

FANUC Power Mate *i*-MODEL D
FANUC Power Mate *i*-MODEL H

CONNECTION MANUAL (HARDWARE)

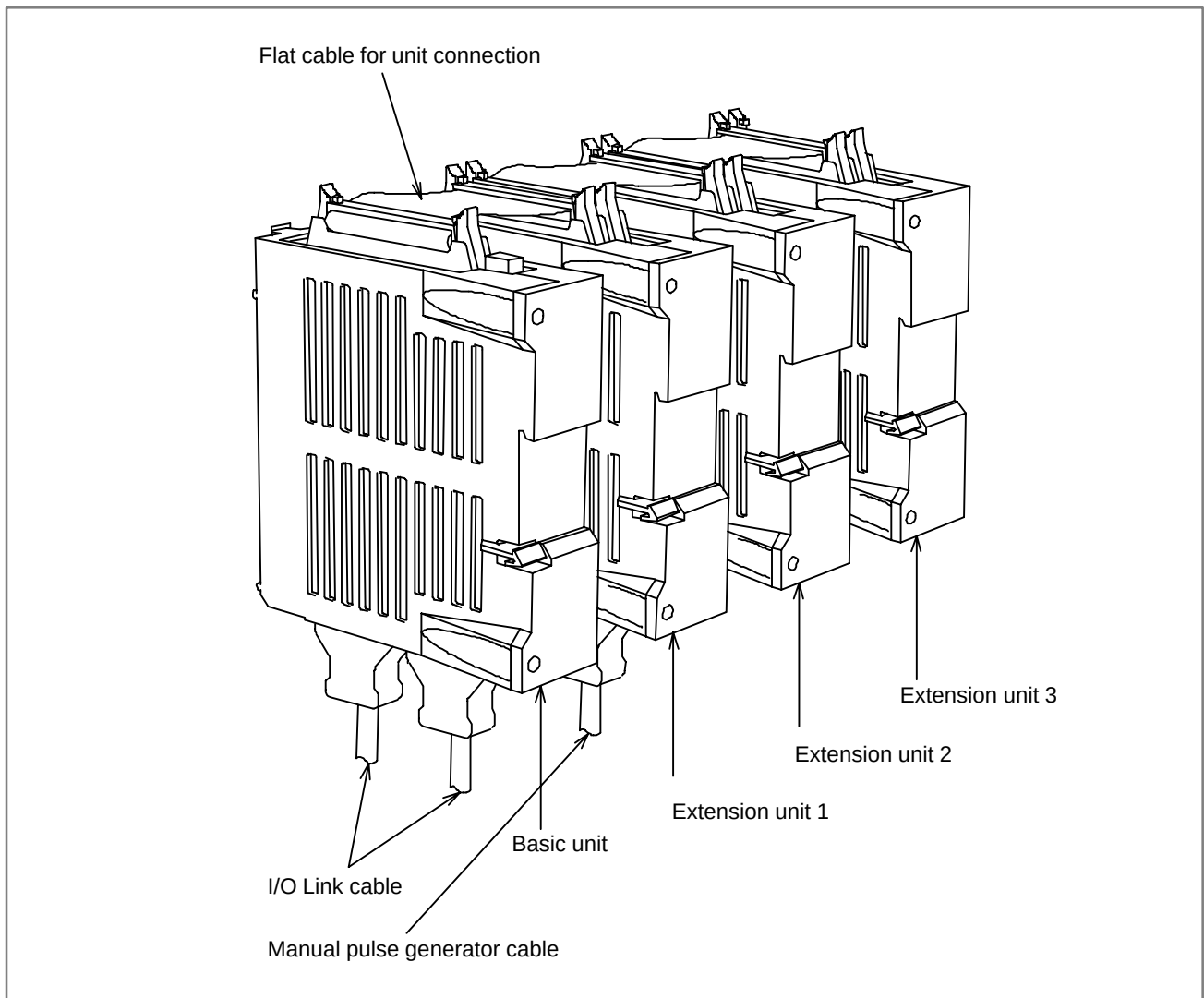
6.7 CONNECTION OF CONNECTOR PANEL I/O MODULE

6.7.1 General

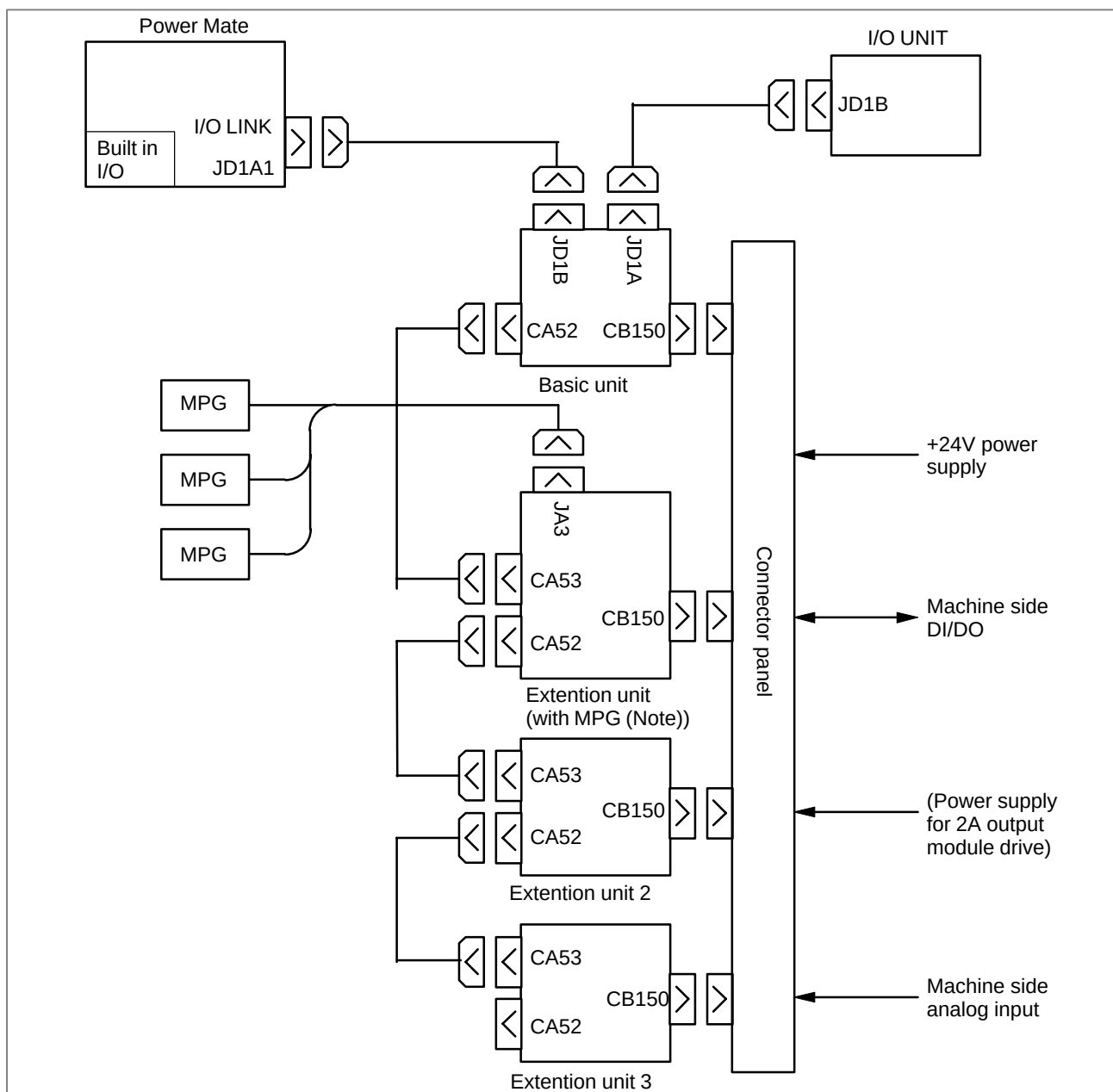
The connector panel I/O module can be connected directly to a customer-designed connector panel printed-circuit board. It can also be installed on the DIN rail.

In an I/O module for local lines, up to three extended units can be added to a single basic unit. The basic unit and the additional extended units form a single FANUC I/O Link group. The following basic unit and extended units are available. (Multiple extended units of the same type can be added.)

Unit name	Drawing No.	Specifications
Basic	A03B-0815-C001	DI/DO : 24/16
Extended A	A03B-0815-C002	DI/DO : 24/16 MPG interface incorporated
Extended B	A03B-0815-C003	DI/DO : 24/16 MPG interface not incorporated
Extended C	A03B-0815-C004	DO : 16 2A output
Extended D	A03B-0815-C005	Analog input



6.7.2 Connection Diagram



NOTE

Ensure that the extension module with the MPG interface is located nearest to the basic unit, as shown in the figure. When the connector panel I/O module is used together with a unit (such as an operator's panel I/O module) connected to the I/O Link supporting another MPG interface, only the MPG interface of the module closest to the Power Mate connected to the I/O Link is effective.

6.7.3 Connector Pin Assignment

1) Basic, expansion A, and expansion B units

33	DOCOM			01	DOCOM
34	Yn+0.0			02	Yn+1.0
35	Yn+0.1	19	0V	03	Yn+1.1
36	Yn+0.2	20	0V	04	Yn+1.2
37	Yn+0.3	21	0V	05	Yn+1.3
38	Yn+0.4	22	0V	06	Yn+1.4
39	Yn+0.5	23	0V	07	Yn+1.5
40	Yn+0.6	24	DICOM0	08	Yn+1.6
41	Yn+0.7	25	Xm+1.0	09	Yn+1.7
42	Xm+0.0	26	Xm+1.1	10	Xm+2.0
43	Xm+0.1	27	Xm+1.2	11	Xm+2.1
44	Xm+0.2	28	Xm+1.3	12	Xm+2.2
45	Xm+0.3	29	Xm+1.4	13	Xm+2.3
46	Xm+0.4	30	Xm+1.5	14	Xm+2.4
47	Xm+0.5	31	Xm+1.6	15	Xm+2.5
48	Xm+0.6	32	Xm+1.7	16	Xm+2.6
49	Xm+0.7			17	Xm+2.7
50	+24V			18	+24V

50 male pins with fittings for fixing the connector covers

2) Extended C

CB154 (HONDA MR-50RMA)					
33	DOCOMA			01	DOCOMA
34	Yn+0. 0			02	Yn+1. 0
35	Yn+0. 1	19	GNDA	03	Yn+1. 1
36	Yn+0. 2	20	GNDA	04	Yn+1. 2
37	Yn+0. 3	21	GNDA	05	Yn+1. 3
38	Yn+0. 4	22	GNDA	06	Yn+1. 4
39	Yn+0. 5	23	GNDA	07	Yn+1. 5
40	Yn+0. 6	24		08	Yn+1. 6
41	Yn+0. 7	25		09	Yn+1. 7
42		26		10	
43		27		11	
44		28		12	
45		29		13	
46		30		14	
47		31		15	
48		32		16	
49	DOCOMA			17	DOCOMA
50	DOCOMA			18	DOCOMA

50 male pins
Hardware for fastening the
connector cover attached

3) Extended D

CB157 (HONDA MR-50RMA)									
33	INM3					01	INM1		
34	COM3					02	COM1		
35	FGND3	19	FGND			03	FGND1		
36	INP3	20	FGND			04	INP1		
37	JMP3	21	FGND			05	JMP1		
38	INM4	22	FGND			06	INM2		
39	COM4	23	FGND			07	COM2		
40	FGND4	24				08	FGND2		
41	INP4	25				09	INP2		
42	JMP4	26				10	JMP2		
43		27				11			
44		28				12			
45		29				13			
46		30				14			
47		31				15			
48		32				16			
49						17			
50						18			

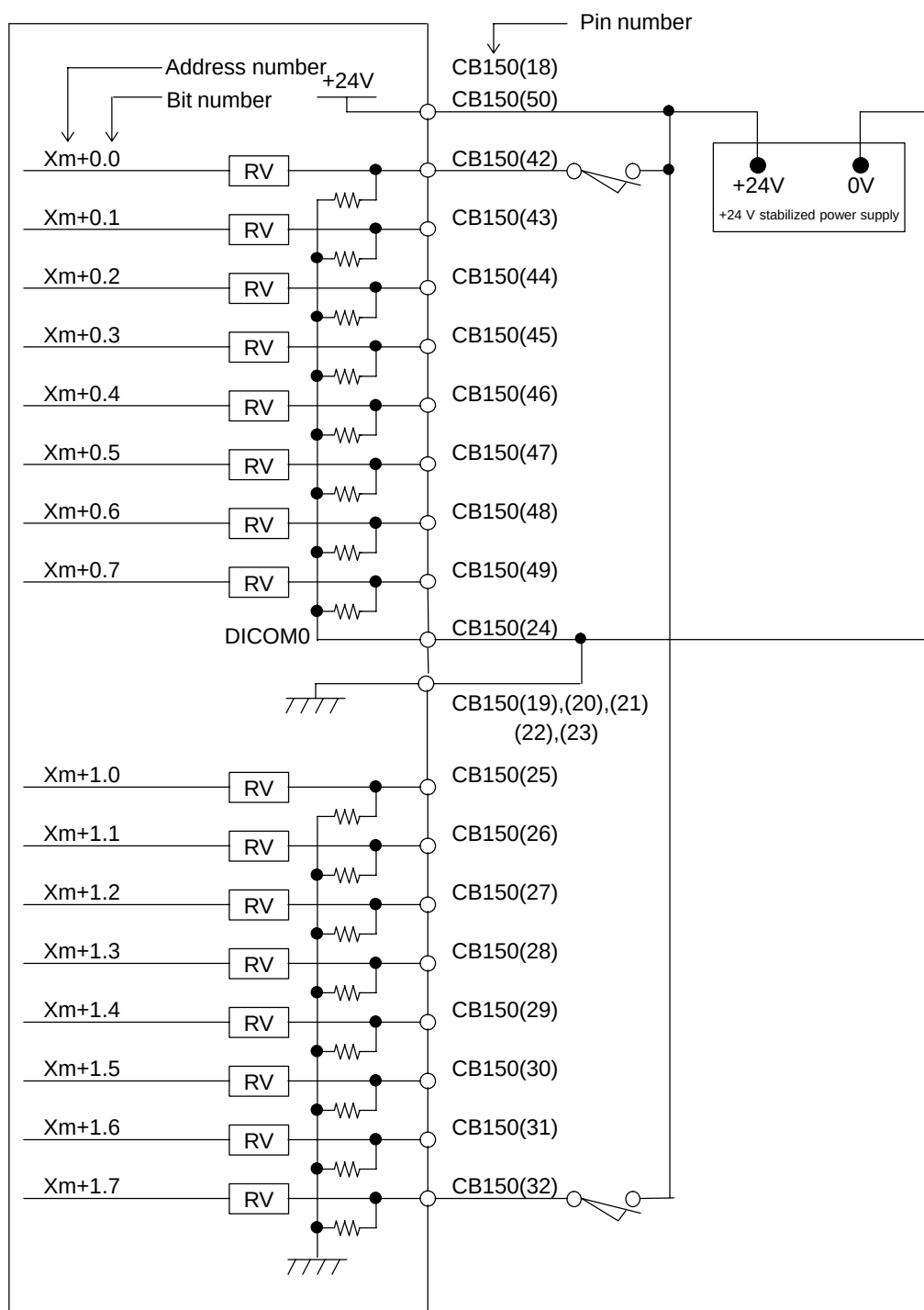
50 male pins
Hardware for fastening the
connector cover attached

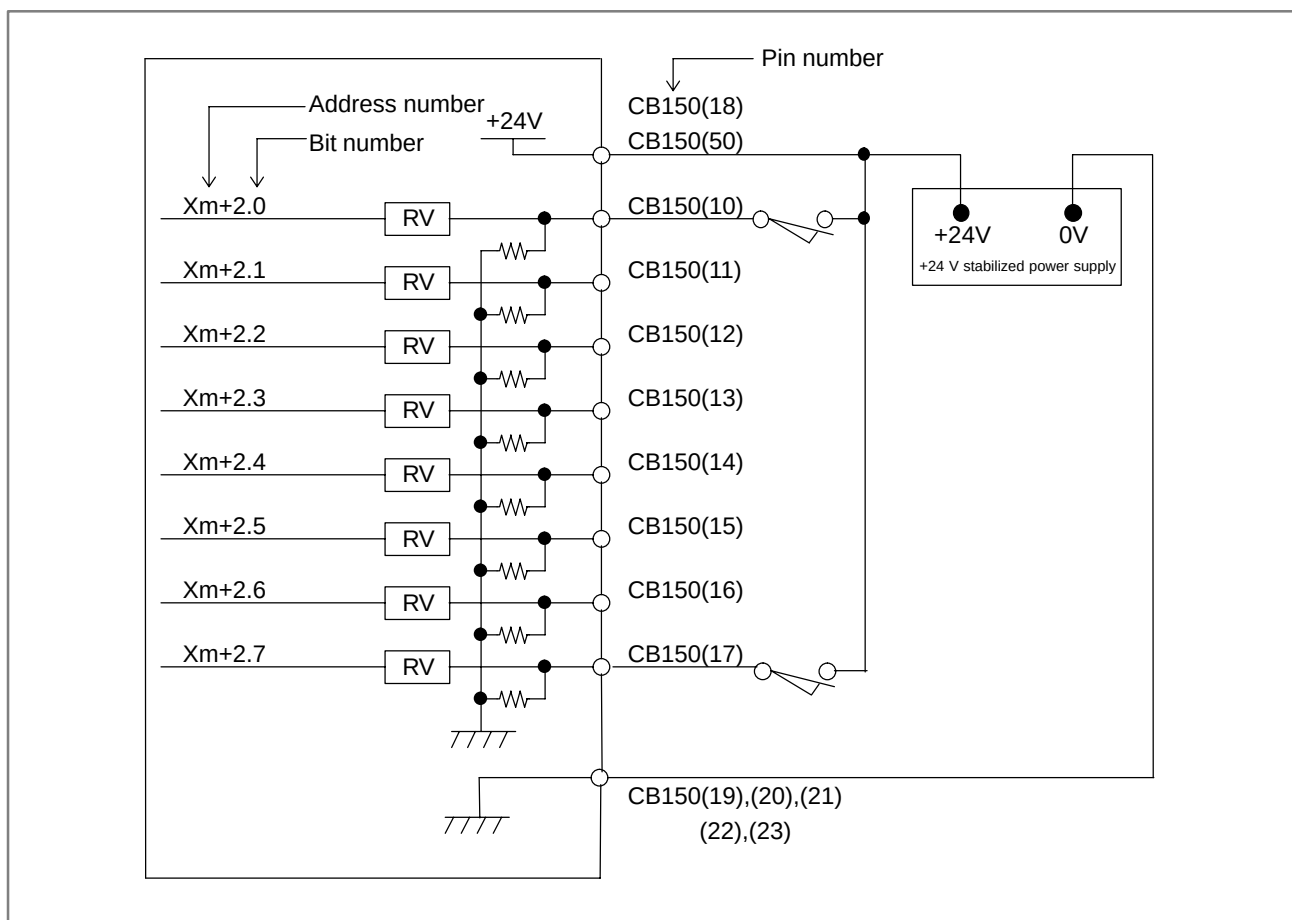
NOTE

- 1 The DI and DO addresses for the basic and extension units run contiguously. These basic and extension unit DI and DO addresses are allocated to the I/O Link as a group. For example, when the DI and DO top addresses are X0004 and Y0000 ($m = 4$ and $n = 0$), respectively, then the addresses are allocated as shown in the following table.
- 2 When the 2A output module is used, the addresses for the DIs of the module cannot be used. (When the 2A output module is used as extended unit 3, X13 to X15 cannot be used.)
- 3 In the analog input module, the DO space is used as an input channel selection area.

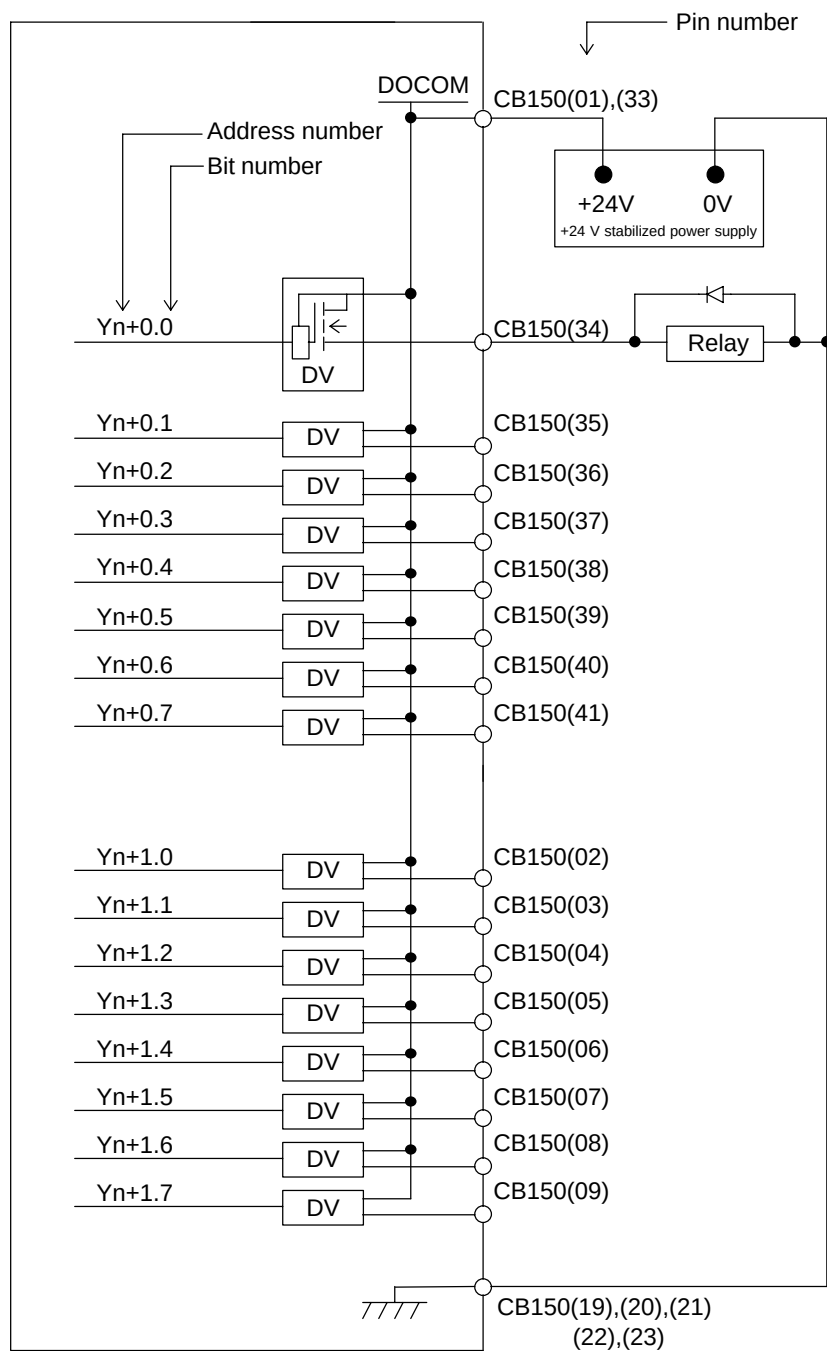
	DI	DO
Basic unit	X4 to X6	Y0 to Y1
Extension unit 1	X7 to X9	Y2 to Y3
Extension unit 2	X10 to X12	Y4 to Y5
Extension unit 3	X13 to X15	Y6 to Y7

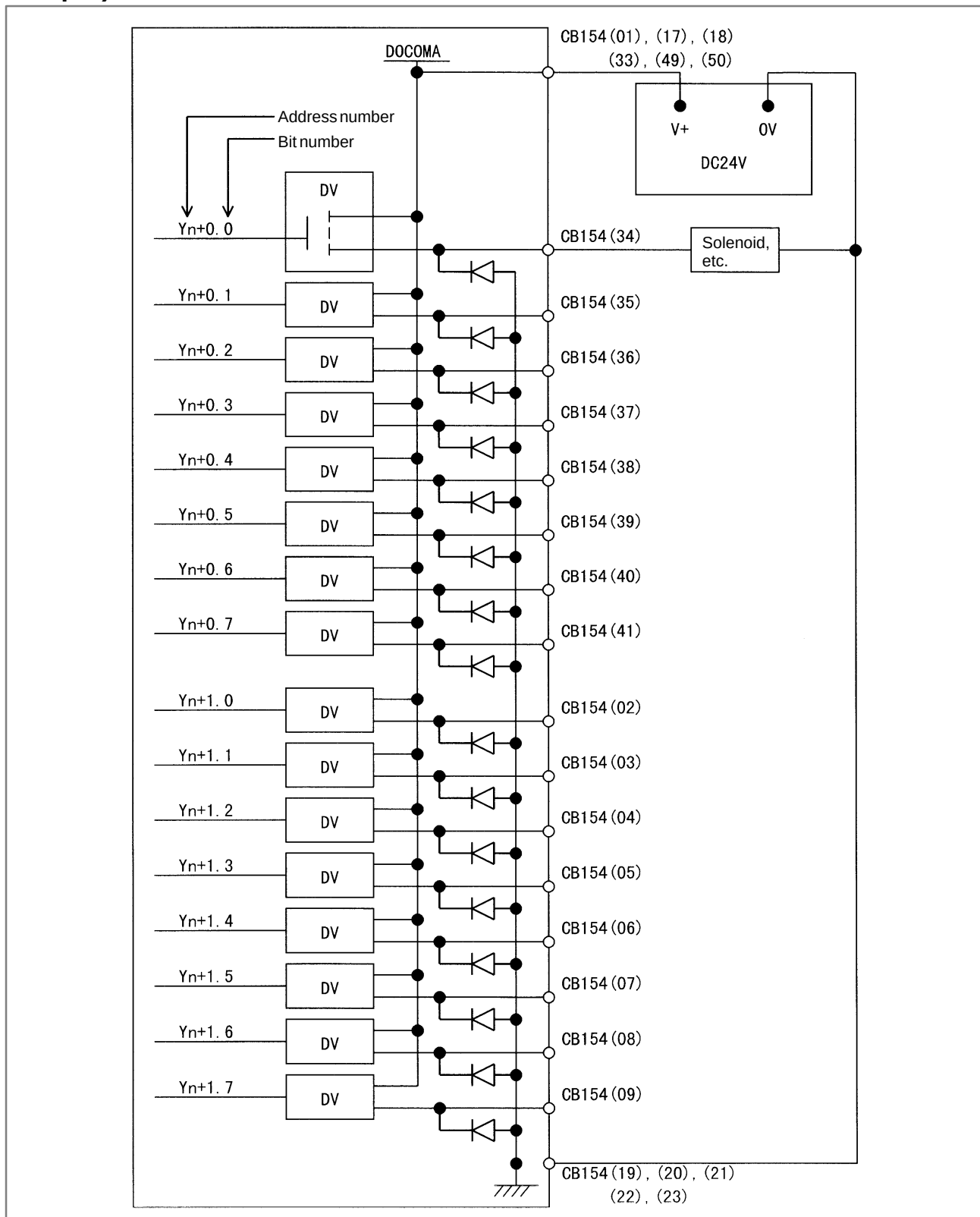
6.7.4 Basic, Expansion A, and Expansion B Units Connection



**NOTE**

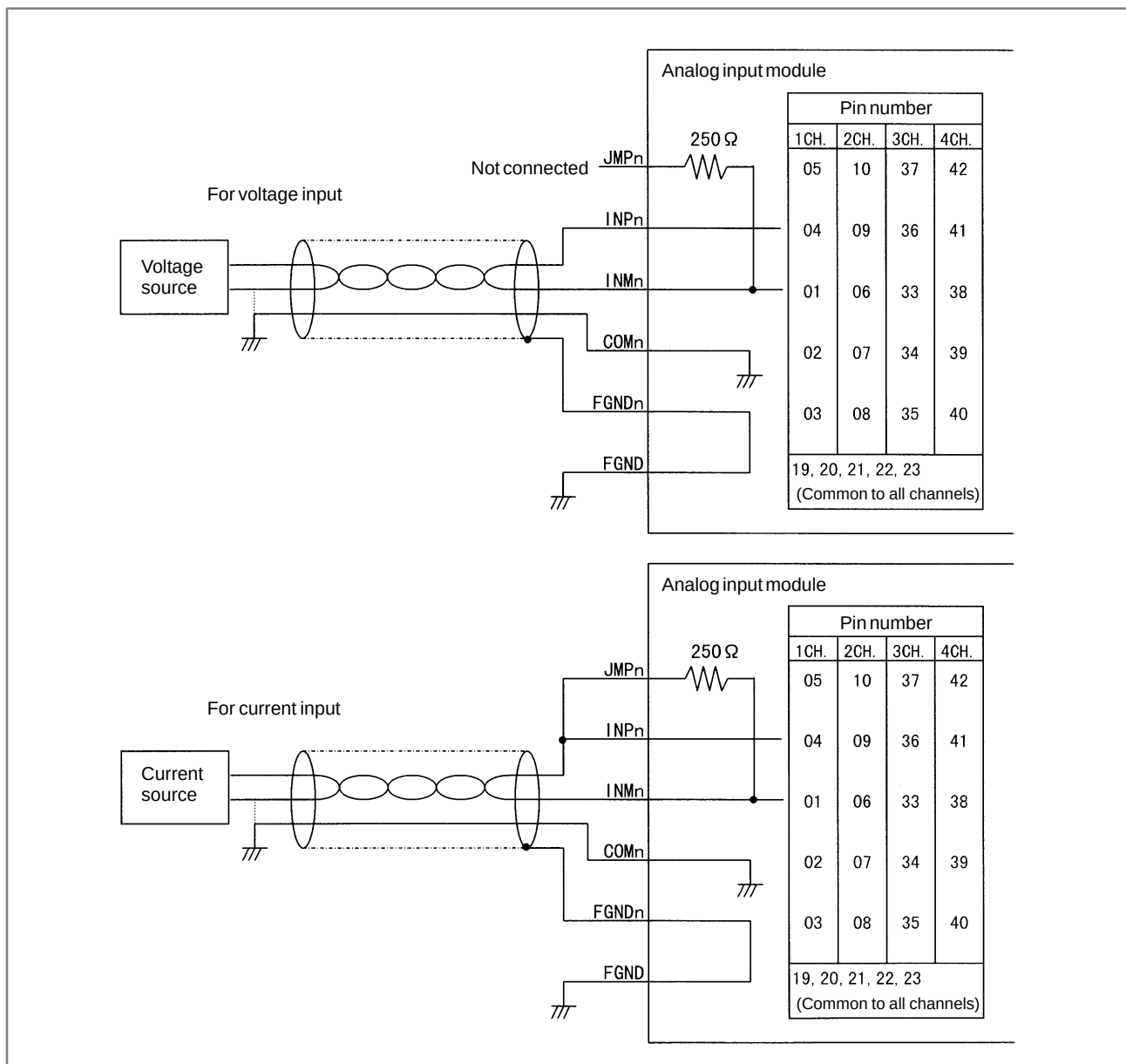
- 1 $X_m+0.0$ through $X_m+0.7$ are DI pins for which a common voltage can be selected. That is, by connecting the Dicom0 CB150(24) pin to the +24 V power supply, a DI signal can be input with its logical state reversed. If, however, a cable is connected to ground, it has the same effect as inputting an ON state DI signal. To prevent such accidents, the connection of the Dicom0 CB150(24) pin to the 0 V power supply is recommended wherever possible.
- 2 For safety reasons, the emergency stop signal needs to be allocated to an appropriate bit $X_0.4$ of the addresses for which the common voltage is fixed. To put it another way, no emergency stop signal can be input from this connector panel I/O module. An emergency stop signal should be allocated to the built-in I/O module of the Power Mate or an I/O module supporting the FANUC I/O Link.
- 3 For unused DI pins allocated to the addresses for which the common voltage is fixed (from $X_m+1.0$ to $X_m+1.7$ and from $X_m+2.0$ to $X_m+2.7$), the logic is fixed to "0". For unused pins allocated to $X_m+0.0$ to $X_m+0.7$ for which the common voltage can be selected, the logic is fixed to "0" when the Dicom0 CB150(24) pin is connected to the 0 V power supply. When the Dicom0 CB150(24) pin is connected to the +24 V power supply, the logic is fixed to "1". The logic of the unused pins allocated to $X_m+0.0$ to $X_m+0.7$ is variable when the contact of the Dicom0 CB150(24) pin is open.



6.7.5**Connecting the
Extended C (2A
Output) Unit**

6.7.6 Connecting the Extended D (Analog Input) Unit

1) Connection diagrams



NOTE

In the figure above, n represents a channel (n = 1, 2, 3, 4).

- Either voltage or current input can be selected for each channel. For current input, short-circuit JMPn and INPn.
- Use shielded twisted pair cables for the connection.
- In the figure above, the shield for each channel is connected to FGNDn, which is connected to FGND. Alternatively, the shield may be connected directly to the frame ground by using a cable clamp, without using FGNDn.

2) Digital output

This analog input module has four input channels. The digital output block is a single 12-bit output in the occupied input points of three bytes. The output format is as follows:

Address within the module	7	6	5	4	3	2	1	0
Xm (even address)	D07	D06	D05	D04	D03	D02	D01	D00
Xm+1 (odd address)	0	0	CHB	CHA	D11	D10	D09	D08

D00 to D11 are 12-bit digital output data. D00 corresponds to 2^0 weight and D11 to 2^{11} weight.

D11 corresponds to the sign bit of a twos complement representation. CHA and CHB represent an analog input channel. Thus, when the PMC program reads the above two bytes, it can read from D11 to D00 the A/D-converted data on the input channel represented by CHA and CHB. For an explanation of CHA and CHB, see “Channel selection” below.

3) Channel selection

This analog input module requires that the PMC program specify which of the four channels is to output data to the digital output block. The DOs for this specification are CHA and CHB in the occupied output points of two bytes. They are mapped as follows:

Address in the module	7	6	5	4	3	2	1	0
Yn	X	X	X	X	X	X	X	X
Yn+1	X	X	X	X	X	X	CHB	CHA

By writing one of the following values to each of CHA and CHB, the corresponding channel is selected and the A/D-converted data on the channel and the data for the selected channel are read as DI data. The Xs above are unused bits and, therefore, either 1 or 0 may be written.

CHB	CHA	Selected channel
0	0	Channel 1
0	1	Channel 2
1	0	Channel 3
1	1	Channel 4

4) Allocation

The start address of the X (DI) of the basic unit containing the analog input module must always be allocated to an even address.

If the start address is allocated in this way, the digital output addresses of the analog input module are as shown below, depending on where the module is mounted.

- If the analog input module is mounted as extended unit 1 (m is the start address for allocation)

Address within the module	7	6	5	4	3	2	1	0
Xm+3 (odd address)	Undefined							
Xm+4 (even address)	D07	D06	D05	D04	D03	D02	D01	D00
Xm+5 (odd address)	0	0	CHB	CHA	D11	D10	D09	D08

- If the analog input module is mounted as extended unit 2 (m is the start address for allocation)

Address within the module	7	6	5	4	3	2	1	0
Xm+6 (even address)	D07	D06	D05	D04	D03	D02	D01	D00
Xm+7 (odd address)	0	0	CHB	CHA	D11	D10	D09	D08
Xm+8 (even address)	Undefined							

- If the analog input module is placed as extended unit 3 (m is the start address for allocation)

Address within the module	7	6	5	4	3	2	1	0
Xm+9 (odd address)	Undefined							
Xm+10 (even address)	D07	D06	D05	D04	D03	D02	D01	D00
Xm+11 (odd address)	0	0	CHB	CHA	D11	D10	D09	D08

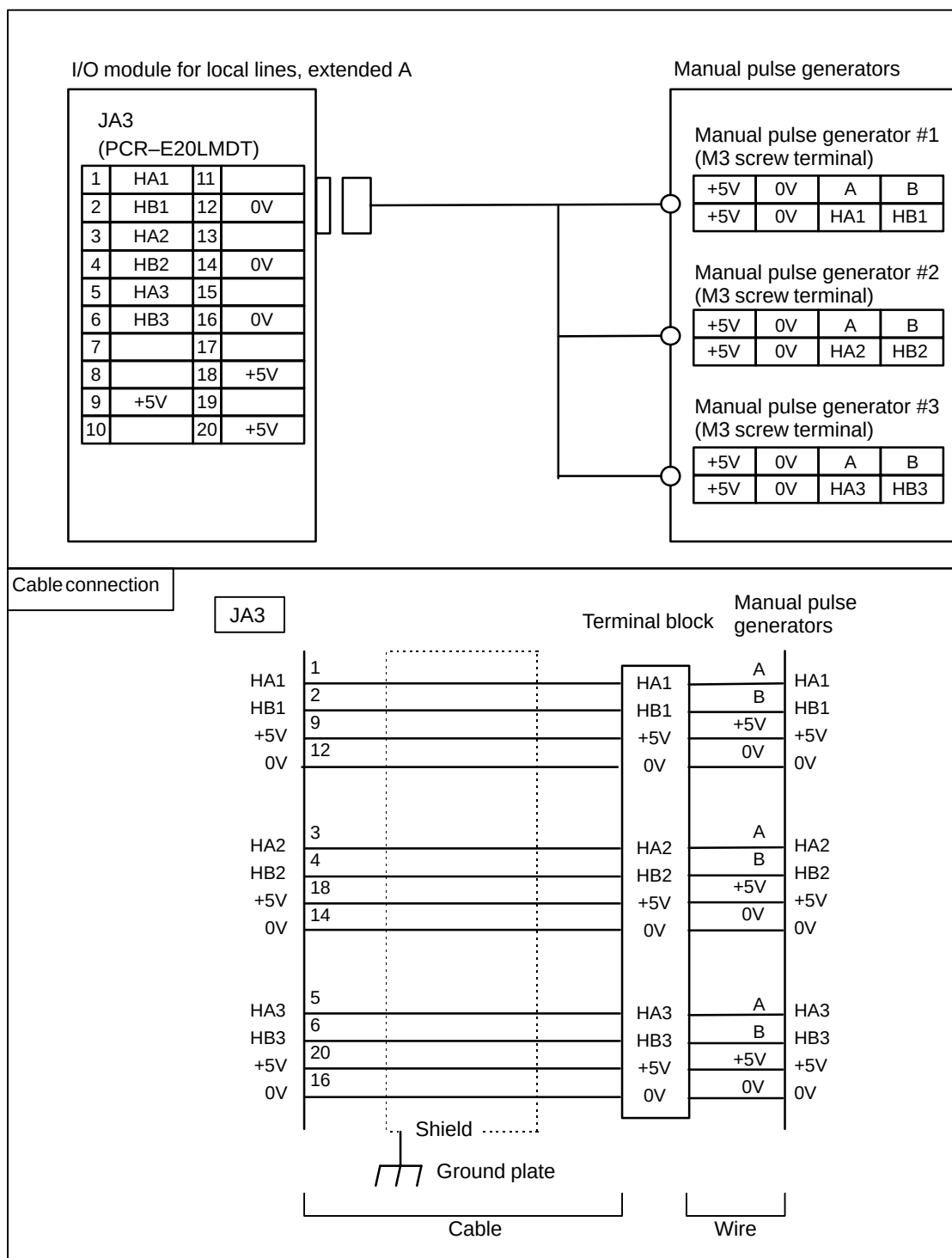
NOTE

If 2-byte digital output addresses are to be referenced with the PMC program, read them in units of words (16 bits).

6.7.7 Manual Pulse Generator Connection

The extended A unit of the I/O module for local lines has a manual pulse generator I/F.

An example in which three manual pulse generators are connected is shown below.



Recommended wire:

A66L-0001-0286 (6 pairs of #20AWG wires and 3 pairs of #24AWG wires)

Recommended connector:

A02B-0120-K303 (such as the following connector and its housing)

(Connector:Soldering-type FI40-2015S, manufactured by Hirose Electric Co., Ltd.)

(Housing:FI-20-CV, manufactured by Hirose Electric Co., Ltd.)

Recommended cables:

A02B-0120-K841 (7 m) (for connecting three manual pulse generators)

A02B-0120-K848 (7 m) (for connecting two manual pulse generators)

A02B-0120-K847 (7 m) (for connecting one manual pulse generator)

(These cables do not include the wire shown in the above figure.)

NOTE

- 1 The Power Mate *i*-D supports the connection of only two manual pulse generators. In such cases, signals HA3 and HB3 are not used.
- 2 The interface cannot be used together with the manual pulse generator interface of the Power Mate *i*.

Cable length for manual pulse generator

Like a pulse coder, the manual pulse generator operates on 5 VDC. The supply voltage drop due to the cable resistance must be held below 0.2 V (when those of the 0-volt and 5-volt wires are combined), as expressed in the following expression:

$$0.2 \geq \frac{0.1 \times R \times 2L}{m} \quad \text{Where}$$

0.1 = manual pulse generator supply current (0.1 A)
R = resistance per unit cable length (Ω/m)
m = number of 0-volt and 5-volt wires
L = cable length (m).

Therefore, the cable length can be determined using the following expression.

$$L \leq \frac{m}{R}$$

In the case of the A66L-0001-0286 cable, for example, when three pairs of signal wires and six power supply wires (20/0.18, 0.0394 Ω/m) are used (three power supply wires connected to 5 V and the other three to 0 V when one manual pulse generator is used), the cable length is:

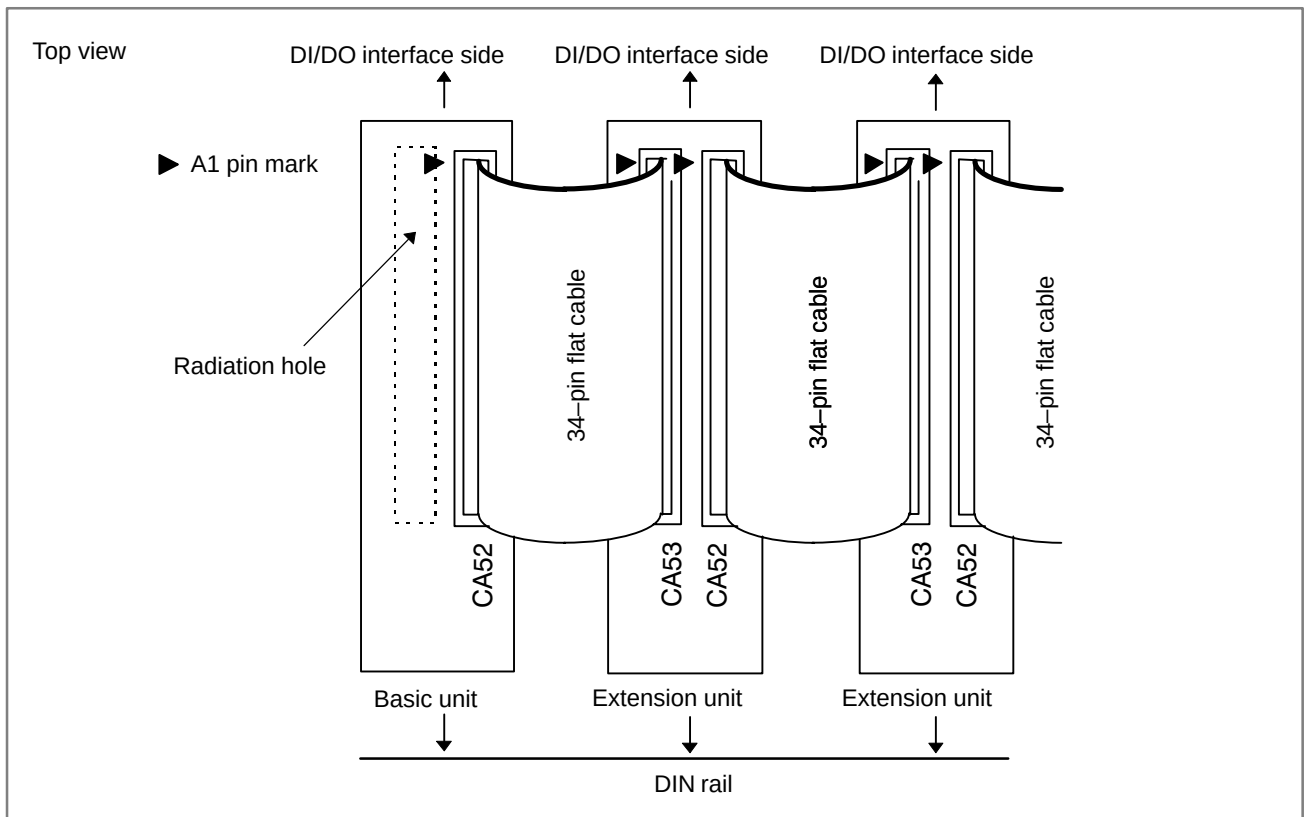
$$L \leq \frac{3}{0.0394} = 76.75[\text{m}]$$

However, the maximum pulse transmission distance for the manual pulse generator is 50 m. Taking this into consideration, the cable length may be extended to:

38.37 m (when two manual pulse generators are used), or
25.58 m (when three manual pulse generators are used).

6.7.8 Connection of Units

Units can be connected in the same way, regardless of whether you are connecting the basic module to an extension unit or connecting two extension units. Connect the units by using 34-pin flat cable connectors as shown in the figure below. Ensure that all 34 pins at one end of the cable are connected to the corresponding pins at the other end; e.g., connect the A1 pin to the pin having the same designation (A1) at the other end.



Flat cable-side connector specification:

HIF3BA-34DA-2.54R (Hirose Electric Co., Ltd.)

Unit connector-side specification:

HIF3BA-34PA-2.54DS (Hirose Electric Co., Ltd.) or

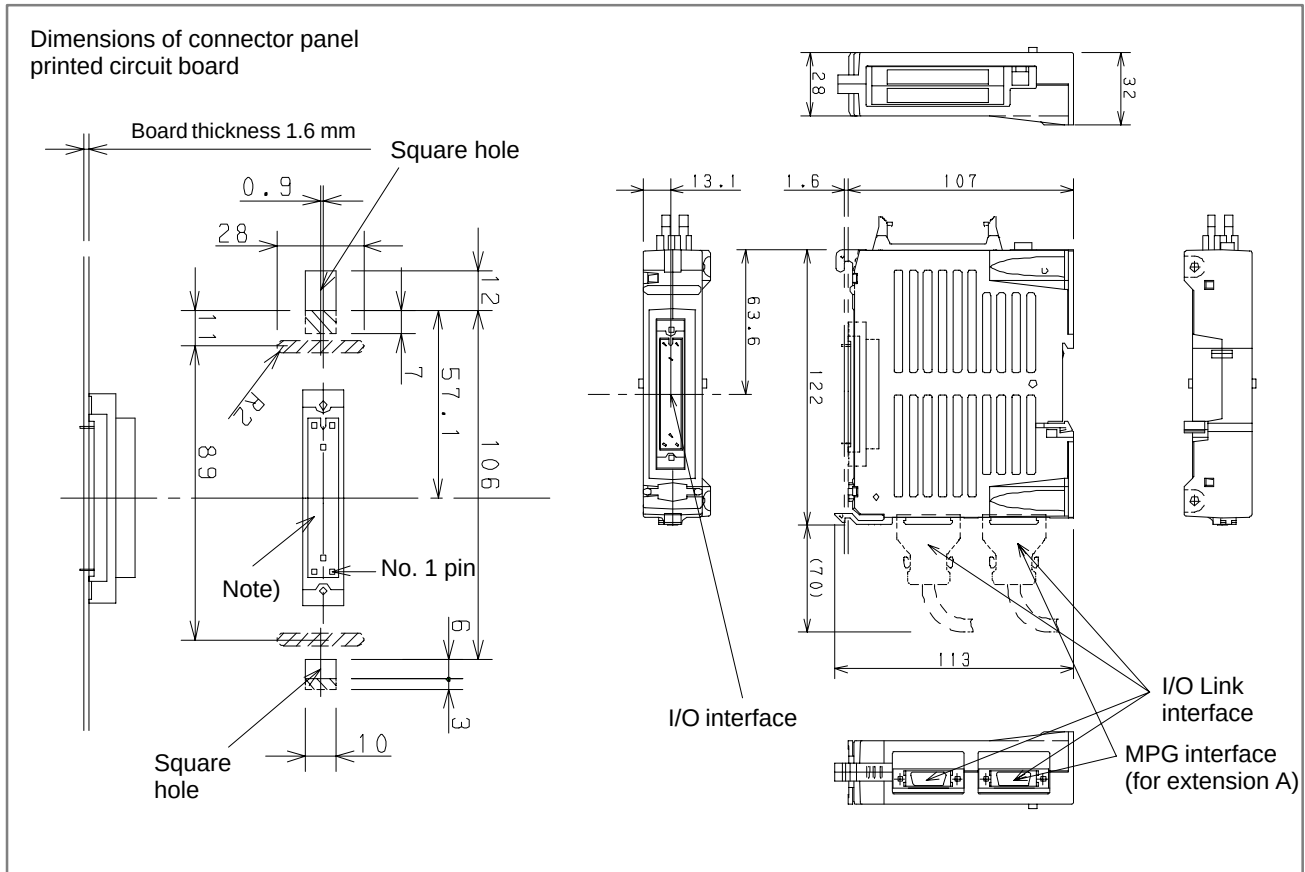
FAP-3403-1202-OBS (Yamaichi Denki Co., Ltd.)

NOTE

- 1 Units need to be spaced at least 32 mm apart, in which case a flat cable of about 20 mm in length is required. To install units further away from each other, the cable length will be 20 mm plus the extra distance. Note that the maximum length of a flat cable is 100 mm.
- 2 To ensure adequate ventilation, install the units in such a way that the flat cables lie on top of them. The basic unit is provided with a heat radiation hole on the upper side (area indicated using the dotted line in the above figure). When installing a flat cable, be careful not to block the hole with the cable. In other words, an expansion unit should be placed for such a direction that the flat cable of the expansion unit will not block the heat radiation hole of the basic unit, as shown above. To be specific, when a connector panel printed-circuit board is connected directly, the expansion unit shall be placed on the right-hand side of the basic unit as viewed when you face the mounting surface. If the DIN rail or screws are used to mount the expansion unit, it shall be placed on the left-hand side.

6.7.9 Module Installation

When connecting a connector panel printed circuit board directly
(external module view and mounting diagram)



Connector panel printed circuit board connector specification:
HONDA MRH-50FD
(50-pin female straight connector without fitting)

NOTE

- 1 A connector with a fitting (HONDA MRH-50RMA) is used for the module-side I/O interface. Always use a connector having no fitting for the connector panel printed circuit board.
- 2 Area where pattern printing is prohibited

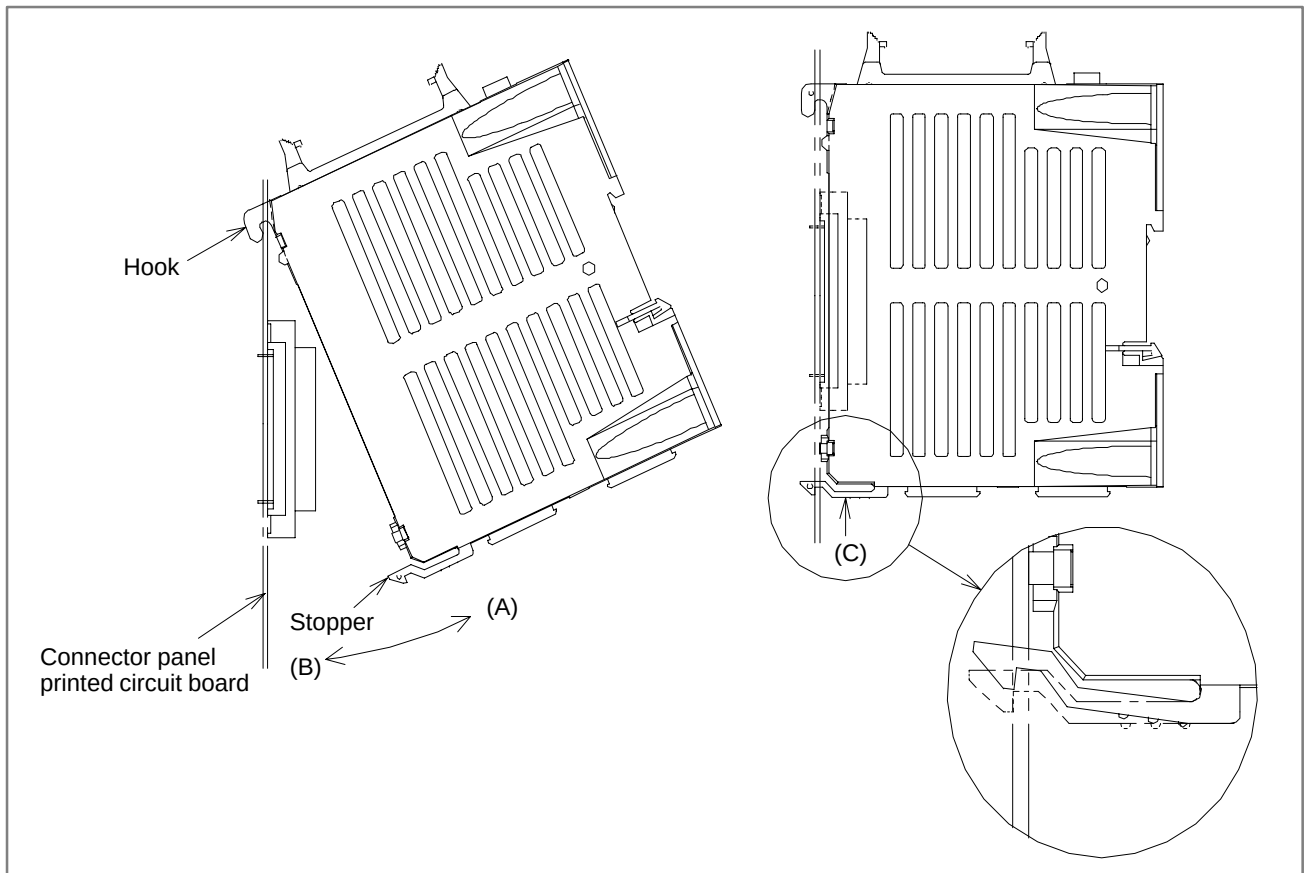


Prohibited area on component side



Prohibited area on soldered side

When connecting a connector panel printed circuit board directly
(mounting and dismounting a module)



Mounting the module

1. Insert the hook of the module into the square hole located at the upper part of the connector panel printed circuit board.
2. Using the hook as a fulcrum, push the module in the direction of (B), and attach the module's connector to the connector on the printed circuit board.
3. Push the stopper into the lower hole of the printed circuit board until it clicks into place.

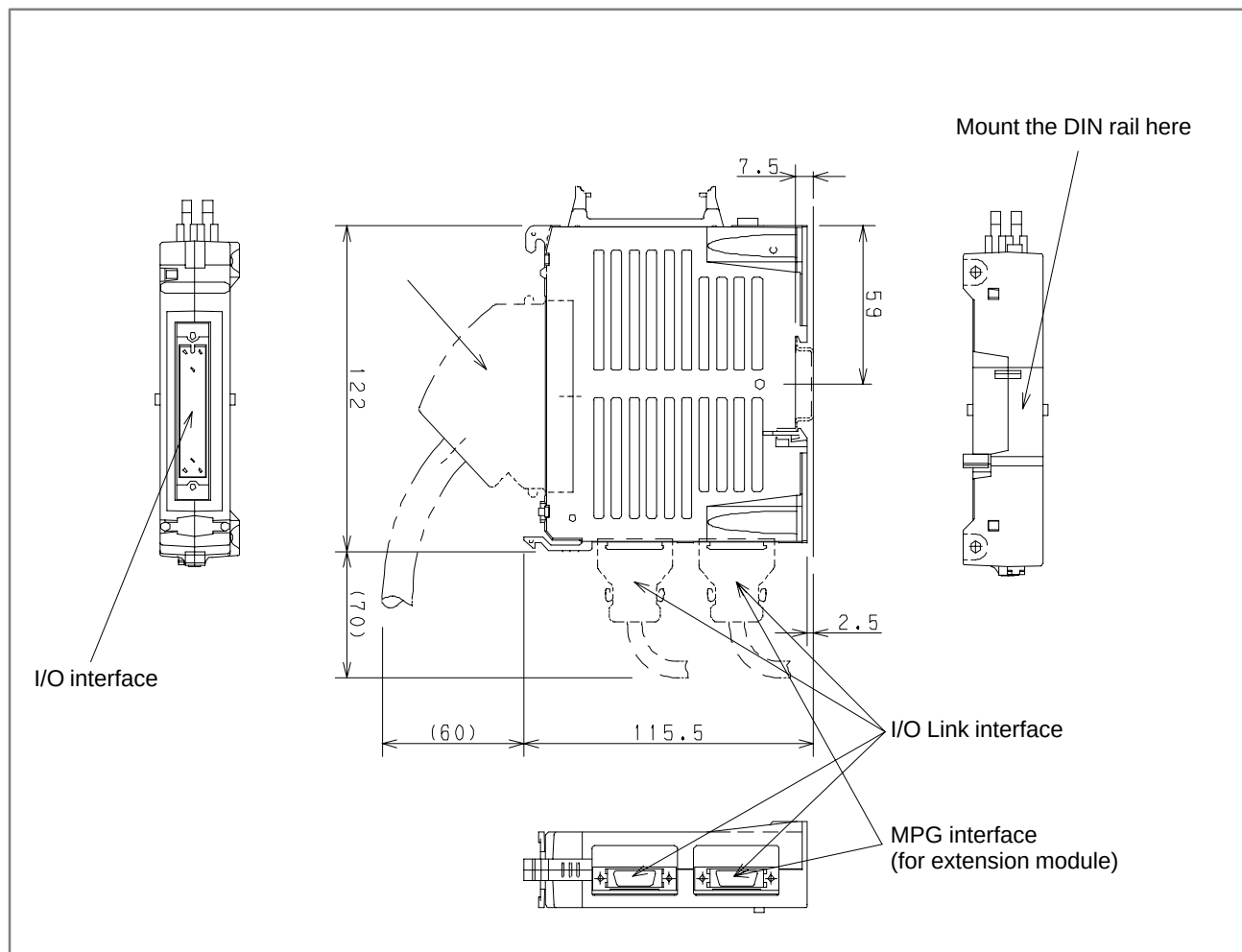
Dismounting the module

1. Press the stopper (C) upward.
2. Using the hook as a fulcrum, pull the lower part of the module in the direction of (A).

NOTE

When mounting and dismounting a module, hold the module by its top and bottom surfaces. Avoid applying force to the sides where there are slits.

When mounting a DIN rail (external module view and mounting diagram)



NOTE

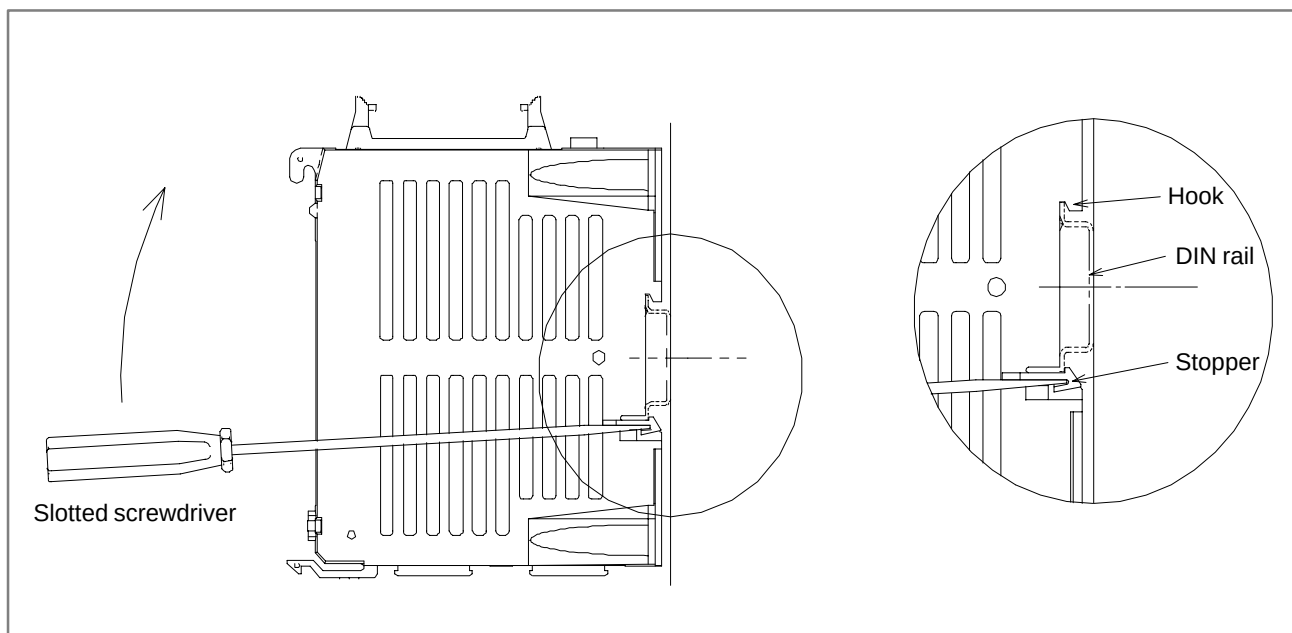
Recommended connector: A02B-0098-K891 (including the following connector and case)

(Connector: HONDA MR-50FH solder type)

(Case: HONDA MR-50NSB angled type)

Recommended cable: A66L-0001-0042 (7/0.18, 50 pins)

When mounting a DIN rail (mounting and dismounting a module)



Mounting the module

1. Hook the module at the upper end of the DIN rail.
2. Push the stopper into the slit located at the lower end of the rail until it clicks into place.

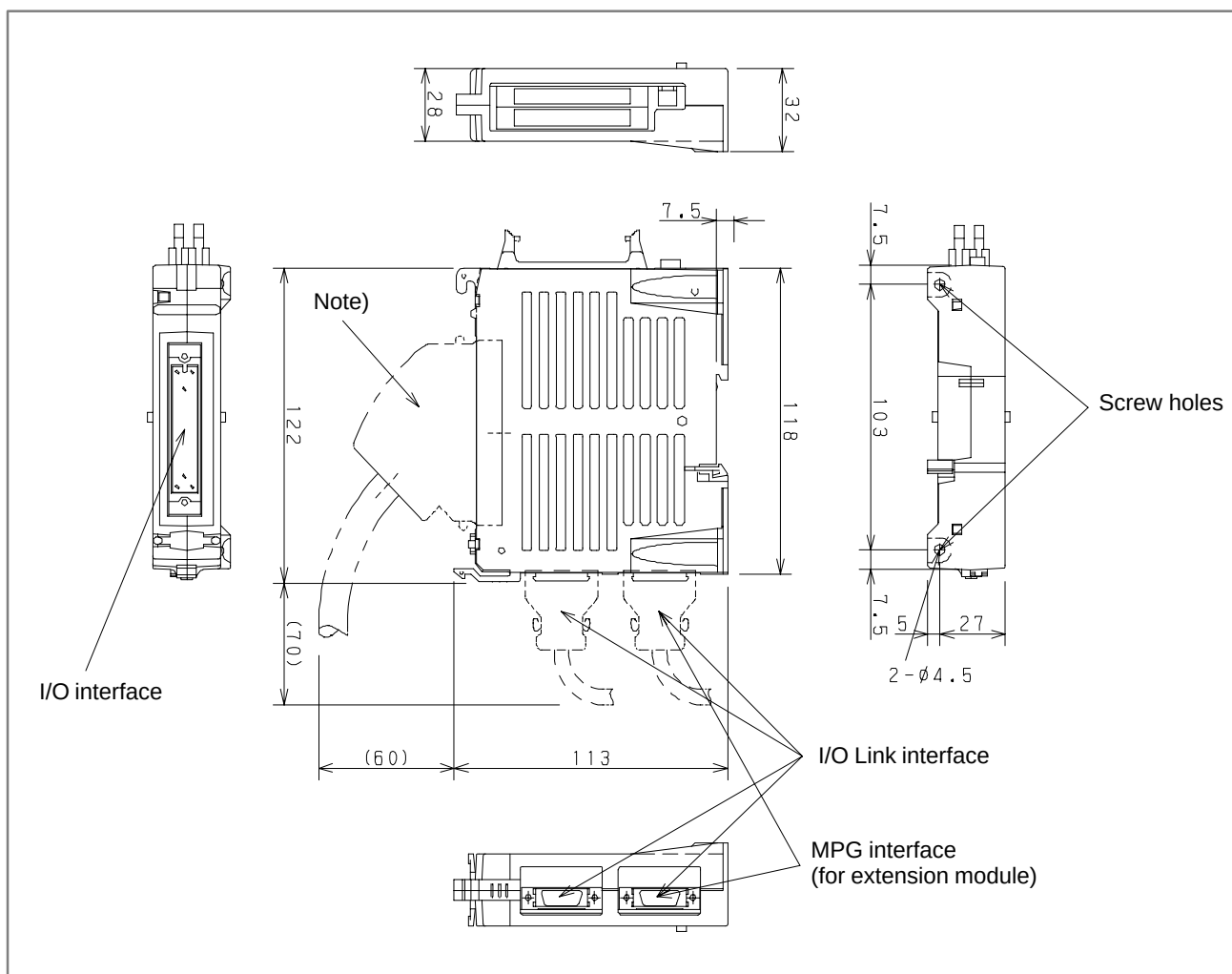
Dismounting the module

1. Insert the tip of the slotted screwdriver and push out the stopper in the direction indicated by the arrow.

NOTE

When dismounting the module, take care not to damage the stopper by applying excessive force with the screwdriver. When mounting and dismounting a module, hold the module by its top and bottom surfaces. Avoid applying force to the sides where there are slits.

When mounting a module using screws (external module view and mounting diagram)



NOTE

Recommended connector: A02B-0098-K891 (including the following connector and case)

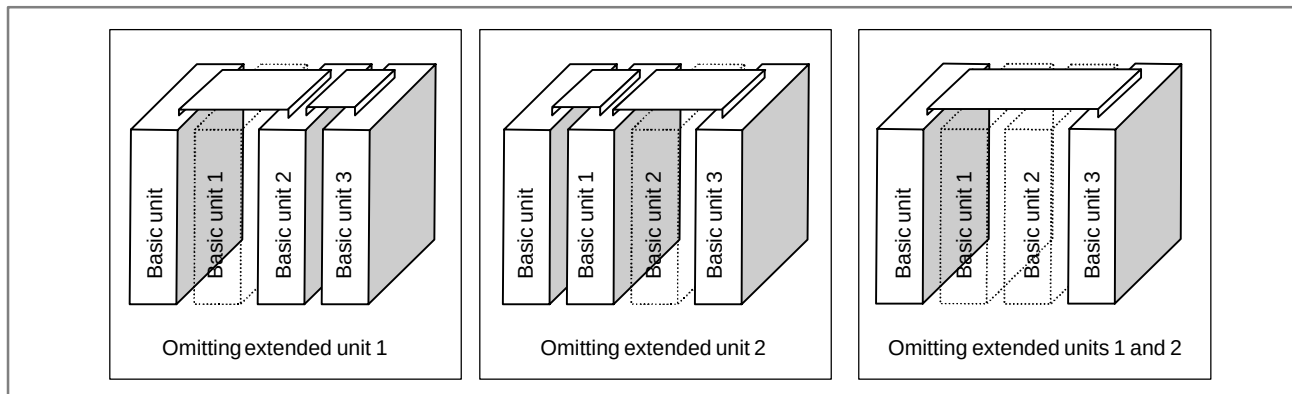
(Connector: HONDA MR-50FH solder type)

(Case: HONDA MR-50NSB angled type)

Recommended cable: A66L-0001-0042 (7/0.18, 50 pins)

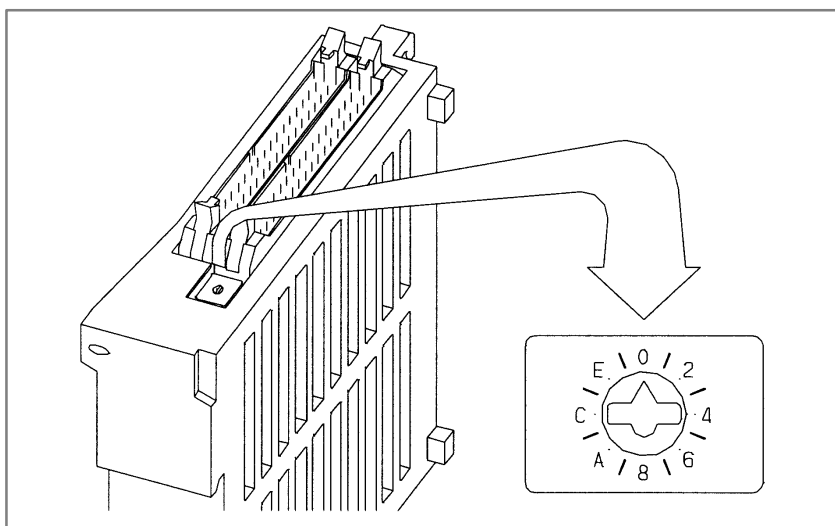
6.7.10 Omitting Units

An extended unit or units may be omitted as shown below by changing the setting of the rotary switch on the appropriate extended unit.



Changing the setting of the rotary switch

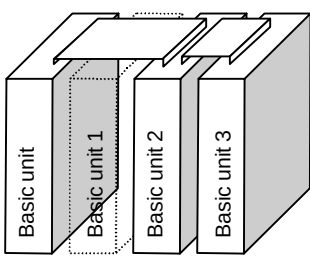
In an extended unit, a rotary switch is located as shown in the figure below. To change the setting of the rotary switch, use a slotted screwdriver with a blade width of about 2.5 mm.



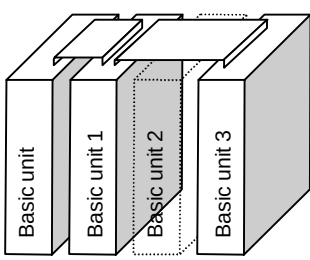
The positions of the rotary switch are described below.

Position	Indication on the switch	Description
0	0	Default position. The rotary switch is set to this position prior to shipment. Set the rotary switch to this position when not omitting an extended unit.
1	—	To omit one extended unit to be mounted on the preceding stage, set the rotary switch to this position
2	2	To omit two extended units to be mounted on the preceding stage, set the rotary switch to this position.
3	—	Not allowed.
4 to F	4, —, 6, —, 8, —, A, —, C, —, E, —	Not allowed.

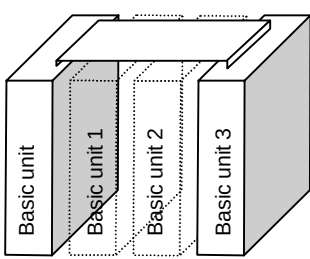
Examples



To omit extended unit 1:
On extended unit 2, set the rotary switch to position 1. On extended unit 3, the rotary switch need not be changed from position 0.



To omit extended unit 2:
On extended unit 3, set the rotary switch to position 1. On extended unit 1, the rotary switch need not be changed from position 0.



To omit extended units 1 and 2:
On extended unit 3, set the rotary switch to position 2.

This is a new function. It will be added according to the unit type, as follows:

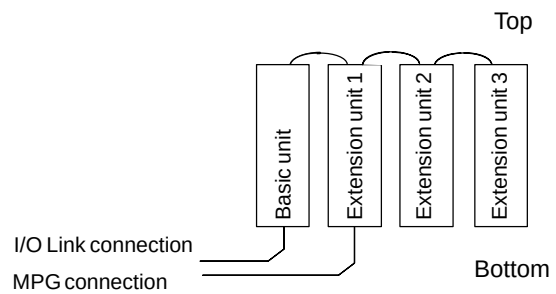
Extended B (DI/DO=24/16, manual pulse generator I/F not attached)	A03B-0815-C003	June 1998
Extended C (DO=16, 2A output)	A03B-0815-C004	August 1998
Extended D (analog input)	A03B-0815-C005	August 1998

NOTE

Extended A unit will be provided with the rotary switch due to the changes in the other units. Because, however, the extended A unit is always mounted in extended unit 1 position, the setting of the rotary switch need not be changed.

6.7.11 Specifications

Installation specifications

Ambient temperature	During operation 0° to 55°C During storage and transportation -20°C to 60°C
Relative humidity	30 to 95% (no condensation)
Vibration	During operation: 0.5 G or less
Environment	Inter of units: Each unit should be placed in a cabinet to keep it from pollutants (such as dust, coolant, organic solvents, acid, corrosive gas, and salt).
Other requirements	(1) Install the I/O module in a fully enclosed cabinet. (2) To ensure adequate ventilation between I/O modules, install them as shown in the figure below. Allow a minimum of 100 mm above and below each module for wiring and ventilation. Do not place heat-generating apparatus under the I/O modules. (3) Ensure that the flat cables do not cover the vents of the basic unit. For details, see 6.7.8. 

Ordering specifications

Item	Specification	Remarks
Connector panel I/O module basic	A03B-0815-C001	DI/DO: 24/16
Connector panel I/O module extension A	A03B-0815-C002	DI/DO: 24/16 with MPG interface
Connector panel I/O module extension B	A03B-0815-C003	DI/DO: 24/16
Connector panel I/O module expansion C	A03B-0815-C004	DO: 16 2A
Connector panel I/O module expansion D	A03B-0815-C005	Analog input
Fuse (replacement part)	A03B-0815-K002	1 A
Flat cable for unit connection	A03B-0815-K100	Cable length: 20 mm (when units are spaced 32 mm apart)

Module specifications

Item	Specification	Remarks
DI points	24 points	24 points per module (both basic and extension modules)
DO points	16 points	16 points per module (both basic and extension modules/source type output)
Power Mate interface	FANUC I/O Link connection	Up to 16 modules can be connected as Power Mate slaves. Or, a maximum of 1024 points can be supported on both the input and output sides.
Interface between basic and extension units	Bus connection using flat cables	Up to three extension units can be connected to one basic unit. Four units can support up to 96 DI and 64 DO points.
MPG interface	Max. 3 modules	Available in the extended A unit

Power supply rating

Module	Supply voltage	Power supply rating	Remarks
Basic	24 VDC $\pm 10\%$ is supplied from I/O connector CB150. The $\pm 10\%$ tolerance includes momentary and ripple currents.	0.2 A+7.3 mA×DI	DI = number of DI points in the ON state
Expansion A, B		0.1 A+7.3 mA×DI	DI = number of DI points in the ON state
Expansion C, D		0.1 A	

Input signal specifications

1) Basic, expansion A, and expansion B

Contact rating	30 VDC, 16 mA or more
Open circuit intercontact leakage current	1 mA or less (at 26.4 V)
Closed circuit intercontact voltage drop	2 V or less (including cable voltage drop)
Delay	Receiver delay: Max. 2 ms The time required for I/O Link transmission between the Power Mate and I/O module (max. 2 ms + ladder scan cycle) must also be taken into account.

2) Extended D

Item	Specification												
Analog input	DC-10 to +10V (input resistance 4.7MΩ) DC-20 to +20mA (input resistance 250Ω)												
Digital output	12-bit binary 2s complement representation												
Input/output support	<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>	Analog input	Digital output	+10V	+2000	+5V or +20mA	+1000	0V or 0mA	0	-5V or -20mA	-1000	-10V	-2000
Analog input	Digital output												
+10V	+2000												
+5V or +20mA	+1000												
0V or 0mA	0												
-5V or -20mA	-1000												
-10V	-2000												
Resolution	5mV or 20μA												
Total precision	Voltage input ± 0.5% Current input ± 1% (of full scale)												
Maximum input voltage/current	± 15V/ ± 30mA												
Minimum conversion time	Ladder scan period of the connected CNC												

Output signal specifications

1) Basic, expansion A, and expansion B

Maximum load current in ON state	200 mA or less (including momentary current)
Saturation voltage in ON state	Max. 1 V (when load current is 200 mA)
Withstand voltage	24 V +20% or less (including momentary values)
Leakage current in OFF state	20 μA or less
Delay	Driver delay: Max. 50 μs The time for I/O Link transmission between the Power Mate and I/O module (max. 2 ms + ladder scan cycle) must also be taken into account.

2) Extended C

DO (output signal specification)

Number of points	16 (per module)
ON-time maximum load current	2A per point 12A in the entire module (DO: 16 points) (including instantaneous current)
Withstand voltage	24 V + 20% or less (including instantaneous voltage)
OFF-time leak current	100 μA or less
Delay time	The I/O Link transfer time of 2 ms (max.) plus the ladder scan period (due to the CNC) must be considered.