.
Base unit. 10 slots	Horizontal type		ABU10A	A03B-0807-J001	A03B-0807-C001	A20B-9001-0040
	Vertical type		ABU10B	A03B-0807-J004	A03B-0807-C004	A20B-2000-0550 or -2003-0100
Base unit 5 slots	Horizontal type		ABU05A	A03B-0807-J002	A03B-0807-C002	A20B-2000-0020
	Vertical type		ABU05B	A03B-0807-J003	A03B-0807-C003	A20B-9001-0510
Interface module			AIF01A	A03B-0807-J011	A03B-0807-C011	A20B-8000-0410
Interface module			AIF01B	A03B-0807-J012	A03B-0807-C012	A20B-8000-0420
Interface module			AIF02C	A03B-0807-J013	A03B-0807-C013	A20B-8000-0710
DC input module	Non-insulations	32 points. 20ms	AID32A1	A03B-0807-J101	A03B-0807-C101	A20B-9000-0970
		32 points. 2ms	AID32B1	A03B-0807-J102	A03B-0807-C102	A20B-9000-0971
		8 points. 2ms 24 points. 20ms	AID32H1	A03B-0807-J111	A03B-0807-C111	A20B-9000-0972
	Insulations	16 points. NEG, 20ms	AID16C	A03B-0807-J103	A03B-0807-C103	A20B-9000-0931
		16 points. POS, 20ms	AID16D	A03B-0807-J104	A03B-0807-C104	A20B-9000-0901
		16 points. NEG, 2ms	AID16K	A03B-0807-J113	A03B-0807-C113	A20B-9000-0932
		16 points. POS, 2ms	AID16L	A03B-0807-J114	A03B-0807-C114	A20B-9000-0902
		32 points. 20ms	AID32E1	A03B-0807-J105	A03B-0807-C105	A20B-9001-0010
		32 points. 20ms	AID32E2	A03B-0807-J110	A03B-0807-C110	A20B-9001-0280
		32 points. 2ms	AID32F1	A03B-0807-J106	A03B-0807-C106	A20B-9001-0011
		32 points. 2ms	AID32F2	A03B-0807-J109	A03B-0807-C109	A20B-9001-0281
AC input module. 16 points			AIA16G	A03B-0807-J107	A03B-0807-C107	A20B-8000-0341
DC output module	Non insulations	32 points. NEG	AOD32A1	A03B-0807-J162	A03B-0807-C162	A20B-9001-0110
	Insulations	8 points. NEG	AOD08C	A03B-0807-J151	A03B-0807-C151	A20B-9001-0210 or -9000-0951
		8 points. POS	AOD08D	A03B-0807-J152	A03B-0807-C152	A20B-9001-0220 or -9000-0911

Name				Arrangement drawing No.	Unit drawing No.	PCB drawing No.
DC output module	Insulations	16 points. NEG	AOD16C	A03B-0807-J153	A03B-0807-C153	A20B-9000-0941
		16 points. POS	AOD16D	A03B-0807-J154	A03B-0807-C154	A20B-9000-0921
		32 points. NEG	AOD32C1	A03B-0807-J155	A03B-0807-C155	A20B-9001-0070
		32 points. NEG	AOD32C2	A03B-0807-J172	A03B-0807-C172	A20B-9001-0530
		32 points. POS	AOD32D1	A03B-0807-J156	A03B-0807-C156	A20B-8000-0440
		32 points. POS	AOD32D2	A03B-0807-J167	A03B-0807-C167	A20B-8000-0510
AC output module		5 points. 2A	AOA05E	A03B-0807-J157	A03B-0807-C157	A20B-8000-0470 or -8000-0251
		8 points. 1A	AOA08E	A03B-0807-J158	A03B-0807-C158	A20B-8000-0480 or -8000-0381
		12 points. 0.5A	AOA12F	A03B-0807-J159	A03B-0807-C159	A20B-8000-0321
Relay output module		8 points. 4A	AOR08G	A03B-0807-J160	A03B-0807-C160	A20B-9001-0200 or -9000-0961
		16 points. 2A	AOR16G	A03B-0807-J161	A03B-0807-C161	A20B-8000-0101
		16 points. 2A	AOR16H2	A03B-0807-J165	A03B-0807-C165	A20B-8000-0500
Analog input module			AAD04A	A03B-0807-J051	A03B-0807-C051	A20B-8000-0450
Analog output module (12-bit)			ADA02A	A03B-0807-J052	A03B-0807-C052	A20B-8000-0460
Analog output module (14-bit)			ADA02B	A03B-0807-J060	A03B-0807-C060	A20B-8001-0980
High speed counter module			ACT01A	A03B-0807-J053	A03B-0807-C053	A20B-8000-0540
Tempereture input module		Pt/Pt	AT104A	A03B-0807-J056	A03B-0807-C056	A74L-0001-0083#Pt
		J/K	AT104B	A03B-0807-J057	A03B-0807-C057	A74L-0001-0083#JK
Relay terminal unit		Pt/Pt	ATB01A	A03B-0807-J350	A03B-0807-C350	A20B-1005-0920
		J/K	ATB01B	A03B-0807-J351	A03B-0807-C351	A20B-1005-0930
Optical adapter				A13B-0154-B0001	-	A20B-1004-0240
Dummy unit				A13B-0167-B0001	-	A20B-8000-0940

2 INDICATION

The interface modules and the I/O modules with up to 16 input/output points have LEDs toindicate their states.

2.1 INTERFACE MODULE (AIF01A) LEDS



Marking	Name	Description
PWR	Power-on	On: The interface module is supplied with power of 24 VDC.
LINK	Link	On: The I/O Link is operating properly. Normally, this LED lights several to ten-odd seconds after the master is turned on.
BA1 BA0	Base address	These LEDs indicate which base unit the inter-face module is transferring data with. If a failure occurs (the LINK LED is turned on, then off), BA0 or BA1, whichever is operating, is turned on.

BA1	BA0	Base number
○	○	Base #0
○	●	Base #1
●	○	Base #2
●	●	Base #3

○ : Off
● : On

Failures, their causes, and required actions

1) PWR is off.

① Power (24 VDC) is not supplied or the supply voltage is abnormal.

⇒ Supply power of 24 VDC ± 10%.

② A The fuse in the interface module has blown.

⇒ Eliminate the cause that made the fuse to blow, then replace the fuse with a spare. (See Section 3.) The following may cause the fuse to blow:

- A sum of power requirements for all input modules exceeds the rating. (Refer to I-4.4)
- A voltage of +24 VDC, supplied from input module AID32A1, AID32B1 or AID32H1 to the outside, is short-circuited to the cabinet or the like.
- The interface module or any of the I/O modules is defective.

③ An I/O module is defective.

⇒ Remove the I/O modules sequentially to pinpoint the defective one. Then, eplace it with a spare.

④ An interface module is defective.

⇒ Replace it with a spare.

2) LINK has never been turned on since power is supplied.

① If PWR is off, go to item 1).

② The attempted power turn-on sequence was incorrect.

⇒ The slaves (I/O Unit-A, Power Mate, Series 0, etc.) must be supplied with power at the same time or before the master (CNC or F-D Mate) is supplied withpower. (Refer to I-4.2)
If an attempt is made to supply power to a slave on an interface module after the master isurned on, LINK on the interface module is not turned on provided that the interface module corresponds to that slave or to any slave ahead of that slave (one on the far side with respect to the master).

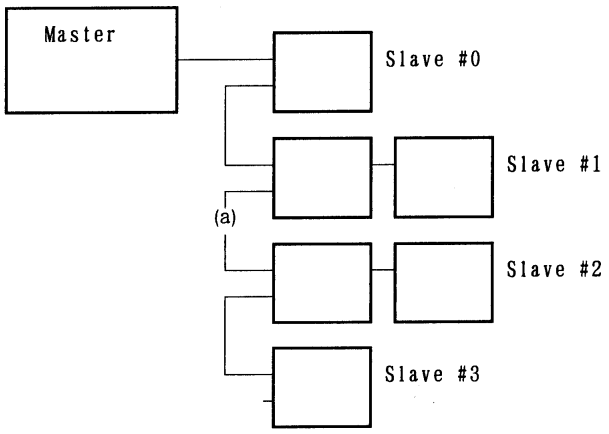
③ I/O Link cables are broken or short-circuited.

⇒ With reference to Note below, check the cables, and take an appropriate action.

④ Any device on the I/O Link is defective.

⇒ With reference to Note below, find a defective device, and take an appropriateaction. If an I/O unit seems to be defective, replace interface module AIF01Awith a spare.

NOTE
How to pinpoint a failure in the I/O Link in event of items ② to ④.
Check the LEDs on the master to find out which group contains slaves whose I/OLink is established with the master. (Refer to the maintenance manual for themaster.)



For example, if the master is linked to slaves (slave #0 and #1) that belong to separate groups, the timing of turning on slave #2 is bad, the cable is broken or short-circuited at point (a), slave #2 is defective.

If the master is not linked to any slave, the master may be defective.

3) LINK is turned on once, then off.

① One of the devices on the I/O Link is turned off.

⇒ Turn off all devices, then turn them on.

② The DI/DO assignment for the master is invalid.

⇒ When I/O unit bases 1 to 3 (units under control of interface module AIF01B) are not connected, if DI/DO units are assigned to these bases, LINK is turned on, but turned off immediately.
Correct the DI/DO assignment.

③ The I/O Link cable is broken or short-circuited.

⇒ Check the cable, and take an appropriate action.

④ Any device on the I/O Link is defective.

⇒ With reference to the maintenance manual for the master, find a defective device, and take an appropriate action. If an I/O unit seems defective, replace the interface module (AIF01A or AIF01B) installed in the base unit indicated by BA1 or BA0.

2.2 INTERFACE MODULE (AIF01B) LEDS

Marking	Name	Description
PWR	Power-on	On: The interface module is supplied with power of 24 VDC.
LINK	Link	On: The I/O Link is operating properly. Normally, this LED lights several to ten-odd seconds after the master is turned on.

Failures, their causes, and required actions

1) PWR is off.

① Power (24 VDC) is not supplied or the supply voltage is abnormal.
⇒ Supply power of 24 VDC ±10%.

② The fuse in the interface module has blown.

⇒ Eliminate the cause that made the fuse to blow, then replace the fuse with a spare. (See Chapter 3.) The following may cause the fuse to blow:

- A sum of power requirements for all input modules exceeds the rating. (Refer to I-4.4)
- A voltage of +24 VDC, supplied from input module AID32A1, AID32B1 or AID32H1 to the outside, is short-circuited to the cabinet or the like.
- The interface module or any of the I/O modules is defective.

③ An I/O module is defective.

⇒ Remove the I/O modules sequentially to pinpoint the defective one. Then, replace it with a spare.

④ An interface module is defective.

⇒ Replace it with a spare.

2) LINK has never been turned on since power is supplied.

① If PWR is off, go to item 1).

② If LINK on the AIF01A in the same group is off, go to Section 2.1.

③ The signal cable between I/O units in the same group is broken or short-circuited.

⇒ Check the cable, and take an appropriate action.

④ An interface module is defective.

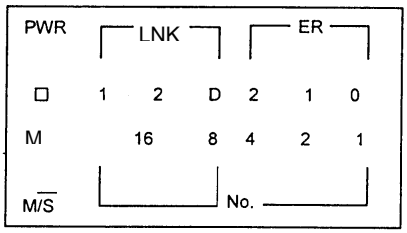
⇒ Replace it with a spare.

3) LINK is turned on once, then turned off.

① See section 2.1.

2.3 INTERFACE MODULE (AIF02C) LED INDICATORS

The LED indicator panel of the AIF02C is shown below. Each of its components are described in the following paragraphs.



2.3.1 PWR indicator

This LED lights when the power is switched on.

2.3.2 LNK indicators

(1) LNK-1 : Lights when the I/O link for the I/O Unit-A is operating normally.

(2) LNK-2 : Lights when the I/O link for the I/O Unit-B is operating normally.

(3) LNK-D : Lights when the distributed link with the I/O Unit-B is operating normally. (The indicator dims if only a few base units are connected.)

2.3.3 ER indicators

An ER indicator lights if an error occurs on the distributed link.

See the tables on the following page for details.

2.3.4 LED indicators

(1) When the unit No. (1 to 16) is off (o-on and ×-off)

M/S	ER2	ER1	ER0	Error	Description	Major cause of error
O	×	×	O	Interface unit peripheral error	The interface unit is abnormal.	Interface unit failure
O	×	O	×	Interface unit RAM parity error	The interface unit is abnormal.	Interface unit failure
O	O	×	×	I/O link error reception	An error has occurred in a unit connected to the I/O link.	Failure in a unit connected to the I/O link
O	O	×	O	I/O link framing error	The I/O link communication end signal is abnormal.	-
O	O	O	×	I/O link CRC error	I/O link communication data is abnormal.	-
O	O	O	O	Interface unit watchdog timer error	Communication from the I/O link host has stopped.	-

(2) When the unit No. (1 to 16) is on (o-on and ×-off)

M/S	ER2	ER1	ER0	Error	Description	Major cause of error
×	×	×	O	Basic unit peripheral error	The basic unit is abnormal.	Basic unit failure
O	×	O	×	Basic unit number error	A unit with an invalid unit number has responded to the interface unit.	-
×	×	O	O	Basic unit reception data count error	The number of communication bytes has exceeded four.	Two or more units have the same unit number, or the unit of interest is not provided with a terminating resistor.
×O (*1)	O	×	×	Basic unit framing error	The communication end signal is abnormal.	Two or more units have the same unit number, or the unit of interest is not provided with a terminating resistor.
×O (*1)	O	×	O	Basic unit DMI error	The communication waveform has been distorted.	Two or more units have the same unit number, or the unit of interest is not provided with a terminating resistor.
×O (*1)	O	O	×	Basic unit CRC error	The communication data is abnormal.	Two or more units have the same unit number, or the unit of interest is not provided with a terminating resistor.
×	O	O	O	Basic unit watchdog timer error	Communication with the interface unit has stopped.	-

NOTE (*1)
If M/S lights, it means that the interface detected the error.
If it does not light, it means that the basic unit detected the error.

2.3.5 M/$\overline{S}$ indicator

If an error occurs on a distributed link, the M/S indicator indicates whether the error was detected in the interface module or basic error side.

On: The error has been detected on the interface module side.
Off: The error has been detected on the basic unit side.

2.3.6 No. Indicators

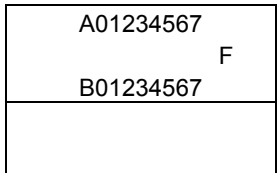
If an error occurs on a distributed link, the No. indicators indicate the basic unit No. where the error is detected. The sum of the values for which a lamp lights corresponds to the basic unit No.

Example)

No.					
16	**8**	**4**	**2**	**1**	**Unit No.**
×	×	×	×	O	1
×	×	O	×	O	5
×	O	×	O	×	10
O	×	O	×	×	20

O-On
×-Off

2.4 LED INDICATORS ON THE INPUT/OUTPUT MODULES (HAVING 16 OR FEWER INPUT/OUTPUT POINTS)



Label	Name	Description
A0 to 7 B0 to 7	Input/output indicator	On : The corresponding input or output is on.
F	Fuse alarm	On : A fuse incorporated in the output module has blown.

3 FUSES

The modules listed below have built-in fuses. If a fuse blows, remove the cause, then replace the fuse with a spare.

Module	Indication	Rating	Fuse specification
Interface module AIF01A	PWR is off	3.2A	A60L-0001-0290#LM32
Interface module AIF01B	PWR is off.	3.2A	A60L-0001-0290#LM32
Interface module AIF02C	PWR is off.	3.2A	A60L-0001-0290#LM32
Output module with 8 DC points AOD08C	F is on.	5A	A60L-0001-0260#5R00
Output module with 8 DC points AOD08D	F is on.	5A	A60L-0001-0260#5R00
Output module with 5 AC points AOA05E	F is on.	3.15A	A60L-0001-0276#3.15
Output module with 8 AC points AOA08E	F is on.	3.15A	A60L-0001-0276#3.15
Output module with 12 AC points AOA12F	F is on.	3.15A	A60L-0001-0276#3.15

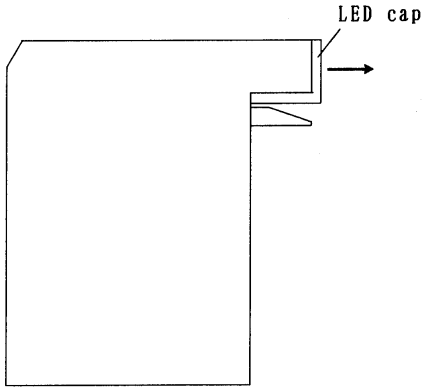
The fuses are on the PC boards in the modules.

4 REMOVING PC BOARDS

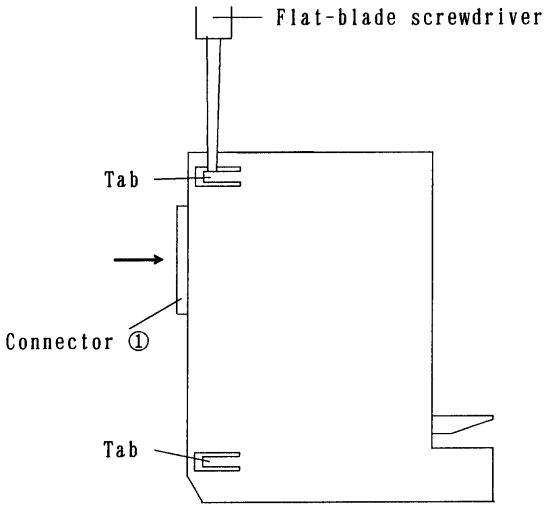
4.1 HOW TO REMOVE TERMINAL BOARD-TYPE I/O MODULE PC BOARDS

① Remove the terminal board. (Refer to I-4.5)

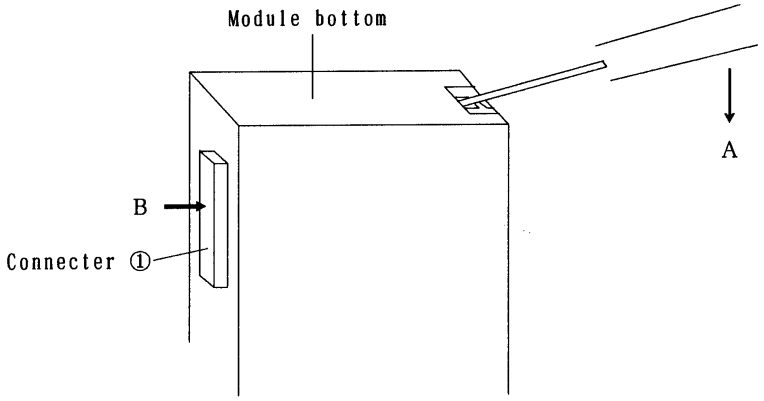
② Pull the LED cap in the direction of the arrow to remove it.



③ While pressing connector ① in the direction of the arrow, raise the tabs (two) on the module case with a flat-blade screwdriver.

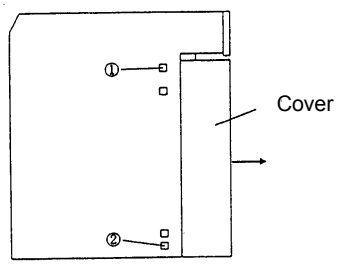


④ Put the tip of a flat-blade screwdriver into the gap between the module case and terminal board connector, as shown below. While pressing the screwdriver in the direction of arrow A, push connector ① in the direction of arrow B, and the PC board will come out.

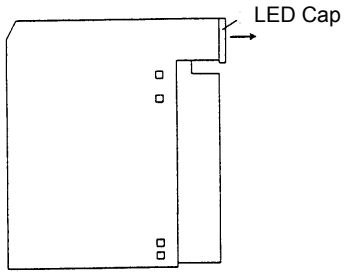


4.2 HOW TO REMOVE INTERFACE AND CONNECTOR-TYPE I/O MODULE PC BOARDS

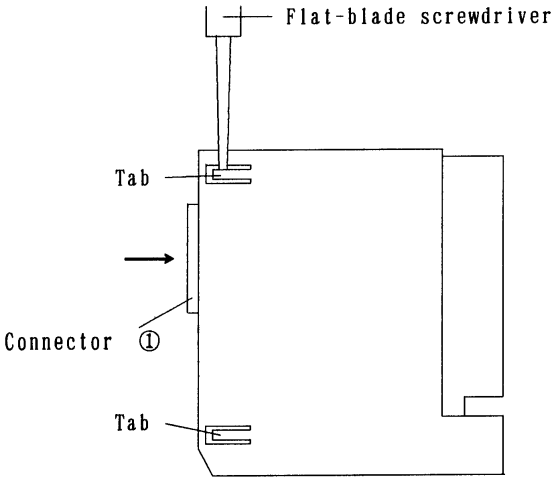
① While pulling the cover in the direction of the arrow, press points ① and ② (on each side) with a flat-blade screwdriver to remove the cover.



② Pull the LED cap in the direction of the arrow to remove it.



③ While pressing connector ① in the direction of the arrow, raise the tabs (two for a connector type I/O module and 4 for an interface module) with a flat-screwdriver, then push connector ① in the direction of the arrow, and e PC boardwill come out.



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Revision Record

FANUC I/O Unit-MODEL A CONNECTION·MAINTENANCE MANUAL (B-61813E/03)

03	Feb.,2000	• Addition of “I/O Link dummy unit” • Addition of Inter face module (AIF02C) • Addition of Input module (AID16K, AID16L) • Addition of High-resolution type analog output module (ADA02B) • Addition of “Temperature input module” • Modification of “High speed counter module”			
02	Apr.,1992	• Addition of high speed counter module • Addition of Optical fiber Cable			
01	Dec.,1990	———			
Edition	**Date**	**Contents**	**Edition**	**Date**	**Contents**