FANUC

GE Fanuc Automation

Computer Numerical Control Products

I/O Unit – Model A

Connection / Maintenance Manual

GFZ-61813E/02 *April 1992*

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.

GE Fanuc Automation makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

Contents

This manual describe the following products:

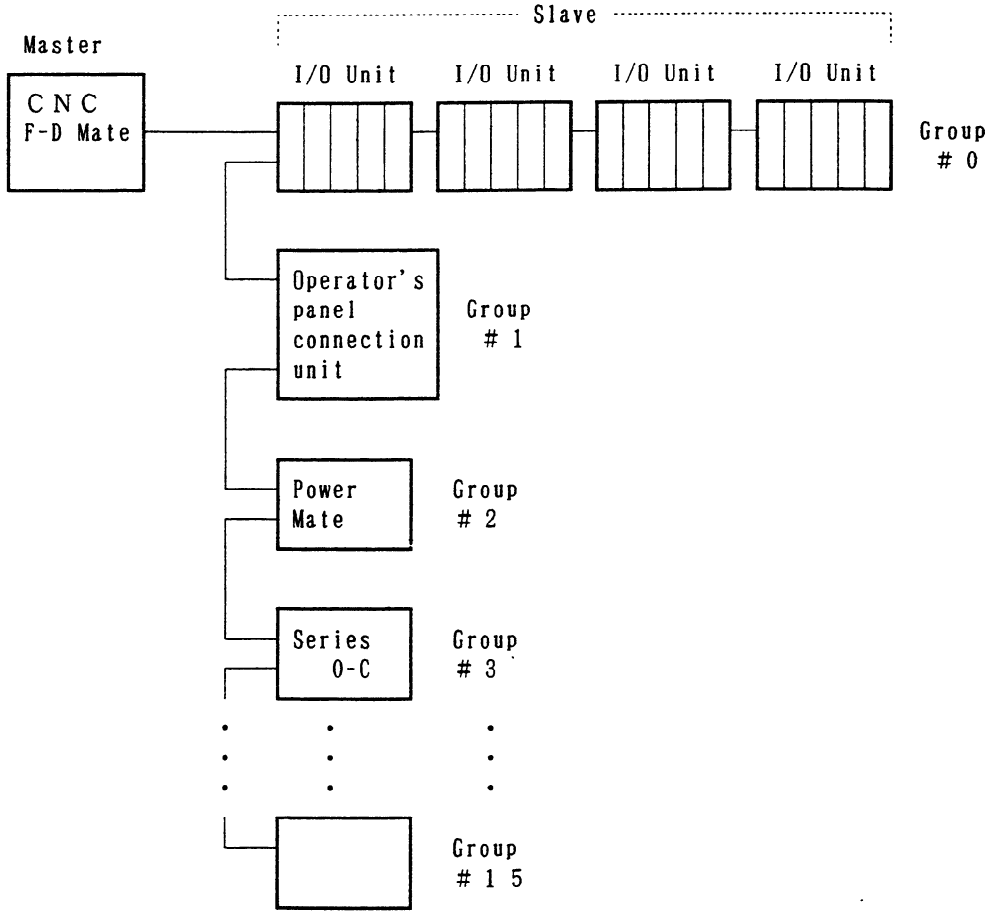
Name of products	Abbreviation
FANUC I/O Unit-MODEL A	I/O Unit-A
FANUC Power Mate-MODEL A	Power Mate-A
FANUC Power Mate-MODEL B	Power Mate-B
FANUC Power Mate-MODEL C	Power Mate-C
FANUC Series 0(MODEL C)	Series 0-C
FANUC Series 15	Series 15
FANUC Series 16	Series 16
FANUC Series 18	Series 18
FANUC SYSTEM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

I. CONNECTIONS

1. FANUC I/O Link

I/O Link is a serial interface with a purpose to transfer I/O signals (bit data) between CNC, 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.
   Mater : Series 0-C, Series 15, Series 16, Series 18, F-D Mate
   Slave : I/O Unit-A, Power Mate-A, B, C operator's panel connection unit, Series 0-C

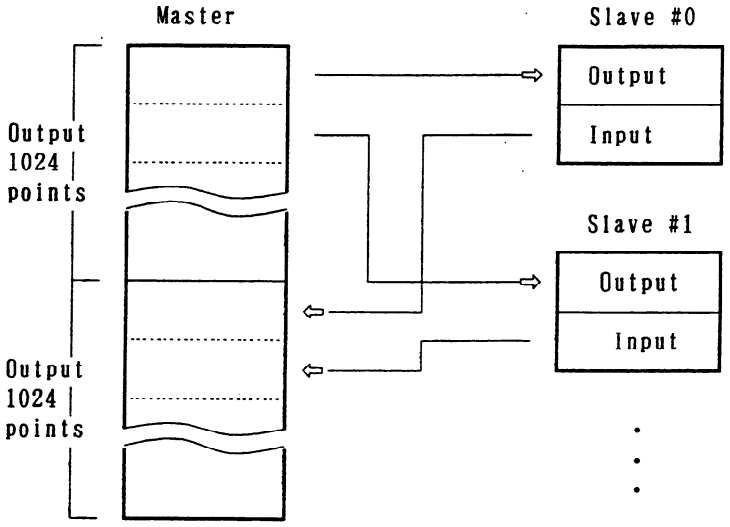
2) Up to 16 groups of slaves can be connected with a single I/O Link.
   Number of slaves per one group is as follows.

I/O Unit-A	: Up to 4 units (i.e.4 bases) but when Master is ② Series 0-C, Series 15, Series 16 or Series 18 up to 2 units.
Power Mate-A, B, C	: 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 ≦ 1024
Number of output points ≦ 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-A, B, C		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 ≦ 1024 (per one I/O Link)
   Number of output points ≦ 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 ≦ 256 (per one group)
   Number of output points ≦ 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

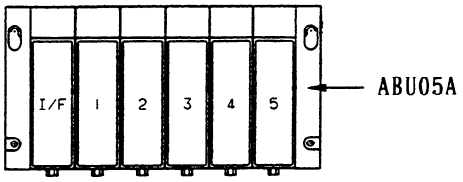
Example 2: When the following modules are used in the group No.2

AOD16C	7	AID16C	4
AOA05E	9	AIA16G	3

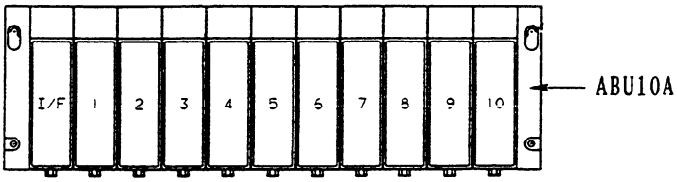
[Output points]
16 ×7 +8 ×9 =184 ⇨ 256 points
[Input points]
16 ×4 +16×3 =112 ⇨ 128 points
In this case, as the number of input points is not larger than that of the output points, the number of input points is assumed to be equal to that of the output points, in other words, 256 points.

2. I/O Unit CONFIGURATION

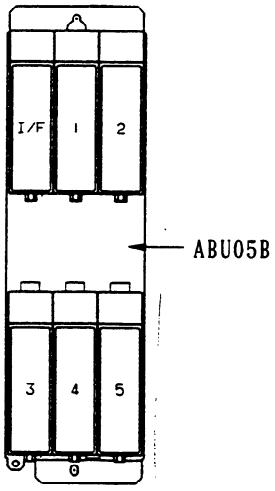
5-slot horizontal base unit (ABU05A)



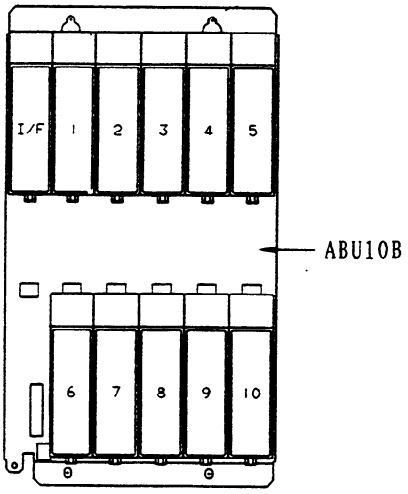
10-slot horizontal base unit (ABU10A)



5-slot vertical base unit (ABU05B)



10-slot vertical base unit (ABU10B)



(Note) I/F : Interface module (AIF01A or AIF01B)
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℃
   During preservation and transportation: -20 to 60℃

2) Temperature changing rate: Max. 1.1℃/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

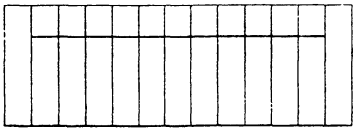
5) Atmosphere
   When the unit is used in areas with high density of dust, cutting fluid or organic solvent, the user should consult FANUC.

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.

Upside

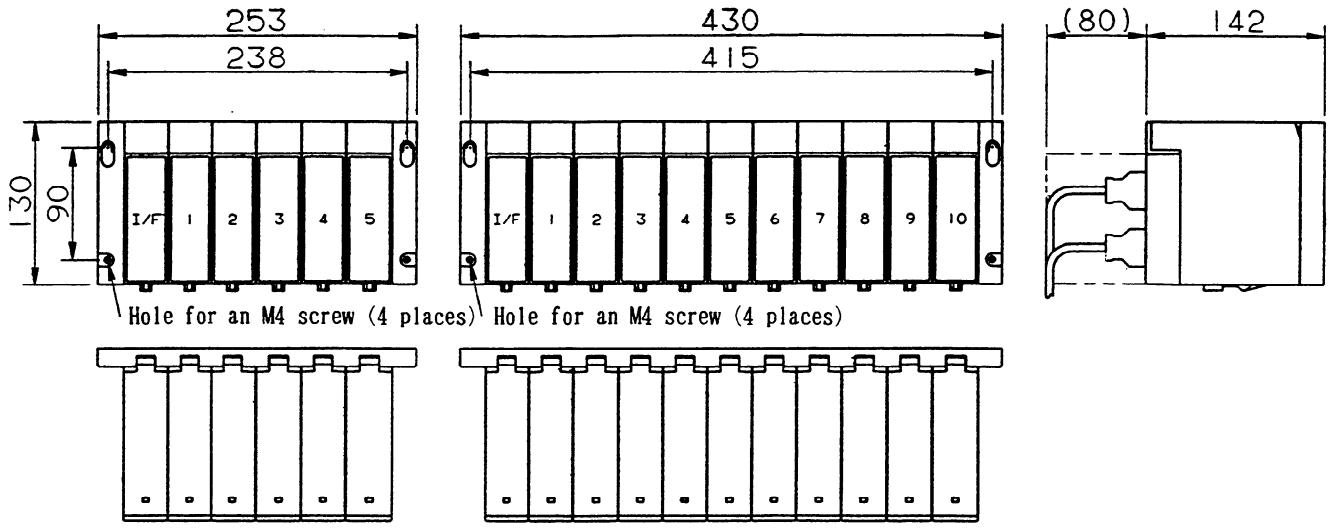


Downside

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 3.2

3.3 Outer Dimension of I/O Unit

Horizontal base units (ABU05A and ABU10A)



Vertical base units (ABU05B and ABU10B)

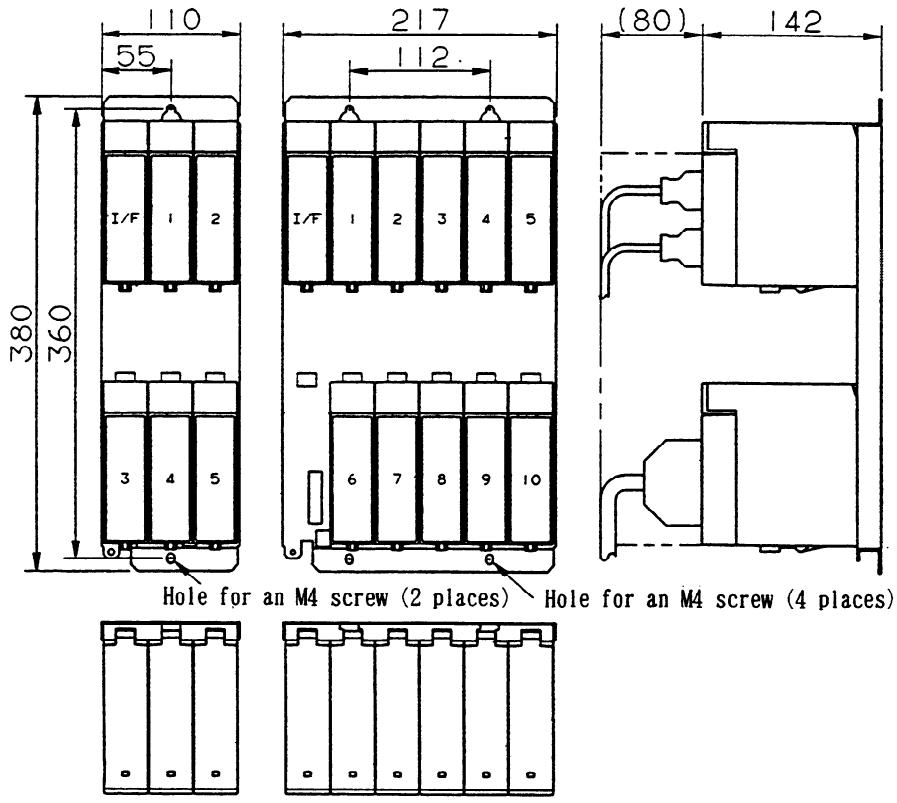


Table 3.3 Heat value of each module

	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
	AID16C	0.1	0.21
	AID16D	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	$0.01+0.8\times IL^2$
※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	——
	ACT01A	4.1	——

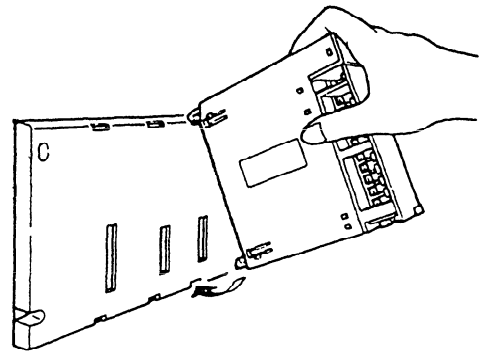
- Total 'Heat value per 1 I/O point' for simultaneous ON points plus 'Basic heat value' is the heat value of the module.
- IL:Load current of output
- A□D32□1 of "※1～※7" is the same module as former A□D32□.
  (Example : AID32E1 is equal to former AID32E.)

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.

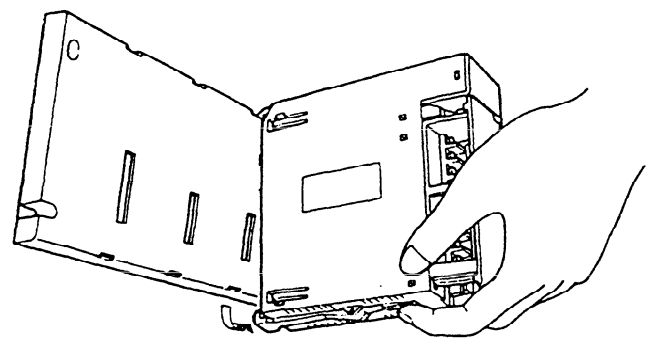
Mounting

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.



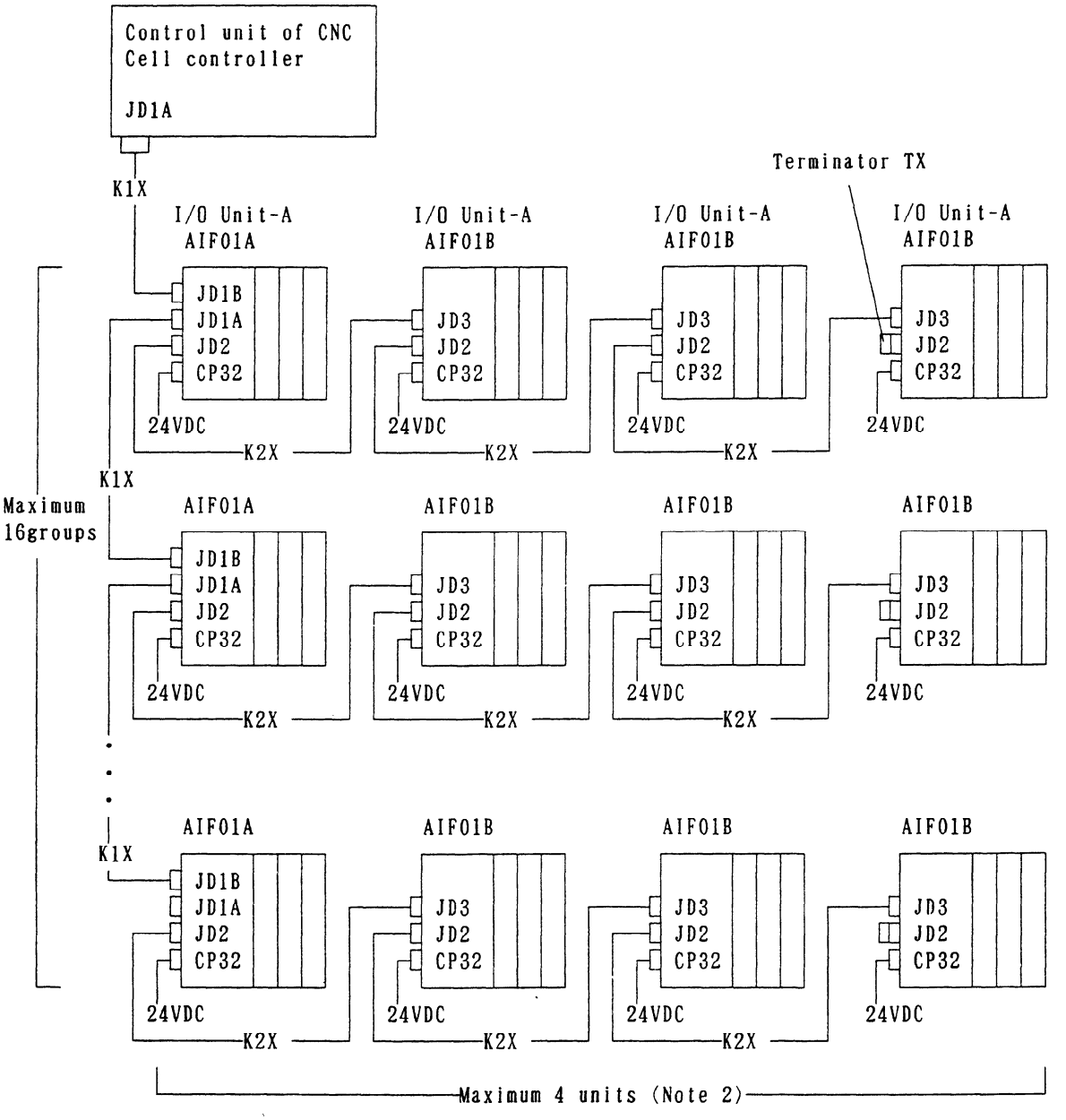
Dismounting

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."

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

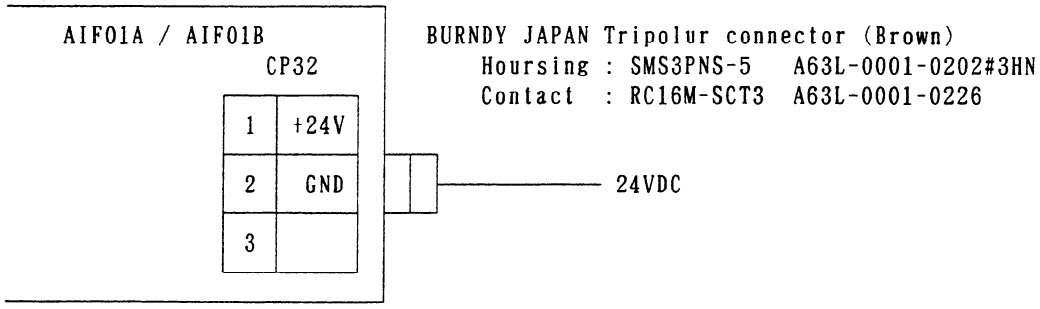
(Note 3) Cable K1X can be an optical fiber cable by using the optical I/O link adapter. See chapter 8.

(Note 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.

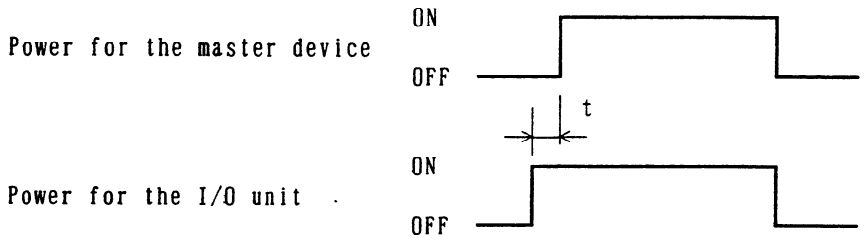
4.2 Connecting Input Power Source

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

- Voltage: 24VDC ±10%
- Current: Determine from Table 4.3



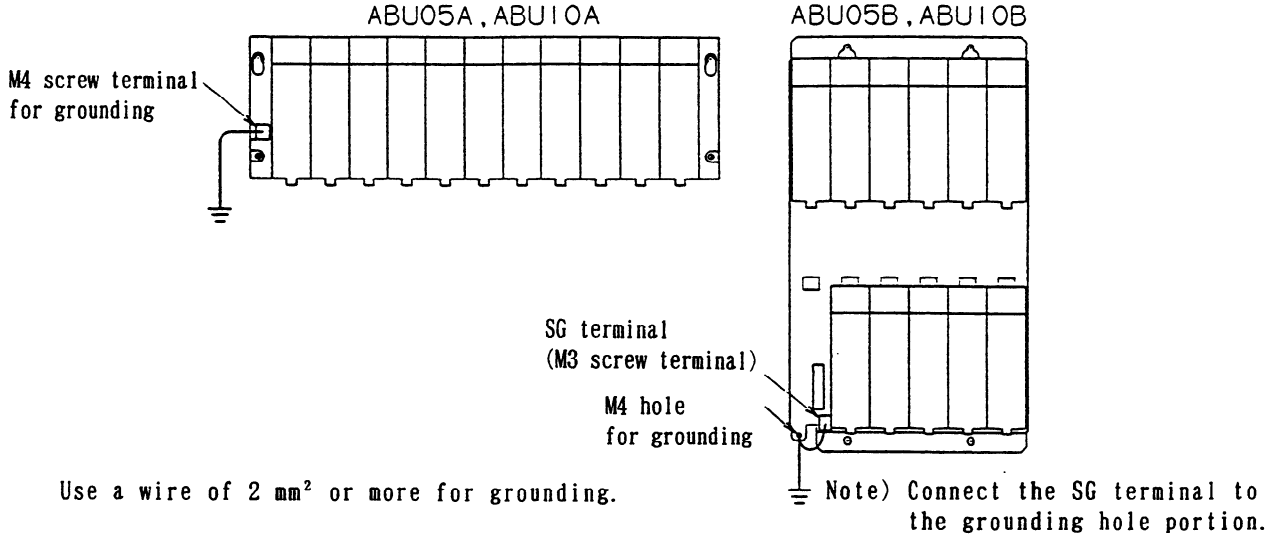
(Note) Turn ON the power for the I/O unit just when or before the power for the CNC or the cell controller is turned ON. When the CNC or cell controller power is turned OFF, make sure to turn the power to the I/O unit OFF as well.
If the power is not turned on and off according to the above procedure,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

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



Use a wire of 2 mm² or more for grounding.

Note) Connect the SG terminal to the grounding hole portion.

(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.

Table 4.3 Required current of each module

Module name	Required current (mA) of+24V A	B
AIF01A	50	
AIF01B	50	
AID32A1	20+0.5×n	30+7.5×n
AID32B1	20+0.5×n	30+7.5×n
AID32H1	20+0.5×n	30+7.5×n
AID16C	5	
AID16D	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
ACT01A	170	

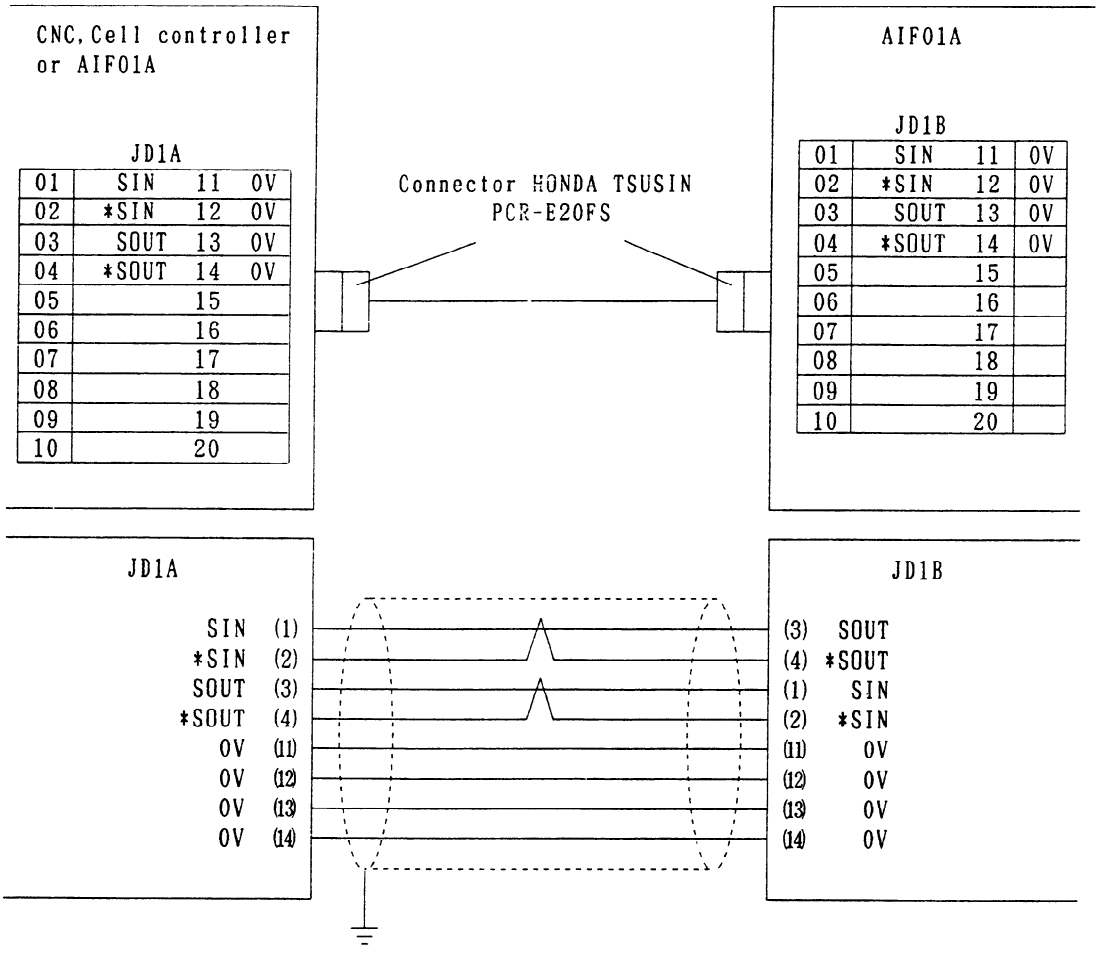
n: Number of the input and output points (for each module) which turn ON simultaneously

- Add the sums of the columns A and B for the modules to be used. The sum is the required current. (Unit:mA)
- Use modules under the condition that the sum of the column A is 500 or less and that of the column B is 1500 or less.

4.4 Connecting Signal Cables

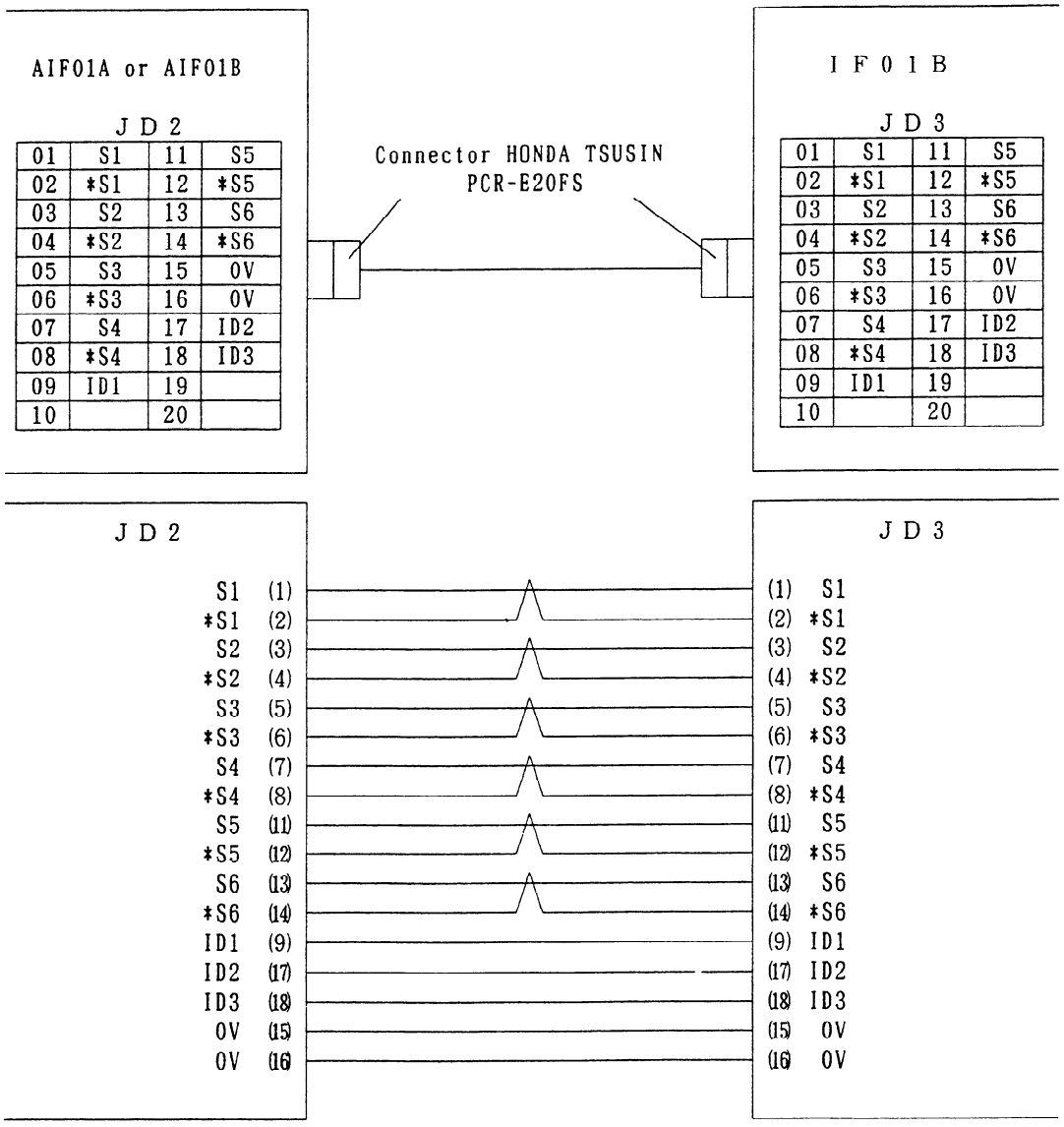
Details of the cables K1X, K2X and the terminator shown in the general connection diagram are as follows.

1) Cable K1X



- Make sure to use twisted pair wires for signal SIN and *SIN, and signals SOUT and *SOUT.
  - Reconnecnded cable material: A66L-0001-0284#10P (twisted pair/shielded)
  - 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.)
  - Maximum cable length: 10 m
  - Make sure not to connect to the connector spare pins.
  - In the following cases, make sure to use an optical I/O link adapter and an optical fiber cable. (See chapter 8)
    - 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.
  - 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 8.)

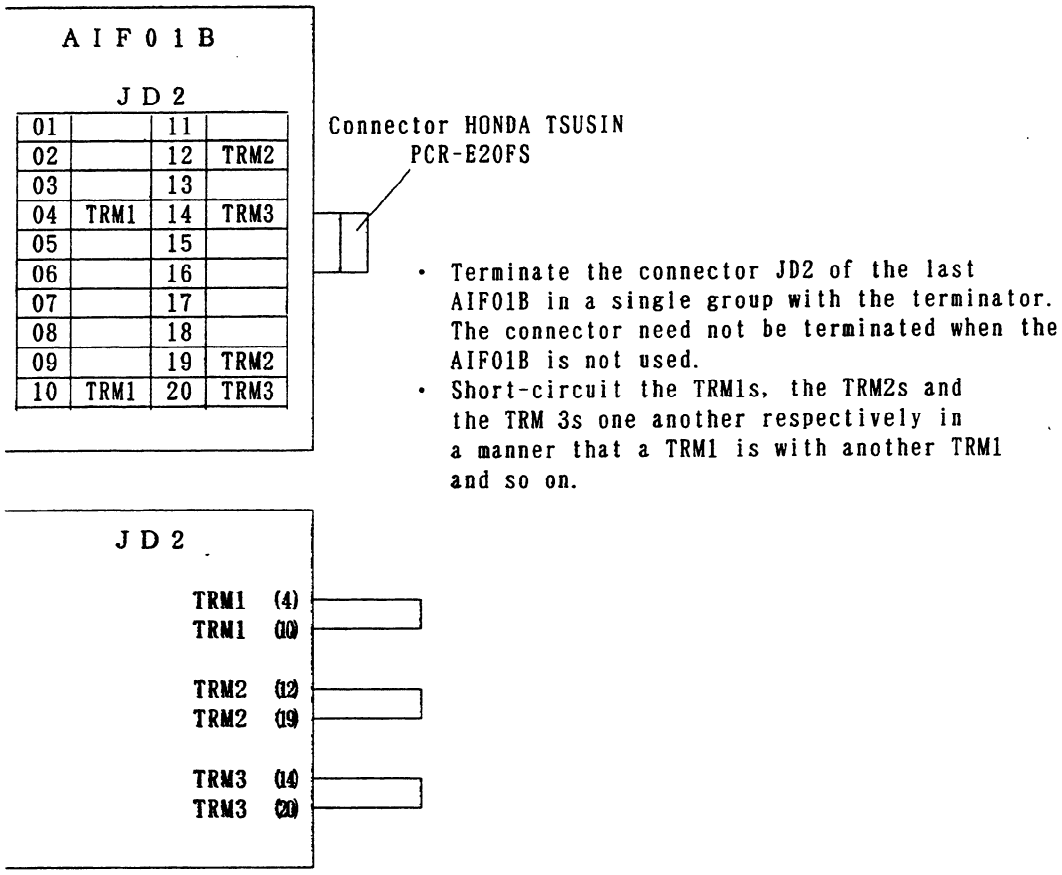
2) Cable K2X



- 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

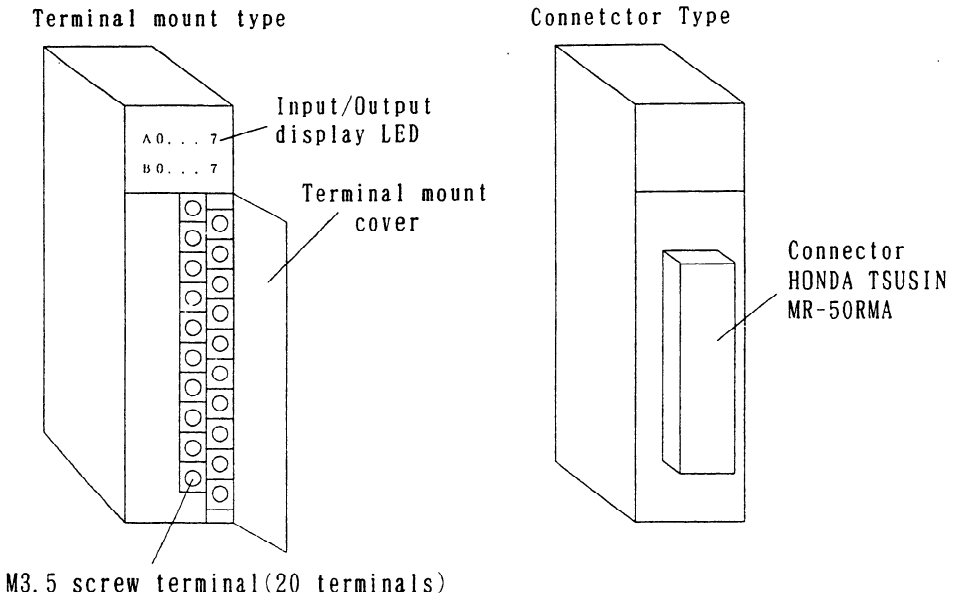
3) Terminator TX



- 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.

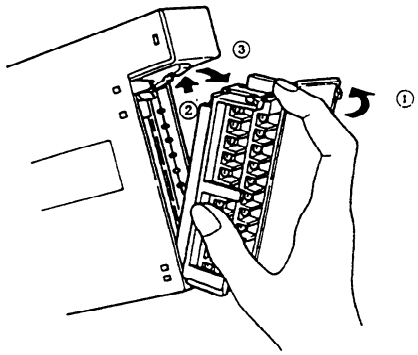
4.5 Connecting with I/O Modules

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.

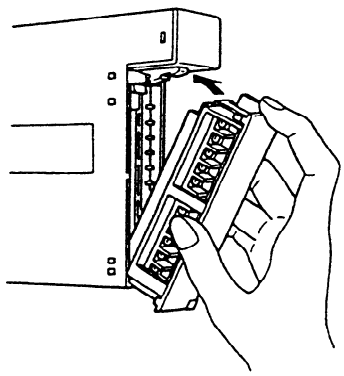


1) Connect with each module following the connection diagrams of sections 4.2 and 5.3.
2) The terminal block is a removable type.

[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.



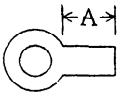
[Mounting the terminal block]
① Insert the protruding portion at the bottom of the terminal block in the groove of the module side.
② Push the terminal block using the engaging point of the protruding portion and the groove as an axis and mount it in the module firmly.
③ Open the cover of the terminal 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 ~ 18 (0.3~0.75 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
	AID16D	24VDC	7.5 mA	POS	Maximum 20 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	100～120VAC	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.

(Note 2)
Connector A : HONDA MR Connector
Connector B : Flat Cable Connector

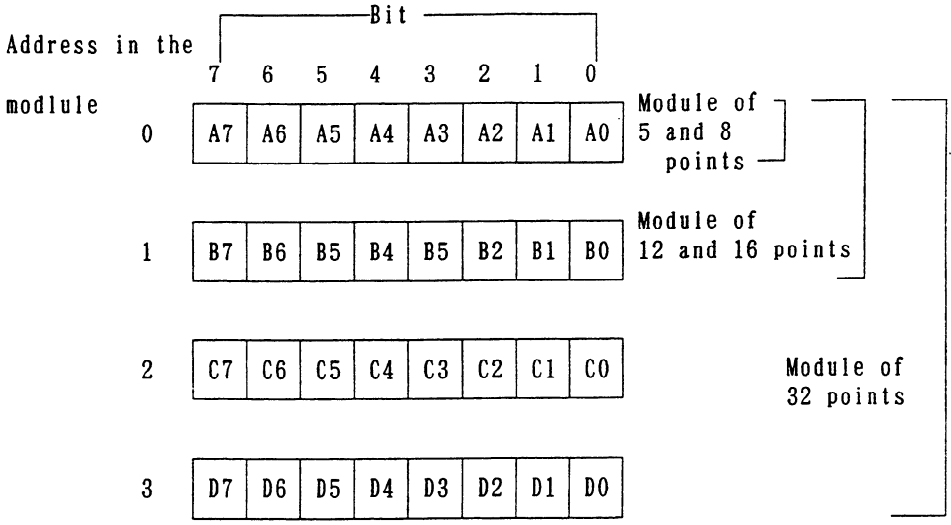
(Note 3) For the details of the specifications for each module, refer to the section 5.3.

Digital output modules

Output type	Module name	Rated voltage	Maximum current	Polarity	Points	Points/common	External connection	LED display	Fuse
Non-insulation type DC output	AOD 32A1	5 ~ 24VDC	0.3A	NEG	32	8	Connector A	not provided	not provided
Insulation type DC output	AOD08C	12~ 24VDC	2 A	NEG	8	8	Terminal block	provided	provided
	AOD08D		2 A	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 ~ 240VAC	2 A	—	5	1	Terminal block	provided	provided
	AOA08E		1 A	—	8	4	Terminal block	provided	provided
	AOA12F	100 ~ 120VAC	0.5A	—	12	6	Terminal block	provided	provided
Relay output	AOR08G	Maximum 250VAC /30VDC	4 A	—	8	1	Terminal block	provided	not provided
	AOR16G		2 A	—	16	4	Terminal block	provided	not provided
	AOR16H2	30VDC	2 A	—	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.
(Note 2)
Connector A : HONDA MR Connector
Connector B : Flat Cable Connector
(Note 3) For the details of the specifications for each module, refer to the section 5.3.

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."

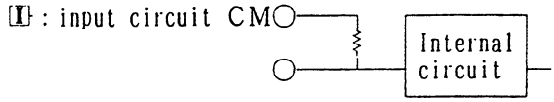
5.3 Specification for each Module

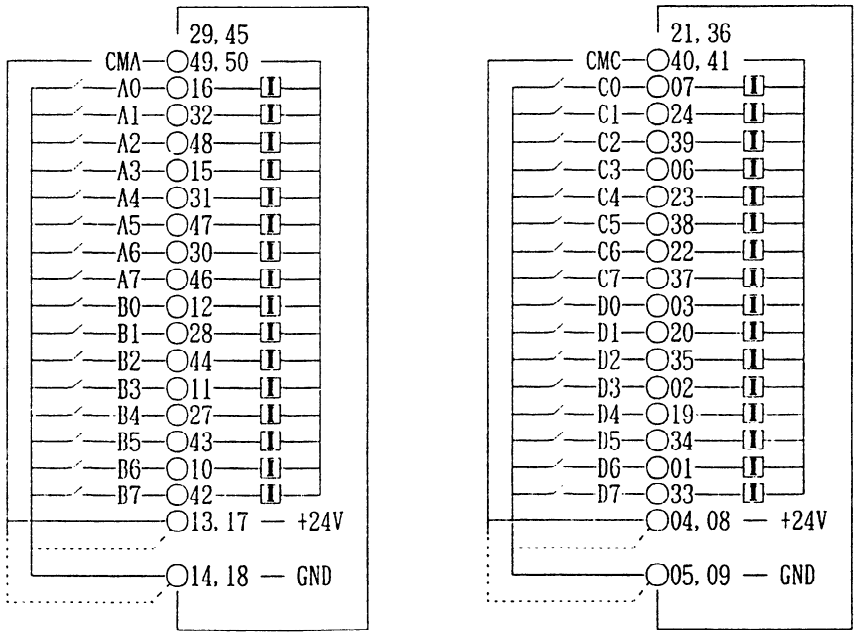
Specifications for each I/O module are shown in the following pages.

(1) Input module AID32A1
(2) Input module AID32B1
(3) Input module AID32H1
(4) Input module AID16C
(5) Input module AID16D
(6) Input module AID32E1
(7) Input module AID32E2
(8) Input module AID32F1
(9) Input module AID32F2
(10) Input module AIA16G
(11) Output module AOD32A1
(12) Output module AOD08C
(13) Output module AOD08D
(14) Output module AOD16C
(15) Output module AOD16D
(16) Output module AOD32C1
(17) Output module AOD32C2
(18) Output module AOD32D1
(19) Output module AOD32D2
(20) Output module AOA65E
(21) Output module AOA08E
(22) Output module AOA12F
(23) Output module AOR08G
(24) Output module AOR16G
(25) 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			

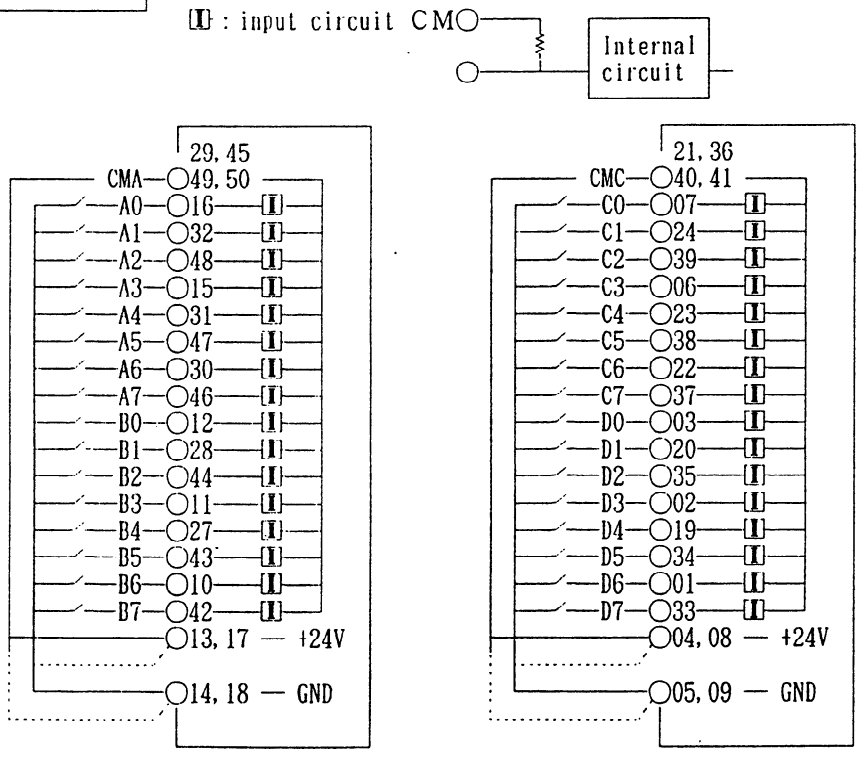




+24V or GND can be selected for input common as above fig.
(Note) Make sure to connect all common (CMA, CMC) pins.

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

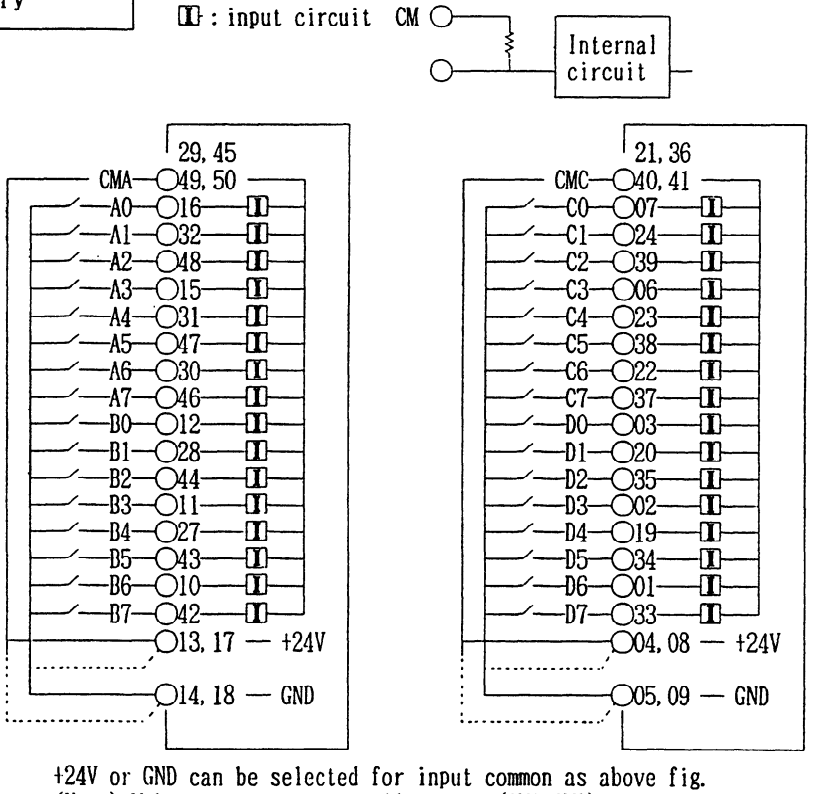
Item		Specifications	
Points/module		32 points	
Points/common		16 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 18VDC, min. 6mA	
OFF voltage, current		Max. 6VDC, max. 1.5mA	
Response time	OFF →ON	Max. 2ms	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) Make sure to connect all common (CMA, CMC) pins.

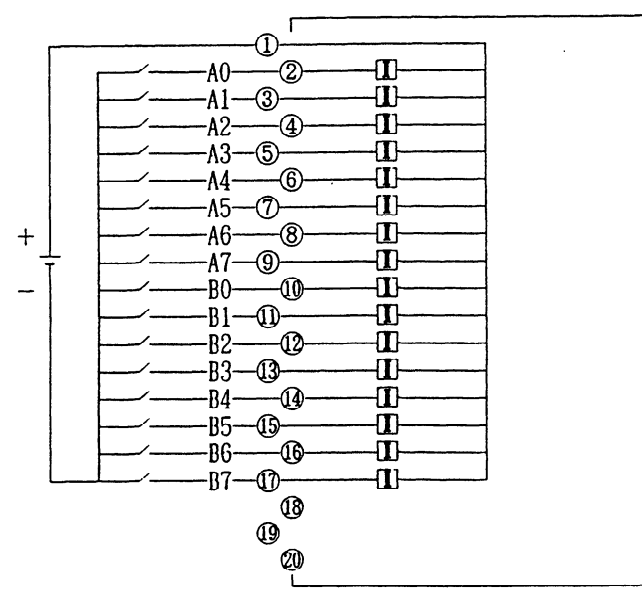
(3) Input module AID32H1

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～A7) Max. 20ms(B0～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～A7) Max. 20ms(B0～D7)	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			

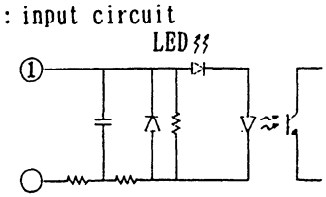


+24V or GND can be selected for input common as above fig.
(Note) Make sure to connect all common (CMA, CMC) pins.

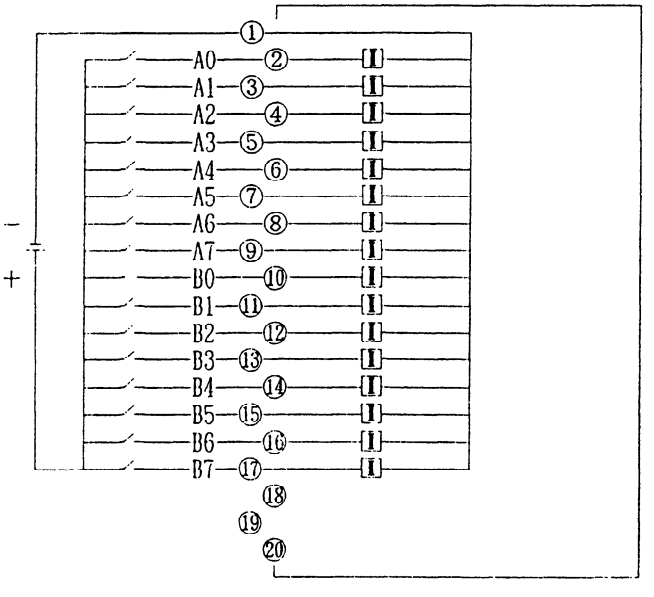
(4) Input module AID16C

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	
Extermal connection		Terminal block connector(20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			

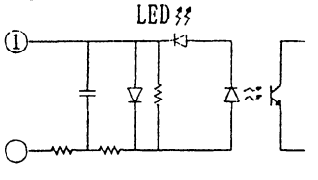
: input circuit



(5) Input module AID16D

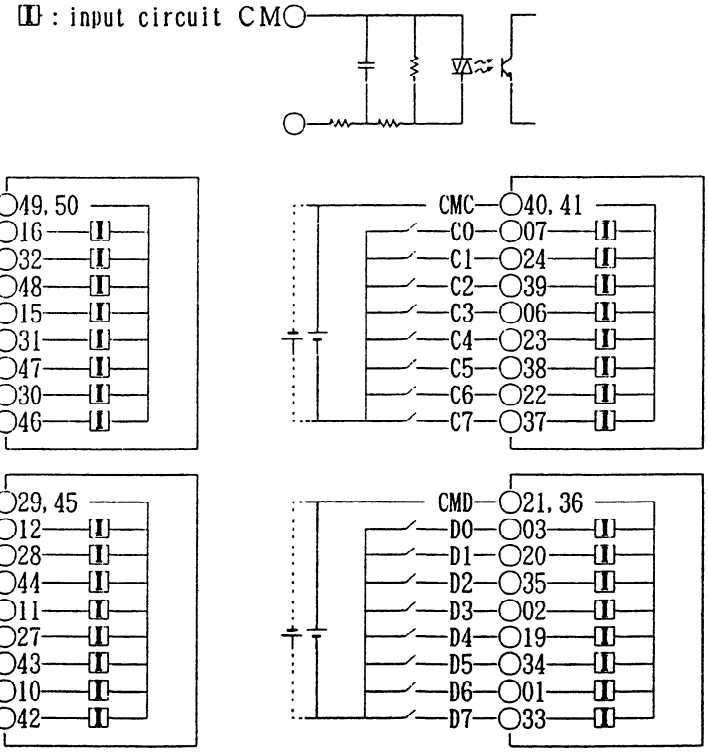
Item		Specifications	
Points/module		16 points	
points/common		16 points/common	
Sink/source current		Sink current type	
Input voltage		24VDC +10%, −20%	
Input current		7.5 mA(average)	
ON voltage, current		Min. 15VDC, min. 4mA	
OFF voltage, current		Max. 5VDC, max. 1.5mA	
Response time	OFF →ON	Max. 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	
Input connection		Terminal block connector (20 terminals, M3.5 screw termina)	
Terminal connection and circuitry			

[I] : input circuit



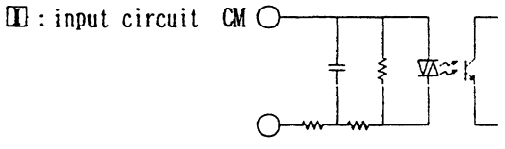
(6) Input module AID32E1

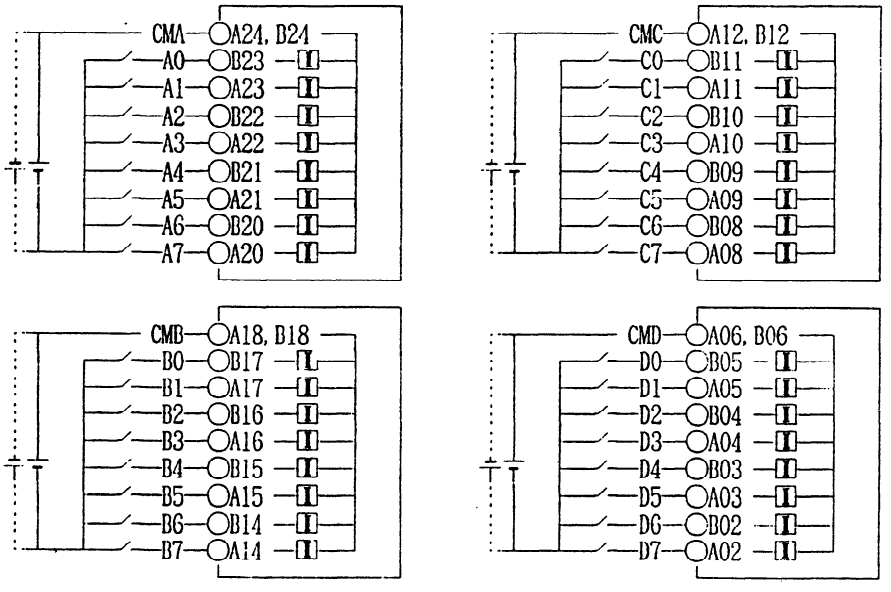
Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF →ON	Max. 20ms	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			



(7) Input module AID32E2

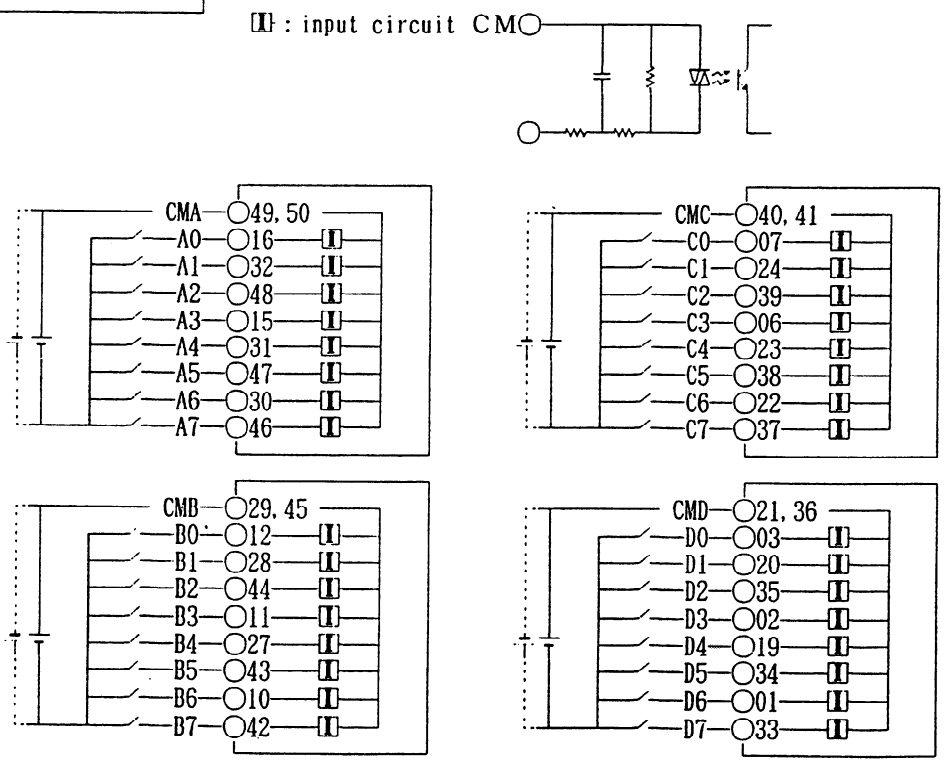
Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF →ON	Max. 20ms	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			





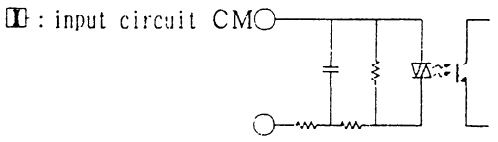
(8) Input module AID32F1

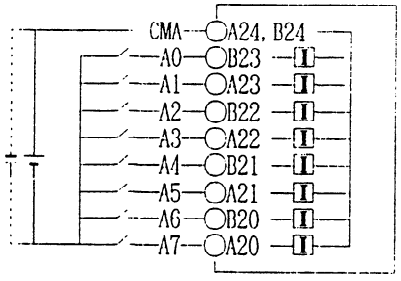
Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF →ON	Max. 2 ms	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. 2 ms	
Input display		Not provided	
External connection		Connector (HONDA TSUSIN MR-50RMA)	
Terminal connection and circuitry			

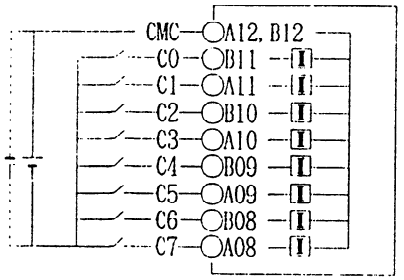


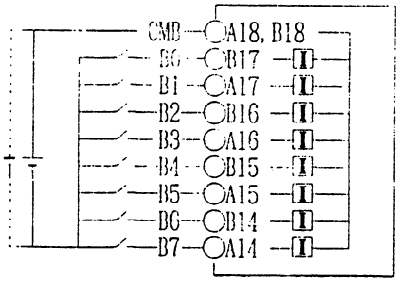
(9) Input module AID32F2

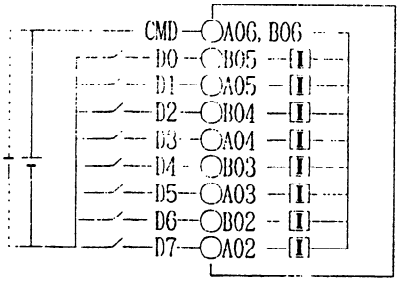
Item		Specifications	
Points/module		32 points	
Points/common		8 points/common	
Sink/source current		Both directions	
Input voltage		24VDC +10%, −20%	
Input current		7.5mA (average)	
ON voltage, current		Min. 15VDC, min. 4.5mA	
OFF voltage, current		Max. 6VDC, max. 2mA	
Response time	OFF →ON	Max. 2 ms	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. 2 ms	
Input display		Not provided	
External connection		Connector (HIROSE ELECTRIC HIF3BB-50PA-2.54DS In accordance with MIL standard)	
Terminal connection and circuitry			





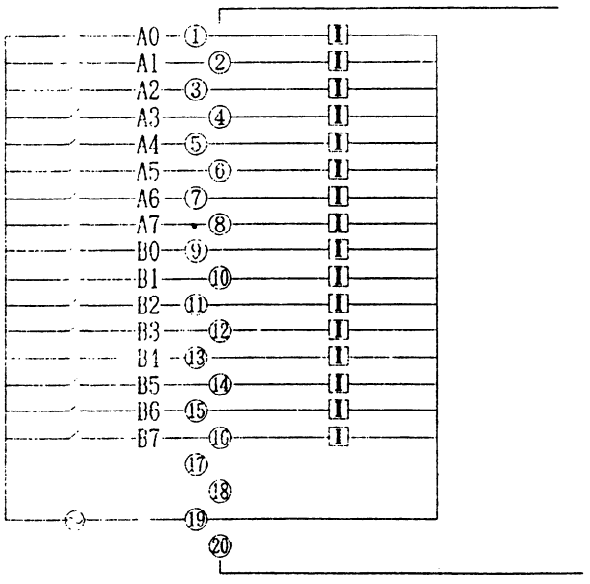




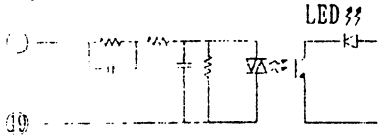


(10) Input module AIA16G

Item	Specifications		
Points/module	16 points		
Points/common	16points/common		
Rated load voltage	100～115VAC±15%		
Maximun input voltage	132Vrms. 50/60Hz		
Input current	10.5mArms (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			

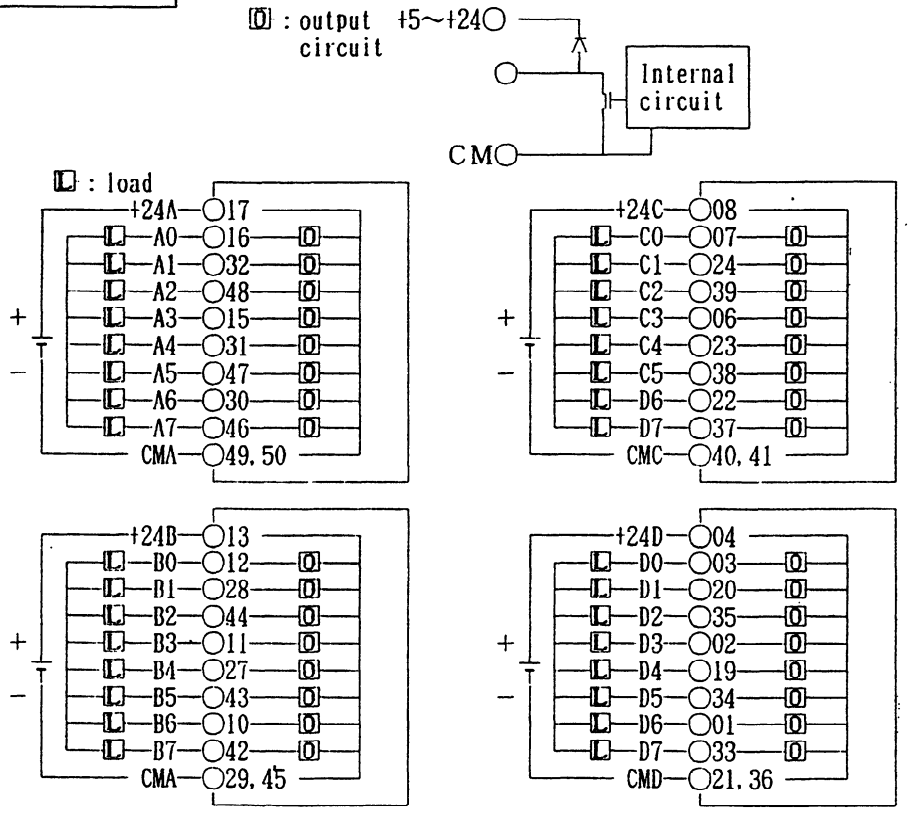


: input circuit



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

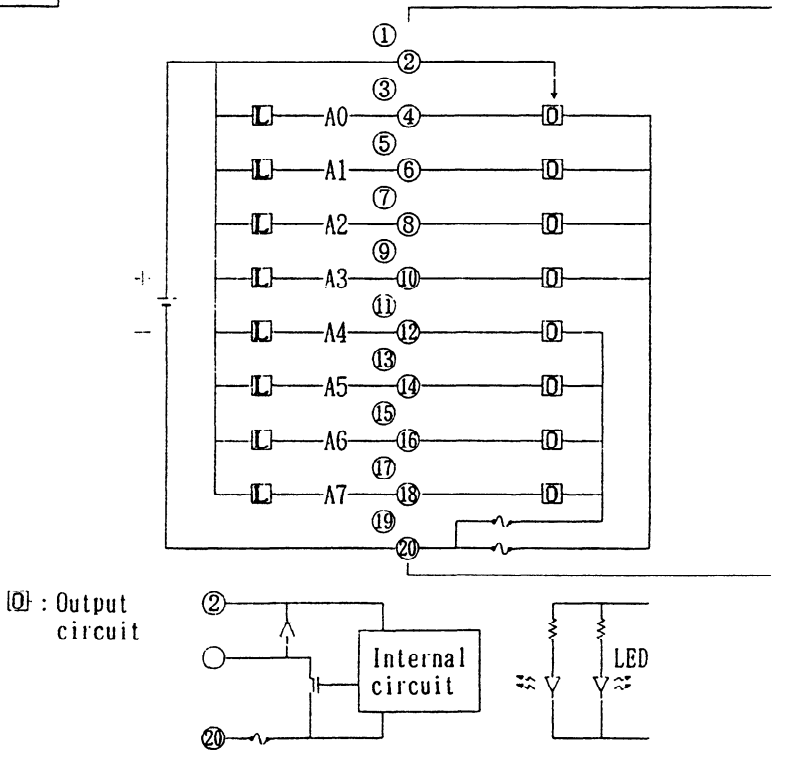
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Sink current type
Rated load voltage		5～24VDC +20%, −15%
Maximum load current		0.3A(however 2A/common)
Maximum voltage drop when ON		0.24V(load current×0.8Ω)
Maximum leak current when OFF		0.1mA
Response 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.

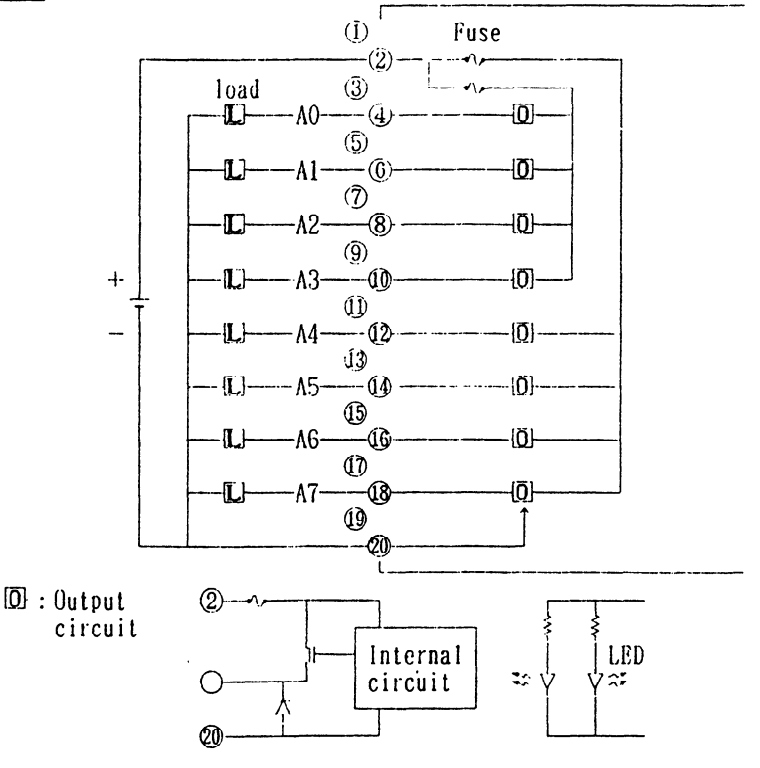
(12) Output module A0D08C

Item		Specifications	
Points/module		8 points	
Points/common		8 points/common	
Sink/source current		Sink current type	
Rated load voltage		12～24VDC +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			



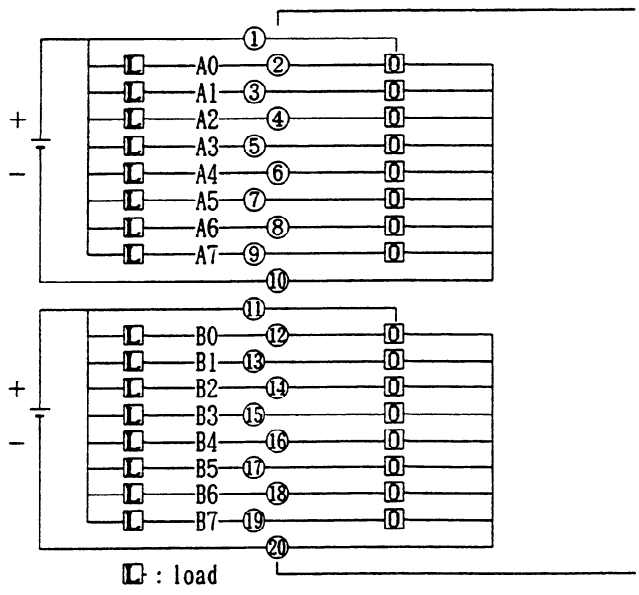
(13) Output module A0D08D

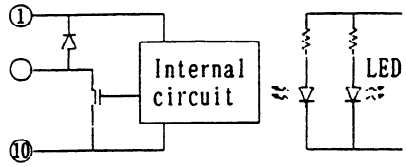
Item		Specifications	
Points/module		8 points	
Points/common		8 points/common	
Sink/source current		Source current type	
Rated load voltage		12～24VDC +20%, −15%	
Maximum load current		2A (however 4A/fuse)	
Limit of load		Refer to load derating curve (Fig.5.3(a))	
Maximum voltage drop when ON		1.2V (load current x 0.6Ω)	
Maximum leak current when OFF		0.1mA	
Response time	OFF →ON	Max. 2 ms	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. 2 ms	
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			



(14) Output module AOD16C

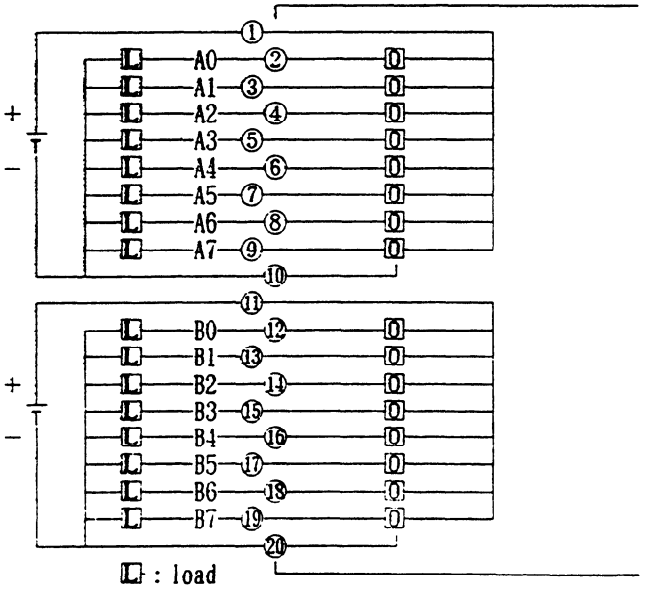
Item		Specifications	
Points/module		16 points	
Points/common		8 points/common	
Sink/source current		Sink current type	
Rated load voltage		12～24VDC +20%, −15%	
Maximum load current		0.5A (however 2A/common)	
Maximum voltage drop when ON		0.7V (load current × 1.4Ω)	
Maximum leak current when OFF		0.1mA	
Response time	OFF →ON	Max. 2 ms	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. 2 ms	
Output display		LED display	
External connection		Terminal block connector(20 terminals, M3.5 screw terminal)	
Terminal connection and circuitry			



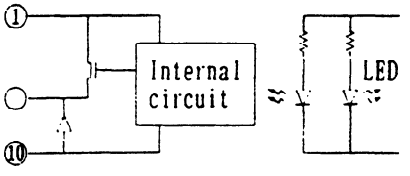


(15) Output module A0D16D

Item		Specifications	
Points/module		16 points	
Points/common		8 points/common	
Sink/source current		Source current type	
Rated load voltage		12～24VDC +20%. −15%	
Maximum load current		0.5A(however 2A/common)	
Maximum voltage drop when ON		0.7V (load current×1.4Ω)	
Mixiimum 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 teminals, M3.5 screw teminal)	
Terminal connection and circuitry			

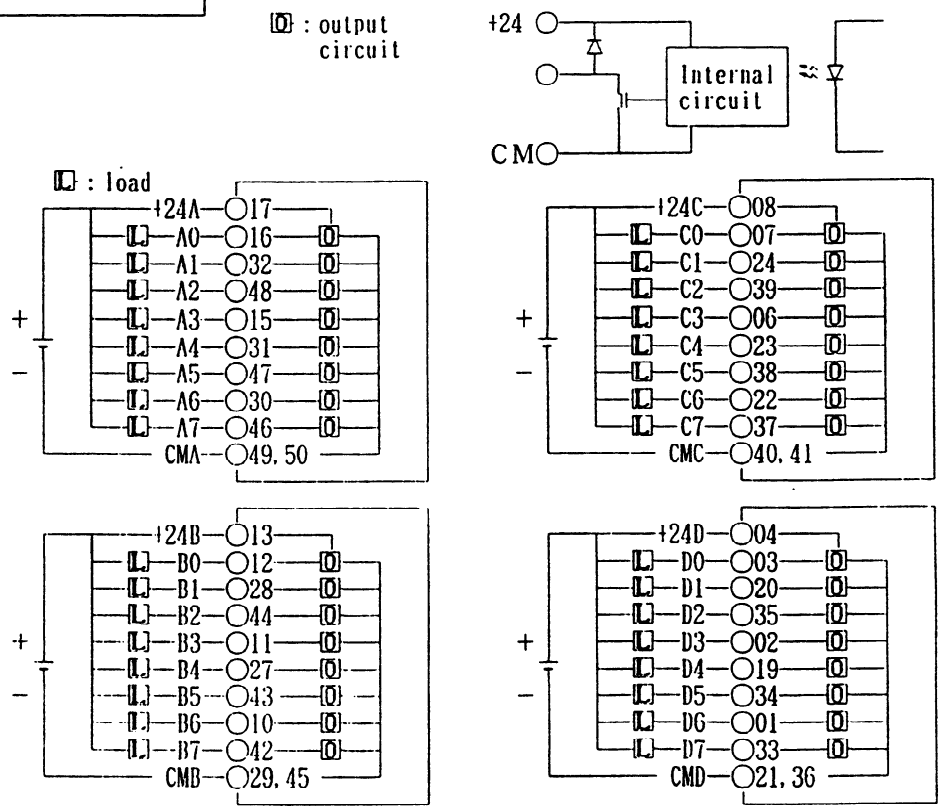


: output circuit



(16) Output module A0D32C1

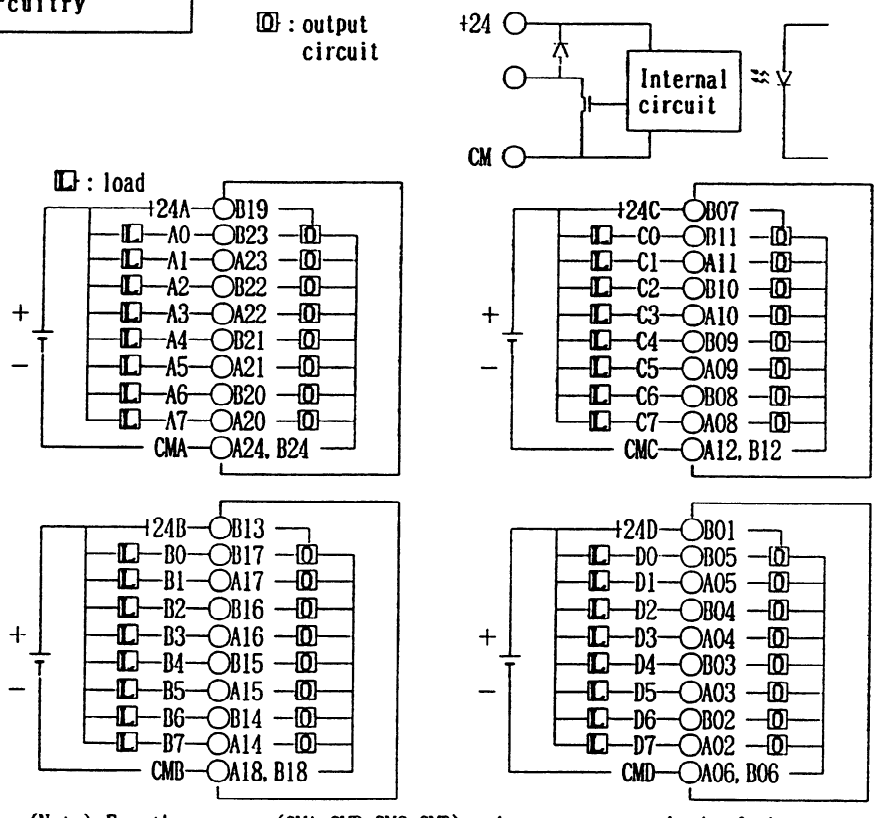
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Sink current type
Rated load voltage		12～24VDC +20%, −15%
Miximum load current		0.3A(however 2A/common)
Maximum voltage drop when ON		0.24V(load current×0.8Ω)
Maximum leak current when off		0.1mA
Response 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.

(17) Output module AOD32C2

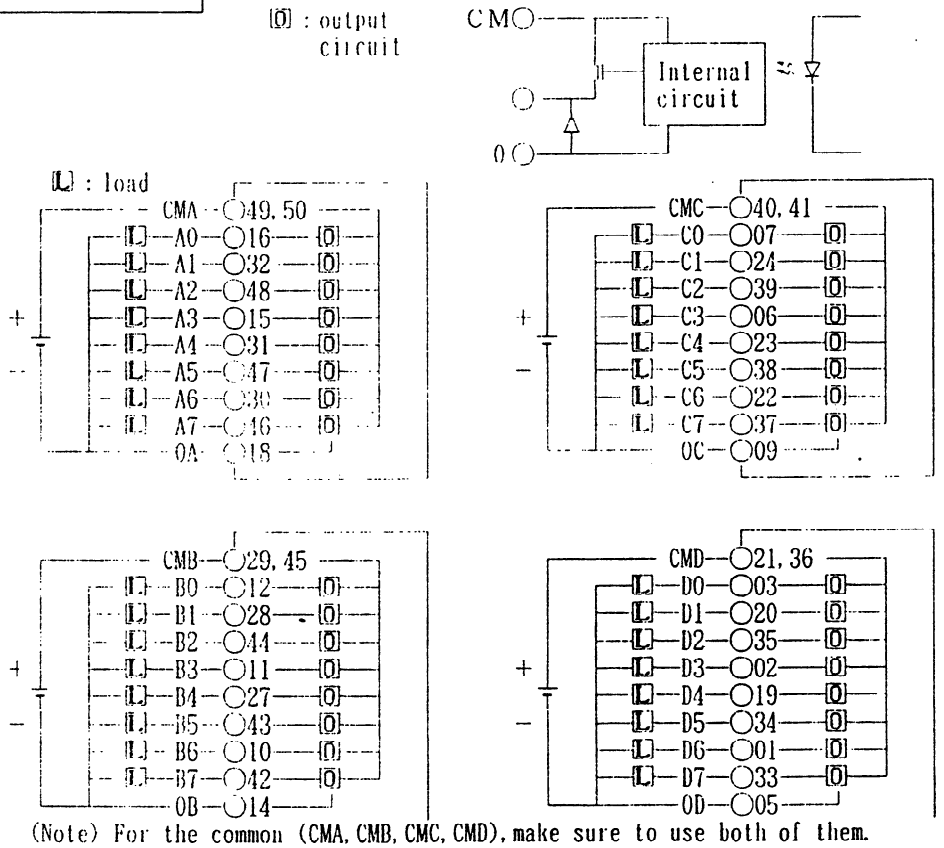
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Sink current type
Rated load voltage		12～24VDC +20%, −15%
Miximum load current		0.3A(however 2A/common)
Maximum voltage drop when ON		0.24V(load current×0.8Ω)
Maximum leak current when off		0.1mA
Response 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.

(18) Output module A0D32D1

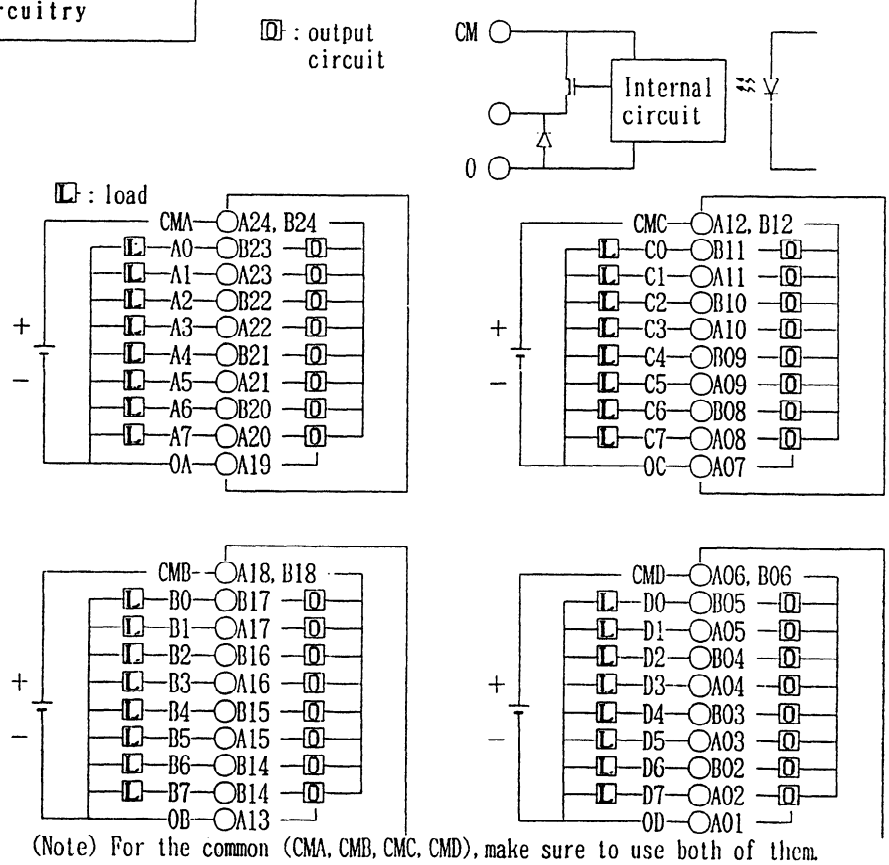
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Source current type
Rated load voltage		12～24VDC +20%, −15%
Maximum load current		0.3A (however 2A/common)
Maximum voltage drop when ON		0.24V(load current×0.8Ω)
Maximum leak current when OFF		0.1mA
Response time	OFF →ON	Max. 2 ms
	ON →OFF	Max. 2 ms
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 A0D32D1

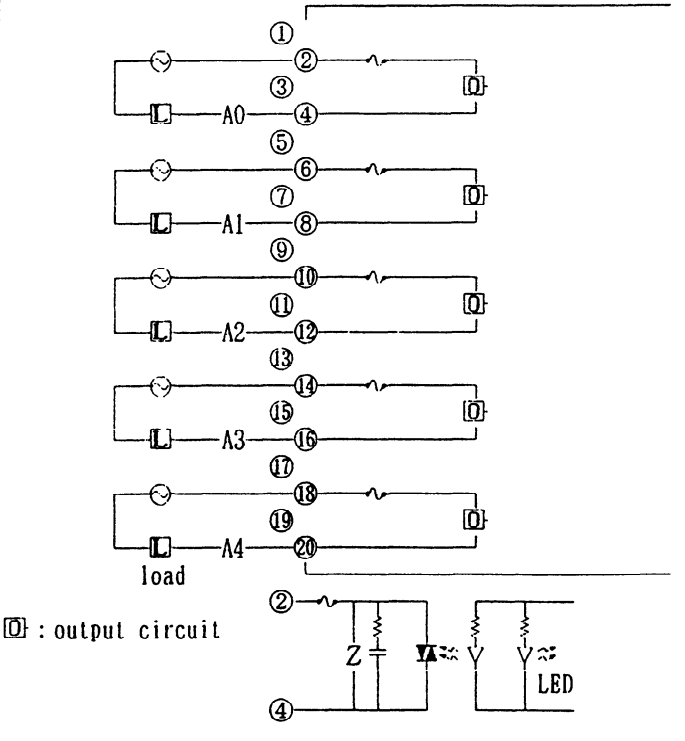
Item		Specifications
Points/module		32 points
Points/common		8 points/common
Sink/source current		Source current type
Rated load voltage		12～24VDC +20%, −15%
Maximum load current		0.3A (however 2A/common)
Maximum voltage drop when ON		0.24V(load current×0.8Ω)
Maximum leak current when OFF		0.1mA
Response time	OFF →ON	Max. 2 ms
	ON →OFF	Max. 2 ms
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.

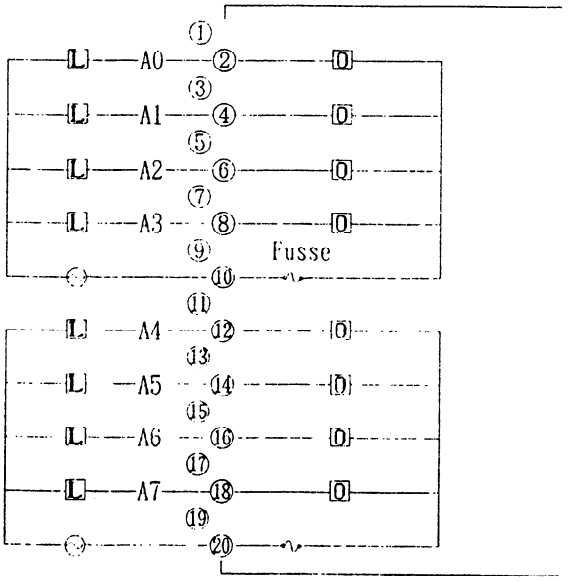
(20) Output module AOA05E

Item		Specifications	
Points/module		5 points	
Points/common		1 point/common	
Rated load voltage		100～230VAC±15%, 47～63Hz	
Maximum load current		2A (however 5A/module)	
Maximum in 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 moudle. The actual value is determined by adding it to the scanning time depending on each system.
	ON →OFF	Half of the load frequency 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～A4	
Terminal connection and circuitry			

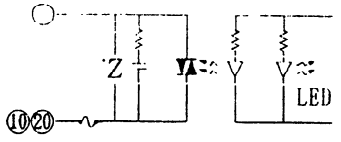


(21) Output module AOA08E

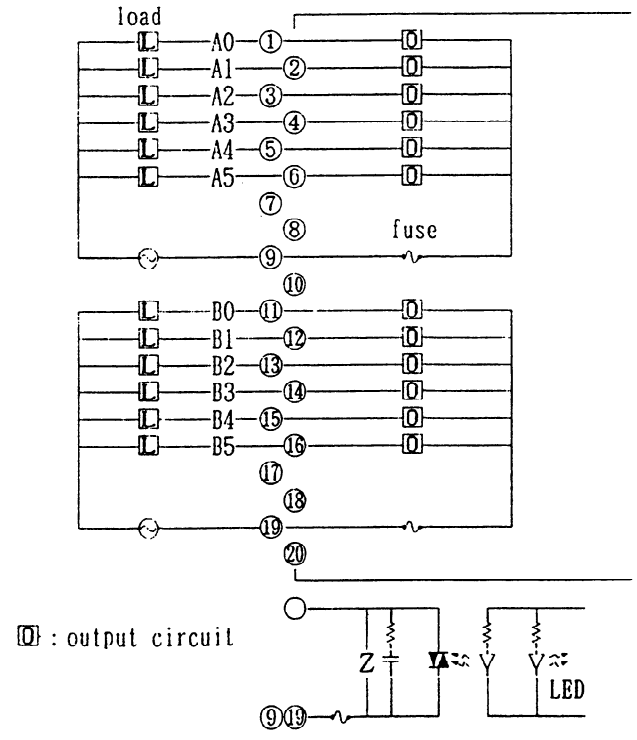
Item		Specifications	
Points/module		8 points	
Points/common		4 points/common	
Rated load voltage		100～230VAC ±15%, 47～63Hz	
Maximum load current		1A (however 2A/common)	
Maximum in rush current		10A(1 period)	
Maximum voltage descent when ON		1.5Vrms	
Maximum leak current when OFF		3.0mA(115VAC), 6.0mA(230VAC)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



O : output circuit

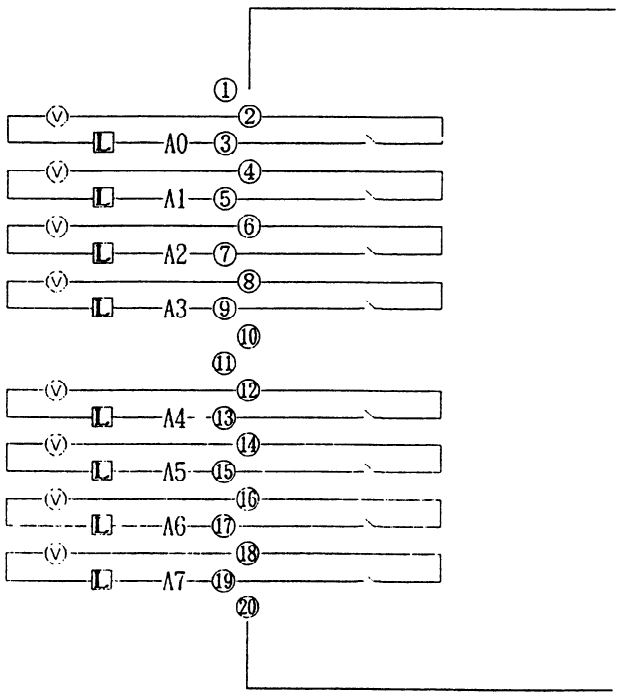


(22) Output module AOA12F

Item		Specifications	
Points/module		12 points	
Points/common		6 points/common	
Rated load voltage		100～115VAC ±15%, 47～63Hz	
Maximum load current		0.5A/point (however, 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 frequency 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～A5 and B0～B5	
Terminal connection and circuitry			

(23) Output module A0R08G

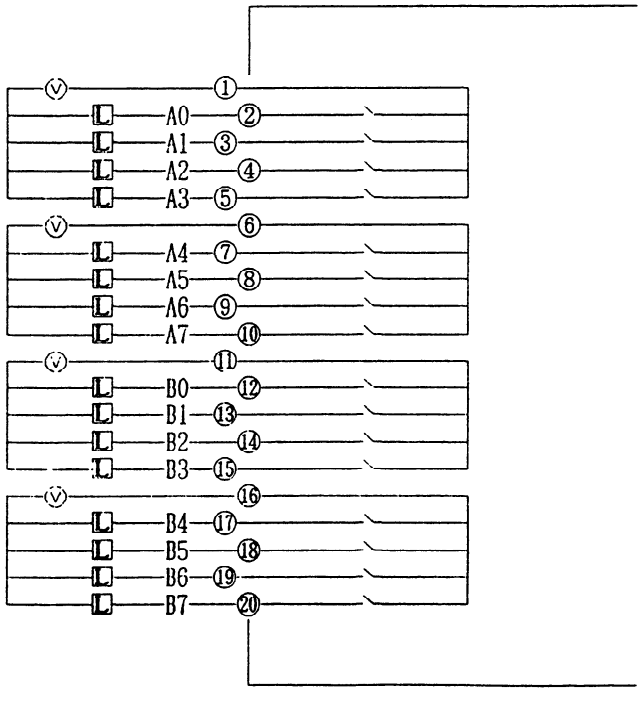
Item		Specifications	
Points/module		8 points	
Points/common		1 point/common	
Maximum load		30VDC/250VAC, 4A(resistance load)	
Minimum load		5VDC, 10mA	
Limit of load		Refer to load derating curve (Fig.5.3(d))	
Response time	OFF →ON	Max.15ms	This is the value from input to output in the module. The actual 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

(24) Output module AOR16G

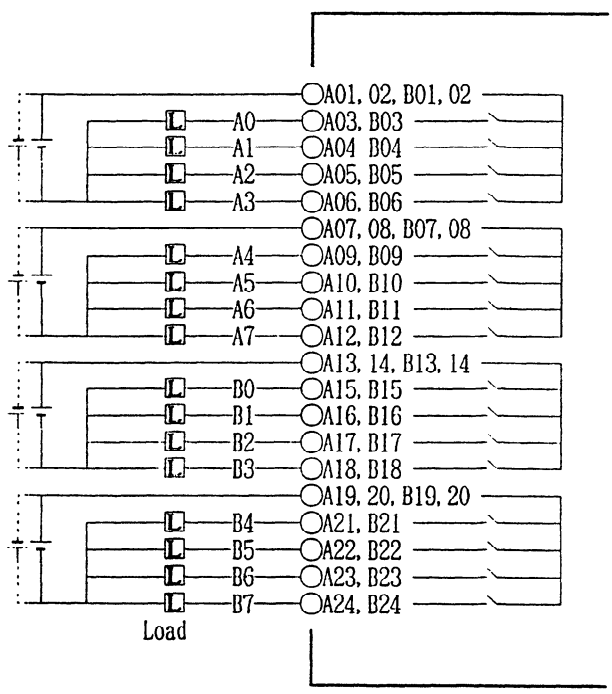
Item		Specifications	
Points/module		16 points	
Points/common		4 points/common	
Maximum load		30VDC/250VAC, 2A(resistance load)	
Minimum load		5VDC, 10mA	
Maximum current		4A/common	
Limit of load		Refer to load derating curve (Fig.5.3(e))	
Response time	OFF →ON	Max.15ms	This is the value from input 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

(25) 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

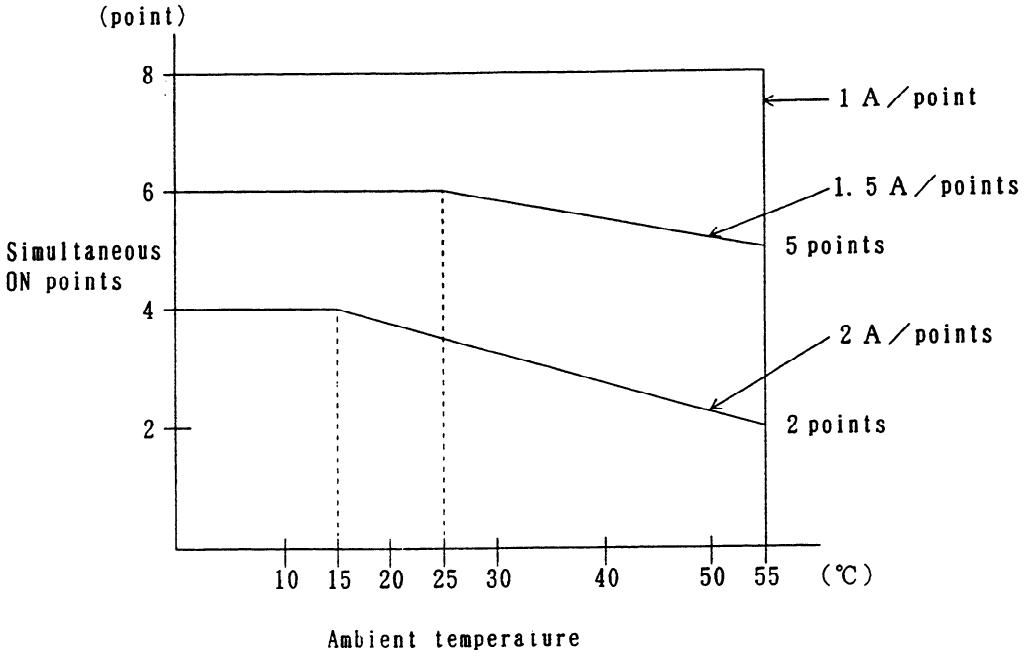


Fig. 5. 3 (a) A O D 0 8 D Load reduction curve

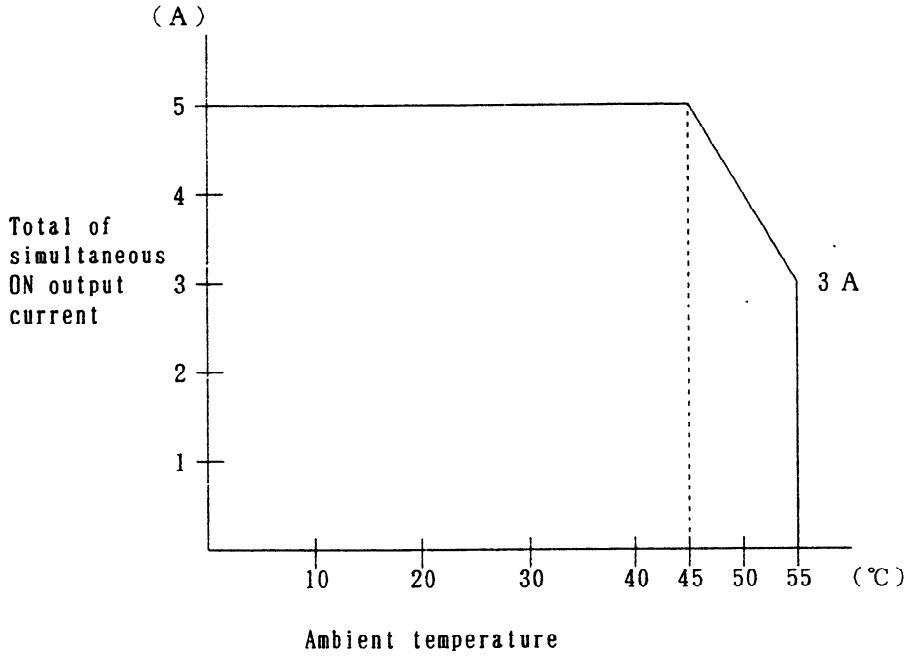


Fig. 5. 3(b) A O A 0 5 E Load reduction curve

(Note) Ambient temperature means the temperature surrounding the I/O unit and not that surrounding the cabinet containing the I/O unit.

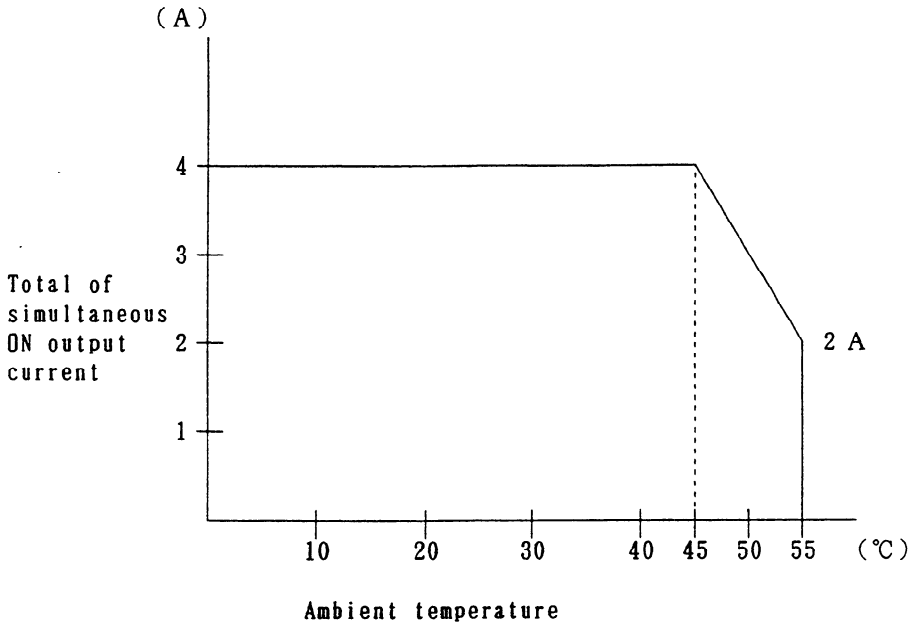


Fig. 5.3(c) AOA12F Load reduction curve

(Note) Ambient temperature means the temperature surrounding the I/O unit and not that surrounding the cabinet containing the I/O unit.

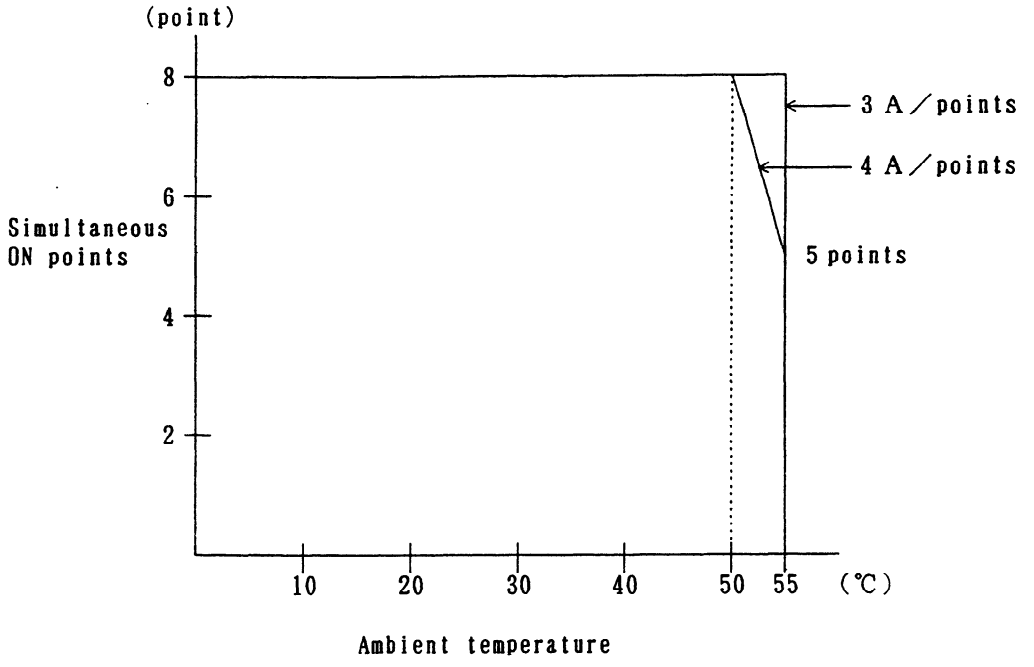


Fig. 5. 3 (d) A O R 0 8 G Load reduction curve

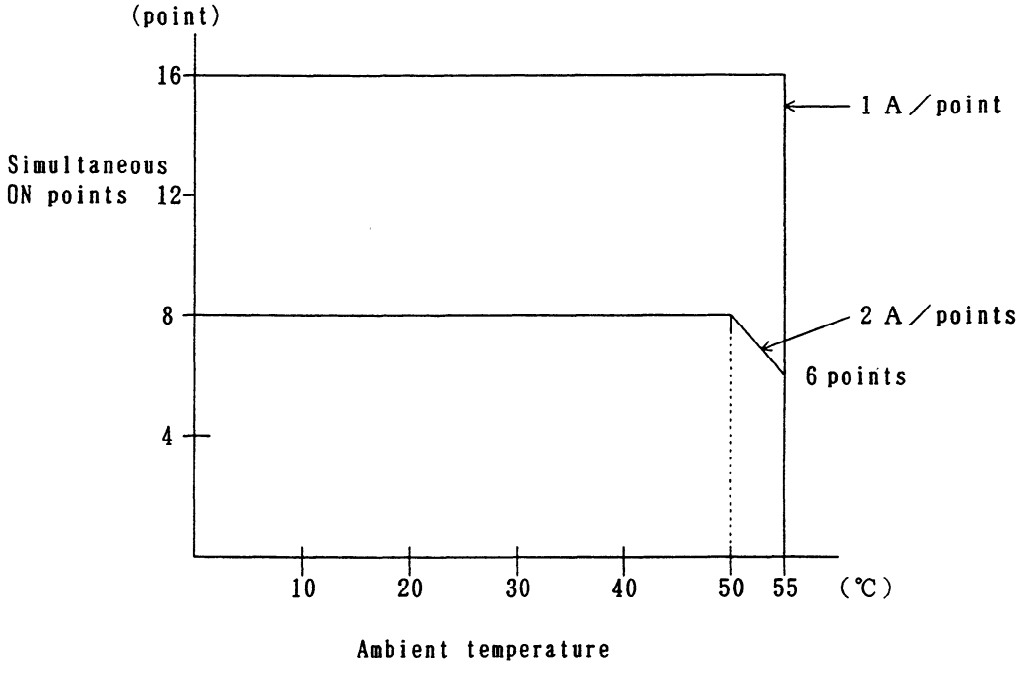


Fig. 5. 3 (e) A O R 1 6 G, A O R 1 6 H 2 Load reduction curve

(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

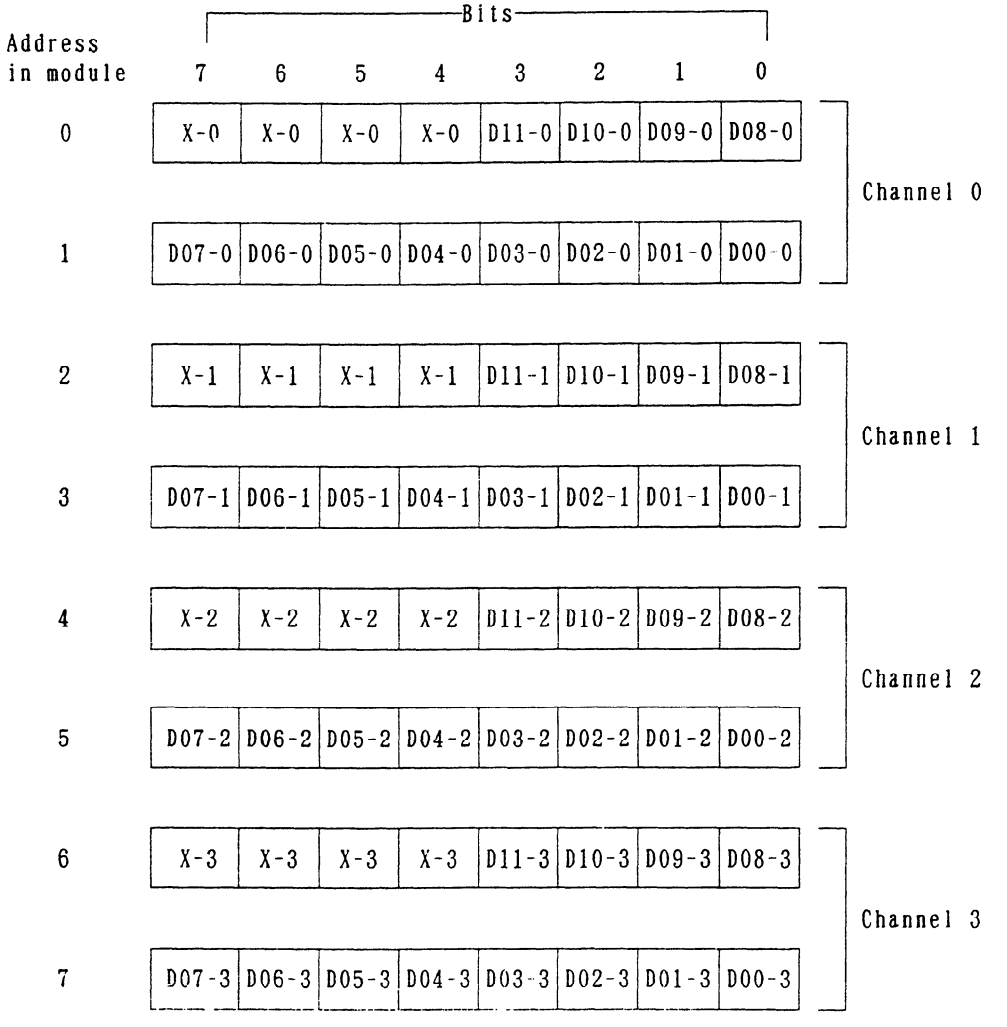
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Number of input channel</td><td>4 channel/module</td></tr>
<tr><td>Analog input</td><td>−10VDC to+10VDC(input resistance 4.7MΩ)
−20mADC to+20mADC(input resistance 250Ω)Selectable</td></tr>
<tr><td>Digital output</td><td>12 bit binary (complementary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

(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.

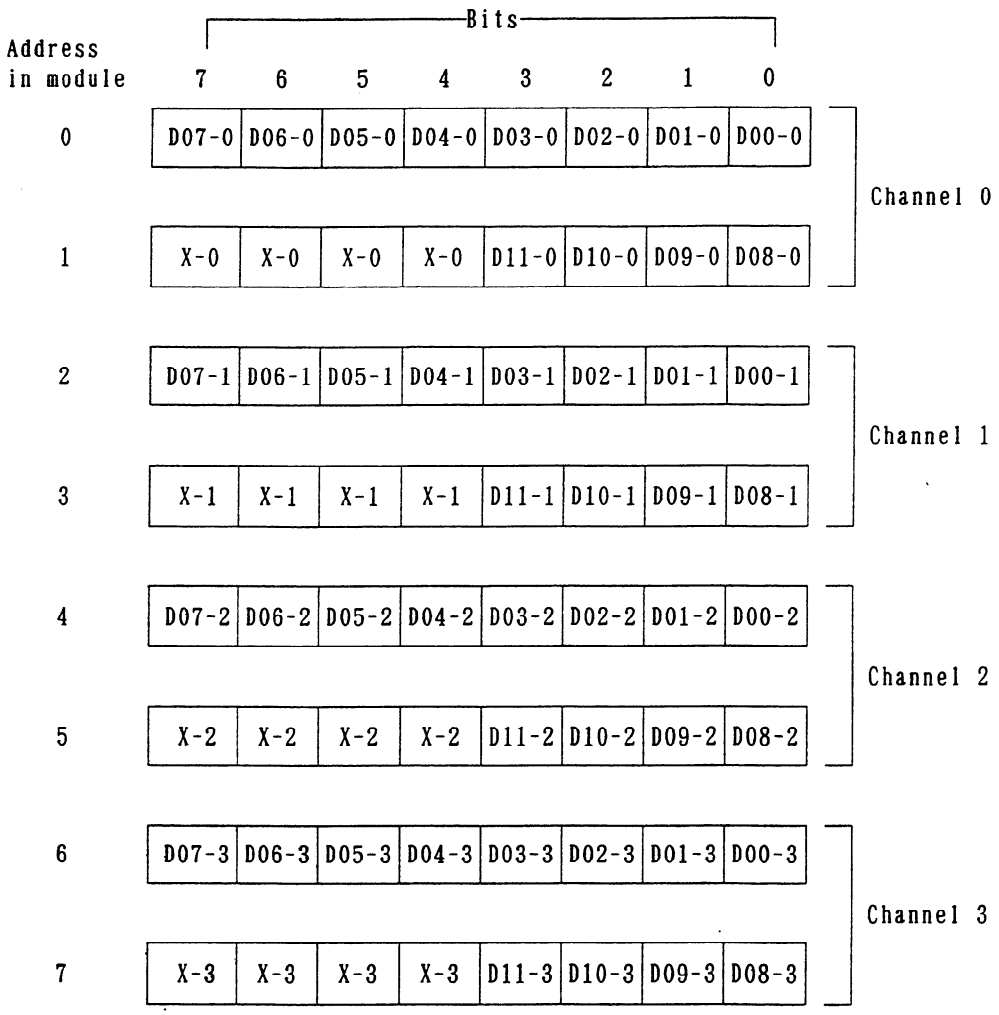
(1) PMC-N, Q (PMC for Series 15 AND F-D Mate)



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).

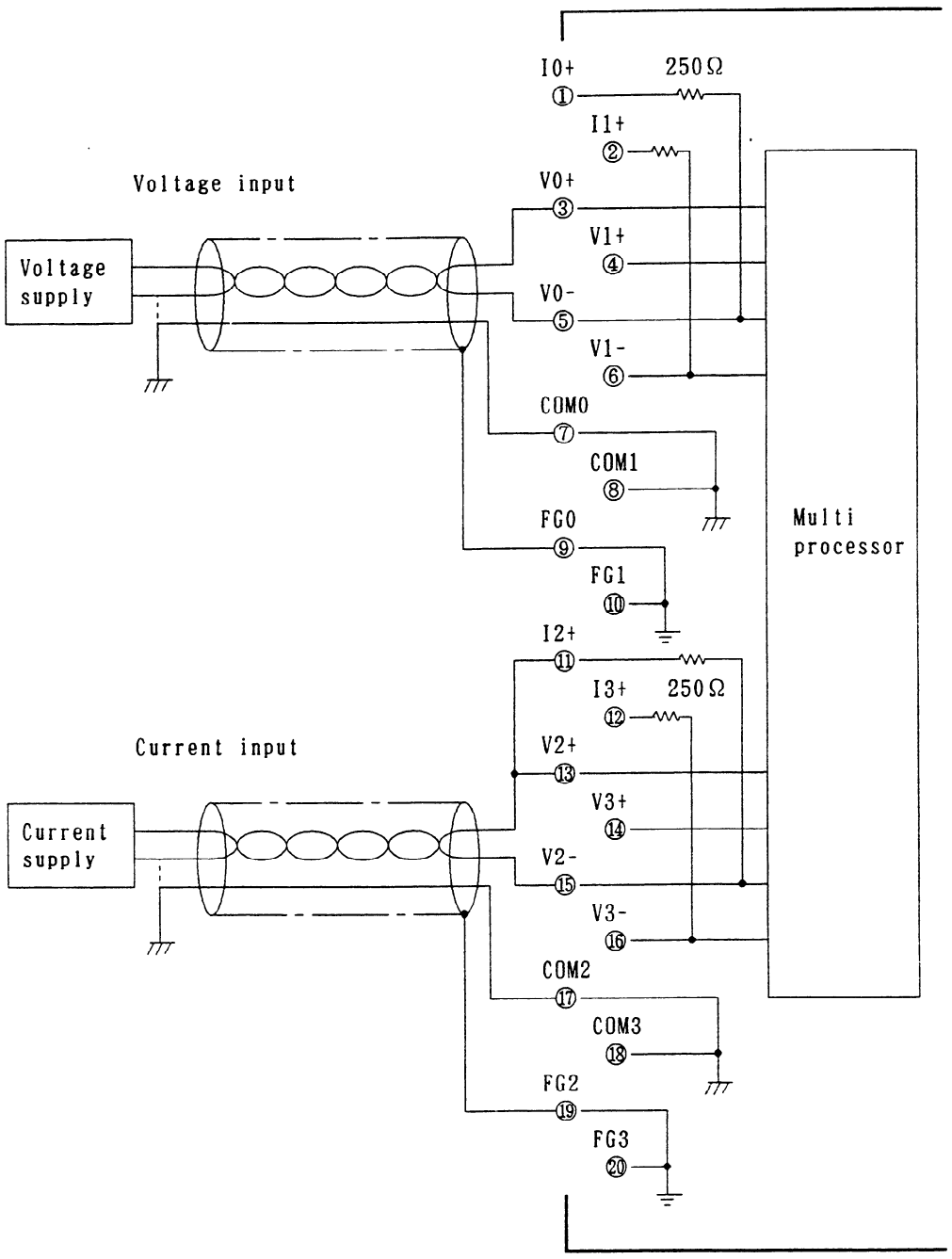
(2) PMC-M, R (PMC for Series 0, Series 16, Series 18)



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).

(Note 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+.

(Note 3) Use shielded cables of twisted pair for connecting.

7. ANALOG OUTPUT MODULE (ADA02A)

7.1 Analog Output Module Specification

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Number of output channels</td><td>2 channels/module</td></tr>
<tr><td>Digital input</td><td>12-bit binary (2's complement representation)</td></tr>
<tr><td>Analog output</td><td>-10VDC～+10VDC(external load resistance: 10KΩ or more)
selectable
0mADC～+20mADC(external load resistance: 400Ω or less) usable</td></tr>
<tr><td>Input/output correspondence</td><td>
<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>
</td></tr>
<tr><td>Resolution</td><td>5mV or 20μA</td></tr>
<tr><td>Comprehensive accuracy</td><td>Voltage output ±0.5% (For the full scale)
Current output ±1% (For the full scale)</td></tr>
<tr><td>Converting time</td><td>1ms or less (note)</td></tr>
<tr><td>Insulation</td><td>Photocoupler insulation (between output signal and base).
However, non-insulation between output channels.</td></tr>
<tr><td>External connection</td><td>At removable terminal block (20 terminals, M3.5 screw terminals)</td></tr>
<tr><td>Number of occupied output points</td><td>82</td></tr>
</table>

(Note) 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.

7.2 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)

Addresses 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	

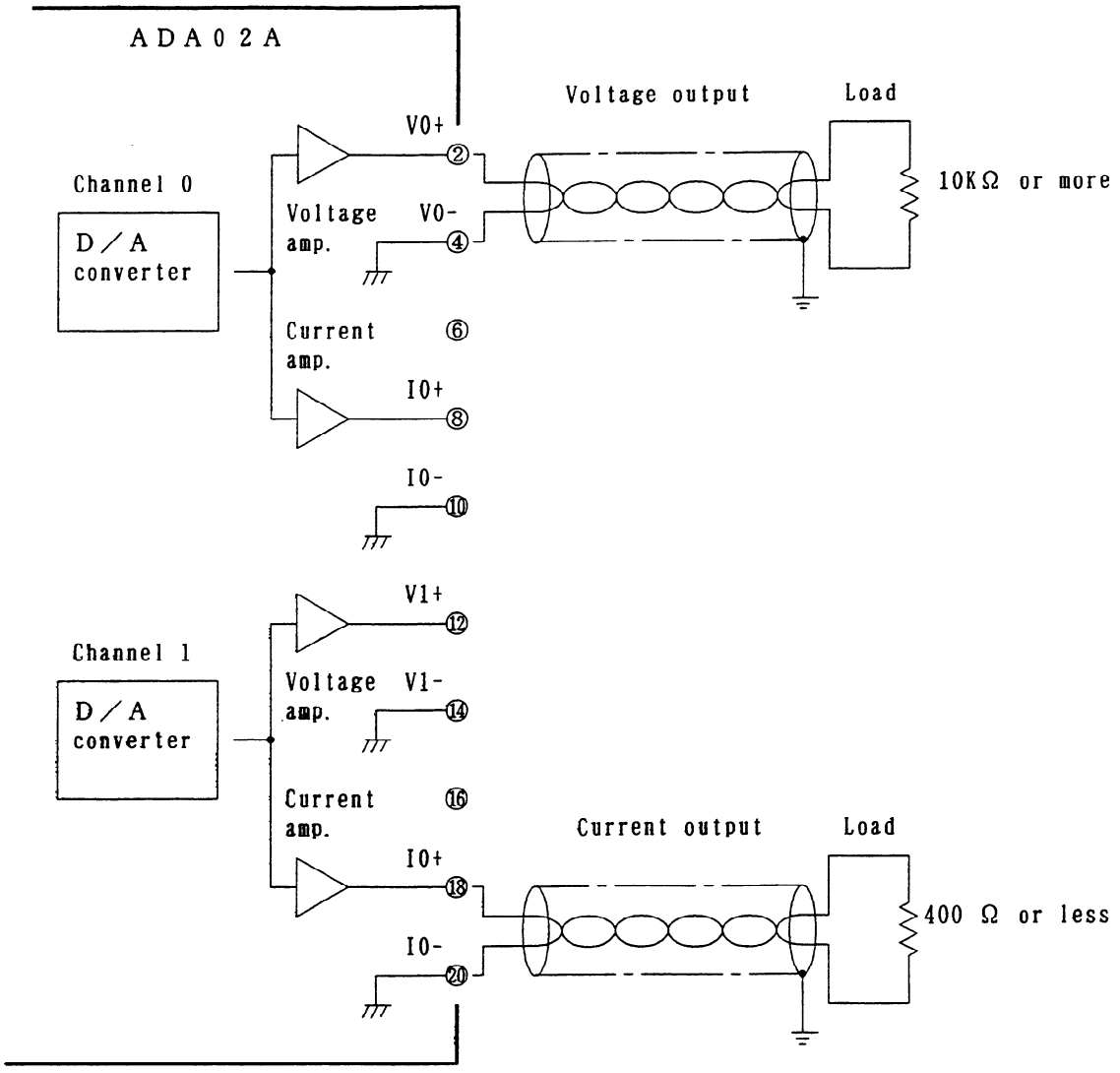
(2) For PMC-M/R (PMC for Series 0/Series 16)

Addresses 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).

7.3 Connection to Analog Output Module



(Note 1) Use a 2-core twisted shielded cable as the connection cable.

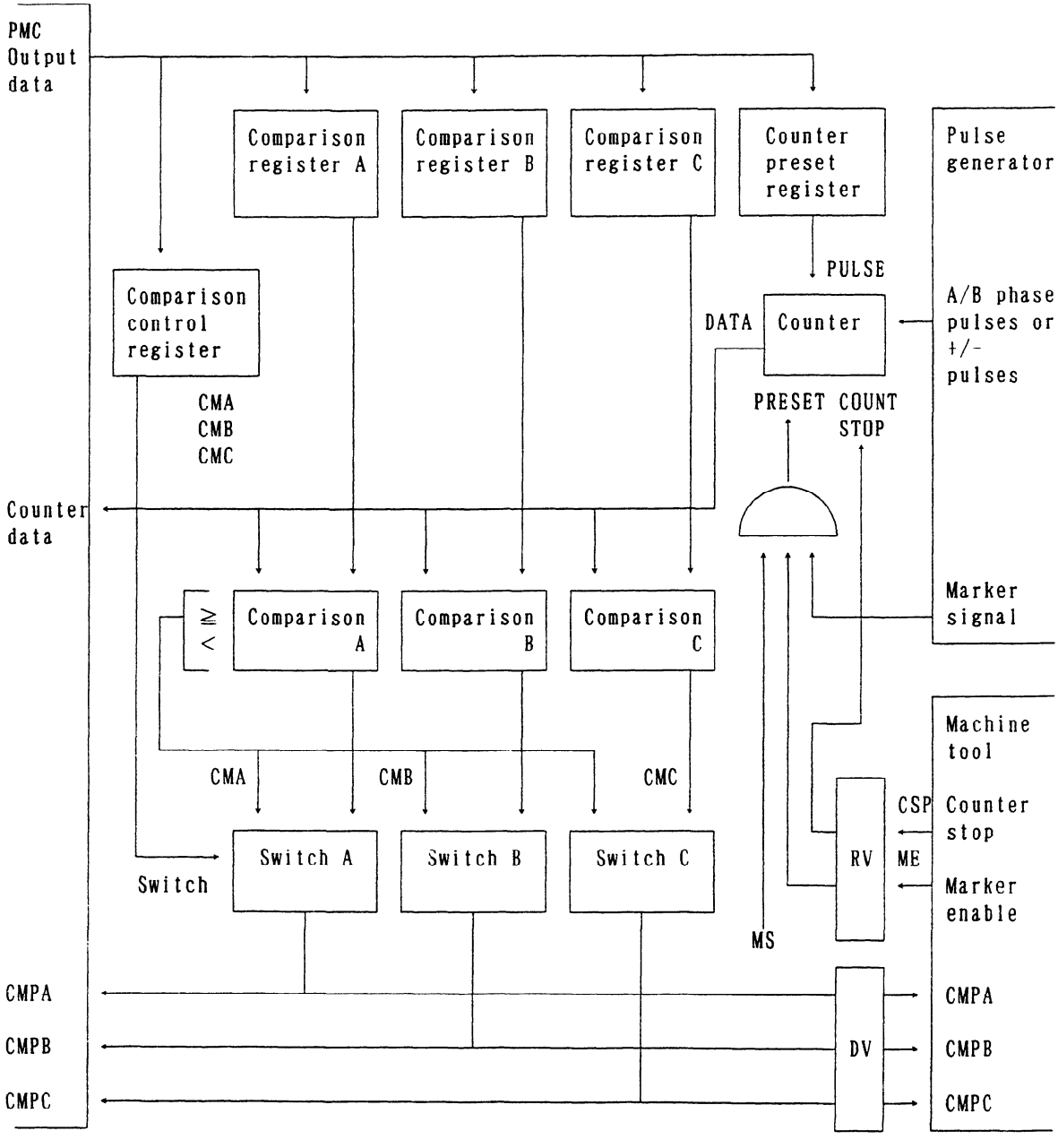
(Note 2) Ground the cable shield on the load side.

8. HIGH SPEED COUNTER MODULE

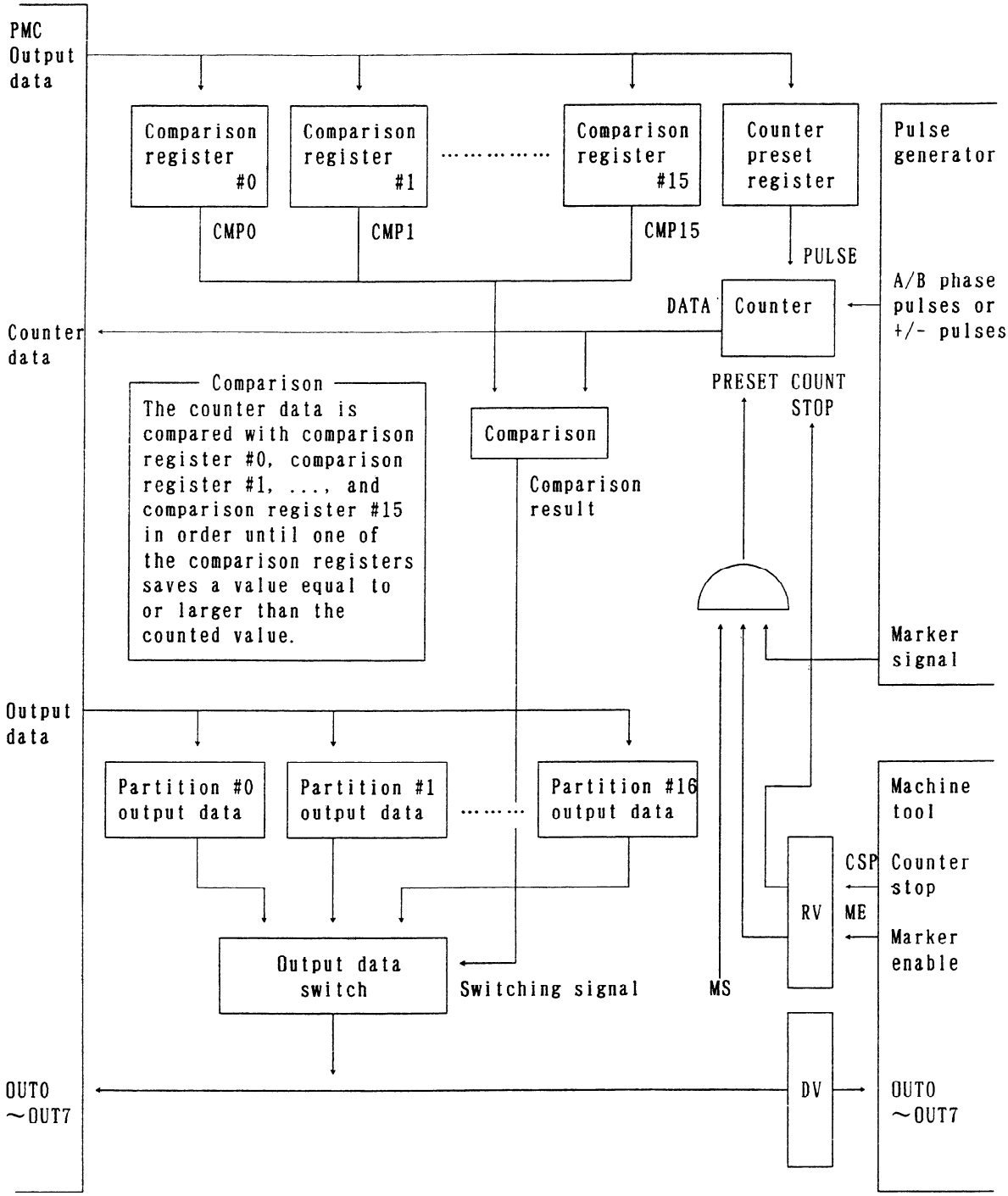
8.1 Outline of High Speed Counter Module

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 registers for comparing preset values with counter data. The module can read the counter data and output 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 ~OUT7
OUT0 ~OUT7

8.2 Specifications of High Speed Counter Module

8.2.1 Pulse counter

(1) Binary up/down counter (1)

(2) Counter capacity
0 ~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 values depend 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 CMPA=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

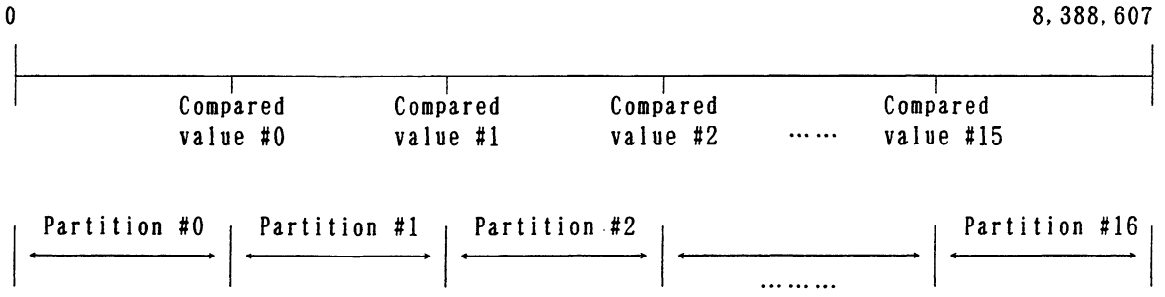
(2) Mode B

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 < value in register 15

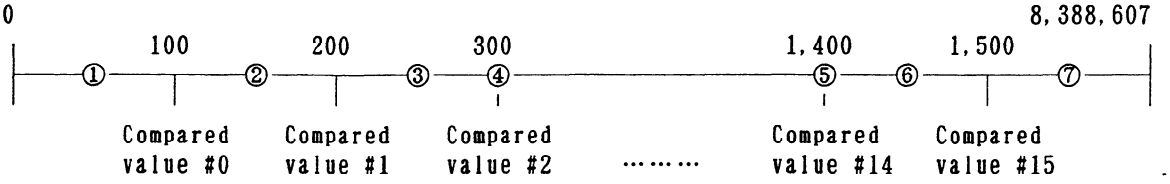
B. Comparison output
The results (OUT0 to OUT7) of comparing the count data in the pulse counter with the data set in the comparison registers are output.

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 made which 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.



Example)



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 in① 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.

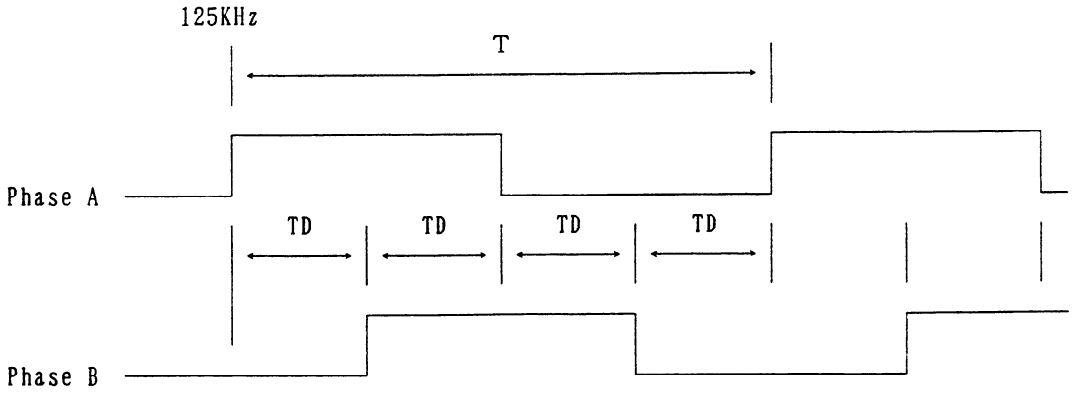
Select either type of the detection pulse.

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

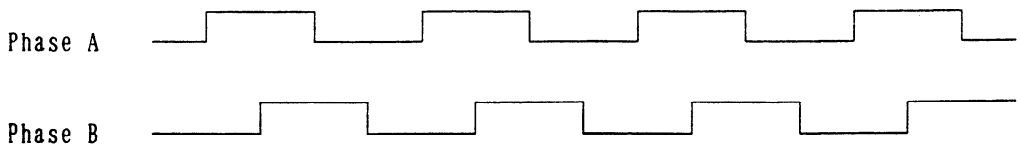


Tmin. = 8 μ S (minimum period)
TDmin. = 1.2 μ S (minimum time between edges)

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.

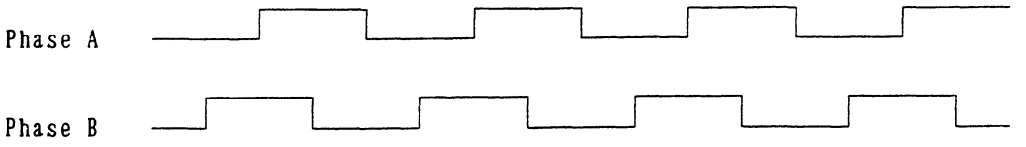
Positive count

Advance of phase A before phase B



Negative count

Advance of phase B before phase A

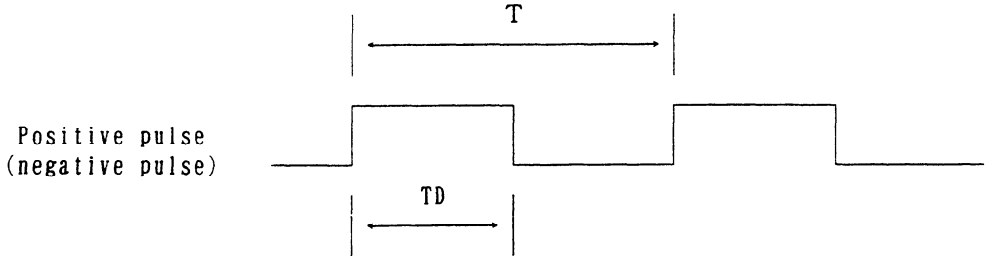


(2) Positive/negative pulse interface
Positive and negative pulses are selected when the PSEL signal is connected to 0 VDC.

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

B. Maximum frequency

500KHz



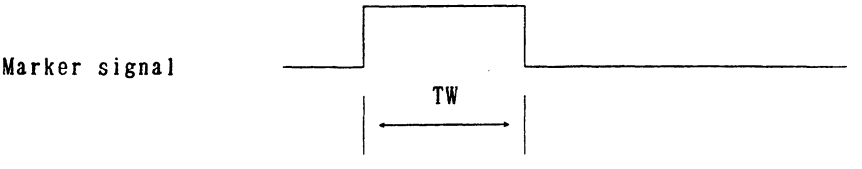
Tmin. = 2 μS (minimum period)
TDmin. = 0.5 μS (minimum pulse width)

(3) Marker signal

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

B. Minimum pulse width

1 μs or more



TWmin. = 1 μS

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 signal input (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 Table 8.1.

(2) ALM0 and ALM1 indicators
See Table 8.1.

(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.

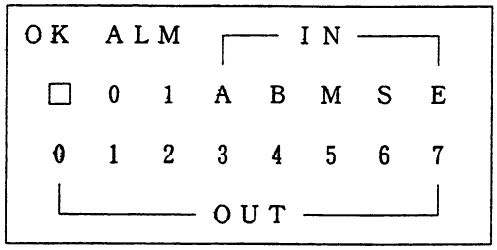
(5) Count stop signal indicator (S)
The count stop signal indicator is on when the contact of the count stop signal input sent from the machine is closed.

(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 - OUT7 resulting from the comparisons between the count data and comparison resisters are set 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 are specified 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".
Note 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 are specified 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 when the 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 changes to 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.

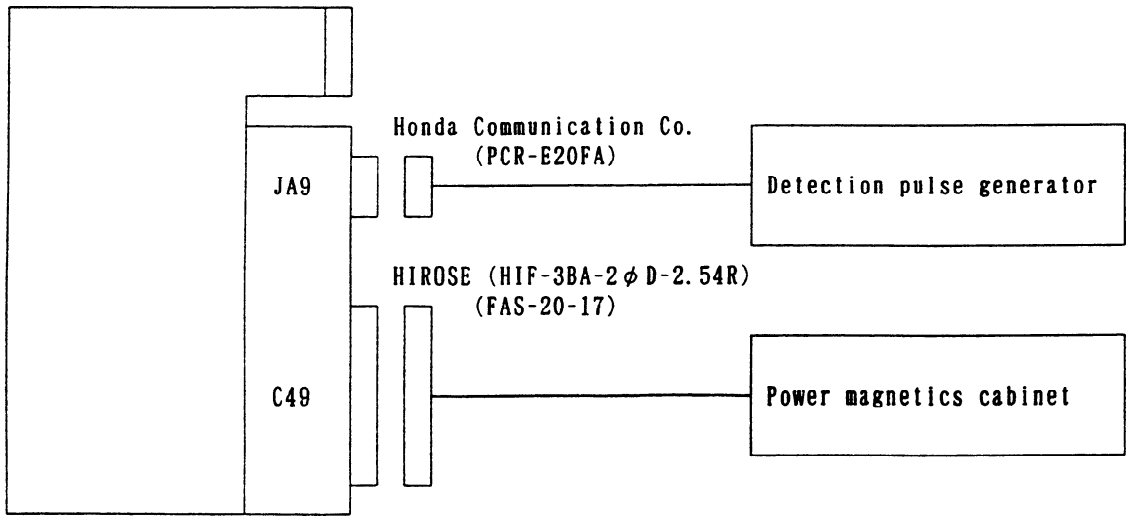
4) MS (marker synchronization signal)
The MS signal determines whether marker synchronization is provided. When the MS is 1 and the the contact of external input signal ME is closed, the counter is preset to the value in the counter preset register at the rising edge of the first marker signal. If the MS is set to 0 then set to 1 or the MHR is set to 1 then set to 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. The MHR 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	15		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
LGND : 0V

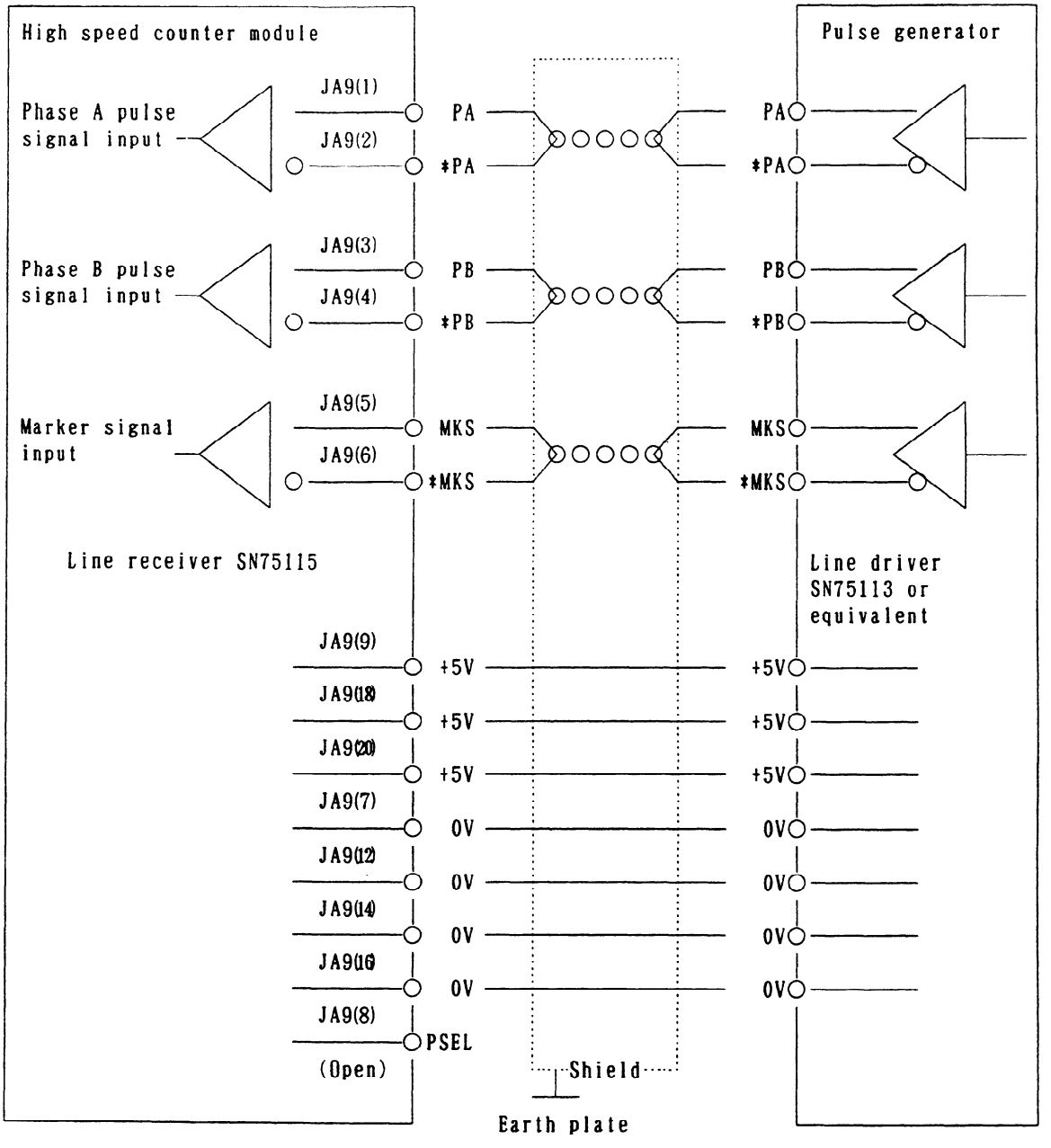
C49

	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

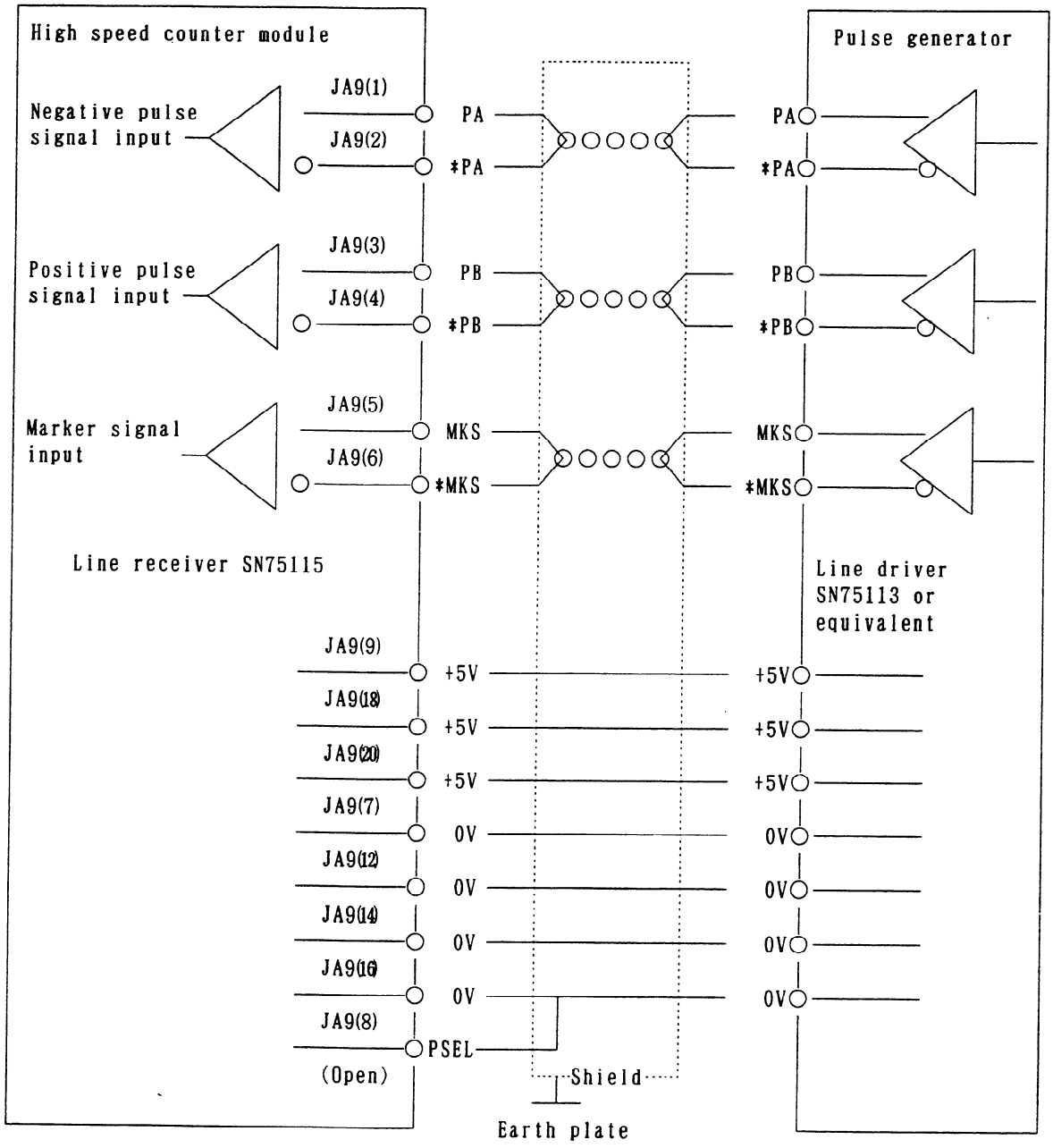
8.5 Connection with pulse generator

8.5.1 Use of phase A and B pulses



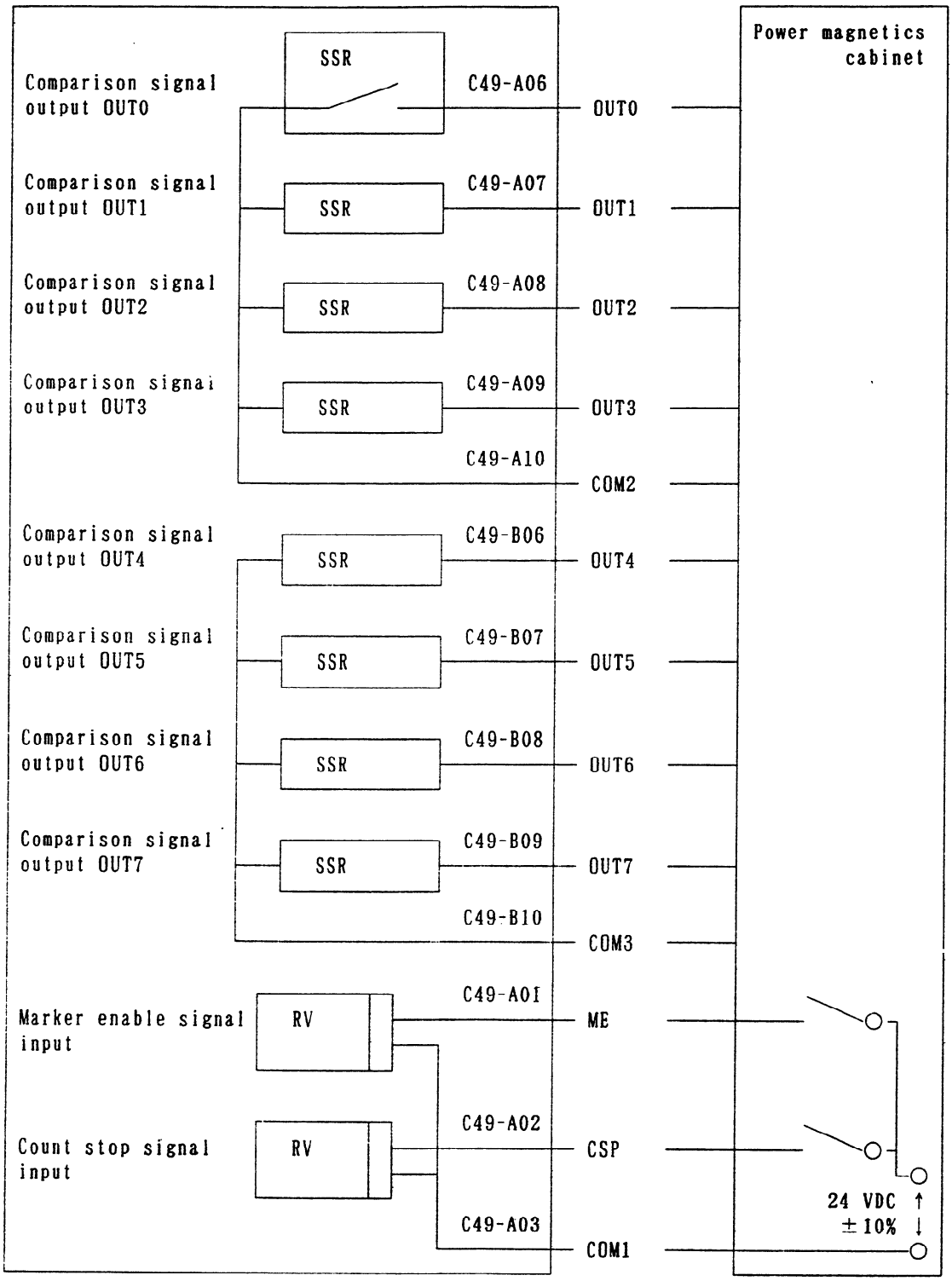
Recommended cable
A66L-0001-0286(#20AWG×7, #24AWG×3 Pairs)

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

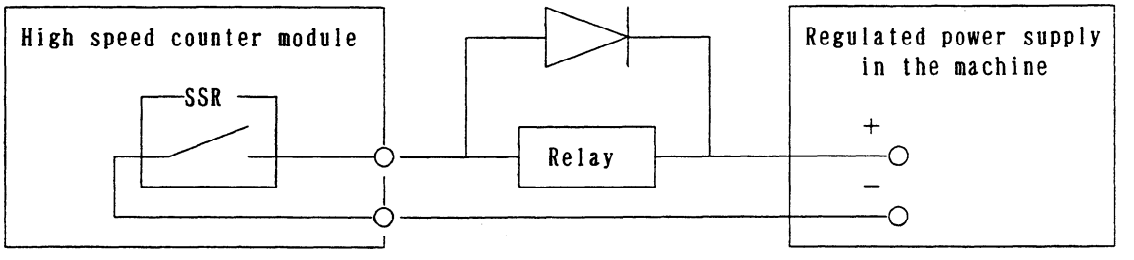
i) Maximum load current at output-on
250 mA: Up to three outputs set to on
125 mA: Eight outputs set to on

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

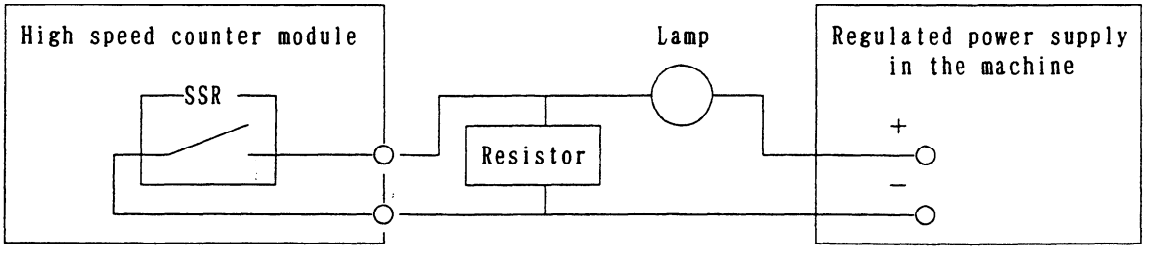
iv) Leak current at output-off
Not more than 100 μA

(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.

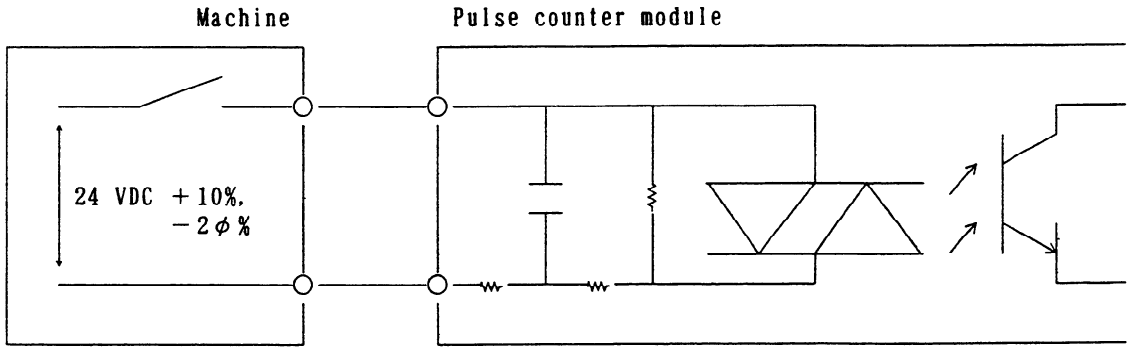
(1) Input conditions
On voltage and current: 15 VDC or more, 4.5 mA or more
Off voltage and current: 6 VDC or less, 2 mA or less
Response time: 20 mA or less

(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



9. OPTICAL I/O LINK ADAPTER

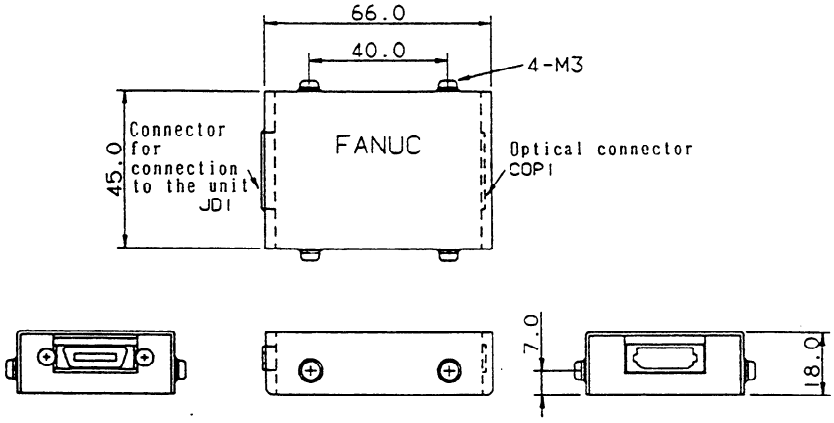
The signal cable KIX shown in the general connection deagram (in section 4.1) can be extended to the maximum length of 200 m with optical fiber cables using an optical I/O link adapter.

(Note1) For the cable K2X, the optical I/O link adapter can not be applied to.

(Note2) In the following cases, make sure to use an optical fiber cable for KIX.

- When the cable is more than 10 meters long.
- When the cable KIX runs between different cabinets and it is impossible to connect the cabinets with a wire of 5.5 mm^2 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.

9.1 External Dimension of Optical I/O Link

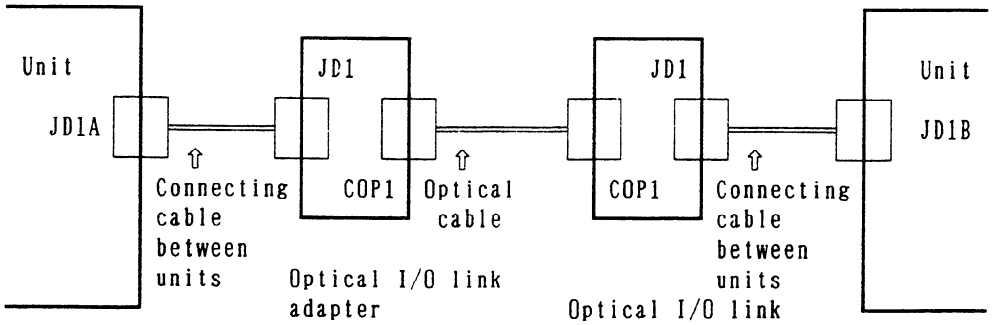


9.2 Weight of Optical I/O Link

1) Main body: Approx. 100g

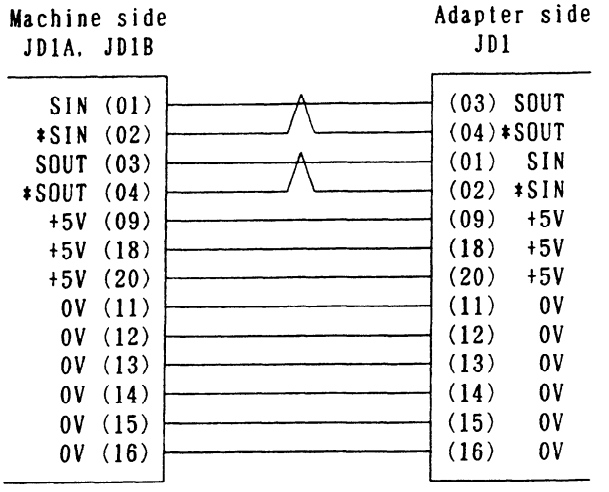
9.3 Connection of Optical I/O Link

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)

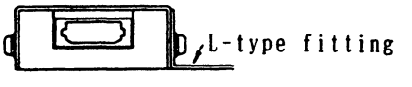
3) Optical cable
① Specification: A66L-6001-0009(Make sure to use one with this specification)
② Cable length: Max. 200m

9.4 Power Source of Optical I/O Link

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

9.5 Installation Conditions of Optical I/O Link

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.

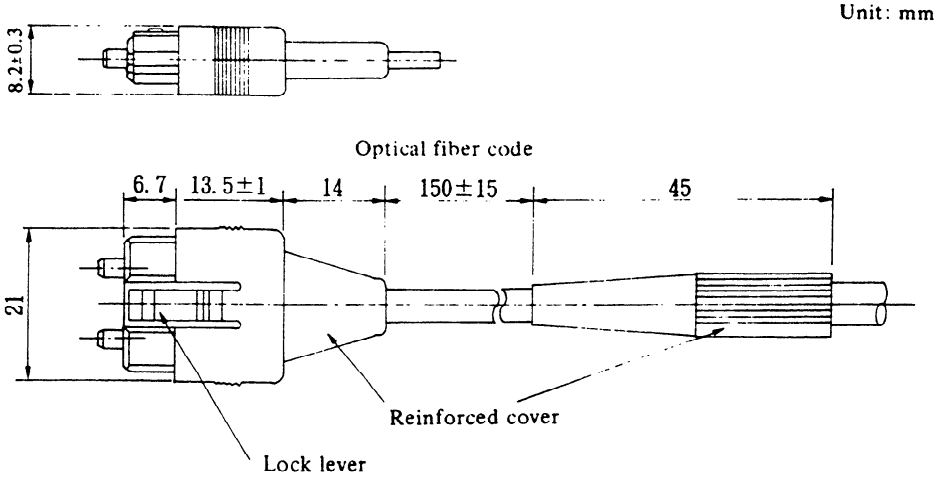


9.6 Optical Fiber Cable

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.

9.6.1 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.

9.6.2 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.

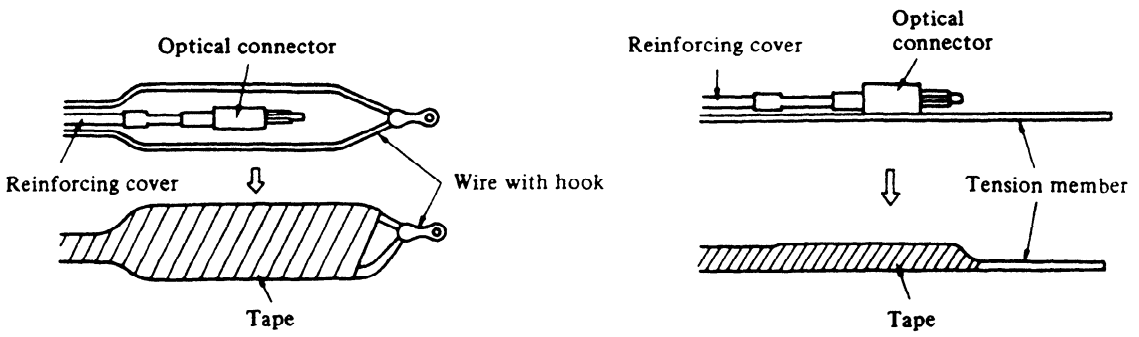
(2) Detaching and attaching of optical connector should always be made by touching connector. Optical fiber code should not be touched when replacement.

(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 optical connector does not receive pulling strength.

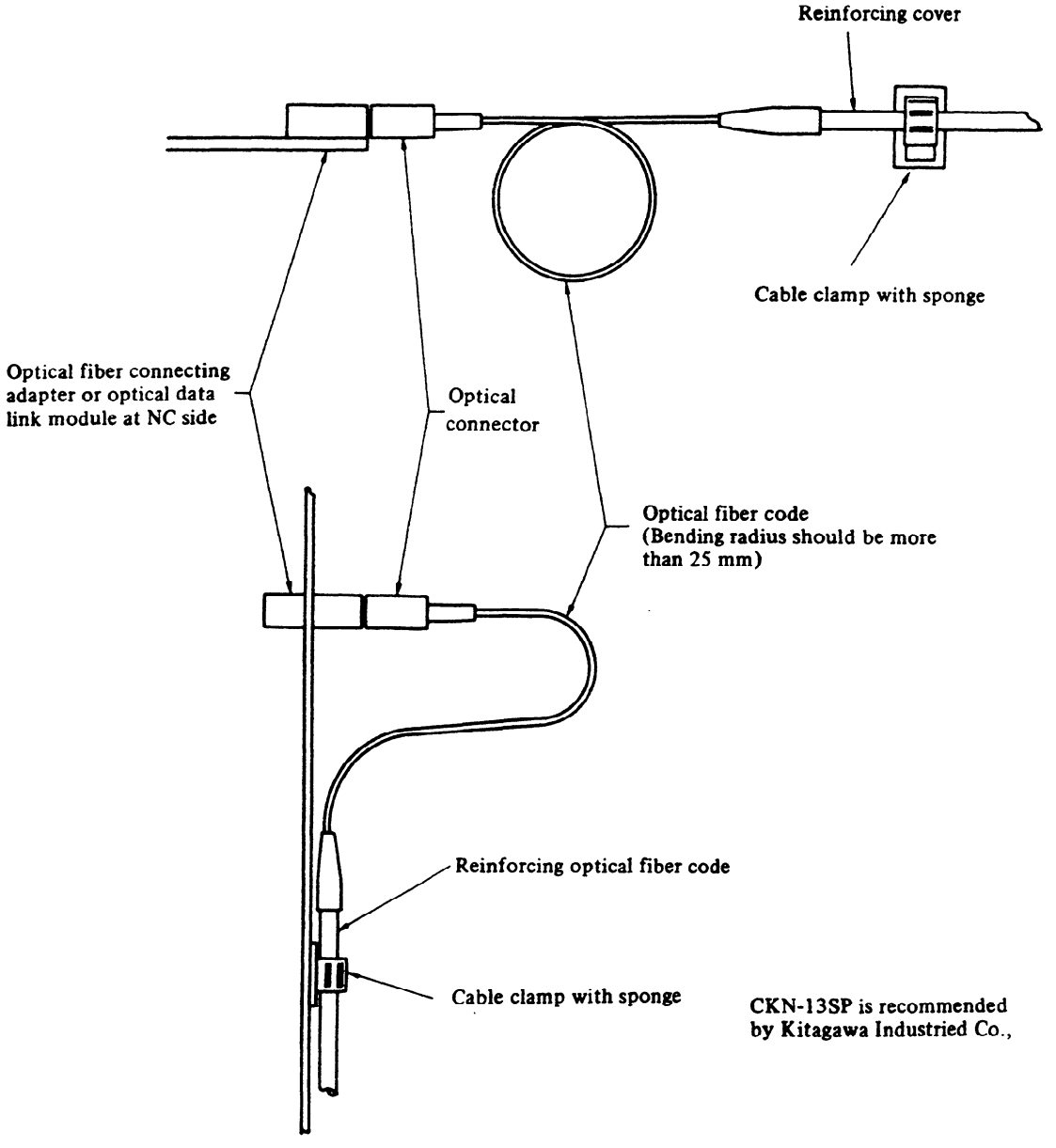


(6) Reinforcing cover is fixed to cable lamp so that optical fiber cable could not weigh directly the connecting part of connector.

(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.

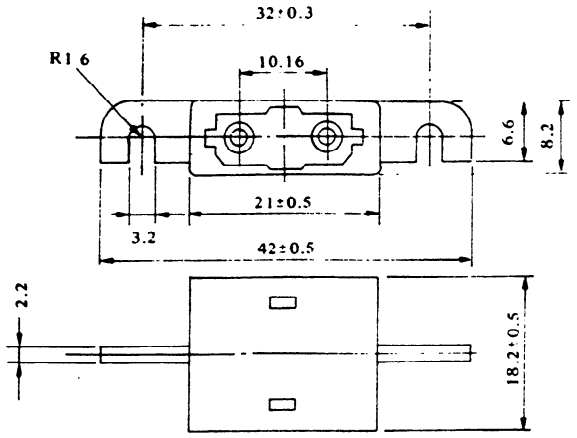
9.6.3 Optical fiber cable clamping method

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.

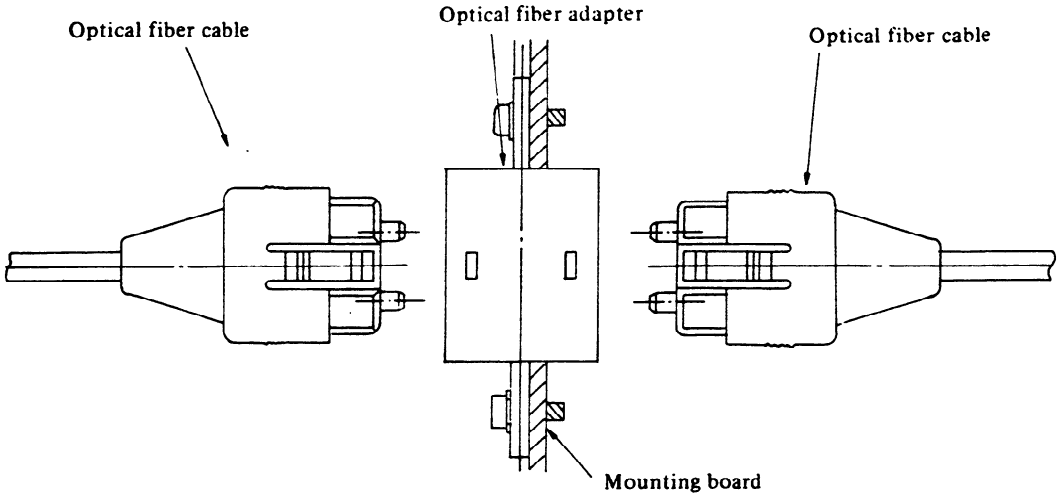


9.6.4 Relay using an optical fiber adapter

(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.

9.6.5 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.

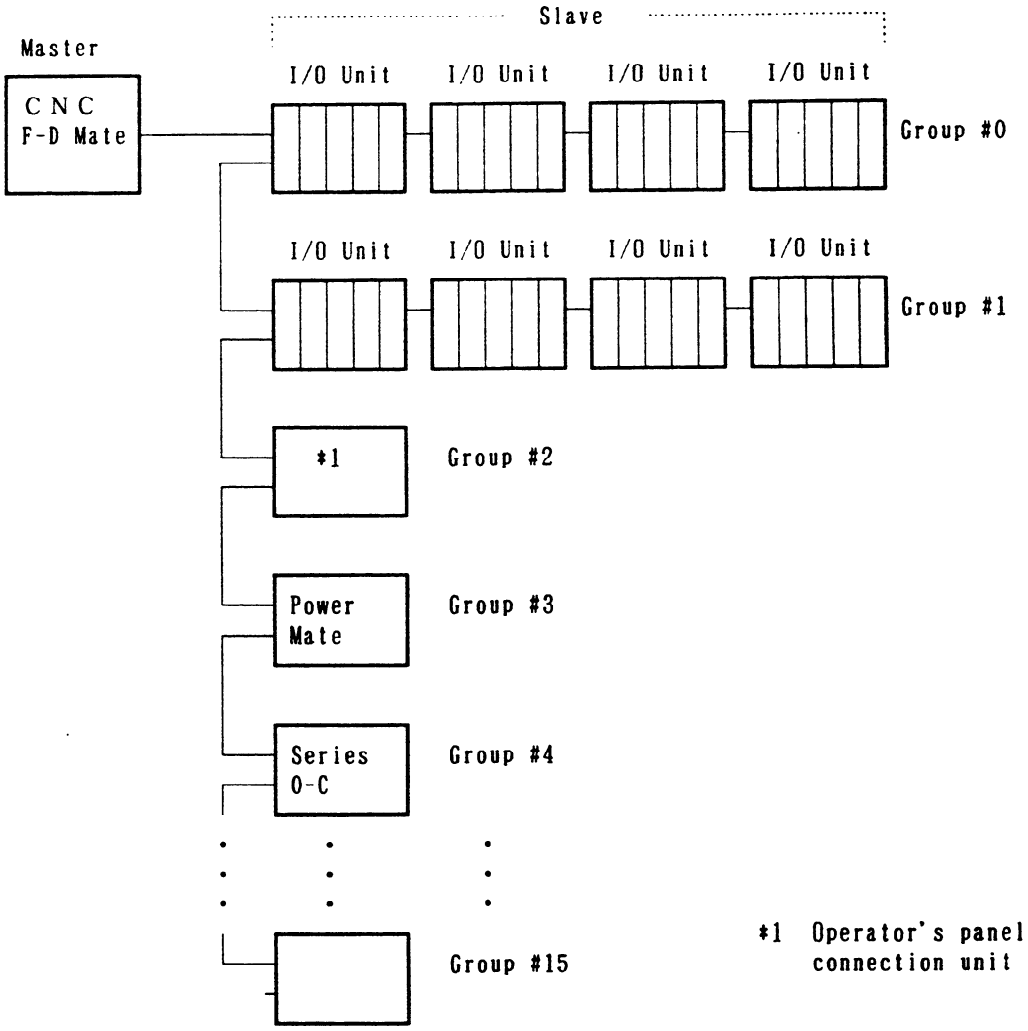
Relay points	Max. trans. distance (total)
0	200m
1	100m

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.



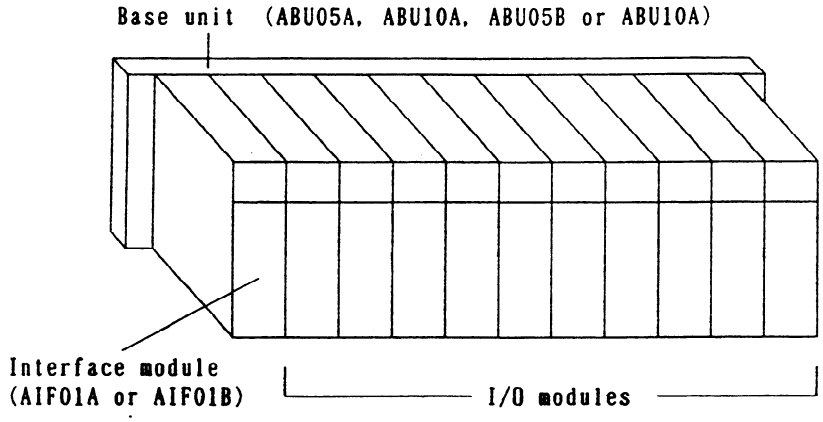
1) The I/O Link consists of a master and slaves.

   Master: Series 0-C, Series 15, Series 16, Series 18 and F-D Mate
   Slave: I/O Unit-A, Power Mate-A, B, C operator's panel connection unit, and Series 0-C

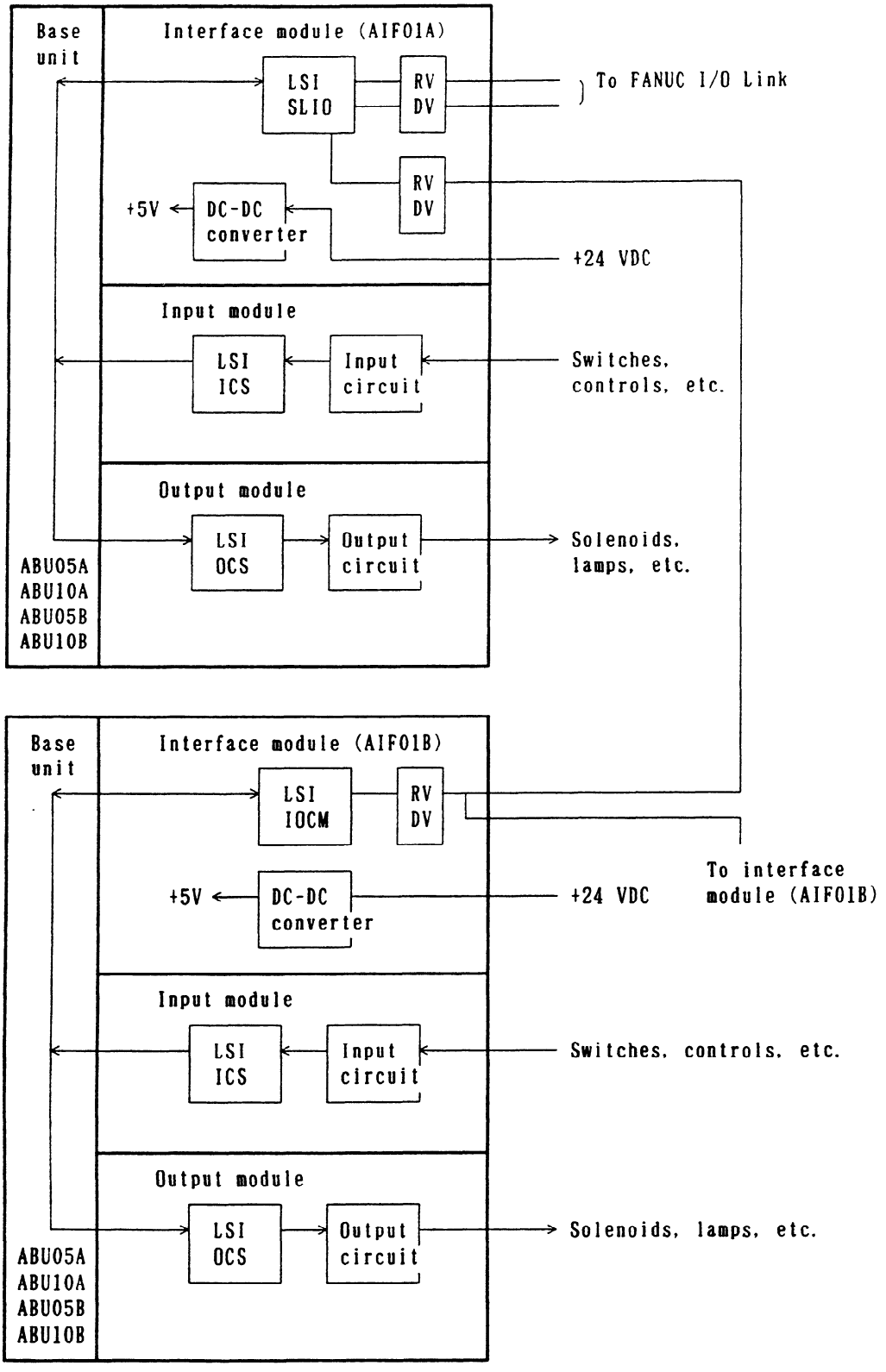
2) One I/O Link can connect to up 16 groups of slaves. If the master is not a CNC, one slave group can contain up to 4 of I/O Unit A (4 base units). If the master is a CNC (Series 0-C, Series 15, Series 16 or Series 18), the number of units per slave group is limited to within 2.

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-9001-0550
Base unit. 5 slots	Horizontal type		ABU05A	A03B-0807-J002	A03B-0807-C002	A20B-9001-0020
	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
DC input module	Non-insulations	32 points. 20ms	AID32A1	A03B-0807-J101	A03B-0807-C101	A20B-9000-0970
		32 points. 2 ms	AID32B1	A03B-0807-J102	A03B-0807-C102	A20B-9000-0971
		8 points. 2 ms 24 points. 20 ms	AID32H1	A03B-0807-J111	A03B-0807-C111	A20B-9000-0972
	Insulations	16 points. NEG	AID16C	A03B-0807-J103	A03B-0807-C103	A20B-9000-0931
		16 points. POS	AID16D	A03B-0807-J104	A03B-0807-C104	A20B-9000-0901
		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. 2 ms	AID32F1	A03B-0807-J106	A03B-0807-C106	A20B-9001-0011
		32 points. 2 ms	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

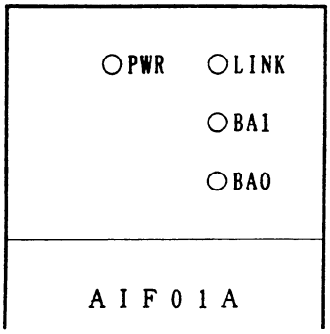
(to be continued)

Name				Arrangement drawing No.	Unit drawing No.	PCB drawing No.
DC output module	Insula-tions	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. 2 A	AOA05E	A03B-0807-J157	A03B-0807-C157	A20B-8000-0470 or -8000-0251
		8 points. 1 A	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. 4 A	AOR08G	A03B-0807-J160	A03B-0807-C160	A20B-9001-0200 or -9000-0961
		16 points. 2 A	AOR16G	A03B-0807-J161	A03B-0807-C161	A20B-8000-0101
		16 points. 2 A	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			ADA02A	A03B-0807-J052	A03B-0807-C052	A20B-8000-0460
High speed counter module			ACT01A	A03B-0807-J053	A03B-0807-C053	A20B-8000-0540

2. INDICATION

The interface modules and the I/O modules with up to 16 input/output points have LEDs to indicate 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 interface 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 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-4.2)
- 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 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 with power. (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.

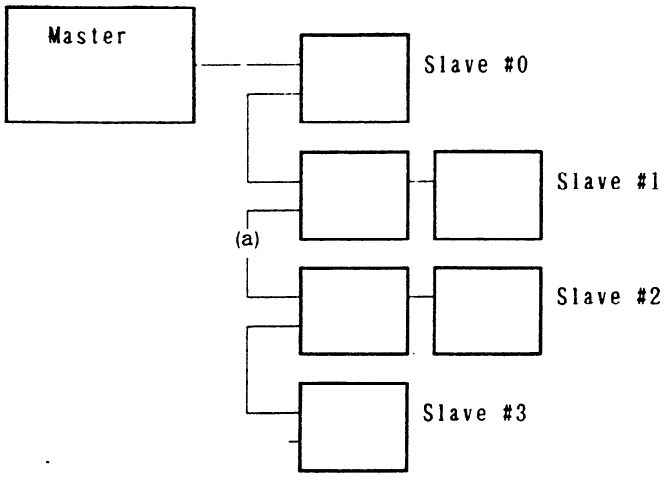
⇨ With reference to Note below, check the cables, and take an appropriate action.

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

⇨ With reference to Note below, find a defective device, and take an appropriate action. If an I/O unit seems to be defective, replace interface module AIF01A with 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/O Link is established with the master. (Refer to the maintenance manual for the master.)



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.

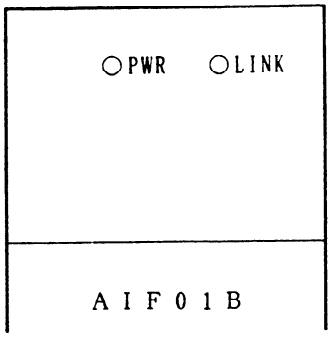
③ The I/O Link cable is broken or short-circuited.

⇨ 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 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-4.2)
- 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.

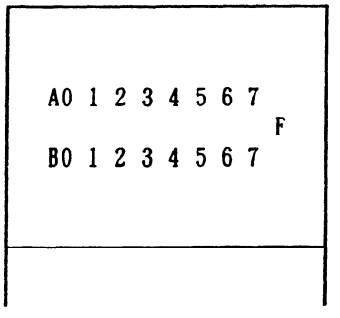
④ An interface module is defective.

⇨ Replace it with a spare.

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

① See section 2.1.

2.3 I/O Module LEDs (Module with 16 or Less I/O Points)



Marking	Name	Description
A0～7 B0～7	I/O indication	On: The corresponding input or output point is operating.
F	Fuse alarm	On: The fuse 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
Output module with 8 DC points A0D08C	F is on.	5A	A60L-0001-0260#5R00
Output module with 8 DC points A0D08D	F is on.	5A	A60L-0001-0260#5R00
Output module with 5 AC points A0A05E	F is on.	3.15A	A60L-0001-0276#3.15
Output module with 8 AC points A0A08E	F is on.	3.15A	A60L-0001-0276#3.15
Output module with 12 AC points A0A12F	F is on.	3.15A	A60L-0001-0276#3.15

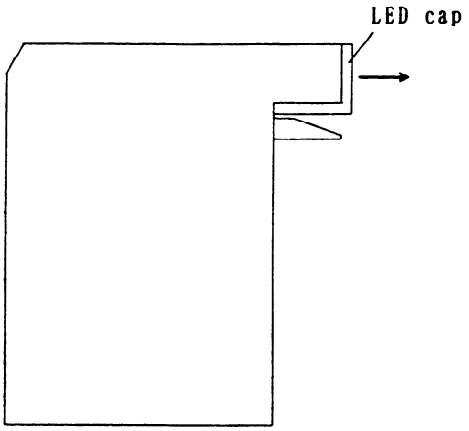
The fuses are on the PC boards in the modules.

4. REMOVING PC BOARDS

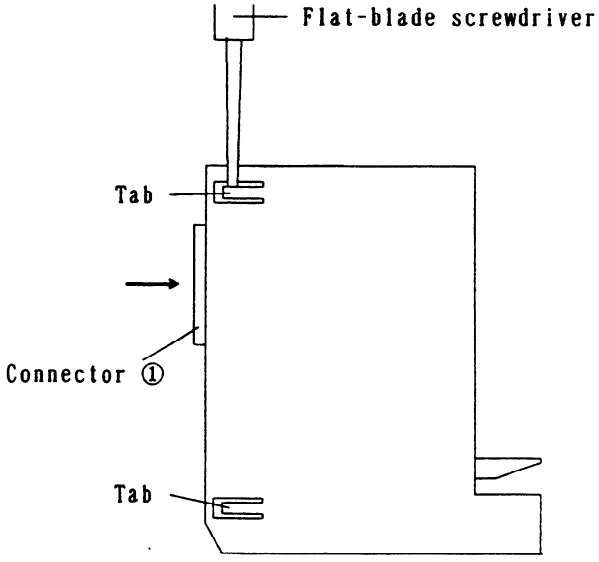
4.1 How To Remove Terminal Board-type I/O Module PC Boards

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

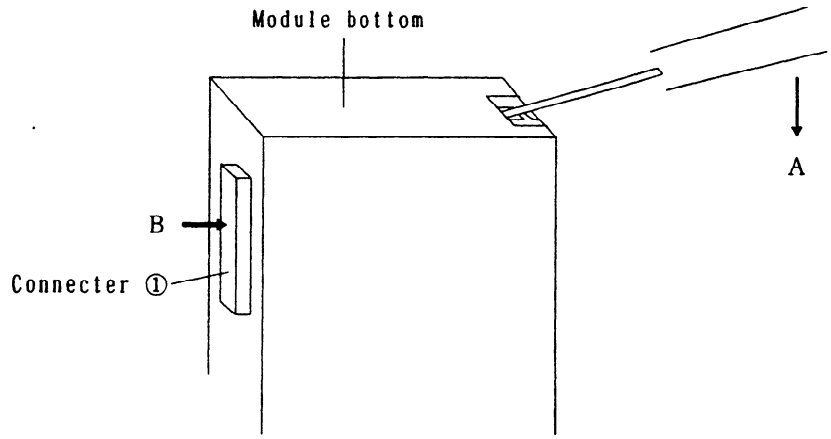
② Pull the LED cap in the direction of the arrow to remove it.



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

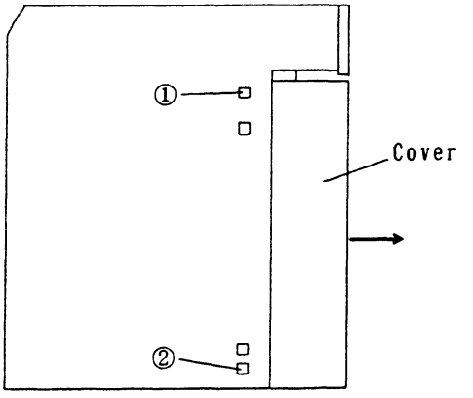


④ Put the tip of a flat-blade screwdriver into the gap between the module case and terminal board connector, as shown below. While pressing the screwdriver in the direction of arrow A, push connector① in the direction of arrow B, and the PC board will come out.

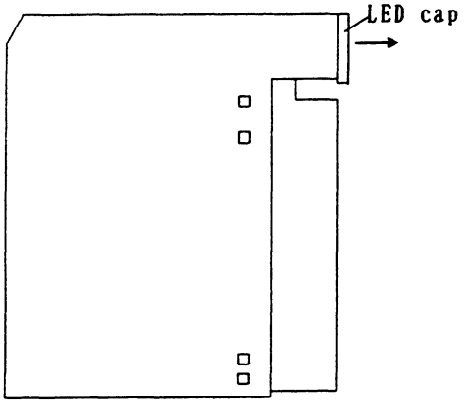


4.2 How To Remove Interface and Connector-type I/O Module PC Boards

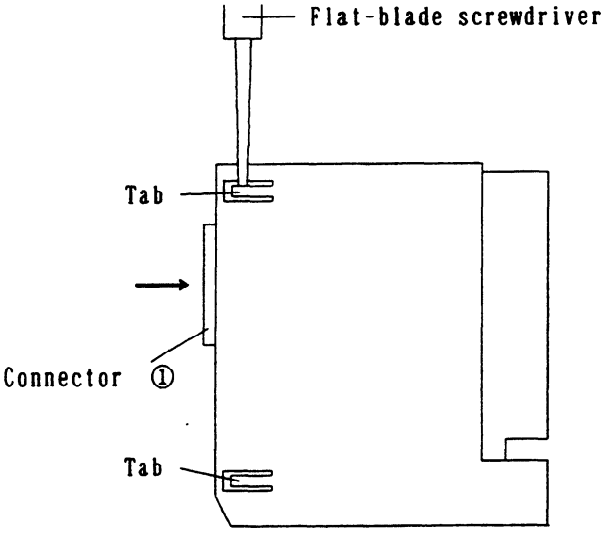
① While pulling the cover in the direction of the arrow. press points ① and ② (on each side) with a flat-blade screwdriver to remove the cover.



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 board will come out.



INDEX

Revision Record

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

Edition	Date	Contents	Edition	Date	Contents
02	Apr., '92	• Addition of high speed counter module • Addition of Optical fiber Cable			
01	Dec., '90	———			