

## **GE Fanuc Automation**

**Computer Numerical Control Products** 

Series 15i-Model B Series 150i-Model B

**Connection Manual (Hardware)** 

GFZ-63783EN/01

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### Warnings, Cautions, and Notes as Used in this Publication

### Warning

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

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

Caution

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

### Note

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

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

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### **DEFINITION OF WARNING, CAUTION, AND NOTE**

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

### WARNING

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

### CAUTION

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

### NOTE

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

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

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### GENERAL

**Contents of this manual** This manual describes the electrical and structural specifications required for connecting the CNC control units, FANUC Series 15*i*/150*i*, with a machine tool, and covers the equipment shown in the configuration diagram in Chapter 2. When using the CNC control units, be sure to connect and install them following the instructions in this manual. The manual outlines the units commonly used for Fanuc CNC control units, that is, the I/O unit, servo motor, spindle motor, and so on, and describes additional information on using these units for the Series 15*i*/150*i*. Refer to individual manuals for the detailed specifications of each unit.

### How this manual is organized

This manual comprises the following chapters and appendix.

### 1. GENERAL

This chapter. It describes the outline and organization of this manual, names of models applied and other related manuals.

### 2. CONFIGURATION

This chapter describes the configuration of the electrical system of the machine tool with which the CNC is used.

### 3. INSTALLATION

This chapter describes how to install the CNC.

### 4. TOTAL CONNECTION

This chapter shows the connection diagrams for the CNC and each device.

### 5. POWER SUPPLY UNIT CONNECTION

This chapter describes the connection of the CNC to the power supply unit and input unit.

### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

This chapter describes the connection of the CNC to the I/O unit to machine interface.

### 7. CONNECTION TO CNC PERIPHERALS

This chapter describes the connection of the CNC to peripherals.

### 8. CONNECTION TO OTHER NET-WORKS

This chapter describes how to connect the Series 15i/150i to networks.

### 9. HIGH-SPEED SERIAL BUS (HSSB)

This chapter describes the high–speed serial bus (HSSB), which enables transfer of data between the CNC and the personal computer.

### **10.CNC DISPLAY UNIT WITH PC FUNCTIONS**

This chapter describes how to connect the CNC to the CNC display unit with PC functions.

### **11.EMERGENCY STOP SIGNAL**

This chapter describes the handling of emergency stop signals.

### APPENDIX

### A. UNIT EXTERNAL DIMENSION DIAGRAMS

### **B. EXTERNAL DIMENSIONS OF CONNECTORS**

C. 20-PIN INTERFACE CONNECTORS AND CABLES

#### **D. OPTICAL FIBER CABLE**

### E. LIQUID CRYSTAL DISPLAY (LCD)

F. MEMORY CARD INTERFACE

**G. TERMINAL MODULE** 

H. TERMINAL MODULE A

### I. RELAY MODULE A

**Applicable models** 

This manual can be used with the following models. The abbreviated names may be used.

Product Name	Abbrevi	ations
FANUC Series 15 <i>i</i> –MB	15 <i>i</i> –MB	Series 15 <i>i</i>
FANUC Series 150 <i>i</i> –MB	150 <i>i</i> –MB	Series 150 <i>i</i>

### **Related manuals**

The table below lists manuals related to FANUC Series 15i/150i-MODEL B.

In the table, this manual is marked with an asterisk(\*).

### Table 1 Related manuals

Manual name	Specification number	
DESCRIPTIONS	B-63782EN	
CONNECTION MANUAL (Hardware)	B-63783EN	*
CONNECTION MANUAL (Function)	B-63783EN-1	
OPERATOR'S MANUAL (PROGRAMMING)	B–63784EN	
OPERATOR'S MANUAL (OPERATION)	B–63784EN–1	
MAINTENANCEMANUAL	B–63785EN	
PARAMETER MANUAL	B-63790EN	

# 2 CONFIGURATION

The following figure shows the configuration of the electrical system of the machine tool with which this control is used.

This manual describes how to connect the units illustrated in this diagram. The machine tool body, machine operator's panel, power magnetic circuit, and sensor/actuator are specific to the machine tool and are the builder's responsibility. This manual does not cover the internal connection of these units to the machine tool.

- 4 ----





### 3.1 ENVIRONMENTAL REQUIREMENTS OUTSIDE THE CABINET

### 3.1.1 Environmental Conditions Around the Cabinet

The peripheral units and the control unit have been designed on the assumption that they are housed in closed cabinets. In this manual "cabinet" refers to the following:

- Cabinet manufactured by the machine tool builder for housing the control unit or peripheral units;
- Operation pendant, manufactured by the machine tool builder, for housing the control unit or operator's panel.
- Equivalent to the above.

The environmental conditions when installing these cabinets shall conform to the following table. Section 3.3 describes the installation and design conditions of a cabinet satisfying these conditions.

	Condition	Case of not using hard disk	Case of using hard disk
Ambient	Operating	0°C to 45°C	5°C to 40°C
Temperature	Storage, Transport	–20°C to 60°C	
Temperature Change		Max. 0.3°C/min.	Max. 0.3°C/min.
Humidity	Normal	75%RH or less, no condensation	10% to 75%RH, no condensation
	Short period (less than 1 month)	95%RH or less, no condensation	10% to 90%RH, no condensation
Vibration	Operating	0.5 G or less	
Vibration	Non-operating	1.0 G or less	
Altitude	1000 m or less		
Environ- ment	Normal machine sh (The environment r location where the solvent is relatively	op environment nust be considered if t density of dust, coolar high.)	he cabinets are in a it, and/or organic

### 3.1.2

Installation Conditions for the CNC and Servo Unit Inside the Cabinet

	Operating: 0°C to 55°C (no hard disk drive used)
Ambient temperature	Operating: 5°C to 50°C (hard disk drive used)
	Storage and transportation: –20°C to 60°C
Humidity	95% or less (relative) with no condensation (no hard disk drive used)
	(hard disk drive used)
Vibration	0.5 G or less
Environment	The unit shall not be exposed direct to cutting oil, lubricant or cutting chips.

### NOTE

When using the CNC display unit with PC functions, also see Subsection 10.5.1.

### 3.2 POWER REQUIREMENTS

The power requirement of the CNC control unit is calculated as the sum of the power required by the control and servo sections.

The control section power requirement includes the power required for control, the LCD, I/O units, the operator panel interface, and the on/off–controlled 200 VAC service outlet (2.5 A maximum) for the power supply unit.

Control section power requirement	1.2 KVA
Servo section power requirement	Varies with the type of related servo motor

### 3.3 DESIGN AND INSTALLATION CONDITIONS OF THE MACHINE TOOL MAGNETIC CABINET

When a cabinet is designed, it must satisfy the environmental conditions described in Section 3.1. In addition, the magnetic interference on the screen, noise resistance, and maintenance requirements must be considered. The cabinet design must meet the following conditions :

• The cabinet must be fully closed.

The cabinet must be designed to prevent the entry of airborne dust, coolant, and organic solvent.

- The cabinet to hold the control unit must be designed to maintain a difference in temperature of up to 10°C between the air in the cabinet and the outside air when the temperature in the cabinet rises. For details of the thermal design, see 3.4.
- A closed cabinet must be equipped with a fan to circulate the air within. (This is not necessary for a unit with fan.)
  The fan must be adjusted so that the air moves at 0.5 m/sec along the surface of each installed unit.
  CAUTION : If the air blows directly from the fan to the unit, dust easily adheres to the unit. This may cause the unit to fail.
- For the air to move easily, a clearance of 100 mm is required between each unit and the wall of the cabinet. (This is not necessary for a unit with fan.)
- Packing materials must be used for the cable port and the door in order to seal the cabinet.
- The LCD unit and MDI unit must not be installed in such a place that coolant would directly fall onto the unit. The front panels of the LCD unit and the MDI unit are dustproof. However, avoid installing the units in locations where their front panels directly receive coolant. For an explanation of the dust protection measures for the power magnetics cabinets and pendant boxes of machine tools, see Section 3.4.
  - Noise must be minimized. As the machine and the CNC unit are reduced in size, the parts that generate noise may be placed near noise–sensitive parts in the magnetics cabinet. The CNC unit is built to protect it from external noise. Cabinet design to minimize noise generation and to prevent it from being transmitted

to the CNC unit is necessary. See section 3.6 for details of noise elimination/management.

- When determining the layout of units in the cabinet, consider maintainability; arrange the units in such a way that they can be easily replaced during maintenance and inspection.
- The hard disk drive and floppy disk drive must not be installed near the source of a strong magnetic field.
- The installation conditions of the I/O unit and connector panel I/O module must be satisfied.

To obtain good ventilation in the module, the I/O unit and connector panel I/O module must be installed in the direction shown in the following figure. Clearances of 100 mm or more both above and below the I/O unit are required for wiring and ventilation.

Equipment radiating too much heat must not be put below the I/O unit and connector panel I/O module.



- If the CNC unit is installed at an altitude of over 1,000 m, an upper limit is placed on the ambient temperature (one of the environmental conditions described in Section 3.1) for the CNC within the cabinet. Each increment of 100 m over 1,000 m requires that 1.0°C be subtracted from the maximum allowable ambient temperature for the CNC in the cabinet.
  - Example) If a cabinet containing the CNC is installed at an altitude of 1,750 m, the maximum allowable ambient temperature for the CNC is:  $55^{\circ}C 750/100 \times 1.0^{\circ}C = 47.5^{\circ}C$

The allowable ambient temperature range for the CNC is therefore from  $0^{\circ}$ C to 47.5°C.

If the hard disk drive in the CNC is used, the CNC can be installed only at an altitude ranging from:

-60 to 3,000 m when in operation

-60 to 12,000 when not in operation

• Unspecified frequencies may cause the CNC control unit and hard disk drive to vibrate at their resonance frequency, possibly subjecting unit components to an acceleration higher than allowable. After mounting the CNC control unit on your machine, carefully check for any abnormal conditions.

### CAUTION

For a control unit with a hard disk, data stored on the hard disk may be destroyed due to operator errors or accidents even when the environmental conditions above are satisfied. To guard against such data loss, back up the important hard disk data regularly. In particular, never turn off the power, even momentarily, while the hard disk is being accessed or the operating system is running, as doing so is highly likely to destroy part of the contents of the disk. End users should be made fully aware of this, to ensure that they do not inadvertently lose important data.

### 3.4 PROTECTION OF PARTS INSIDE A CABINET OR A PENDANT BOX FROM DUST

When a cabinet or a pendant box, which houses a display and an operator's panel, is designed, it must satisfy following conditions to prevent from the entry of airborne dust, coolant, and organic solvent.

- (1) A cabinet or a pendant box must be fully closed.
- (2) Packing materials must be used for the fixed side of a display and an operator's panel in order to seal a cabinet or a pendant box.
- (3) Packing materials must be used for the door of a cabinet or a pendant box in order to seal a cabinet or a pendant box.
- (4) Packing materials must be used for a back panel in order to seal a cabinet or a pendant box.
- (5) Packing materials and conduit connector and so on must be used for the cable port in order to seal a cabinet or a pendant box.
- (6) ALL holes must be filled.
- (7) A display and an operator's panel must not be placed in a location where coolant and cutting chips would directly fall onto them.
- (8) Don't let oil drip from the top of a cabinet or a pendant to panel sides.



### 3.5 THERMAL DESIGN OF THE CABINET

The purpose of the thermal design of the cabinet is to limit the difference in temperature between the air in the cabinet and the outside air to  $10^{\circ}$ C or less when the temperature in the cabinet increases.

The internal air temperature of the cabinet increases when the units and parts installed in the cabinet generate heat. Since the generated heat is radiated from the surface of the cabinet, the temperature of the air in the cabinet and the outside air balance at certain heat levels. If the amount of heat generated is constant, the larger the surface area of the cabinet, the less the internal temperature rises. The thermal design of the cabinet refers to calculating the heat generated in the cabinet, evaluating the surface area of the cabinet, and enlarging that surface area by installing heat exchangers in the cabinet, if necessary. Such a design method is described in the following subsections.

### 3.5.1 Temperature Rise within the Cabinet

The cooling capacity of a cabinet made of sheet metal is generally 6 W/°C per  $1\text{m}^2$  surface area, that is, when the 6W heat source is contained in a cabinet having a surface area of  $1 \text{ m}^2$ , the temperature of the air in the cabinet rises by  $1^\circ\text{C}$ . In this case the surface area of the cabinet refers to the area useful in cooling, that is, the area obtained by subtracting the area of the cabinet. There are two preconditions : The air in the cabinet must be circuited by the fun, and the temperature of the air in the cabinet must be almost constant. The following expression must then be satisfied to limit the difference in temperature between the air in the cabinet and the outside air to  $10^\circ\text{C}$  or less when the temperature in the cabinet rises:

Internal heat loss  $P[W] \leq$ 

 $6[W/m^2 \cdot C] \times surface area S[m^2] \times 10[^{\circ}C] of rise in temperature For example, a cabinet having a surface area of 4m<sup>2</sup> has a cooling capacity of 24W/^{\circ}C. To limit the internal temperature increase to 10°C under these conditions, the internal heat must not exceed 240W. If the actual internal heat is 320W, however, the temperature in the cabinet rises by 13°C or more. When this happens, the cooling capacity of the cabinet must be improved using the heat exchanger described next.$ 

### 3.5.2 Cooling by Heat Exchanger

If the temperature rise cannot be limited to  $10^{\circ}$ C by the cooling capacity of the cabinet, a heat exchanger must be added. The heat exchanger forcibly applies the air from both the inside and outside of the cabinet to the cooling fin to obtain effective cooling. The heat exchanger enlarges the surface area.

### Example

For a cabinet with a surface area of  $4 \text{ m}^2$ , if a heat exchanger with a heat radiation capacity of  $9 \text{ W/}^{\circ}\text{C}$  is used, the total heat radiation capacity increases to

 $6W/m^{2.\circ}C \times 4m^{2.+.9}W/^{\circ}C = 33W/^{\circ}C$ 

This means that even if the internal heat generation is 320 W, the temperature rise is held below 10  $^{\circ}$ C.

### 3.5.3 Calorific Value of Each Unit

Product name		Calorific value	Remarks	
Control unit	Basic unit (2 slots)	64W		
	Basic unit (4 slots)	68W		
	Main CPU board	38W		
	Additional axis board	10W		
	HSSB board	4W		
	Data server board A1	6W		
	Data server board A2	6.3W	Including the 0.3 W of the ATA card(*1)	
	Fast data server	6.3W	Including the 0.3 W of the ATA card(*1)	
	PMC C-language board	7W		
	Serial communication board	7W		
	DeviceNet board B	5W		
	DeviceNet board C	4W		
	Profibus board (master)	4W		
	Profibus board (slave)	6W		
	Etehrnet board	6W		
	Fast Ethernet board	6W		
LCD unit	10.4" color LCD unit	20W		
	9.5" monochrome LCD unit	18W		
Hard disk unit for data s	server	13W		
Separate detector	Basic unit	9W	(*2)	
	Basic unit + Additional unit	14W	(*2)	
Connection unit	Connection unit 1	16W + 0.18W × Number of O	16W + 0.18W × Number of ON inputs	
	Connection units 1 and 2	25W + 0.18W × Number of ON inputs		
Operator's panel conne	ection unit	3.6W + 0.18 W × Number of C	3.6W + 0.18 W × Number of ONs	
I/O unit model A	AIF01A, AIF01B	1.2W	1.2W	
	AID32A, AID32B	1.2W + 0.23W × Number of C	1.2W + 0.23W × Number of ON inputs	
	AID16A, AID16B	0.1W + 0.21W × Number of ON inputs		
	AID32E, AID32F	0.1W + 0.23W × Number of ON inputs		

Product name		Calorific value	Remarks
I/O unit model B	BIF04A1	1.6W	
	AIF02C	1.2W	
	BID16A1, BID16B1	1.5W + 0.23 × Number of ON inputs	
	BID16P1, BID16Q1	0.6W + 0.23 × Number of ON inputs	
	BOA12A1	$0.9W + (0.09 + 1.1 \times IL^2)$ x Number of ON outputs	
	BOD16A1	1.0W + (0.13 + 0.3 × IL <sup>2</sup> ) Number of ON outputs	
	BOD16P1	$0.3W + (0.13 + 0.3 \times IL^2)$ x Number of ON outputs	
	BIA16P1	0.1W + 0.21 × Number of ON inputs	
	BMD88A1, BMD88B1	$1.3W + 0.23 \times Number of ON input points + (0.13 + 0.3 \times IL^2) \times Number of ON output points$	
	BMD88P1, BMD88Q1	$0.4W + 0.23 \times Number of ON input points +$ (0.13 + 0.3 × IL <sup>2</sup> ) × Number of ON output points	
I/O module for operator's panel		3.6W + 0.18W × Number of ON inputs	
I/O module for con-	Basic unit	3.6W + 0.18W × Number of ON inputs	
nector panel	Extension unit	3.6W + 0.18W × Number of ON inputs	
Exported transformer for control unit		51W	
CNC display unit with PC functions 10.4" (A13B–0193–B031 to –B038)		40W	During normal operation (*3)
CNC display unit with PC functions 12.1" (A13B–0193–B041 to –B048)		52W	During normal operation (*3)
CNC display unit with PC functions 15.0" (A13B–0193–B051 to –B057)		52W	During normal operation (*3)

### NOTE

1 The calorific value of the ATA flash card is subject to change because of the adoption of a large–capacity card, changes in the card specifications, and so on.

- 2 Does not include the calorific value of the heat generated inside the separate detector.
- 3 Units assumed to be active during normal operation: CNC display unit with PC functions, HDD unit, HDD fan, FDD unit, full keyboard, and mouse. Units assumed to be inactive during normal operation: PCMCIA card, serial interface expansion device, parallel-interface-connected device. Note that the generated heat will increase if peripheral devices and PCI expansion boards are connected.

The CNC has been steadily reduced in size using surface-mount and custom LSI technologies for electronic components. The CNC also is designed to be protected from external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and noise has many uncertain factors. It is important to prevent both noise from being generated and generated noise from being introduced into the CNC. This precaution improves the stability of the CNC machine tool system.

The CNC component units are often installed close to the parts generating noise in the power magnetics cabinet. Possible noise sources into the CNC are capacitive coupling, electromagnetic induction, and ground loops.

When designing the power magnetics cabinet, guard against noise in the machine as described in the following section.

### 3.6.1 Separating Signal Lines

The cables used for the CNC machine tool are classified as listed in the following table:

Process the cables in each group as described in the action column.

Group	Signal line	Action	
A	Primary AC power line	Bind the cables in group A sepa-	
	Secondary AC power line	rately (Note 1) from groups B and C, or cover group A with an electromagnetic shield (Note 2).	
	AC/DC power lines (containing		
	the power lines for the servo and spindle motors)	See Section 3.6.4 and connect	
	AC/DC solenoid	solenoid and relay.	
	AC/DC relay		
В	DC solenoid (24VDC)	Connect diodes with DC sole- noid and relay.	
	DC relay (24VDC)	Bind the cables in group B sepa- rately from group A, or cover group B with an electromagnetic shield.	
	DI/DO cable between the I/O unit and power magnetics cabinet		
		Separate group B as far from	
	DI/DO cable between the I/O unit	lt is more desirable to sover	
		group B with the shield.	
	Cable between the CNC and I/O unit	Bind the cables in group C sepa- rately from group A, or cover group C with an electromagnetic shield. Separate group C as far from Group B as possible.	
	Cable for position and velocity feedback		
	Cable between the CNC and spindle amplifier		
	Cable for the position coder	Be sure to perform shield pro-	
С	Cable for the manual pulse gen- erator	cessing in Section 3.6.5.	
	Cable between the LCD and the MDI		
	RS-232C and RS-422 interface cable		
	Cable for the battery	]	
	Other cables to be covered with the shield		

	<ul> <li>NOTE</li> <li>1 The groups must be 10 cm or more apart from one another when binding the cables in each group.</li> <li>2 The electromagnetic shield refers to shielding between groups with grounded steel plates.</li> </ul>	
262	The CNC machine tool has three grounding systems:	
3.0.2	The CNC machine tool has three grounding systems:	
Grounding	<ul> <li>Grounding system for signals The grounding system for signals provides the reference potential (0 V) for the electric signal system.</li> </ul>	
	• Protective grounding system The protective grounding system is intended to ensure safety and shield any external noise and internally–generated noise. It consists of device frames, unit cases, panels, as well as the shields of the interface cables connecting devices.	
	<ul> <li>Protective earth (PE) system</li> <li>The protective earth (PE) system connects the protective grounding</li> </ul>	



# Notes on wiring for the grounding systems The ground resistance of the protective earth (PE) system must be 100 Ω or less (as per class–D grounding). The connection cable for the protective earth (PE) system must be so large in cross section that the accidental current can flow through the protective earth (PE) system safely in the event of an accident such as a short–circuit. (In general, the cross section must be equal to or greater than that of the AC power line.) The connection cable for the protective earth (PE) system must be

# • The connection cable for the protective earth (PE) system must be integral with the AC power line so that the power is not supplied when the grounding line is disconnected.

### 3.6.3 Grounding Units

(a) Control unit

Connect the 0V line of the electronic circuits inside the control unit to the earth plate on the cabinet via the signal ground (SG) terminal (bottom front of main board).



### NOTE

Connect an twisted wire earth cable lead 2mm<sup>2</sup> or more to the earth plate on the cabinet keeping the lead as short as possible.

### (b) Display unit



### (c) MDI unit



(d) Connection units 1, 2



### (e) Operator's panel connection unit



(f) I/O unit model A



### NOTE

Connect the SG terminal to the grounding mounting hole.



### NOTE

Connect the grounding cable of the hard disk unit via the grounding terminal for signals that is located on the control unit. (Do not connect the cable directly to the grounding plate of the cabinet.)

(h) External power supply

When using an external DC power supply for the units, be sure to ground the 0 V terminal of the power supply.

3.6.4 Noise Suppresser	<ul> <li>AC/DC solenoids and relays are used in the power magnetics cabinet.</li> <li>A high pulse voltage is caused by coil inductance when these devices are turned on or off.</li> <li>This pulse voltage induced through the cable causes the electronic circuits to be disturbed.</li> <li>Generally, to reduce this pulse voltage, use a spark killer when an AC power source is used, and a diode when a DC power source is used.</li> </ul>
	power source is used, and a diode when a DC power source is used.

Notes on selecting the spark killer

- Use a CR spark killer. (A varistor is useful in clamping the peak voltage of the pulse voltage, but cannot suppress the sudden rise of the pulse voltage. FANUC therefore recommends a CR spark killer.)
- The reference capacitance and resistance of the spark killer shall conform to the following based on the current (I (A)) and DC resistance of the stationary coil:
  - 1) Resistance (R): Equivalent DC resistance of the coil
  - 2) Capacitance (C):  $I^{2}/10$  to  $I^{2}/20$  ( $\mu$ F)



### 3.6.5 Cable Clamp and Shield Processing

The CNC cables that require shielding should be clamped by the method shown below. This cable clamp treatment is for both cable support and proper grounding of the shield. To ensure stable CNC system operation, follow this cable camp method.

Partially peel out the sheath and expose the shield. Push and clamp by the plate metal fittings for clamping the part.

Metal fittings for clamp are supplied with the CNC.

The ground plate must be made by the machine tool builder, and set as follows:



Fig. 3.6.5 (a) Cable clamp (1)



Fig. 3.6.5 (b) Cable clamp (2)

Prepare ground plate like the following figure.



Fig. 3.6.5 (c) Ground plate

For the ground plate, use a metal plate of 2 mm or thicker, which surface is plated with nickel.


Fig. 3.6.5 (d) Ground plate holes





Fig. 3.6.5 (e) Outer drawings of metal fittings for clamp

Ordering specification for metal fittings for clamp A02B–0118–K001 (5 pieces)

#### NOTE

Select cables of appropriate length.

Cables longer than necessary are not recommended. If cables longer than necessary are used, their resistance to noise may be reduced or noise may be induced on other cables. If surplus cable is wound up, inductance increases and an extremely high voltage may be induced during ON/OFF switching. This may result in malfunction or erroneous operation caused by noise.

## 3.7 MEASURES AGAINST SURGES DUE TO LIGHTNING

To protect the devices from surge voltages due to lightening, it is recommended to install surge–absorbing elements between the lines of the input power and between one line and ground. This does not, however, assures protection from all surges due to lightening.

#### NOTE

The device might break by lightning even when the surge-absorbing elements is installed.

## 3.7.1 Installation Procedure of Surge Protector

The surge–absorbing elements used for measures against surges due to lightening must be installed in the input power unit as shown in the figure below. The figure below shows an example in which an insulating transformer, shown by dotted line, is not installed. If an insulating transfer is installed, surge–absorbing element <2> (between line and ground) is not required.



3.7.2 Notes	<ul> <li>(1) For better surge absorbing effect, the wiring shown by heavy line in Fig. 3.7.1 (a) must be as short as possible.</li> <li>Wire: The wire size must be 2 mm<sup>2</sup> or greater.</li> <li>Wire length: The sum of the wire for the connection of surge protector &lt;1&gt; a and that of surge protector &lt;2&gt; b must be 2 m or less.</li> </ul>						
	<ul> <li>(2) If conducting dielectric strength tests by applying overvoltages (1000 VAC and 1500 VAC) to the power line, remove surge protector &lt;2&gt;. Otherwise, the overvoltages will activate the protector.</li> <li>(3) The nonfuse breaker (5A) is required for line protection if a surge exceeding the capacity of the surge protectors is applied, causing the surge protectors to be short–circuited.</li> <li>(4) Because no current flows through surge protectors &lt;1&gt; and &lt;2&gt; during normal operation, the nonfuse breaker (5A) can be shared by other devices. It can be connected to the control power for the power supply module and to the power for the fan motor of the spindle motor.</li> </ul>						
				3.7.3 Examples of Surge Protectors	For the surge absorbers made by Okaya Denki Sangyo Co. For the 200–V system		
					Between lines	R·A·V–781BYZ–2	
Between line and ground	R·A·V–781BXZ–4						
For the 400–V system							
Between lines	R·A·V–152BYZ–2A						
Between line and ground	R·A·V–801BXZ–4						

## 3.8 CONTROL UNIT

## 3.8.1 Configuration and Installation of the Control Unit

The Series 15i/150i control boards are mounted on the rack having two or more slots.



#### Fig. 3.8.1 (a) Configuration of Series 15*i*/150*i* control unit

Mounting position	Name of board
Slot PSU	Power supply unit
Slot 1	Main CPU board
Slot 2	Fast data server
Slot 3	Additional axis board

The rack is made of plastic, and comprises a fan motor and backplane board.

The fan motor is mounted on the rack. Air enters the rack from the bottom, and exits from the fan motor mounted at the top.

Make sure that the space shown in Fig. 3.8.1(b)((1) and (2)) is maintained to ensure air flow. (1) is necessary for replacing the fan.

When a hard disk is used as the data server, hard disk installation area (4) is required. (The external dimensions of the hard disk are subject to change without notice in the interest of product improvement. Before you design a rack using the hard disk contact FANUC regarding the outside dimensions of the hard disk.)



Fig. 3.8.1 (b) Installation of the control unit

## **3.8.2** Replacing the Battery for Memory Backup

**Replacing the lithium** 

battery

Part programs, offset data, and system parameters are stored in CMOS memory in the control unit. The power to the CMOS memory is baked up by a lithium battery mounted on the front panel of the control unit. The above data is not lost even when the main battery goes dead. The backup battery is mounted on the control unit at shipping.

When the voltage of the battery becomes low, alarm message "BAT" blinks on the LCD display and the battery alarm signal is output to the PMC.

If an alarm is issued, replace the battery within one week. Otherwise, the contents of the memory will be lost.

If the voltage of the battery becomes any lower, memory can no longer be backed up. Turning on the power to the control unit in this state causes system alarm [screen display: RAM parity error (low battery voltage)] to occur as the contents of memory are lost. Clear the entire memory and reenter data after replacing the battery.

Before replacing the memory backup battery, the control unit power off. The following two kinds of batteries can be used.

- Lithium battery built into the main board of the Series 15*i*/150*i*.
- Two alkaline dry cells (size D) in the external battery case.

#### Procedure

- (1) Prepare a new lithium battery (A02B–0200–K102).
- (2) Turn the control unit on for about 30 seconds.
- (3) Turn the control unit off.
- (4) Remove the old battery from the top of the main board.First, remove the claws holding the battery, and then remove the battery from the battery holder and disconnect the connector.
- (5) Replace the battery, insert the battery into the battery holder, and connect the connectors. Make sure that the battery holder claws are firmly holding the battery in place.



#### Fig. 3.8.2 Replacing the lithium battery

## WARNING

Using other than the recommended battery may result in the battery exploding.

Replace the battery only with the specified battery (A02B–0200–K102).

#### NOTE

Steps (3) to (5) should be completed within 30 minutes. Do not leave the control unit without a battery for any longer than the period, as this will result in the contents of memory being lost.

If battery replacement may take longer than 30 minutes, download all the data in CMOS memory to a memory card so that CMOS memory can be restored if the contents of memory are lost.

Dispose of used batteries as follows.

- (1) Small quantities (less than 10)Discharge the batteries and dispose of them as ordinary unburnable waste.
- (2) Large quantities Please consult FANUC.

## Replacing the alkaline dry cells (size D)

- (1) Prepare two new alkaline dry cells (size D).
- (2) Turn the Series 15i/150i on.
- (3) Remove the battery case cover.
- (4) Replace the batteries, paying careful attention to their orientation.
- (5) Replace the battery case cover.

#### NOTE

When replacing the dry cells while the power is off, use the same procedure as that for lithium battery replacement procedure, described above.



# Use of alkaline dry cells (size D)

## Connection

Power from the external batteries is supplied through the connector to which the lithium battery is connected. The lithium battery, provided as standard, can be replaced with external batteries in the battery case (A02B–0236–C281) according to the battery replacement procedures described above.



#### NOTE

Install the battery case (A02B–0236–C281: 14–m cable) in a location where the batteries can be replaced even when the control unit power is on.

The battery cable connector is attached to the control unit by means of a simple lock system. To prevent the connector from being disconnected due to the weight of the cable or tension within the cable, fix the cable section within 50 cm of the connector.

## 3.9 CABLE-LEAD-IN DIAGRAM

## **3.9.1** Control Unit Periphery Connector Layouts



Fig. 3.9.1 (a) Control unit connector installation pitch



Fig. 3.9.1 (b) Power supply unit connector layout



Fig. 3.9.1 (c) Main CPU board connector layout

## NOTE

This connector is provided when the TYPE B axis control card is used. TYPE A: One optical connector (FSSB line) is attached.

TYPE B: Two optical connectors (FSSB line) are attached.



Fig. 3.9.1 (d) Additional axis board connector layout

## NOTE

This connector is provided when the TYPE B axis control card is used. TYPE A: One optical connector (FSSB line) is attached. TYPE B: Two optical connectors (FSSB line) are attached.



Fig. 3.9.1 (e) Fast data server board connector layout



Fig. 3.9.1 (f) HSSB board connector layout



Fig. 3.9.1 (g) Data servo board A1 connector layout



Fig. 3.9.1 (h) Locations of the Connectors of Data Server Board A2



Fig. 3.9.1 (i) Locations of the Connectors of Serial Communication Boards A1 and A2



Fig. 3.9.1 (j) Locations of the Connectors of Ethernet board



Fig. 3.9.1 (k) Locations of the Connectors of Fast Ethernet board



Fig. 3.9.1 (I) Locations of the Connectors of PROFIBUS-DP board



Fig. 3.9.1 (m) Locations of the Connectors of DeviceNet board

## 3.9.2 LCD Unit Periphery Connector Layout



Fig 3.9.2 (a) LCD unit connector mounting pitch (when one LCD unit is connected) (rear view)



Fig 3.9.2 (b) LCD unit connector mounting pitch (when two LCD units are connected) (rear view)



Fig. 3.9.2 (c) LCD unit connector layout (when one LCD unit is connected)

## 3. INSTALLATION



Fig. 3.9.2 (d) LCD unit connector layout (when the two LCD units are connected)

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## 4.1 CONNECTIONS BETWEEN CONTROL UNITS





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## 4. TOTAL CONNECTION



Fig. 4.1 (a) Connections between control units (3/3)

## NOTE

The equipment connected to the controller and units must not generate dangerous voltages even when a failure or another abnormal condition occurs.

## 4.2 CONNECTIONS BETWEEN SERVO CARD



Fig. 4.2 (a) Connections between TYPE A servo card



Fig. 4.2 (b) Connections between TYPE B servo card

## 4.3 CONNECTIONS BETWEEN LCD UNIT



Fig. 4.3 (a) Connection between one LCD unit



#### Fig. 4.3 (b) Connection between two LCD units





## 5.1 POWER SOURCE UNIT PANEL CONNECTOR LAYOUT





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## 5.2 POWER SUPPLY CONNECTION

## 5.2.1 Connection when an Input Unit is Used

Like the Series 15B, the power source unit of the Series 15i/150i is provided with a power ON/OFF control function. Therefore, basically, the input unit need not be prepared for the power source unit on the Series 15i/150i for power ON/OFF control.

## NOTE

When the input unit is used, the capacitance of the ON/OFF–controlled AC output and the number of connectors are as shown in the figure below.



(1) CP1

This is the AC input connector for the control unit. The AC specifications are as follows:

- R, S 200 to 240VAC+10% -15%, 1-phase, 50Hz/60Hz±3Hz
- G Ground (class 3 grounding)

## NOTE

The above AC input specifications may partially be limited depending on the equipment that is powered from CP2 and CP3.

#### (2) CP2, CP3

These AC outputs are ON/OFF–controlled synchronized with power ON/OFF of the control unit.

The AC output specifications are the same as those for AC input to CP1.

The AC input specifications of CP1 may be limited depending on the AC input specifications of the equipment connected to CP2 and CP3.

Example) When the equipment connected to CP2 is 200/220VAC equipment (not 240VAC equipment), the AC input specifications of CPS becomes 200/220VAC.

The maximum AC output supplied from CP2 and CP3 combined is 2.5A. If capacitance is insufficient, refer to 5.2.3.

To prevent deterioration of the control unit due to rush current when the power is turned on, the capacitance of the load connected to CP2 and CP3 must be kept to  $440 \,\mu\text{F}$  for CP2 and CP3 combined. When an inductive load is connected, insert a spark killer parallel to the load.

## (3) CP4

This connector is for control the power source of ON/OFF button connections, for example.

(a) Power source ON/OFF (ON, OFF, COM)

The power of control units is turned ON and OFF.





#### (Contact Specifications)

Withstand voltage50 VDC min. (across contacts)Current100 mA min. (min. load 2 mA)

(b) Alarm inputs (AL, OFF)

The alarm inputs are for turning the system power off when an alarm signal from outside the control unit is received. Input the signal of the input to close when an alarm state is generated.

### (Contact Specifications)

Withstand voltage30 VDC min. (across contacts)Current100 mA min. (min. load 1 mA)

#### (c) Alarm outputs (FA, FB)

FA and FB are short-circuited when the DC output fuse used for the power source unit of the control unit blows, or when overvoltage, overcurrent or other abnormality occurs in the DC output of the power source unit. FA and FB are also short-circuited in the same way by the alarm inputs (AL, OFF) closing. This signals are held until the OFF button is pressed, or the input power source (AC input of power source unit) is cut. When these signals are output, the power source of the control unit is cut, and the function of the power ON button is disabled.

(Contact Rating) 50VDC max. 0.5A max. 50VAC max. 5VA max.

(4) CP5

This is the +24VDC output.

CP5 is used as the power sources for the LCD unit and hard disk unit.

(5) CP6

This is the power source (+24VDC) for the machine interface I/O (e.g. connection unit, operator's panel connection unit).

2A is the maximum DC output that is supplied from CP6.

.2.2	Power on units in the following sequence or simultaneously:	
ower ON/OFF equence	<ol> <li>(200VAC) of overall machine tool, separate detector (scale)</li> <li>Slave I/O unit connected by I/O Link, separate detector I/F unit and LCD unit (24VDC), servo amplifier control</li> <li>CNC control unit (200VAC)</li> </ol>	
	"Simultaneously" here means that 1 and 2 above must be turned on within	

500 ms at the most of turning 3 on. When the separate detector (scale) is used, the output signal of the

separate detector must be allowed to stabilize within 500 ms at the most of turning the separate detector I/F unit on.

Be sure to turn the separate detector (scale) on before the separate detector I/F unit sometimes according to the specifications of the separate detector (scale).

The battery for separate absolute pulse coder must remain connected regardless of whether the control unit is on or off. If the battery is removed with the control unit on, the position data of the pulse coder is lost.

The CNC display unit with PC functions is not subject to any power on sequence limitations.

Either the CNC display unit with PC functions or the CNC control unit starts fast, whichever is powered on later.

5 Ρ S

Power off units in the following sequence or simultaneously:

- 1. CNC control unit (200VAC)
- Slave I/O unit connected by I/O Link, separate detector I/F unit and LCD unit (24VDC), servo amplifier control
- 3. (200VAC) of overall machine tool, separate detector (scale)

"Simultaneously" here means 2 and 3 may be turned off within 500 ms before 1 is turned off. If 2 and 3 are turned off earlier, alarm information remains in the CNC.

Though the CNC display unit with PC functions is not subject to any power off sequence limitations, exit the application and OS according to the regular shutdown procedure before it is powered off.

Motor control is not possible when the power is turned off or a momentary power interruption occurs. Take the required action on the machine tool side for any irregularities that may occur as a result of not being to control the motor.

For example, apply the brake to prevent the shaft from falling when controlling axes that move in the gravity axis direction. If servos do not start normally, or if the motor does not operate, clamp the motor, and unclamp only the currently operating motor. Normally clamp the servo motor, if the servo axis cannot be controlled when the power is turned off or a momentary power interruption occurs. When you clamp the servo motor, the axes that are currently being controlled may fall within the time until the relays for clamping the servo motor. So, whether or not problems will occur in the axis travel distance must be carefully evaluated.


# CONNECTION OF I/O UNITS TO MACHINE INTERFACE

#### CAUTION

A signal or the power supply may possibly be assigned to a pin currently indicated as unused in the connector signal assignment table without prior notice. Do not use any pins indicated as being unused.

# 6.1 GENERAL

Combinations of the units listed in Table 6.1 can be used as the machine interface I/O.

The I/O unit for the FANUC I/O Link is installed separately from the control unit, and the two units are mutually connected by a specialized serial link (FANUC I/O Link). Multiple units can be placed in separate locations as shown below. The machine operator's panel that uses many input/output signals can be easily interfaced especially by placing the interface unit for machine operator's panel and the operator's panel connection unit in the immediate vicinity of the machine operator's panel. The FANUC I/O Link enables high-speed data transfer between the control unit and an external unit. The statuses of signals input from the machine are transferred to the control unit at constant intervals. The output signals from the control unit are sent to the external unit at constant intervals. The FANUC I/O Link has more applications. For example, the FANUC I/O Link is used to connect the FANUC Power Mate, which is single-axis CNC, or the FANUC System F-Model D Mate (F-D Mate), which is a cell controller. For details, see the subsequent description. For details of the units which are not listed in Table 6.1, see the corresponding operating manual.

Unit	Description	Reference
Connector panel I/O module	Distribution type I/O unit that handles the input/output signals required by the pow- er magnetics circuit; it has an interface with a manual pulse generator.	Sec. 6.3
Operator's panel I/O module (for ma- trix input)	Unit having an interface with a machine operator's panel; it has an interface with a manual pulse generator.	Sec. 6.4
Operator's panel I/O module	Unit having an interface with a machine operator's panel that handles the input/ output signals required by the power magnetics circuit; it has an interface with a manual pulse generator.	Sec. 6.5
FANUC I/O Unit– MODEL A	Modular I/O unit that supports a com- bination of the input/output signals re- quired by a power magnetics circuit.	Sec. 6.6 (B–61813E)
FANUC I/O Unit– MODEL B	Distribution type I/O unit that supports a combination of input/output signals re- quired by a power magnetics circuit.	B-62163E
Machine operator's panel interface unit	Unit having an interface with a matrix of key switches and LEDs on the machine operator's panel as well as an interface with a manual pulse generator.	Sec. 6.7
Connection unit	Unit having an interface with a machine.	Sec. 6.8

Table 6.1	Types of machine interface I/O (for FANUC I/O Link)
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Unit	Description	Reference
Sink–type output operator's panel connection unit	Unit having an interface with a machine operator's panel.	Sec. 6.9
Source type output operator's panel connection unit	Unit having an interface with a machine operator's panel; a source type output circuit is used in the DO signal output driver.	Sec. 6.10

Table 6.1 Types of machine interface I/O (for FANUC I/O Link)

#### CAUTION

- 1 The emergency stop signal should be simultaneously input to the CNC control unit and servo unit so that the power supply to the motor is interrupted. For detailed connection of the servo emergency stop signal, refer to "FANUC Servo Amplifier  $\alpha$  series (B–65162E)."
- 2 The input signals X006.0 to X006.7 include an emergency stop signal. These signals require a sink–type connection.

Unit	Description	Reference
Machine operator's panel	Machine operator's panel having remov- able, customizable keytops on the opera- tor's panel and keyboard	Section 6.12

# 6.2 CONNECTION OF THE FANUC I/O LINK

In the I/O there are the master station and its slave stations. The master is the control unit of the CNC, and the slave is the interface for I/O units. The slaves are divided into groups, and up to 16 groups can be connected to one I/O Link. <u>A maximum of two base I/O units can be connected as a group using I/O Unit–MODEL A</u>. The operator's panel connection unit and connection unit are each counted as one group.

The I/O Link is connected in different ways depending on the types of units actually used and the number of I/O points. To connect the I/O Link, the assignment and addresses of the I/O signals have been made programmable with the PMC program. The maximum number of I/O points is 1024.

The two connectors of the I/O Link are named JD1A and JD1B, and are common to all units.

A cable is always connected from JD1A of a unit to JD1B of the next unit. Although JD1B of the last unit is not used and left open, it need not be connected with a terminator. (The terminator is needed on the last interface module in the same group containing an I/O Unit–MODEL A.) The pin assignments of connectors JD1A and JD1B are common to all units on the I/O Link, and are shown on the following page. Use the figures when connecting the I/O Link irrespective of the type of unit.



Fig.6.2 I/O Link connection diagram

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# 6.2.1 Connection of FANUC I/O Link by Electric Cable



+5V terminals are for an optical I/O Link adapter. They are not necessary when connecting with a metal clamp.



# 6.2.2 Connection of FANUC I/O Link Optical Fiber Cable

The FANUC I/O Link can be extended to the maximum length of 200 m with optical fiber cables using an optical I/O link adapter.

#### NOTE

- In the following cases, use an optical fiber cable.
- When the cable is more than 15 meters long.
- When the cable runs between different cabinets and it is impossible to connect the cabinets with a grounding wire of 5.5 mm<sup>2</sup> or thicker.
- When there is concern that the cable is influenced by strong noise; for example :

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

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

# External dimension of optical I/O link adapter

The external dimensions are the same for a standard type (A13B–0154–B001) and a high–speed type (A13B–0154–B002).



# Weight of optical link adapter

Main body : Approx. 100 g.

The weight is the same for a standard type (A13B–0154–B001) and a high–speed type (A13B–0154–B002).

#### Connection

• Connection diagram



• Interunit connecting cables

01 02	SIN *SIN	11 12	0V 0V	Unit side JD1A,JD1B	Adapter side JD1
02 03 04 05 06 07 08 09 10	*SIN SOUT *SOUT +5V	12 13 14 15 16 17 18 19 20	0V 0V 0V 0V 0V +5V +5V	SIN(01) *SIN(02) SOUT(03) *SOUT(04) +5V(09) +5V(18) +5V(20) 0V(11) 0V(12) 0V(13) 0V(14) 0V(15) 0V(14)	(03)SOUT (04)*SOUT (01)SIN (02)*SIN (09)+5V (18)+5V (20)+5V (11)0V (12)0V (12)0V (13)0V (14)0V (15)0V
				00(10)	(10)00

- Recommended connector for cable side : PCR-E20FS (made by HONDA TSUSHIN KOGYO CO., LTD.)
- Recommended cable (wire material) : A66L–0001–0284#10P
- Cable length : Max. 2 m (when the recommended cable is used)
- Optical cable

- Cable length:

Max. 200 m (standard type) Max. 100 m (high-speed type)

	<b>NOTE</b> Do not bend optical cable beyond its bending radius of 25 mm. Do not unnecessarily twist optical cable.		
Maximum number of stages	<ul> <li>On the I/O Link, the conventional optical I/O Link adapter can be connected up to five stages using a standard type (A13B-0154-B001) and up to 16 stages using a high-speed type (A13B-0154-B002).</li> <li>1) Standard type (A13B-0154-B001) Number of connectable stages: 5</li> <li>2) High-speed type (A13B-0154-B002)</li> </ul>		
	Number of connectable stages: 6		
NC or I/O Unit Ink adapter	Optical I/O     NC or     Optical I/O     Optical I/O     NC or       link adapter     I/O Unit     link adapter     link adapter     I/O Unit		
	/		
1 sta	ge		
	<b>NOTE</b> The high-speed type and the standard-type cannot be mixed on a single line.		
Power source	The power source is the same for a standard type (A13B–0154–B001) and a high–speed type (A13B–0154–B002).		
	(a) Power voltage: 4.75V to 5.25V (at the receiving end)		
	(b) Consumption current: 200 mA		
Installation conditions	• The optical I/O link adapter enclosure is not fully sealed; install it with the CNC control unit in the fully enclosed cabinet.		
	• Ground the case using the case fixing screw of the optical I/O link adapter.		
	• The optical I/O link adapter is light, and it may not be necessary to mount it with screws. However, keep it from coming in contact with other circuits to prevent possible short-circuits. When mounting the optical I/O link adapter in a cabinet, attach it with an L-type fitting using the case fixing screws (M3) of the optical link adapter.		
	L fitting		

#### **Required parts**

For making up an I/O link using the optical link adapter, the following parts are necessary:

1

- Optical I/O link adapter 2
- Interunit connecting cable 2
- Optical cable
- External dimensions of optical fiber link adapter



• Application example of optical fiber link adapter



#### NOTE

A relay is possible at only one location. When the high–speed type optical I/O link adapter is used, the optical fiber connection adapter cannot be used.

# Relay by optical fiber link adapter

• Maximum transfer distances using optical fiber cable The following table shows the maximum transfer distances using optical fiber cable. This distance varies according to the number of relays made using the connection adapter.

	Number of Relays	Maximum Transfer Distance
Standard type	0	200 m
	1	100 m (total)
High-speed type	0	100 m
	1	Not allowed

# 6.3 CONNECTION OF CONNECTOR PANEL I/O MODULE

# 6.3.1 Configuration



#### NOTE

When mounting an expansion module directly on the branch–connection PC board, place it on the right side of the basic module as you face the mounting surface. When mounting an expansion module using a DIN rail or screws, place it on the left side of the basic module.

# 6.3.2 Connection Diagram



#### NOTE

In the above example connection diagram, the expansion module section contains a DI/DO module, a 2A–output module, and an analog input module. These expansion modules can be used in any combination.

# 6.3.3 Module Specification

#### Module types

Name	Drawing number	Specification	Reference
Branch–connection I/O module (basic module)	A03B-0815-C001	DI/DO: 24/16	
Branch–connection I/O module (expansion module A)	A03B-0815-C002	DI/DO: 24/16 With MPG interface	
Branch–connection I/O module (expansion module B)	A03B-0815-C003	DI/DO: 24/16 Without MPG inter- face	
Branch–connection I/O module (expansion module C)	A03B-0815-C004	DO: 16 2A–output module	
Branch–connection I/O module (expansion module D)	A03B-0815-C005	Analog input mod- ule	
Fuse (spare)	A03B-0815-K002	1A (for the basic mod- ule)	
Module-to-module flat cable	A03B-0815-K100	20 mm long Usable when the in- terval between two adjacent modules is 32 mm.	

Module specification (common items)

ltem	Specification	Remarks
Interface with the CNC	FANUC I/O Link con- nection	Enables expansion as slaves of the CNC to up to 16 units or 1024/1024 points.
Interface between the basic and expansion modules	Bus connection via flat cable	Up to three expansion mod- ules can be connected for each basic module.

For the specification (such as signal input/output rating) for specific modules, see the descriptions on the respective pages.

# Installation conditions

Unit ambient temperature	Operating: 0°C to 55°C Storage and transportation: –20°C to 60°C		
Temperature drift	0.3°C/min (maximum)		
Humidity	Ordinary operation: 75% or less (relative) Short–period operation (within one month): 95% or less (relative)		
Vibration	Operation: 0.5 G or lower		
Atmosphere	Ordinary factory environment (extra consideration is required if the unit is to be used in an environment where the concentration of dust, cutting fluid, or organic solvent is high.)		
Other conditions	<ul> <li>(1) This I/O module must be used in a cabinet that has a completely sealed structure.</li> <li>(2) To keep I/O modules well-ventilated, mount them in the orientation shown below, and allow a space of at least 100 mm above and below for cabling and ventilation. In addition, do not place any unit generating a large amount of heat under the I/O modules.</li> <li>(3) Be careful not to block the vents of the basic module with the flat cable; see the relevant description in Section 6.3.17 (for connection between the basic and expansion modules).</li> </ul>		
	I/I/O Link connection Bottom		

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### **Power requirements**

Module	Supply voltage	Power requirement	Remarks
Basic module	24 VDC 10% shall be supplied via the I/O	0.2A+7.3mA×DI	Number of DI points for which DI = ON
Expansion modules A and B	of the basic module; ±10% contains	0.1A+7.3mA×DI	Number of DI points for which DI = ON
Expansion module C (2A–output module)	changes and ripple.	0.1A	
Expansion module D (analog input module)		0.1A	

Estimate the amount of heat generated by each module as its power requirement  $\times$  24 (W).

# 6.3.4 DI/DO Connector Pin Assignment

Pin-outs of DI/DO connectors on the basic module and expansion modules A and B are shown below.

33	DOCOM			01	DOCOM
34	Yn+0.0		0)/	02	Yn+1.0
35	Yn+0.1	19	00	03	Yn+1.1
36	Yn+0.2	20	00	04	Yn+1.2
37	Yn+0.3	21	00	05	Yn+1.3
38	Yn+0.4	22	00	06	Yn+1.4
39	Yn+0.5	23		07	Yn+1.5
40	Yn+0.6	24		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

#### NOTE

- 1 The DI and DO addresses for the basic and extension modules run contiguously. These basic and extension module 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 Pins 18 and 50 (+24 V) of connector CB150 are used to supply 24 V to the module from an external source. This voltage must always be supplied because it is used in the module.

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

# 6.3.5 DI (Input Signal) Connection This section explains how DI points (input signals) are connected to the basic module and expansion modules A and B. A maximum of 96 points are provided (24 points per module; 1 basic module + 3 extension modules).





#### NOTE

- 1 Xm+0.0 through Xm+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 of the addresses for which the common voltage is fixed, ranging from Xm+1.0 to Xm+1.7 or from Xm+2.0 to Xm+2.7. See 6.2 for information about how to allocate the emergency stop signal.
- 3 For unused DI pins allocated to the addresses for which the common voltage is fixed (from Xm+1.0 to Xm+1.7 and from Xm+2.0 to Xm+2.7), the logic is fixed to "0". For unused pins allocated to Xm+0.0 to Xm+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 Xm+0.0 to Xm+0.0 to Xm+0.7 is variable when the contact of the DICOM0 CB150(24) pin is open.

## 6.3.6 DO (Output Signal) Connection

This section explains how DO points (output signals) are connected to the basic module and expansion modules A and B.

• A maximum of 64 points are provided (16 points per module; 1 basic module + 3 extension modules).



# 6.3.7 DI/DO Signal Ratings

This section describes the DI/DO signal ratings for the basic module and expansion modules A and B.

#### DI (input signal ratings)

Number of points	24 (per module)
Contact capacity	30 VDC, 16 mA or higher
Open–circuit contact–to–contact leakage current	1 mA or lower (at 26.4 V)
Closed–circuit contact–to–contact voltage drop	2 V or lower (including drop across the cable)
Delay time	2 ms (maximum) across the receiver In addition, it is necessary to consider the sum of the I/O Link transfer time (up to 2 ms) between the CNC and I/O module and the ladder scan cycle time (in the CNC).

#### DO (output signal ratings)

Number of points	16 (per module)
On-state maximum load current	200 mA or lower, including instantaneous changes
On–state saturation voltage	1 V (maximum) measured when the load current is 200 mA
Withstand voltage	24 V +20% or lower, including instantaneous changes
Off-state outflow leak- age current	20 A or lower
Delay time	50 $\mu$ s (maximum) across the driver In addition, it is necessary to consider the sum of the I/O Link transfer time (up to 2 ms) between the CNC and I/O module and the ladder scan cycle time (in the CNC).

Turning on and off power (common to DO points) for the DO points (output signals)

Turning off (opening) power supply pin DOCOM for the DO points (output signals) turns off all DO points of each module at one time. The state of the DO points is as shown below.



#### NOTE

If a DO is on in the sequence, the on/off state of the DOCOM is reflected on that DO as shown in the dotted area. Do not turn off +24 V supplied to the I/O module during operation. If it is turned off, an alarm is issued for communication with the CNC. This +24 V must be turned on at the same time or before the power to the CNC is turned on. It must be turned off at the same time or after the power to the CNC is turned off.

Parallel connection of DO points (output signals)

Connecting two DO points in parallel for simultaneous on/off control in the sequence can double the maximum allowable DO load current, allowing up to 400 mA to be obtained, since the maximum allowable load current of one DO point is 200 mA. Note, however, that when the DO points are off, their leakage current is also doubled (to up to 40 A).



# 6.3.8 2A–Output Connector Pin Assignment Diagram

This section describes the pin assignments of the 2A–output connector used for expansion module C.

	CB154 (HONDA MR–50RMA)								
33	DOCOMA				01	DOCOMA			
34	Yn+0.0	40	0		02	Yn+1.0			
35	Yn+0.1	19	G		03	Yn+1.1			
36	Yn+0.2	20	GI		04	Yn+1.2			
37	Yn+0.3	21	G		05	Yn+1.3			
38	Yn+0.4	22	GI		06	Yn+1.4			
39	Yn+0.5	23	GI	NDA	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–pin male connector with metal fixture for connector housing

#### NOTE

- 1 The DI/DO addresses of the basic and expansion modules are sequential. These addresses are assumed to be in one group when they are assigned to the I/O Link. That is, if the first address in the assignment is X0004 and Y0000 (m = 4, n = 0), the DI/DO addresses are as listed below.
- 2 If the 2A–output module is used, its DI addresses cannot be used. (If the 2A–output module is used as expansion module 3, X13 to X15 cannot be used.)

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

# 6.3.9 2A DO (Output Signal) Connection

This section describes how the 2A–output connector pins are connected for expansion module C.



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# 6.3.10 2A–Output DO Signal Ratings

This section describes the 2A-output DO signal ratings for expansion module C.

DO (output signal ratings)

Number of points	32 (per module)
On-state maximum load current	2 A per point Up to 12 A for the entire module (16 DO points), including instantaneous changes
Withstand voltage	24 V +20% or lower, including instantaneous changes
Off–state outflow leakage current	100 μA or lower
Delay time	It is necessary to consider the sum of the I/O Link transfer time (up to 2 ms) and ladder scan cycle time (in the CNC).

Turning the on and off power (common to DO points) for the DO points (output signals)

Turning off (opening) power supply pin DOCOM for the DO points (output signals) turns off all DO points of each module at one time. The state of the DO points is as shown below.



#### NOTE

If a DO is on in the sequence, the on/off state of the DOCOM is reflected on that DO as shown in the dotted area. Do not turn off +24 V supplied to the I/O module during operation. If it is turned off, an alarm is issued for communication with the CNC. This +24 V must be turned on at the same time or before the power to the CNC is turned on. It must be turned off at the same time or after the power to the CNC is turned off.

Parallel connection of DO points (output signals)

For the 2A–output module, it is impossible to connect DO points in parallel. In addition, its DO points cannot be connected in parallel with those of any other module.

## 6.3.11 Analog Input

Connector Pin Assignment Diagram This section describes the pin assignments of the analog input connector used for expansion module D.

CB157 (HONDA MR–50RMA)								
33	INM3			01	INM1			
34	COM3	10	EGND	02	COM1			
35	FGND3	19		03	FDND1			
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		1		17				
50		1		18				

50–pin male connector with metal fixture for connector housing

#### NOTE

- 1 The DI/DO addresses of the basic and expansion modules are sequential. These addresses are assumed to be in one group when they are assigned to the I/O Link. That is, if the first address in the assignment is X0004 and Y0000 (m = 4, n = 0), the DI/DO addresses are as listed below.
  - n = 0, the DI/DO addresses are as listed below.
- 2 Also the DO space can be used as an input channel selection area for the analog input module.

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

# 6.3.12 Analog Input Signal Connection

This section shows the connection diagram for the analog input connector of expansion module D



#### NOTE

- 1 In the above diagram, letter n stands for a channel number (where n = 1, 2, 3, or 4).
- 2 Either voltage input or current input can be selected for each channel. If current input is selected, be sure to strap JMPn and INPn.
- 3 The conductors of the connector cable should be shielded twisted pairs.

module D.

In the above diagram, the shielding for each channel is separately connected to FGNDn, all of which are connected to FGND. However, as the frame ground, you may connect each shielding directly to a cable clamp without using FGNDn.
 When the voltage supply (current supply) has a GND pin as shown in the figure, connect the

COMn pin to the GND pin. When not, connect INMn to COMn on the analog input module.

## 6.3.13 Analog Input Signal Ratings

Item Specification Remarks Number of input 4 channels (NOTE) Analog input -10 to +10 VDC (with input re-Either voltage input sistance of 4.7 M $\Omega$ ) or current input is -20 to +20 mADC (with input reselectable separatesistance of 250  $\Omega$ ) ly for each channel. Digital output Twos complement 12-bit binary (NOTE) representation Supported input/ Analog input Digital output output +10V +2000 +5V or +20mV +1000 0V or 0mA 0 -5V or -20mA -1000-10V -2000Resolution 5 mV or 20 µA Overall precision Voltage input: ±0.5% In reference to the Current input: ±1% full-scale reading Maximum input volt-±15V/±30mA age/current Minimum conver-Ladder scan cycle by the consion time (NOTE) nected CNC Number of occupied DI = 3 bytes, DO = 2 bytes input/output points (NOTE)

This section describes the analog input signal ratings for expansion

#### NOTE

This analog input module has four input channels, but its digital output section uses one 12-bit output in the 3 bytes for the number of occupied input points. That is, the ladder dynamically selects which channel to use. A channel switching DO for channel selection is in the 2 bytes for the number of occupied output points.

# 6.3.14(About digital output)Analog Input<br/>Specification(About digital output)<br/>This analog input module has four input channels, but its digital output<br/>section uses one 12-bit output in the 3 bytes for the number of occupied<br/>input points. The format of the output is as listed below.

Module internal address	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	СНВ	CHA	D11	D10	D09	D08

D00 to D11 form 12–bit digital output data. D00 and D11 correspond to weights of  $2^0$  and  $2^{11}$ , respectively.

D11 corresponds also to the sign bit of a twos complement representation. CHA and CHB represent analog input channels. That is, if the 2 bytes mentioned above are read by the PMC program, D11 to D00 reflect the A–D conversion result for input channels represented by CHA and CHB. See the following description about channel selection for details of CHA and CHB. There are some items to be considered when data is read from the PMC program. See the relevant description on assignment in Section 6.3.

(About channel selection)

For this analog input module, you must use the PMC program to select from the four channels a channel to be used for output to the digital output section. CHA and CHB in the 2 bytes for the number of occupied output points are used as DO points for channel selection. They are mapped as shown below.

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Module internal address	7	6	5	4	3	2	1	0
Yn	Х	Х	Х	Х	Х	Х	X	Х
Yn+1	Х	Х	Х	Х	Х	Х	CHB	CHA

Specifying a pair of values listed below for CHA and CHB causes the corresponding channel to be selected, thus enabling the A-D conversion and selection data for the channel to be read as DI data. Letter X in the above table indicates a bit not in use. It can be either 0 or 1.

СНВ	СНА	Channel to be selected
0	0	Channel 1
0	1	Channel 2
1	0	Channel 3
1	1	Channel 4

(About the addresses)

The first address for X (DI) of the basic modules containing an analog input module must be even-numbered. With this assignment, the digital output address of the analog input module is determined based on the space where it is mounted, as listed below.

• If the analog input module is mounted in the space for expansion module 1 (m is the top address assigned)

Module internal address	7	6	5	4	3	2	1	0
Xm+3 (odd address)				Undefin	ed			
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 in the space for expansion module 2 (m is the first assigned address)

oduleinternal address	7	6	5	4	3	2	1	0
Xm+6 (odd address)	D07	D06	D05	D04	D03	D02	D01	D00
Km+7 (even address)	0	0	СНВ	CHA	D11	D10	D09	D08
Xm+8 (odd address)	Undefined							

Мо >

# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

• If the analog input module is mounted in the space for expansion module 3 (m is the first assigned address)

Module internal address	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

When the 2–byte digital output address is referenced by the PMC program, its data should be read in word (16–bit) units.

# 6.3.15 Manual Pulse Generator Connection

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



Recommended material: A66L–0001–0286 (#20AWG  $\times$  6 + #24AWG  $\times$  3 pairs)

#### NOTE

Since some pins of this connector, unlike other 20–pin connectors, have been removed, resulting in a unique pin arrangement, be careful when identifying pin numbers. See Figure 2 in Appendix B and Table C (a) in Appendix C.

Recommended connector: A02B–0120–K303 (includes the following body and housing)

(Body: FI40–2015S, soldering type, from Hirose Electric Co., Ltd.) (Housing: FI40–20–CV5, from 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)  $% \left( {{\left[ {{{\rm{B}}} \right]}_{{\rm{B}}}}_{{\rm{A}}}} \right)$ 

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

#### NOTE

The number of manual pulse generators that can be connected varies with the model and the configuration of options.

6.3.16 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:

$$0.2 \ge \frac{0.1 \times \mathbf{R} \times 2\mathbf{L}}{\mathbf{m}} \qquad \text{Wher} \\ 0.1$$

0.1 = manual pulse generator supply current (0.1 A)

 $R = resistance \ per \ unit \ cable \ length \\ (\Omega/m)$ 

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  $\Omega/m$ ) are used (three power supply wires connected to 5 V and the other three to 0 V), the cable length is:

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

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 generators are used), or 25.58 m (when three generators are used).

# 6.3.17 Connection of Basic and Extension Modules

Modules can be connected in the same way, regardless of whether you are connecting the basic module to an extension module or connecting two extension modules. Connect the modules 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.) Module connector–side specification: HIF3BA–34PA–2.54DS (Hirose Electric Co., Ltd.) or FAP–3403–1202–OBS (Yamaichi Denki Co., Ltd.)

#### NOTE

- 1 Modules 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 modules 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 modules in such a way that the flat cables lie on top of them. The basic module has a vent at the top (as indicated by the dotted lines in the above figure). When connecting modules, install extension modules so that the flat cables do not cover the vent, as shown in the above figure.

When mounting an expansion module directly on the branch–connection PC board, place it on the right side of the basic module as you face the mounting surface. When mounting an expansion module using a DIN rail or screws, place it on the left side of the basic module.

# 6.3.18 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 soldered side



Prohibited area on component 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

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)

## 6.3.19 Other Notes

#### DO signal reaction to a system alarm

If a system alarm occurs in a CNC using the connector panel I/O module, or if I/O Link communication between the CNC and connector panel I/O module fails, all the DO signals of the I/O module are turned off. Therefore, due care must be taken when setting up the machine sequence. Also, the same phenomenon occurs if the power to the CNC or the I/O module is turned off.

#### Address allocation

For the connector panel I/O module, I/O addresses are mapped as follows.

DI space r	nap	DO	space map
Xm		Yn	Designedula
Xm+1	Basic module	Yn+1	Basic module
Xm+2		Yn+2	Extension
Xm+3		Yn+3	module 1
Xm+4	Extension	Yn+4	Extension
Xm+5		Yn+5	module 2
Xm+6		Yn+6	Extension
Xm+7	Extension module 2	Yn+7	module 3
Xm+8			
Xm+9			
Xm+10	Extension		
Xm+11	module 5		
Xm+12 (for 1st MPG)			
Xm+13 (for 2nd MPG)	Extension		
Xm+14 (for 3rd MPG)			
Xm+15 (DO alarm detection)	Basic module		

The basic connector panel I/O module is allocated a group of DI addresses (16 bytes) and a group of DO addresses (8 bytes). Up to three hardware extension modules can be added or removed as required. The reason for this address allocation is explained below.

The MPG interface (MPG counter) occupies a DI space from Xm+12 through Xm+14. These addresses are fixed regardless of whether extension module 2 or 3 is used, and Xm+12 through Xm+14 must be allocated as a DI work area to enable the use of the MPG. Therefore, when using an MPG for the i series CNC, allocate DI addresses in units of 16 bytes. Do not use the DI space from Xm+12 through Xm+14 for Ladder; the CNC processes the MPG counter value directly.

DI address Xm+15 is used for detecting overcurrent and overheating alarms that occur in the IC used in the DO driver. [For details, see the section describing the detection of DO (output signal) alarms.] This address is fixed regardless of whether extension module 2 or 3 is used, and it must be allocated as a work area before it can be used. When using this area, therefore, allocate DI addresses in units of 16 bytes.

Basically, I/O addresses can be allocated to the connector panel I/O modules freely. When allocating DI addresses, however, consider also the addresses that are directly supervised by the CNC, and keep the following in mind.

ADDRESS	7	6	5	4	3	2	1	0
X0006				*ESP				
X0008				AE2	AE1			
X0011		SKIP1						

#### Fixed addresses directly supervised by the CNC (for FS15*i*/150*i*)

### When DI addresses are allocated in units of 16 bytes, starting at X0005

X0005		← *ESP fixed signals				
X0006	Basic module	, č				
X0007						
X0008						
X0009	Extension	<*AEn fixed signal				
X0010						
X0011						
X0012	Extension	<ul> <li>SKIP1 fixed signal</li> </ul>				
X0013	module 2	,				
X0014		Use one basic module in a minimum configuration. Use expan-				
X0015	Extension module 3	sion modules 1, 2, and 3 as required. In this case, it is impossible				
X0016	module o	to use the fixed AEn or SKIP1 signal, or the MPG interface in ex-				
X0017 (for 1st MPG)	<b>-</b>	signal in the basic module in a minimum configuration by assign-				
X0018 (for 2nd MPG)	Extension module 1	ing it to the address permanently set for 24 V common.				
X0019 (for 3rd MPG)						
X0020 (DO alarm detection)	Basic module	1				

### DO (output signal) alarm detection

The DO driver of the I/O module is capable of detecting an overcurrent and measuring its own temperature. If an accident, such as the connecting of the cable to ground, causes an abnormal increase in the load current or in the driver temperature, a protection circuit, which is provided for each DO driver (1 byte), is activated and keeps the DO signal for the relevant 1 byte in the OFF state until the cause of the problem is eliminated. Even if this occurs, the CNC and I/O module continue operating. The DI address (Xm+15) identifies the DO driver which has detected the alarm. The following table shows the correspondence between the DI address (Xm+15) bits and the DO addresses. Bit value "1" indicates that the corresponding DO driver has detected an alarm. The contents of the Xm+15 area can be checked by using the DGN screen of the CNC or by performing alarm processing for the area in advance by using Ladder. This helps alarm detection and recovery.

## 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

Alarm detection address and bit	DO address	Location
Xm+15.0	Yn+0	Basic module
Xm+15.1	Yn+1	Basic module
Xm+15.2	Yn+2	Extension module 1
Xm+15.3	Yn+3	Extension module 1
Xm+15.4	Yn+4	Extension module 2
Xm+15.5	Yn+5	Extension module 2
Xm+15.6	Yn+6	Extension module 3
Xm+15.7	Yn+7	Extension module 3

#### NOTE

This function is supported by neither the 2A–output module nor the analog input module.

#### 2A-output and analog input module assignment

The 2A–output and analog input modules can be allocated in any of the spaces for expansion modules 1, 2, and 3. It is also possible to allocate up to three 2A–output or analog input modules in all these module spaces. If the MPG interface is required, however, it occupies expansion module 1, and therefore, neither a 2A–output nor analog input module can be allocated in this module space.

Because no DI is available in the 2A–output module, the DI space corresponding to the 2A–output module cannot be used. For example, if the 2A–output module is allocated in the space for expansion module 2, it is impossible to use a space between Xm+6 and Xm+8. (This will not shift the space for other modules; the DI space for expansion module 3 remains between Xm+9 and Xm+11.)

## 6.3.20 Distribution I/O Setting

By changing the setting (rotary switch) for the expansion modules, connections can be made by omitting some expansion modules as shown below.



Method of setting (control and method of setting the control) As shown below, the control (rotary switch) is located on an expansion module. To change the setting, turn the switch with a flat–bladed screwdriver with a tip width of about 2.5 mm.



Setting position	Actual indication	Meaning of setting
0	0	This is the standard setting. The rotary switch is factory–set to this position. This setting is used when no expansion module is omitted.
1	_	Set the rotary switch on an expansion module to this position when the preceding expansion module is omitted.
2	2	Set the rotary switch on an expansion module to this position when the preceding two expansion modules are omitted.
3	-	This setting is prohibited.
4 to F	4, -, 6, -, 8, -, A, -, C, -, E, -,	<ul> <li>4, 8, or C has the same effect as 0.</li> <li>5, 9, or D has the same effect as 1.</li> <li>6, A, or E has the same effect as 2.</li> <li>7, B, or F has the same effect as 3. (This setting, however, is prohibited.)</li> </ul>

The	function	of the	rotary	switch	10 20	follows
110	runction	or the	Totary	Switch	15 as	10110 W.S.

Examples of setting



This setting capability is a newly added function. Depending on the type of the module, this function is available as indicated below.

Expansion module B (DO/DO = 24/16, without manual pulse interface)	A03B-0815-C003	Starting from June, 1998
Expansion module C (DO = 16, 2A output)	A03B-0815-C004	Starting from August, 1998
Expansion module D (analog input)	A03B-0815-C005	Starting from August, 1998

## NOTE

Expansion module A (DI/DO = 24/16, with manual pulse interface) (A03B–0815–C002) is fitted with an additional rotary switch as other types of modules are modified. However, expansion module A is always mounted at the location of expansion module 1, so that its factory setting need not be changed.

## 6.4 CONNECTION OF OPERATOR'S PANEL I/O MODULE (FOR MATRIX INPUT)

## 6.4.1 Overall Connection Diagram



### Connectors that cannot be used on the cable side

			Specification	Manufacturer
Connector			FI–20–CV7	Hirose Electric Co., Ltd.
Connector connector	case	and	FI30-20S-CV7	Hirose Electric Co., Ltd.

# 6.4.2 Power Connection

Provide the CPD1 (IN) connector, shown below, with the power necessary for printed circuit board operation and that for DI operation. To facilitate power division, the power is output to CPD1 (OUT) exactly as it is input from CPD1 (IN). When power division is required, use CPD1 (OUT).



### NOTE

The specification of the power supply connector CPD1 (IN) is the same as that for CPD1 (OUT). There are no indications on the printed circuit board to distinguish between the IN and OUT connectors. Do not turn off the +24 V supply to the connector during operation. Turning off the +24 V supply will cause a CNC communication alarm. When turning on the power, the +24 V supply to the I/O module must be turned on before or at the same time as the power supply to the CNC.

## 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

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## 6.4.3 DI/DO Connector Pin Arrangement

	CES	3		CE5	4
	А	В		А	В
01	0V	0V	01	0V	0V
02	N.C.	+24V	02	COM1	+24V
03	Xm+0.0	Xm+0.1	03	Xm+1.0	Xm+1.*
04	Xm+0.2	Xm+0.3	04	Xm+1.2	Xm+1.3
05	Xm+0.4	Xm+0.5	05	Xm+1.4	Xm+1.
06	Xm+0.6	Xm+0.7	06	Xm+1.6	Xm+1.
07	Yn+0.0	Yn+0.1	07	Yn+3.0	Yn+3.1
08	Yn+0.2	Yn+0.3	08	Yn+3.2	Yn+3.3
09	Yn+0.4	Yn+0.5	09	Yn+3.4	Yn+3.5
10	Yn+0.6	Yn+0.7	10	Yn+3.6	Yn+3.7
11	Yn+1.0	Yn+1.1	11	Yn+4.0	Yn+4.1
12	Yn+1.2	Yn+1.3	12	Yn+4.2	Yn+4.3
13	Yn+1.4	Yn+1.5	13	Yn+4.4	Yn+4.5
14	Yn+1.6	Yn+1.7	14	Yn+4.6	Yn+4.7
15	Yn+2.0	Yn+2.1	15	Yn+5.0	Yn+5.1
16	Yn+2.2	Yn+2.3	16	Yn+5.2	Yn+5.3
17	Yn+2.4	Yn+2.5	17	Yn+5.4	Yn+5.8
18	Yn+2.6	Yn+2.7	18	Yn+5.6	Yn+5.7
19	KYD0	KYD1	19	Yn+6.0	Yn+6.1
20	KYD2	KYD3	20	Yn+6.2	Yn+6.3
21	KYD4	KYD5	21	Yn+6.4	Yn+6.5
22	KYD6	KYD7	22	Yn+6.6	Yn+6.7
23	KCM1	KCM2	23	KCM5	KCM
24	KCM3	KCM4	24	KCM7	DOCC
25	DOCOM	DOCOM	25	DOCOM	DOCC

(Hitachi Cable, Ltd. or Oki Electric Cable Co., Ltd.))

## 6.4.4 DI (General–purpose Input Signal) Connection



#### NOTE

Xm+1.0 through Xm+1.7 are DI pins for which a common voltage can be selected. That is, by connecting the COM1 CE54(A02) 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 this from occurring, the connection of the COM1 CE54(A02) pin to the 0 V power supply is recommended whereever possible.

For safety reasons, the emergency stop signal needs to be allocated to an appropriate bit of the addresses for which the common voltage is fixed, ranging from Xm+0.0 to Xm+0.7. See "Address allocation" in Section 9.5.10 for details of how to allocate the emergency stop signal.

For unused DI pins allocated to the addresses for which the common voltage is fixed (from Xm+1.0 to Xm+1.7), the logic is fixed to "0". For unused pins allocated to Xm+1.0 to Xm+1.7 for which the common voltage can be selected, the logic is fixed to "0" when the COM1 CE54(A02) pin is connected to the 0 V power supply. When the COM1 CE54(A02) pin is connected to the +24 V power supply, the logic is fixed to "1". The logic of the unused pins allocated to Xm+1.0 to Xm+1.0 to Xm+1.7 is variable when the contact of the COM1 CE54(A02) pin is open.

## • A maximum of 56 points are provided.

## 6.4.5 DI (Matrix Input Signal) Connection

*KCM1	) CE53(A23)	Xn+4.0	_ <mark>Xn+4.1</mark>	X <u>n+4.2</u>	X <u>n+4.3</u> (	_ <mark>Xn+4.4_</mark>	Xn+4.5	_ <mark>Xn+4.6</mark> _(	<sub>⊋</sub> Xn+4.7
*KCM2	) CE53(B23)	Xn+5.0	Xn+5.1	Xn+5.2	Xn+5.3	Xn+5.4	Xn+5.5	Xn+5.6	Xn+5.7
*KCM3	CE53(A24)	Xn+6.0	Xn+6.1	Xn+6.2	Xn+6.3	Xn+6.4	Xn+6.5	Xn+6.6	Xn+6.7
*KCM4	) CE53(B24)	Xn+7.0	Xn+7.1	Xn+7.2	Xn+7.3	Xn+7.4	Xn+7.5	Xn+7.6	Xn+7.7
*KCM5	) CE54(A23)	Xn+8.0	Xn+8.1	Xn+8.2	Xn+8.3	Xn+8.4	Xn+8.5	Xn+8.6	Xn+8.7
*KCM6	) CE54(B23)	Xn+9.0	Xn+9.1	Xn+9.2	Xn+9.3	Xn+9.4	Xn+9.5	Xn+9.6	Xn+9.7
*KCM7	) CE54(A24)	Xn+10.0	Xn+10.1	Xn+10.2	Xn+10.3	Xn+10.4 (	Xn+10.5	Xn+10.6	Xn+10.7
*KYD0	<u>) CE53(A19)</u>								
*KYD1	) CE53(B19)								
*KYD2	) <u>CE53(A20)</u>								
*KYD3	) CE53(B20)								
*KYD4	) CE53(A21)								
*KYD5	) CE53(B21)						]		
*KYD6	) CE53(A22)							]	
*KYD7	) <u>CE53(B22)</u>								

### NOTE

Detour prevention diodes must be incorporated for matrix signal input, as shown in the following figure. Otherwise, only two signals can be input at the same time. Inputting three or more signals simultaneously without using detour prevention diodes may result in data input errors.



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## 6.4.6 DO (Output Signal) Connection

• A maximum of 56 points are provided.





6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### B-63783EN/01



6.4.7 Manual Pulse Generator Connection

For details of the connection of the manual pulse generator, see Section 6.3.15.

## 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

## 6.4.8 External View



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## 6.4.9 Specifications

## Installation specifications

Ambient temperature	During operation0°C to 58°CDuring storage and transportation-20°C to 60°C
Temperature change	Max. 0.3°C/min.
Relative humidity	Normal : 75% or less Short term (1 month or less) : 95% or less
Vibration	During operation : 0.5 G or less
Environment	Ordinary machining factory environment (Special consideration is required when installing the module in a dusty location or where highly concen- trated cutting lubricant or organic solvent is used.)
Other requirements	(1) Install the I/O module in a fully enclosed cabinet.

## Ordering specifications

Item	Specification	Remarks
Operator's panel I/O module	A20B-2002-0470	General–purpose DI: 16 points Matrix DI: 56 points DO: 56 points MPG interface is supported.
Fuse (replacement part)	A03B-0815-K001	1A

## Module specifications

ltem	Specification	Remarks
General-purpose DI	16 points	24–V input
Matrix DI	56 points $(8 \times 7)$	5–V input
DO points	56 points	24 V source type output
CNC interface	FANUC I/O Link connection	Up to 16 modules can be connected as CNC slaves. Or, a maximum of 1024 points can be supported on both the input and output sides.
MPG interface	Max. 3 units	MPG interface can be used only for the <i>i</i> series CNC.

## Power supply rating

Module	Supply voltage	Current rating	Remarks
Operator's panel I/O module	24 VDC $\pm$ 10% supplied from the power supply connector CPD1. The allowance of $\pm$ 10% should include instantaneous voltage and ripple voltage.	0.35A	The total power consumption of DI points is included. The power consumption of DO points is not included.

#### DI (input signal) specifications (General–purpose input signal)

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 CNC and I/O module (max. 2 ms + CNC ladder scan cycle) must also be taken into account.

#### (Matrix input signal)

Contact rating	6 VDC, 2 mA or more
Open circuit intercontact leakage current	0.2 mA or less (at 26 V)
Closed circuit intercontact voltage drop	0.9 V or less (with a current of 1 mA)
Delay	The maximum matrix period of 16 ms, the maximum time of I/O Link transfer between CNC and I/O module of 2 ms, and the ladder scanning period (by CNC) must be considered.

### NOTE

When detour prevention diodes are used, the voltage drop across closed contacts indicated above must be maintained, including the diode voltage drop.

#### DO (output signal) specifications

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 $\mu$ A or less
Delay	Driver delay: Max. 50 $\mu$ s The time required for I/O Link transmission between the CNC and I/O module (max. 2 ms + CNC ladder scan cycle) must also be taken into account.

### NOTE

Ensure that the maximum current per DOCOM pin (DO power supply pin) does not exceed 0.7 A.

## 6.4.10 Other Notes

## DO signal reaction to a system alarm

If a system alarm occurs in the CNC using the operator's panel I/O module, or if I/O Link communication between the CNC and operator's panel I/O module fails, all the DO signals of the I/O module are turned off. Therefore, sufficient care is necessary when setting up the machine sequence. Also, the same phenomenon occurs if the power to the CNC or the I/O module is turned off.

## Address allocation

For the operator's panel I/O module, I/O addresses are mapped as follows.

DI space	пар	DC	space map
Xm	General-purpose	Yn	
Xm+1	input signal	Yn+1	
Xm+2		Yn+2	
Xm+3	Reserved	Yn+3	Output signal
Xm+4		Yn+4	
Xm+5		Yn+5	
Xm+6	Matrix input	Yn+6	
Xm+7	signal	Yn+7	Reserved
Xm+8			•
Xm+9			
Xm+10			
Xm+11	Reserved		
Xm+12 (for 1st MPG)			
Xm+13 (for 2nd MPG)	MPG		
Xm+14 (for 3rd MPG)			
Xm+15 (DO alarm detection)	DO alarm detection		

The operator's panel I/O module is allocated a group of DI addresses (16 bytes) and a group of DO addresses (8 bytes). This address allocation is explained below.

The MPG interface (MPG counter) occupies DI space from Xm+12 through Xm+14. These addresses are fixed, and Xm+12 through Xm+14 must be allocated as a DI work area to enable the use of the MPG. Therefore, when using an MPG for the I series CNC, allocate DI addresses in units of 16 bytes. Do not use the DI space from Xm+12 through Xm+14 for Ladder; the CNC processes the MPG counter value directly.

DI address Xm+15 is used for detecting overcurrent and overheating alarms that may occur in the IC used in the DO driver. [For details, see the section describing the detection of DO (output signal) alarms.] This address is fixed, and must be allocated as a work area before it can be used. Therefore, when using this area, allocate DI addresses in units of 16 bytes.

Arbitrary addresses can be allocated as the I/O addresses of the operator's panel I/O module. In DI allocation, however, when \*ESP (emergency stop signal) is allocated to this I/O module, the other fixed addresses (AE1, AE2, and SKIP1) become unavailable because of the relation with the fixed addresses directly supervised by the CNC.

	7	6	5	4	3	2	1	0
X0006				*ESP				
X0008				AE2	AE1			
X0011		SKIP1						

Fixed addresses directly supervised by the CNC (for FS15*i*/150*i*)

X0006	General-purpose	▲ *ESP fixed signal
X0007	input signal	
X0008		
X0009	Reserved	
X0010		
X0011		
X0012		
X0013	Matrix input	
X0014	signais	
X0015		
X0016		
X0017	Reserved	, , , , , , , , , , , , , , , , , , , ,
X0018(for 1st MPG)		Allocating DI addresses starting from X0005 allows the AEn
X0019(for 2nd MPG)	MPG	signal to be used and the *ESP fixed signal to be allocated
X0020(for 3rd MPG)	1	to an address for which the common voltage is fixed to 24 V
X0021(DO alarm detection)	DO alarm detection	

# Turning the DO (output signal) power on and off (DOCOM)

All the DO signals can be turned off simultaneously by turning off (opening) the DO (output signal) power supply pin "DOCOM". Doing so causes the DO signal status to change as shown below.

DOCOM	ON		
When DO is ON in the sequence	ON — OFF	\	
When DO is OFF in the sequence	ON — OFF		 

## NOTE

When the DO signal is in the ON state in the sequence, the ON or OFF state of the DOCOM pin determines the state of the signal, as indicated by the dotted lines in the above figure. Do not turn off the +24 V supply, provided by the CPD1 to the I/O module, during the operation. Turning off the +24 V supply would cause a CNC communication alarm. When turning on the power, the +24 V supply to the I/O module must be turned on before or at the same time as the power supply to the CNC. When turning off the power, the +24 V supply to the I/O module must be turned off after or at the same time as the power supply to the I/O module must be turned off after or at the same time as the power supply to the CNC.

The DO load current can be doubled by connecting two DO points in parallel and turning them on and off simultaneously in sequence, as shown in the figure below. The maximum load current per DI point is 200 mA. Connecting two DO points in parallel and turning them on at the same time produces a current of 400 mA. Note that, however, when two DO points are connected in parallel, the leakage current also doubles while they are off (max.  $40 \,\mu$ A).



## Parallel DO (output signal) connection

## DO (output signal) alarm detection

The DO driver of the I/O module is capable of detecting an overcurrent and measuring its own temperature. If an accident, such as connecting the cable to ground, causes an abnormal increase in the load current or in the driver temperature, a protection circuit, which is provided for each DO driver (1 byte), is activated which keeps the DO signal for the relevant 1 byte in the OFF state until the cause of the problem is eliminated. Even if this occurs, the CNC and the I/O module continue operating. The DI address (Xm+15) identifies which DO driver has detected an alarm. The following table shows the correspondence between the DI address (Xm+15) bits and the DO addresses. Bit value "1" indicates that the corresponding DO driver has detected an alarm. The contents of the Xm+15 area can be checked by using the DGN screen of the CNC or by performing the alarm processing for the area in advance by using Ladder. This helps alarm detection and recovery.

Alarm detection address and bit	DO address	Remarks
Xm+15.0	Yn+0	
Xm+15.1	Yn+1	
Xm+15.2	Yn+2	
Xm+15.3	Yn+3	
Xm+15.4	Yn+4	
Xm+15.5	Yn+5	
Xm+15.6	Yn+6	
Xm+15.7	Yn+7	Reserved

## 6.5 CONNECTION OF OPERATOR'S PANEL I/O MODULE (NOT FOR MATRIX INPUT)

## 6.5.1 Overall Connection Diagram



#### Connectors that cannot be used on the cable side

	Specification	Manufacturer
Connector case	FI-20-CV7	Hirose Electric Co., Ltd.
Connector case and connector	FI30-20S-CV7	Hirose Electric Co., Ltd.

# 6.5.2 Power Connection

Provide the CPD1 (IN) connector, shown below, with the power necessary for printed circuit board operation and that for DI operation. To facilitate power division, the power is output to CPD1 (OUT) exactly as it is input from CPD1 (IN). When power division is required, use CPD1 (OUT).



Recommended cable-side connector: A02B-0120-K324 (including the following connector housing and case) (Housing: Japan AMP 1-178288-3) (Contacts: Japan AMP 1-175218-5)

### NOTE

- 1 The specification of the power supply connector CPD1 (IN) is the same as that for CPD1 (OUT). There are no indications on the printed circuit board to distinguish between the IN and OUT connectors.
- 2 Do not turn off the +24 V supply to the connector during operation. Turning off the +24 V supply will cause a CNC communication alarm. When turning on the power, the +24 V supply to the I/O module must be turned on before or at the same time as the power supply to the CNC. When turning off the power, the +24 V supply to the I/O module must be turned off after or at the same time as the power supply to the CNC.

## 6.5.3 DI/DO Connector Pin Arrangement

	CE56				
	А	В			
01	0V	+24V			
02	Xm+0.0	Xm+0.1			
03	Xm+0.2	Xm+0.3			
04	Xm+0.4	Xm+0.5			
05	Xm+0.6	Xm+0.7			
06	Xm+1.0	Xm+1.1			
07	Xm+1.2	Xm+1.3			
08	Xm+1.4	Xm+1.5			
09	Xm+1.6	Xm+1.7			
10	Xm+2.0	Xm+2.1			
11	Xm+2.2	Xm+2.3			
12	Xm+2.4	Xm+2.5			
13	Xm+2.6	Xm+2.7			
14	DICOM0				
15					
16	Yn+0.0	Yn+0.1			
17	Yn+0.2	Yn+0.3			
18	Yn+0.4	Yn+0.5			
19	Yn+0.6	Yn+0.7			
20	Yn+1.0	Yn+1.1			
21	Yn+1.2	Yn+1.3			
22	Yn+1.4	Yn+1.5			
23	Yn+1.6	Yn+1.7			
24	DOCOM	DOCOM			
25	DOCOM	DOCOM			

	CE5	7
	А	В
01	0V	+24V
02	Xm+3.0	Xm+3.1
03	Xm+3.2 Xm+3.3	
04	Xm+3.4	Xm+3.5
05	Xm+3.6	Xm+3.7
06	Xm+4.0	Xm+4.1
07	Xm+4.2	Xm+4.3
08	Xm+4.4	Xm+4.5
09	Xm+4.6	Xm+4.7
10	Xm+5.0	Xm+5.1
11	Xm+5.2	Xm+5.3
12	Xm+5.4	Xm+5.5
13	Xm+5.6	Xm+5.7
14		DICOM5
15		
16	Yn+2.0	Yn+2.1
17	Yn+2.2	Yn+2.3
18	Yn+2.4	Yn+2.5
19	Yn+2.6	Yn+2.7
20	Yn+3.0	Yn+3.1
21	Yn+3.2	Yn+3.3
22	Yn+3.4	Yn+3.5
23	Yn+3.6	Yn+3.7
24	DOCOM	DOCOM
25	DOCOM	DOCOM

Flat cable–side connector specification: A02B–0120–K342 (HIFBB–50D–2.54R (Hirose Electric Co., Ltd.)) 50 contacts Cable material specification: A02B–0120–K886 (61–meter, 50–pin cable (Hitachi Cable, Ltd. or Oki Electric Cable Co., Ltd.))

	Pin number
Address number	CE56(B01)
	CE57(B01)
$\downarrow \qquad \qquad$	
Xm+0.1	CE56(B02)
	0550(4.00)
	CE56(A03)
Xm+0.3	CE56(B03)
Xm+0.4 RV	CE56(A04)
Xm+0.5	CE56(B04)
Xm+0.6	CE56(A05)
	CE36(B03)
•	CE56(A14)
	CE56(A01)
	CE57(A01)
Ym+1.0	
Xm+1.1	CE56(B06)
	CE56(A07)
Xm+1.3	CE56(B07)
Xm+1.4 RV + + (	CE56(A08)
Xm+1 5	CE56(B08)
Xm+1.6	CE56(A09)
<u>xm+1.7</u> RV • C	
<b>●</b> -₩	, i i i i i i i i i i i i i i i i i i i
L	

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#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

		Pin number	
	Address number +24V	CE56(B01)	
	Bit number	CE57(B01)	
Xm+2.0		CE56(A10)	
X OI			
<u>Xm+2.1</u>	RV		
Xm+2.2		CE56(A11)	
Ym 12.2	•-w-]	CE56(B11)	
Xm+2.4		CE56(A12)	
Xm+2.5	<b>∳</b> _₩]	CE56(B12)	
<u>Xm+2.6</u>		CE56(A13)	
Xm+2.7	<b>●</b> -₩-┘	CE56(B13)	
		Ť	
	7777		
Xm+3.0		CE57(A02)	
View O 4	V V V		
<u> </u>	RV +	CE57(B02)	
Xm+3.1 Xm+3.2		CE57(B02)	
Xm+3.1		CE57(B02) CE57(A03)	
Xm+3.2 Xm+3.3		CE57(B02) CE57(A03) CE57(B03)	
Xm+3.1 Xm+3.2 Xm+3.3 Xm+3.4		CE57(B02) CE57(A03) CE57(B03) CE57(A04)	
<u>Xm+3.1</u> <u>Xm+3.2</u> <u>Xm+3.3</u> <u>Xm+3.4</u>		CE57(B02) CE57(A03) CE57(B03) CE57(A04)	
<u>Xm+3.1</u> <u>Xm+3.2</u> <u>Xm+3.3</u> <u>Xm+3.4</u> <u>Xm+3.5</u>		CE57(B02) CE57(A03) CE57(B03) CE57(A04) CE57(B04)	
<u>Xm+3.1</u> <u>Xm+3.2</u> <u>Xm+3.3</u> <u>Xm+3.4</u> <u>Xm+3.5</u> <u>Xm+3.6</u>		CE57(B02) CE57(A03) CE57(B03) CE57(A04) CE57(B04) CE57(A05)	
<u>Xm+3.1</u> <u>Xm+3.2</u> <u>Xm+3.3</u> <u>Xm+3.4</u> <u>Xm+3.5</u> <u>Xm+3.6</u> Xm+3.7		CE57(B02) CE57(A03) CE57(B03) CE57(A04) CE57(B04) CE57(B04) CE57(A05)	
<u>Xm+3.1</u> <u>Xm+3.2</u> <u>Xm+3.3</u> <u>Xm+3.4</u> <u>Xm+3.5</u> <u>Xm+3.6</u> <u>Xm+3.7</u>		CE57(B02) CE57(A03) CE57(B03) CE57(A04) CE57(B04) CE57(A05) CE57(B05)	

6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

		Pin number
	Address number	CE56(B01)
	Bit number	CE57(B01)
$\downarrow \downarrow \downarrow$		
<u></u>	RV	
Xm+4.1		CE57(B06)
<u>Xm+4.2</u>	RV	CE57(A07)
Xm+4.3	•	CE57(B07)
<u>Xm+4.4</u>		CE57(A08)
Xm+4 5	<b>●</b> _₩]	CE57(B08)
Xm+4.6		CE57(A09)
Xm+4.7	•-w-]	CE57(B09)
	7777	
Xm+5.0	RV +	CE57(A10)
Ym+5 1		CE57(B10)
<u></u>		
Xm+5.2		CE57(A11)
Vm (E 2	•-w-]	
<u></u>		
Xm+5.4		CE57(A12)
<u>Xm+5.5</u>	RV +	-0 CE57(B12)
Xm+5.6		CE57(A13)
<u>Xm+5.7</u>	RV +	
		CE57(B14)
	7777	   CE56(A01)
		0===(1.0.4)

### NOTE

- 1 Xm+0.0 through Xm+0.7 and Xm+5.0 to Xm+5.7 are DI pins for which a common voltage can be selected. That is, by connecting the DICOM0 CE56(A14) or DICOM5 CE57 (B14) 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 this from occurring, the connection of the DICOM0 and DICOM5 pins 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 of the addresses for which the common voltage is fixed. See "Address allocation" in 6.5.9 for details of how to allocate the emergency stop signal.
- 3 For unused DI pins allocated to the addresses for which the common voltage is fixed (DICOM0 or DICOM5), the logic is fixed to "0". When the DICOM0 or DICOM5 pins are connected to the +24 V power supply, the logic is fixed to "1". The logic of the unused pins is variable when the contact of the DICOM0 or DICOM5 pin is open.

## 6.5.5 DO (Output Signal) Connection



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#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



For details of the connection of the manual pulse generator, see 6.3.15.

## 6.5.6 Manual Pulse Generator Connection

## 6.5.7 External View


# 6.5.8 Specifications

# Installation specifications

Ambient temperature	During operation0° to 58°CDuring storage and transportation-20°C to 60°C
Temperature change	Max. 0.3°C/min.
Relative humidity	Normal : 75% or less Short term (1 month or less) : 95% or less
Vibration	During operation: 0.5 G or less
Environment	Ordinary machining factory environment (Special consideration is required when installing the module in a dusty location or where highly concentrated cutting lubricant or organic solvent is used.)
Other requirements	(1) Install the I/O module in a fully enclosed cabinet.

# **Ordering specifications**

ltem	Specification	Remarks
Operator's panel I/O module (with MPG interface)	A20B-2002-0520	General–purpose DI: 48 points DO: 32 points MPG interface is supported.
Operator's panel I/O module (without MPG interface)	A20B-2002-0521	DI: 48 points DO: 32 points MPG interface is not supported.
Fuse (replacement part)	A03B-0815-K001	1A

## Module specifications

ltem	Specification	Remarks
DI points	48 points	24–V input
DO points	32 points	24 V source type output
CNC interface	FANUC I/O Link connection	Up to 16 modules can be connected as CNC slaves. Or, a maximum of 1024 points can be supported on both the input and output sides.
MPG interface	Max. 3 units	MPG interface can be used.

Module	Supply voltage	Current rating	Remarks
Operator's panel I/O module	24 VDC $\pm$ 10% supplied from the power supply connector CPD1. The al- lowance of $\pm$ 10% should include instantaneous voltage and ripple voltage.	0.3 A +7.3 mAXDI	The total power consumption of DI points is included. The power con- sumption of DO points is not in- cluded.

# DI (input signal) specifications

#### (General–purpose input signal)

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 transmis- sion between the CNC and I/O module (max. 2 ms + CNC ladder scan cycle) must also be taken into account.

# DO (output signal) specifications

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 momen- tary values)
Leakage current in OFF state	20 $\mu$ A or less
Delay	Driver delay: Max. 50 $\mu$ s The time required for I/O Link transmis- sion between the CNC and I/O module (max. 2 ms + CNC ladder scan cycle) must also be taken into account.

#### NOTE

Ensure that the maximum current per DOCOM pin (DO power supply pin) does not exceed 0.7 A.

# 6.5.9 Other Notes

#### DO signal reaction to a system alarm

If a system alarm occurs in the CNC using the operator's panel 48/32 I/O module, or if I/O Link communication between the CNC and operator's panel I/O module fails, all the DO signals of the I/O module are turned off. Therefore, sufficient care is necessary when setting up the machine sequence. Also, the same phenomenon occurs if the power to the CNC or the I/O module is turned off.

#### **Address allocation**

For the operator's panel I/O module, I/O addresses are mapped as follows.



The operator's panel 48/32 I/O module is allocated a group of DI addresses (16 bytes) and a group of DO addresses (4 bytes). This address allocation is explained below.

The MPG interface (MPG counter) occupies DI space from Xm+12 through Xm+14. These addresses are fixed, and Xm+12 through Xm+14 must be allocated as a DI work area to enable the use of the MPG. Therefore, when using an MPG, allocate DI addresses in units of 16 bytes. Do not use the DI space from Xm+12 through Xm+14 for Ladder; the CNC processes the MPG counter value directly.

DI address Xm+15 is used for detecting overcurrent and overheating alarms that may occur in the IC used in the DO driver. [For details, see the section describing the detection of DO (output signal) alarms.] This address is fixed, and must be allocated as a work area before it can be used. Therefore, when using this area, allocate DI addresses in units of 16 bytes.

Basically, 48/32 I/O addresses can be allocated to the operator's panel I/O module freely. When allocating DI addresses, however, consider also the fixed addresses that are directly supervised by the CNC, and keep the following in mind.

ADDRESS	7	6	5	4	3	2	1	0
X0006				*ESP				
X0007				AE2	AE1			
X0008		SKIP1						

#### Fixed addresses directly supervised by the CNC (for 15*i*/150*i*)

#### When DI addresses are allocated in units of 16 bytes, starting at X0005



#### Turning the DO (output signal) power on and off (DOCOM)

All the DO signals can be turned off simultaneously by turning off (opening) the DO (output signal) power supply pin "DOCOM". Doing so causes the DO signal status to change as shown below.



#### NOTE

- 1 When the DO signal is in the ON state in the sequence, the ON or OFF state of the DOCOM pin determines the state of the signal, as indicated by the dotted lines in the above figure.
- 2 Do not turn off the +24 V supply, provided by the CPD1 to the I/O module, during the operation. Turning off the +24 V supply would cause a CNC communication alarm. When turning on the power, the +24 V supply to the I/O module must be turned on before or at the same time as the power supply to the CNC. When turning off the power, the +24 V supply to the I/O module must be turned off after or at the same time as the power supply to the CNC.

#### Parallel DO (output signal) connection

The DO load current can be doubled by connecting two DO points in parallel and turning them on and off simultaneously in sequence, as shown in the figure below. The maximum load current per DO point is 200 mA. Connecting two DO points in parallel and turning them on at the same time produces a current of 400 mA. Note that, however, when two DO points are connected in parallel, the leakage current also doubles while they are off (max.  $40 \,\mu$ A).



#### DO (output signal) alarm detection

The DO driver of the I/O module is capable of detecting an overcurrent and measuring its own temperature. If an accident, such as connecting the cable to ground, causes an abnormal increase in the load current or in the driver temperature, a protection circuit, which is provided for each DO driver (1 byte), is activated which keeps the DO signal for the relevant 1 byte in the OFF state until the cause of the problem is eliminated. Even if this occurs, the CNC and the I/O module continue operating. The DI address (Xm+15) identifies which DO driver has detected an alarm. The following table shows the correspondence between the DI address (Xm+15) bits and the DO addresses. Bit value "1" indicates that the corresponding DO driver has detected an alarm. The contents of the Xm+15 area can be checked by using the DGN screen of the CNC or by performing the alarm processing for the area in advance by using Ladder. This helps alarm detection and recovery.

Alarm detection address and bit	DO address	Remarks
Xm+15.0	Yn+0	
Xm+15.1	Yn+1	
Xm+15.2	Yn+2	
Xm+15.3	Yn+3	
Xm+15.4	Yn+4	Reserved
Xm+15.5	Yn+5	Reserved
Xm+15.6	Yn+6	Reserved
Xm+15.7	Yn+7	Reserved

# 6.6 CONNECTION OF THE FANUC I/O UNIT-MODEL A

The FANUC I/O Unit–MODEL A ("I/O Unit") is a modular–type I/O unit. It interfaces with the machine when connected to the control unit (Series 15i/150i) via the I/O Link. One I/O unit can be configured by mounting the I/O modules required for either the 5– or 10–slot base unit. A variety of I/O modules are provided so appropriate modules can be selected according to the use, points, voltage level, current capacity, and signal specifications.

# 6.6.1 Structure of FANUC I/O Unit–MODEL A



AIF01A is used for connection to FANUC I/O Link AIF01B expands I/O Units in the same group.

# 6.6.2 Outer Dimensions

For 5–slot base unit (ABU05A)	253	238
For 10–slot base unit (ABU10A)	430	415

# 6.6.3 Mounting and Dismounting Modules

#### Mounting



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

- 1 Hang the hook at the top of the module on the groove in the upper side of the base unit.
- 2 Make the connector of the module engage with that of the base unit.
- **3** 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.
 Push the module upwards.

# 6.6.4 Connection Diagram



#### CAUTION

- Number of I/O Units and connecting method are restricted depending on the allocation of the I/O points. See 6.2 "Connection of FANUC I/O Link" and 6.6.11 "Number of I/O points for the I/O Unit–A".
- 2 Cable K1X can be an optical fiber cable by using the optical I/O link adapter.
  - Refer to item 6.2.2.
- 3 Attach a terminator to connector JD2 on the last AIF01B in the group. See (3) in Section 6.6.7.

# 6.6.5 Connecting Input Power Source

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

- Voltage : 24VDC±10%
- Current : Determine from Table 6.6.5.



#### CAUTION

Turn ON the power for the I/O unit just before or when the power for the CNC is turned ON. When the CNC power is turned OFF, make sure to turn the power to the I/O unit OFF as well.

Table 6.6.5	Required	current	of	each	module
-------------	----------	---------	----	------	--------

Modulo namo	Required current (mA) of +24V			
Module name	Α	В		
AIF01A	50			
AIF01B	50			
AID32A	20+0.5×n	30+7.5×n		
AID32B	20+0.5×n	30+7.5×n		
AID16C	5			
AID16D	5			
AID32E	5			
AID32F	5			
AIA16G	5+1.5×n			
AOD08C	5+2×n			
AOD08D	5+2×n			
AOD16C	5+2×n			
AOD16D	5+2×n			
AOD32C	5+0.5×n			
AOD32D	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		
AAD04A	5	130		

- n : Number of the input and output points (for each module) which turn ON simultaneously
- The current sum requirement for modules used in Column A should not exceed 500 mA.
- The current sum requirement for modules used in Column B should not exceed 1500 mA.

#### • Ground the base unit (ABU05A, ABU10A) by its grounding terminal

# 

• When the cable K1X (see connection diagram in section 6.6.4) runs between different cabinets, make sure to connect the cabinets with a grounding wire more than 5.5 mm<sup>2</sup>.

# 6.6.6 Grounding

# 6.6.7 Connecting Signal Cables

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

#### Cable K1X



- Use twisted pair wires for signal SIN and \*SIN, and signals SOUT and \*SOUT.
- Recommended 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.
- Maximum cable length: 15 m
- Do not make any wire connections to the connector spare pins.
- Use an optical I/O link adapter and an optical fiber cable, [in the following cases] :
  - When the cable is more than 15 meters long.
  - When the cable runs between different cabinets and there is no appropriate ground wire between the cabinets.
  - U When there is concern that the cable is influenced by strong noise.

#### Cable K2X



- Connect the signals with the 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 : 2 m

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# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

#### **Terminator TX**



B-63783EN/01

# 6.6.8 Connecting with I/O Modules

For an external connecting method, there are two types of I/O modules : one with a terminal block, and one with a connector. The terminal block is a removable type.



# Mounting the terminal block



# Dismounting 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.

- **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.

A wire as thin 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.

A : Appro	x. 4.5mm
DAIDO SOLDERLESS TERMINAL MFG. CO., LTD	1.25–S3.5
NICHIFU EUROPE B.V NICHIFU AMERICA, INC.	1.25–3.5S, etc.

• Mark tube : As short a mark tube as possible ; cover climped part with the mark tube.

# 6.6.9 Digital Input/Output Module

## **Digital input modules**

Input type	Mod- ule name	Rated voltage	Rated current	Polar- ity	Re- sponse time	Points	External connec- tion	LED display
Non-in-	AID 32A	24VDC	7.5mA	Both	Maximum 20ms	32	Connector	not provided
DC input	AID 32B	24VDC	7.5mA	Both	Maximum 2ms	32	Connector	not provided
	AID 16C	24VDC	7.5mA	NEG	Maximum 20ms	16	Terminal block	provided
Insulation	AID 16D	24VDC	7.5mA	POS	Maximum 20ms	16	Terminal block	provided
input	AID 32E	24VDC	7.5mA	Both	Maximum 20ms	32	Connector	not provided
	AID 32F	24VDC	7.5mA	Both	Maximum 2ms	32	Connector	not provided
AC input	AIA 16G	100– 120VAC	10.5mA (120V AC)	ON M OFF N	ON Max 35ms OFF Max 45ms		Terminal block	provided

# CAUTION 1 Polarity Negative : 0 V common (current source type) The input is defined as ON when at a low level Positive : 24 V common (current sink type) The input is defined as ON when at a high level 2 For the details of the specifications for each module, refer to FANUC I/O Unit-MODEL A Connection Maintenance Manual (B–61813E).

## **Digital output modules**

Output type	Mod- ule name	Rated voltage	Rated current	Polar- ity	Points	Points /com- mon	External connec- tion	LED display	Fuse
	AOD 08C	12–24 VDC	2A	NEG	8	8	Terminal block	provided	pro- vided
	AOD 08D		2A	POS	8	8	Terminal block	provided	pro- vided
Insula-	AOD 16C		0.5A	NEG	16	8	Terminal block	provided	not pro- vided
type DC output	AOD 16D		0.5A	POS	16	8	Terminal block	provided	not pro- vided
	AOD 32C		0.3A	NEG	32	8	Connec- tor	not provided	not pro- vided
	AOD 32D		0.3A	POS	32	8	Connec- tor	not provided	not pro- vided
	AOD 05E	100– 240	2A	_	5	1	Terminal block	provided	pro- vided
AC	AOD 08E	VAC	1A	_	8	4	Terminal block	provided	pro- vided
	AOD 12F	100– 120 VAC	0.5A	_	12	6	Terminal block	provided	pro- vided
Relay	AOR 08G	Maxi- mum 250	4A	_	8	1	Terminal block	provided	not pro- vided
output	AOR 16G	30VDC	2A	_	16	4	Terminal block	provided	not pro- vided

## CAUTION

#### 1 Polarity

- Negative : 0 V common (current sink type) - Output is at low level when ON.
- Positive : 24 V common (current source type) – Output is at high level when ON.
- 2 For the details of the specifications for each module, refer to FANUC I/O Unit–MODEL A Connection Maintenance Manual (B–61813E).

# 6.6.10

Correspondence between I/O Signals and Addresses in a Module



Addresses in a module are defined relatively, with the beginning address as 0. Real addresses viewed by 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. For output modules, an output contact point (or transistor) is turned ON when the output signal is "1".

# 6.6.11 Number of Points for I/O Unit–MODEL A

Determine the number of I/O points for the I/O Unit –MODEL A using the following.

#### • Output points

Occupied output point			
32 points			
64 points			
128 points			
256 points			

#### NOTE

Count AOA05E as 8 points and AOA12F as 16 points.

#### • Input points

Sum of the actual input		Occupied input points			
points in a group					
0 to 32	$\rightarrow$	32 points			
40 to 64	$\rightarrow$	64 points			
72 to 128	$\rightarrow$	128 points			
136 to 256	$\rightarrow$	256 points			

As a result of the calculation above, when the number of input points is smaller 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:

#### Example 2:

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

that of the output points, in other words, 256 points.

# 6.7 CONNECTION OF MACHINE OPERATOR'S PANEL INTERFACE UNIT

The machine operator's panel interface unit (A16B–2201–0110) is connected to the control unit through the I/O Link and is used for interfacing with the machine operator's panel.

It features interfaces with matrix key switches, LEDs and manual pulse generators.



# 6.7.1 Function Overview

Number of DI/DO points

Operator's panel control PCB allocation to the I/O Link DI/DO	DI/DO =	128/128	DI/DO = 256/256		
(module name) DI or DO	DI (OC02I)	DO (OC02O)	DI (OC03I)	DO (OC03O)	
Number of matrix key switch inputs	64		96		
Number of matrix LED data outputs		64		64	
Number of general-purpose switch inputs	32		32		
Number of general–purpose LED data outputs		32		32	
Number of total DI/DO points	96	96	128	96	

- Matrix key switch inputs (matrix DI) Ninety-six DI points are provided by a matrix of twelve common signals times eight data signals. Note that I/O Link allocation may limit the number of usable key switch inputs.
- Matrix LED data outputs (matrix DO) Sixty-four DO points are provided by a matrix of eight common signals times eight data signals.
- General-purpose switch inputs (general-purpose DI) Each general-purpose DI point has an individual interface.
- General-purpose LED data outputs (general-purpose DO) Each general-purpose DO point has an individual interface.

Analog signal inputs	• Two inputs (input voltage: 0 to +10 V)
	• Input voltages are converted from analog to digital. The resulting five bits of data are sent to the CNC through the FANUC I/O Link.
	• The analog signal input function can be used regardless of whether I/O Link allocation is 128/128 or 256/256.
Terminal for signal forwarding	• Emergency stop and OT release signals are forwarded without change to the power magnetics cabinet.
	• Power ON/OFF control signals are forwarded without change to an input unit.
	• Analog signal inputs described in item "Analog signal inputs" can be sent out without being changed.
First manual pulse generator	Pulse information from the manual pulse generator is transferred via an I/O Link.
	When this unit is used together with a unit (connector panel I/O module) connected to the I/O Link supporting another MPG interface, only the MPG interface of the unit (module) closest to the CNC connected to the I/O Link is valid.

#### 

# 6.7.2 System Configuration



#### NOTE

- 1 Power requirements
  - When 60% of the DI/DO points are on, this interface unit requires "1.0 A"
- 2 The cable connected to CM26 must not be longer than 30 cm.

# 6.7.3 **Signal Assignment**

**Connector pin signal** assignment

CM15 (General DI/DO)			CM16	CM16 (General DI/DO)			CM17 (General DI/DO)		
	A	В		A	В		A	В	
01	+5E	DI06	01	DI20	DI22	01	0V	0V	
02	0V	DO06	02	DI24	+5E	02	DO20	DO21	
03	+5E	DI07	03	DI23	DI21	03	DO22	DO23	
04	0V	DO07	04	DI25	DI26	04	DO24	DO25	
05	+5E	DI16	05	DI27	+5E	05	DO26	DO27	
06	0V	DO16	06	DO00	0V	06	0V	0V	
07	+5E	DI17	07	DI05	+5E	07	DO30	DO31	
08	0V	DO17	08	DO01	0V	08	DO32	DO33	
09	*ESP	ECM1	09	DI15	+5E	09	DO34	DO35	
10	OTR	ECM2	10	DO02	0V	10	DO36	DO37	
11	DI00	D102	11	DO03	DO04	11	0V	0V	
12	DI04	+5E	12	DO05	0V	12	+5E	+5E	
13	DI03	DI01	13	0V	0V	13	DI30	DI31	
14	DI05	DI10	14	DO10	DO11	14	DI32	DI33	
15	DI12	DI14	15	DO12	DO13	15	DI34	DI35	
16	+5E	DI13	16	DO14	DO15	16	DI36	DI37	
17	DI11	DI15	17	+5E	+5E	17	+5E	+5E	
CA40	CA40 (Connector on the manual pulse generator)								

14	DI37		/=0-0./	01	+5V	
15	01/	08	DI31	02	151/	
15	00	09	DI32	02	-5V	
16	DO37	40	Dioc	03	HA1	
17	01/	10	DI33	04	HB1	
	01	11	DI34	04		
18				05		
10	155	12	DI35	06		
19	+5E	13	DI36	00		
20	+5E	15	DISC	07	DI30	

CNA1 (Connector on the machine side)

		10	FCM2			20	
9	OM	10	LOWIZ	19	OTR	20	
0	0101	8	FCM1	10		18	
7	DO36	0	LOWIT	17	*ESP	10	
'	0000	6	SM	17		16	
5	SM	U	0.01	15	COM	10	
5	Sivi	Δ	OM	15	CON	14	
3	OM	-	0101	13	EOE		
5	0101	2	I M	15	LOI	12	
1	L M	2		11	FON	12	
					LON		

CNB1 (Connector on the operator's panel side) CPD1 (Power supply)

01	LM	05	EON	09	HA1	3	2	1
02	SM	06	EOF	10	HB1		0V	+24V
03	OM	07	COM	11	+5V	6	5	4
04	OM	08	0V	12	0V		0V	+24V

Pins shaded by are those for forwarding signals. Pins with the same name are connected directly to one another.

#### NOTE

- 1 LM and SM also function as input terminals to the A/D converter.
- 2 OM is connected to 0 V on the PCB.

Input/output pins shaded by Z are in pairs. Only one in each pair is usable.

#### JD1A (FANUC I/O Link : NEXT SLAVE)

-		10				20	+5V
9	+5V	8		19		18	±5\/
7		<u> </u>		17		10	151
		6		.,		16	0V
5		Ŭ		15	01/	10	0.
0		4	*TXB	10	0.	14	01/
3	TYR	-	IND	13	0\/	17	0.
5		2	*RXR	15	00	12	01/
1	RYB	-		11	0\/	12	0.
1	IN/LD				00		

#### JD1B (FANUC I/O Link : BEFORE SLAVE)

		10		L		20	+5V
9	+5V	0		19		40	. 51/
7		8		17		18	+5V
- '		6		- ''		16	0V
5				15	0V		•••
3	ΤΥΔ	4	*TXA	13	0\/	14	0V
5	174	2	*RXA	15	00	12	0\/
1	RXA	2	IVA	11	0V	12	00
	1000			1	0.		

#### CM26 (Matrix DI/DO)

	A	В
01	0V	*MND1
02	*KYD0	*KYD1
03	*KYD2	*KYD3
04	*KYD4	*KYD5
05	*KYD6	*KYD7
06	*KYC0	*KYC1
07	*KYC2	*KYC3
08	*KYC4	*KYC5
09	*KYC6	*KYC7
10	*KYC8	*KYC9
11	*KYCA	*KYCB
12	*BZMD	0V
13	*LD0	*LD8
14	*LD1	*LD9
15	*LD2	*LD10
16	*LD3	*LD11
17	*LD4	*LD12
18	*LD5	*LD13
19	*LD6	*LD14
20	*LD7	*LD15
21	LC1L	LC1H
22	LC2L	LC2H
23	LC3L	LC3H
24	LC4L	LC4H
25	0V	0V

DInx	General-purposeDI	LM	Load meter voltage
DOnx	General-purposeDO	SM	Speed meter voltage
*ESP	Emergency stop	ОМ	LM/SM reference voltage (0V)
ECM1	*ESP common signal	*KYDx	Matrix DI data signal
OTR	OT release	*KYCx	Matrix DI common signal
ECM2	OTR common signal	*LDx	Matrix DO data signal
EON/OF	Power ON/OFF control signal	LCnL/H	Matrix DO common signal
СОМ	EON/EOF common signal	*MNDI	Three DI points acceptable
HAI	Input from manual pulse generator	*BZMD	Buzzer off
НВІ	Input from manual pulse generator		

See Subsec. 6.7.4 for details of connection and signal meanings.

# 6.7.4 Interface

#### General-purpose DI



#### Input signal specifications

Contact rating	5VDC, 3.2mA or higher
Leakage current between open contacts	0.2mA or lower (5 VDC)
Voltage drop across closed contacts	0.75V or lower

## General-purpose DO



#### **Output signal specifications**

Maximum load current	0.03A
Maximum open-circuit leakage current	0.1mA
Maximum closed-circuit voltage drop	0.1V

#### NOTE

When using an LED at the DO point, connect an external resistor that meets the requirements of the LED.

## Matrix DI

- Key switch addresses Se
  - See Subsec. 6.7.5 for the corresponding PMC addresses.

*KYC0	)-	CM26-A06	<u></u>	KY06	KY05		КҮ03	КҮ02	КҮ01		BZ0
*KYC1	)-	CM26-B06	<u></u>	<u>KY16</u>	<u>KY15</u>	<u>KY14</u>	КҮ13	<u>KY12</u>	<u>кү11</u>	<u>кү10</u>	BZ1
*KYC2	)_	CM26-A07	<u>кү27</u>	<u>кү26</u>	<u></u>	<u>кү24</u>	<u>кү23</u>	<u> </u>	<u>кү21</u>	<u>кү20</u> Т	BZ2
*KYC3	) )-	CM26–B07	<u>күзт</u>	<u>күзе</u>	<u>күз5</u>	<u>күза</u>	<u>күзз</u> (	<u>күза</u> Т	<u>күзі</u>	<u>күзо</u> Т	BZ3
*KYC4	)_	CM26–A08	КҮ47		<u>KY45</u>	<u>кү44</u>	<u>кү43</u>	<u>KY42</u>	KY41	<u>кү40</u> Т	BZ4
*KYC5	) )-	CM26-B08	<u>кү57</u>	КҮ56	<u></u>	<u>кү54</u>	<u>кү53</u>	<u>кү52</u> Т	KY51	<u>кү50</u> Т	BZ5
*KYC6	) )-	CM26–A09	КҮ67	<u>кү66</u>	<u>KY65</u>		КҮ63	<u>кү62</u>	<u>кү61</u>	<u>кү60</u> Ц	BZ6
*KYC7	ر بر	СМ26-В09		<u>кү76</u>	КҮ75	КҮ74	КҮ73	<u>кү72</u>	<u>кү71</u>	<u>кү70</u>	BZ7
*KYC8	ر بر	CM26-A10	_кү87 Д	<u>кү86</u>	<u>кү85</u>	КҮ84	_кү83 Д	<u>кү82</u> Д		<u>кү80</u> Д	BZ8
*KYC9	ر بر	СМ26-В10	КҮ97	<u>кү96</u>	<u>кү95</u>	<u>кү94</u>	_кү93 Д	<u>кү92</u> Д		<u>кү90</u> Д	BZ9
*KYCA	ر بر	CM26–A11	КҮА7				күаз Д	<u>күа2</u> Д		<u> </u>	BZA
*KYCB	ر بر	СМ26-В11	_күв7 Д	күвө Д		күв4	_күвз Д	<u>күв2</u> Д	күві Д	<u>күво</u> Д	BZB
*KYD7	ر بر	CM26–B05	Ĭ	Ť	Ĭ	Ĭ	Ĭ	Ĭ	, j	Ĭ	
*KVD6	ر بر	CM26–A05									
*KVD5		CM26–B04									
*		CM26–A04									
* 104		CM26–B03									
* * * * *	ע ר	CM26–A03									
* 102		CM26–B02									
***	ע ר	CM26–A02									
KTD0	_ر										
*07140		CM26–A12									
BZIVID	٦										
	$\mathbf{r}$	CM26-B01									
IVINUI	٦				When *M	NDI = 0,	, it enables	s three or	more simu	Iltaneous	inputs.
014	2	CM26–A01			When *M	NDI = 1,	, it inhibits	three or r	nore simul <sup>·</sup>	taneous ir	puts.
00	٦										

#### Mode selection

Preventing malfunctions that may be caused by detouring current When there are three or more matrix DI points, detouring current can cause a nonexistent DI input to be falsely detected as existing. As shown below, if KY01, KY03, and KY21 are closed simultaneously, current detours through the path indicated with

arrows, thus causing a false input of \*KY23 to be detected because of a current path formed by a combination of common signal \*KYC2 and data signal \*KYD3.



Two modes are available to prevent this malfunction. One should be selected according to the user applications.

[Method 1]

- Ignoring all occurrences of three or more simultaneous inputs
  - Action : Make the \*MNDI signal open (see item "● Key switch addresses")

#### NOTE

If there are two inputs and a third is added, all three are ignored. When one of the three inputs is removed, two are accepted.

[Method 2]

- Attaching detour prevention diodes to enable three simultaneous inputs
  - Action : Connect the \*MNDI signal (see item "● Key switch addresses") to 0V.



☐ This PCB can raise a confirmation sound when a key is pressed. The condition to raise an audible alarm is set in 8-bit units, or in \*KYCn units. If \*BZMD and common \*KYCn are disconnected, a KYnx input causes a sound to generate. If they are connected, a KYnx input does not generate the sound.

To generate a confirmation sound for key input, the DO (PMC address DO + 00.7) "MD07" must have been turned to "1" (see Subsec. 6.7.5).

- 1 A diode is necessary to connect \*BZMD and \*KYCn, as shown below.
- 2 This setting cannot be changed when power is supplied.
- 3 The sound is generated when the circuit closes between common signal \*KYCn and data signal \*KYDx. It does not sound when the circuit is disconnected. If key switches are used, the sound is heard at the moment a key is pressed. It does not sound when a key is released or when a key is held pressed.



#### (Example)

If \*BZMD is connected to \*KYC0 and \*KYC2, but disconnected from \*KYC1 and \*KYC3, as shown below, closing a switch at key addresses KY10 to KY17 and KY30 to KY37 causes a confirmation sound for key input to be heard, but closing a switch at key addresses KY00 to KY07 and KY20 to KY27 does not. See item "• Key switch addresses".



## • Signal specification

Contact rating	6VDC, 2mA or higher
Leakage current between open contacts	0.2mA or lower (6VDC)
Voltage drop across closed contacts	0.9V or lower (1 mA) Note )

### NOTE

This voltage must be maintained even when detour prevention diodes are used.

#### Matrix DO

- LED addresses
- See Subsec. 6.7.5 for the corresponding PMC addresses.



#### NOTE The

LC1L (H)



 $+\frac{1}{8ms}$ 



• Internal circuit

The circuit contains a 100–ohm resistor, as shown below. Connecting an LED does not require an external resistor.



6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

#### • Signal specifications

#### The LEDs must have the following rating

Forward voltage	2.4V max (I <sub>f</sub> =5mA)(Typical value)
Forward current	30mA max
Reverse voltage	3V max

# Interface for manual pulse generator

• Connection of connector CNB1

One interface is provided on connector CNB1.



 Connection of connector CA40 Pendant-type manual pulse generator with axis selection and multiplier setting functions can be connected to connector CA40.



#### NOTE

- When DI30 to DI37 of connector CA40 are allocated as the DIs used for the axis selection and multiplier setting, DI30 to DI37 of connector CM17 cannot be used.
- 2 One DO is available for the manual pulse generator side at the user's discretion. When this is used, DO37 of CM17 cannot be used, as in the case for DIs above.

#### Analog signal inputs

# • Connection diagram (example)

Analog inputs received from the outside are forwarded without change to output terminals.

Analog inputs from the spindle amp being output for load meter and speed meter indications.



• Sent to the CNC

Analog inputs received on the Machine operator's panel interface unit are converted to five–bit digital values, which are sent to the CNC though the I/O Link.

See Subsec. 6.7.5 for PMC addresses. LM conversion data : "LM03 to LM07"

SM conversion data : "SM03 to SM07"

#### Analog signal specifications

Acceptable input voltage	0V to +15V				
Voltage that can be converted to digital	0V to +10V	Note)			

#### NOTE

Any voltage higher than +10V is converted to the same digital value as +10V is.

# • A/D conversion specifications

Conversion error	5%	(max)
Resolution	5 bit	(min)

- 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE
- Emergency stop

OT release

A signal generated by the emergency stop switch on the machine operator's panel can be sent to the power magnetics cabinet. (This signal cannot be sent to the CNC through the FANUC I/O Link.)



A signal generated by the OT release switch on the machine operator's panel can be sent to the power magnetics cabinet.

(This signal cannot be sent to the CNC through the FANUC I/O Link.)



#### Power ON/OFF control signal

Signals generated by the power ON/OFF control switches on the machine operator's panel can be sent to an input unit. (These signals cannot be sent to the CNC through the FANUC I/O Link.)



#### NOTE

The LM, OM, SM, D036, ECM, EON, EOF, COM, ESP, and OTR signals are all assigned to the pins of one connector (CNA1).

They can be connected to the machine using only one cable.

# 6.7.5 PMC Addresses

										Sco add	pe in v resses	vhich F s can b	PMC e used	
PMC	7	0	F	BIT NU	MBER	0	4	0		I/0	0 Link 28/128	alloca	tion 56/256	
ADDRESS	/	0	c	4	3	2	1	0	ı —					
DI+00	10/07	10/00	FUSE	10/01	10/00	10/00	10/0/	10.000			Î		Î	
DI+01	KY07	KY06	KY05	KY04	KY03	KY02	KY01	KY00						
DI+02	KY17	KY16	KY15	KY14	KY13	KY12	KY11	KY10						
DI+03	KY27	KY26	KY25	KY24	KY23	KY22	KY21	KY20						
DI+04	KY37	KY36	KY35	KY34	KY33	KY32	KY31	KY30						
DI+05	KY47	KY46	KY45	KY44	KY43	KY42	KY41	KY40						
DI+06	KY57	KY56	KY55	KY54	KY53	KY52	KY51	KY50						
DI+07	KY67	KY66	KY65	KY64	KY63	KY62	KY61	KY60						
DI+08	KY77	KY76	KY75	KY74	KY73	KY72	KY/1	KY70						
DI+09	DI07	D106	DI05	DI04	DI03	DI02	DI01	DI00						
DI+10	DI17	DI16	DI15	DI14	DI13	DI12	DI11	DI10						
DI+11	DI27	DI26	DI25	DI24	DI23	DI22	DI21	DI20						
DI+12	DI37	DI36	DI35	DI34	DI33	DI32	DI31	DI30						
DI+13		LM06	LM05	LM04	LM03									
DI+14		SM06	SM05	SM04	SM03									
DI+15	MP17	MP16	MP15	MP14		MP12	MP11	MP10			¥.			
DI+16			Reserv	ed for use	by FANU									
DI+17	10/07	10/00	10/05		10/00	10/00	10/04	10/00						
DI+18	KY87	KY86	KY85	KY84	KY83	KY82	KY81	KY80						
DI+19	K197	K 196	K195	K 194	K193	K192	KY91	KY90						
DI+20		KYA6	KYA5	KYA4	KYA3	KYA2	KYA1	KYAU KYAU						
DI+21	KIB/	KYB0	KTB5	KYB4	KTB3	KTB2	KIB1	KYBU	I					
DO+00	MD07	MD06	FUSE								1			
DO+01	L1L7	L1L6	L1L5	L1L4	L1L3	L1L2	L1L1	L1L0						
DO+02	L2L7	L2L6	L2L5	L2L4	L2L3	L2L2	L2L1	L2L0						
DO+03	L3L7	L3L6	L3L5	L3L4	L3L3	L3L2	L3L1	L3L0						
DO+04	L4L7	L4L6	L4L5	L4L4	L4L3	L4L2	L4L1	L4L0						
DO+05	L1H7	L1H6	L1H5	L1H4	L1H3	L1H2	L1H1	L1H0						
DO+06	L2H7	L2H6	L2H5	L2H4	L2H3	L2H2	L2H1	L2H0						
DO+07	L3H7	L3H6	L3H5	L3H4	L3H3	L3H2	L3H1	L3H0						
DO+08	L4H7	L4H6	L4H5	L4H4	L4H3	L4H2	L4H1	L4H0						
DO+09	DO07	DO06	DO05	DO04	DO03	DO02	DO01	DO00						
DO+10	DO17	DO16	DO15	DO14	DO13	DO12	DO11	DO10						
DO+11	DO27	DO26	DO25	DO24	DO23	DO22	DO21	DO20						
DO+12	DO37	DO36	DO35	DO34	DO33	DO32	DO31	DO30			V		<b>V</b>	
<ul> <li>When 1, it indicates the +5E fuse has blown. Shorting of the general-purpose DI input is considered as a possible cause. Turn off the power at once, check the general-purpose DI input and its vicinity, replace the fuse and turn the power on.</li> <li>Inx : General-purpose DI</li> <li>M0x : Load meter indication</li> <li>M0x : Speed meter indication</li> <li>KY signal (matrix)</li> <li>.nL (H) x : LED signal (matrix)</li> <li>DOnx : General-purpose DO</li> <li>MD07 : Buzzer mode selection (It is possible to sound the key entry confirmation tone at the matrix DI input by turning this to "1".)</li> <li>MD06 : Buzzer ON/OFF setting (The buzzer sounds as this is turned to "1" and stops as it is turned to "0". This operation is performed irrespective of MD07.</li> </ul>														
MP1X : First	P1X : First manual pulse generator													

6.7.6 Major Connection Precautions	• Use flat cables for connectors CM15, CM16, CM17, and CM26. When splitting and connecting flat cables to the machine operator's panel or other equipment, be careful not to break or short the conductors.
	• All signals with the same name described in Subsec. 6.7.3 are connected to one another.
	• One of the holes for mounting the PCB is also used for grounding. Before mounting the PCB, check the location of that hole with the

diagram in Subsec. 6.7.10.

# 6.7.7

State of the LEDs on

**Panel Interface Unit** 

the Machine Operator's

L1 (green) :

Monitors +5E. When on, it indicates that the fuse is intact (+5E: 5V for connector output).

When off, it indicates that the fuse has blown.

#### L2 (green) :

Monitors key scanning. When blinking, it indicates that the keys are being scanned normally. When on or off, it indicates key scanning is at halt.

#### L3 (red) :

When on, it indicates that an alarm condition has occurred. When off, it indicates that there is no alarm condition.
## 6.7.8

Connector (on the Cable Side) Specifications

Connector	Major use	Specification
CM15, CM16, CM17	General–purpose DI/DO	HIF3BA–34D–2.54R : Manufactured by HIROSE ELECTRIC CO., LTD.
CNA1	Relay terminal (to the machine)	PCR–E20FS : Manufactured by HONDA TSUSHIN KO- GYO CO., LTD.
CNB1	Relay terminal (to the machine operator's panel)	MVSTBR2.5/12–ST–5.08 : Manufactured by PHOENIX CONTACT GmbH & Co.
JD1A, JD1B	FANUC I/O Link	PCR–E20FS : Manufactured by HONDA TSUSHIN KO- GYO CO., LTD.
CPD1	Power supply	Dynamic D3100 (three pins) : Manufactured by AMP JAPAN, LTD. 1–178288–3 : Connector 1–175218–5 : Contact
CM26	Matrix DI/DO	HIF3BB–50D–2.54R : Manufactured by HIROSE ELECTRIC CO., LTD.
CA40	Manual pulse generator	MR–20LFH (solder type): Manufactured by HONDA TSUSHIN KO- GYO CO., LTD.

#### NOTE

1	Several types of connectors are available for use at the
	other end of the cable leading to connector CNB1. Refer to
	brochures of PHOENIX CONTACT GmbH & Co
	The connector used on the machine operator's panel
	interface unit side is MSTBVA2.5/12–G–5.08.
2	Crimped type cable connector is available for CA40. For
	purchase from FANUC, please specify as below.
	A02B–0029–K890 : Solder type
	A02B–0029–K892 : Crimped type

### 6.7.9 Machine Operator's Panel Interface Unit Dimension Diagram (Including Connector Locations)



## 6.7.10 Machine Operator's Panel Interface Unit Mounting Dimension Diagram

### Mounting hole position





## Sheet fixing area (mounting face side)

It is possible to fix the sheet, spacer, etc. only in the area shown in the diagram below.

### **NOTE** Applied to the PCB version number "03A" and beyond.

## Sheet fixing area (Soldering face side)

It is possible to fix the sheet, spacer, etc. only in the area shown in the diagram below.



**NOTE** Applied to the PCB version number "03A" and beyond.

## 6.7.11 Fuse Mounting Position



NOTE

FU2 is not mounted on Revision 05A or later.

## 6.8 CONNECTING THE CONNECTION UNIT

A connection unit (A20B–1005–0310 or A20B–1003–0200) is connected to the control unit of the Series 15i/150i via FANUC I/O Link and used for interfacing with the machine.

Electrical interfaces and pin assignment for connectors C01 to C05 and C09 to C13 used for interfacing with the machine are fully compatible with the connection unit of the Series 15–A/B. The numbers of input and output points for each configuration are listed below.

Name	Ordering code	Input	Output
Connection unit 1	A02B-1005-0310	96	64
Connection unit 1 + Connection unit 2	A20B–1005–0310 + A20B–1003–0200	192	128

Ground the connection unit 1/2.





#### Power input specifications

Voltage:	$24 \text{ VDC } \pm 10\%$				
Capacity:	$670 + 7.3 \times n \text{ (mA)}$ :	When	only connec	tion unit	1 is
		used			
	$1150 + 7.3 \times n \text{ (mA)}$ :	When	connection	unit 1	and
		connec	ction unit 2 a	re used	
n	: Number of input point	ts which	n are simultan	eously tu	rned
	on				
	Use a 30/0.18 (0.75 n	nm <sup>2</sup> ) wi	re or thicker	for the po	ower
	cable.	,		1	

## 6.8.1

(a) Between CP52 and CP55

## Connecting Connection Unit 1 and Connection Unit 2



Use a  $30/0.18 (0.75 \text{ mm}^2)$  wire or thicker for the power cable.

AF-3U	,	1			FAF-50	-1		_
A01	0V	B01	0V		A01	0V	B01	0
A02		B02			A02		B02	
A03		B03			A03		B03	
A04	0V	B04			A04	0V	B04	╞
A05		B05			A05		B05	T
A06		B06	0V	Cable	A06		B06	ſ
A07	*D7	B07	*D6		A07	*D7	B07	t
A08	*D5	B08	*D5		A08	*D5	B08	T
A09	0V	B09	*D3		A09	0V	B09	T
A10	*D2	B10	*D1		A10	*D2	B10	t
A11	*D0	B11	0V		A11	*D0	B11	t
A12	0V	B12	0V		A12	0V	B12	t
A13	AU	B13	A4		A13	AU	B13	t
A14	A3	B14	0V		A14	A3	B14	
A15	A2	B15	A1		A15	A2	B15	t
A16	A0	B16	0V		A16	A0	B16	t
A17	*OE	B17	0V		A17	*OE	B17	t
A18	0V	B18	0V		A18	0V	B18	t
A19	*DVWE	B19	0V		A19	*DVWE	B19	T
A20	0V	B20			A20	0V	B20	t
A21	0V	B21	0V		A21	0V	B21	T
A22	*ALRO	B22	0V		A22	*ALRO	B22	T
A23	*CLR	B23	EN		A23	*CLR	B23	T
A24		B24	0V		A24		B24	1
A25	*ASIO	B25			A25	*ASIO	B25	T

#### (b) Between CDD1 and CDD2

The following cable is available.

Name	Ordering code	Length				
Cable	A02B-0072-K818	150mm				

Maximum wire length: 1 m Connectors at the ends of the cable:

FAS-50-17 (A63L-0001-0209#50)

6.8.2 Input Signal Regulations for the	Input signals for the connection unit conform to a non-insulation type interface. There are two input types: Direct current input signal A and direct current input signal B.
Connection Unit	<ol> <li>Direct current input signal A Direct current input signal A is a signal sent to the CNC from the machine, e.g., from a button, limit switch, relay contact, or proximity switch.</li> </ol>
	(a) The contacts on the machine must meet the following requirements:
	Contact capacity: 30 VDC, 16 mA or more
	Leakage current between contacts when the circuit is open: 1 mA or less (Voltage: 26.4 V)
	Voltage drop between contacts when the circuit is closed: 2 V or
	less (Current: 8.5 mA)
	(Including the voltage drop through the cable)

(b) Fig. 6.8.2 (a) shows the receiver circuit for the signal.



#### Fig. 6.8.2 (a) Receiver circuit





#### Fig. 6.8.2 (b) Width and delay time of the input signal

(2) Direct current input signal B

Direct current input signal B is a signal sent from the machine to the CNC and used at high speed.

(a) The contacts on the machine must meet the following requirements:

Contact capacity: 30 VDC, 16 mA or more

Leakage current between contacts when the circuit is open:

1 mA or less (Voltage: 26.4 V) Voltage drop between contacts when the circuit is closed:

2 V or less (Current: 8.5 mA)

(Including the voltage drop through the cable)

(b) Fig. 6.8.2 (c) shows the receiver circuit for the signal.



#### Fig. 6.8.2 (c) Receiver circuit

As shown in Fig. 6.4.2 (c), the common voltage for the connection unit can be selected from +24 V and 0 V by the wiring on the machine.

- (a) To use the connection unit with the +24 V common voltage
  - Connect (A) with (B) and (C) with (D). Logical 0 when the transistor is off. Logical 1 when the transistor is on.
- (b) To use with the 0 V common voltage

Connect (A) with (D) and (B) with (C). Logical 1 when the transistor is off. Logical 0 when the transistor is on.

Fig. 6.8.2. (d) shows the time specifications for the signal.



#### Fig. 6.8.2 (d) Width and delay time of the input signal

# 6.8.3

(1) Connection unit 1

### **Connector Pin** Assignment for the **Connection Unit**

C01		M	R–50R	MA													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	DIB5	DIB1	DIB6										DI44	DI40	DI45	DI16	DI60
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32		~	
$\land$	0V	DIB7	DIB4					DI26	DI37	DI06	DI33	DI50	DI62	51			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24	DIB2	DIB0	DIB3	COMI1				DI32	DI36	DI31	DI35	DI30	DI34	DI63	DI61		DI56

C02

MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DI52	DI65	DI64	DI91	DI92	DI95	DI41	DI77	DI47	DI46	DI73	DI74	DI53	DI67		DI05	DI15	DI25
$\square$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	DI93	DI94	D190	DI22	DI12	DI02	DI97	DI55	DI43	DI42		DI82	DI81	D180			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24	DI07	DI17	DI27	DI23	DI13	DI03	D196	DI57	DI70	DI71	DI72	D100	DI01	DI10	DI11	DI20	DI21

C03

#### MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DIA0	DIA1	DIA2	DI80	DI81	DI82	DI85	D186	DI66	DI87			DIA7	DIA6	DO26	COM12	DO27	COM13
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	DIA3	DIA4	DIA5	DI83	DO67	DO66	DO65	DO64	DO63	DO62	DO61	DO60	DO22	COM17			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24V	DI04	DI14	DI24	DI84	DI54	DI75	DI76	D077	DO76	DO75	D074	DO73	D072	D071	D070	DO23	COM18

C04

MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DO04	0V	0V	0V	DO03	COM1	COM16	DO57	DO55	DO54	DO56	DO12	MOM6			COM10	DO24	COM3
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	COM4	DO01	DO30	DO31	DO32	DO33	COM14	DO13	DO21	COM9	COM5	COM2	COM11	DO07			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
DO05	DO10	DO00	DO02	DO34	DO35	DO36	DO37	DO20	COM7	DO17	DO11	DO06	DO25	COM8	DO14	DO15	DO16

C05

MR-20RMA

1	2	3	4	5	6	7
COM15	COM15					
$\square$	8	9	10	11	12	13
	DO40	DO41	DO42	DO43	DO44	DO45
14	15	16	17	18	19	20
DO46	DO47	DO50	DO51	DO52	DO53	

(2) Connection unit 2

C09		Μ	R–50R	MA													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	DI75	DI71	DI76										DI104	DI100	DI105	DID6	DI102
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
$\land$	0V	DI177	DI174					DIE6	DIF7	DIC6	DIF3	DI110	DI122	DI111			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24	DI172	DI170	DI173	COM12				DIF2	DIF6	DIF1	DIF5	DIF0	DIF4	DI123	DI121		DI116

C10

MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DI112	DI125	DI124	DI151	DI152	DI155	DI101	DI137	DI107	DI106	DI133	DI134	DI113	DI127		DIC5	DID5	DIE5
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	DI153	DI154	DI150	DIE2	DID2	DIC2	DI157	DI115	DI103	DI102		DI142	DI141	DI140			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24	DIC7	DID7	DIE7	DIE3	DID3	DIC3	DI156	DI117	DI130	DI131	DI132	DIC0	DIC1	DID0	DID1	DIE0	DIE1

#### C11 MR–50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DI160	DI161	DI162	DI140	DI141	DI142	DI145	DI146	DI126	DI147			DI167	DI166	DOA6	COM30	DOA7	COM31
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	DI163	DI164	DI165	DI143	DOE7	DOE6	DOE5	DOE4	DOE3	DOE2	DOE1	DOE0	DOA2	COM35			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24	DIC4	DID4	DIE4	DI144	DI114	DI135	DI136	DOF7	DOF6	DOF5	DOF4	DOF3	DOF2	DOF1	DOF1	DOA3	COM36

C12

#### MR–50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DO84	0V	0V	0V	DO83	COM19	COM34	DOD7	DOD5	DOD4	DOD6	DO92	COM24			COM28	DOA4	COM21
$\bigtriangledown$	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	COM22	DO81	DOB0	DOB1	DOB2	DOB3	COM32	DO93	DOA1	COM27	COM27	COM20	COM29	DO87		$\sim$	
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
DO85	DO90	DO80	DO82	DOB4	DOB5	DOB6	DOB7	DOA0	COM25	DO97	DO91	DO86	DOA5	COM26	DO94	DO95	DO96

C13

MR–20RMA

1	2	3	4	5	6	7
COM33	COM33					
$\bigtriangledown$	19	20	21	22	23	24
	DOC0	DOC1	DOC2	DOC3	DOC4	DOC5
33	34	35	36	37	38	39
DOC6	DOC7	DOD0	DOD1	DOD2	DOD3	

### 6.8.4 Details of the Connection between the Connection Unit and the Machine

					+24V				
	001/	99) 0	00(00)	- 					
		33), t	02(33)	, (03(33)					
			Conne	ector nin				— A	ddress number
	Г		numb	er					Bit number
<	C02(	34)			<b></b>	Х	n+0	. 7	D:
I	107				RV -				signal A
		l	R						518.0011
— D	106 C01(	28)		111		Х	n+0	. 6	"
— D	105 C02(	16)				Х	n+0	. 5	"
— D	I04 C03(	34)				Х	n + 0	. 4	"
— D	103 C02(	39)				Х	n+0	. 3	"
— D	102 C02(	24)				Х	n + 0	. 2	"
D	I01 C02(	46)				Х	n + 0	. 1	"
D	100 C02(	45)				Х	n+0	. 0	"
n	117 0.02(	35)				Х	n+1	. 7	"
D	116 001(	17)				Х	n+1	. 6	//
— 1	115 002(	17)				Х	n+1	. 5	//
1	I14 C03(	35)				Х	n+1	. 4	"
D	I13 C02(	38)				Х	n+1	. 3	"
— D	112 C02(	23)				Х	n+1	. 2	"
D	I11 C02(	48)				Х	n+1	. 1	"
— D	I10 C02(	47)				Х	n+1	. 0	"
r	127 0.02(	36)				Х	n+2	. 7	//
D	126 C01(	26)				Х	n+2	. 6	//
— D	125 002(	18)				Х	n+2	. 5	//
— 0	124 003(	36)				Х	n+2	. 4	"
	123 C02(	37)				Х	n+2	. 3	"
— D	122 C02(	22)				Х	n+2	. 2	"
D	121 CO2(	50)				Х	n+2	. 1	"
— D	120 CO2(	49)				Х	n+2	. 0	"
n	137 001(	97)				X	n+3	. 7	"
I	136 001(	42)				X	n+3	. 6	"
ע ח	135 001(	44)				X	n+3	. 5	"
D	134 001(	46)				X	n+3	. 4	"
ם ח	133 001(	29)				X	n+3	. 3	"
n	132 001(	41)				X	n+3	. 2	"
ע ח	131 001(	43)				X	n+3	. 1	"
ע ת	130 001(	45)				X	n+3	. 0	"

NOTE

The machine tool builder can determine address number n.

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE

The machine tool builder can determine address number n.



#### NOTE

The machine tool builder can determine address number n. DI82 to DI80 are assigned to two connector pins each.



#### NOTE

The machine tool builder can determine address number n.

The common voltage for DIB7 to DIB0 can be selected from +24 V and 0 V by the wiring on the machine. The above figure shows the connection when the +24 V common voltage is used. The common voltage is common to DIB7 to DIB0. It is therefore not possible to use a signal with the +24 V common voltage and another signal with the 0 V common voltage.



#### NOTE

The machine tool builder can determine address number m. The common voltages for DO05 to DO00 are connected in connection unit 1 (COM1). The common voltages for DO16 to DO14 are connected in connection unit 1 (COM8).

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE

The machine tool builder can determine address number m.



### NOTE

The machine tool builder can determine address number m.

The common voltages for DO21, DO20, and DO37 to DO30 are connected in connection unit 1 (COM14).

The common voltages for DO57 to DO54 are connected in connection unit 1 (COM16).



#### NOTE

The machine tool builder can determine address number m.

The common voltages for DO22 and DO67 to DO60 are connected in connection unit 1 (COM17).

The common voltages for DO23 and DO77 to DO70 are connected in connection unit 1 (COM18).



### NOTE

The machine tool builder can determine address number m.

The common voltages for DO47 to DO40 and DO53 to DO50 are connected in connection unit 1 (COM15).

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

			+24V				
		C09(33), C10(33), C11(3	3)				
					r		Address number
		Connector pin nu	umber			[	Bit number
		¢ C10(34)		Хг	↓ 1+12.	↓ 7	
	- DIC7	R	RV				Direct current inpu signal A
	DICC			v r	110	6	"
		(10(16))			1⊤12. 1∔19	5	"
		010(10) 011(94)		л I Үт	ı⊧ı⊿. ı∔19	1	"
	DIC4	UII(04) C10(20)		л I Ү +	ı⊧⊥⊿. n∔19	મ ૧	
		(10(39))		л I Хг	1+12.	2	"
		(10(24))		Y r	1 + 12	1	"
	DICO	C10(45)		Xr	1+12.	0	"
		(10(35))		Хг	1+13.	7	"
		C09(17)		Хт	1+13.	6	//
		C10(17)		Хг	1+13.	5	"
		(11(35))		Хr	ı+13.	4	//
	DID3	C10(38)		Хг	ı+13.	3	"
	DID2	(10(23))		Хr	n+13.	2	11
	DID1	C10(48)		Хг	n+13.	1	//
	DIDO	C10(47)		Хг	n+13.	0	"
_	DIE7	C10(36)		Xr	n+14.	7	"
	DIE6	C09(26)		Xr	1+14.	6	"
	DIE5	C10(18)		Xr	1+14.	5	"
	DIE4	C11(36)		Xr	1+14.	4	"
	DIE3	C10(37)		Хr	1+14.	3	"
	DIE2	C10(22)		Xr	ı+14.	2	//
	DIE1	C10(50)		Xr	ı+14.	1	//
	DIEO	C10(49)		Xr	n+14.	0	"
	DIF7	C09(27)		Xr	n+15.	7	"
	DIF6	C09(42)		Xr	1+15.	6	//
	DIF5	C09(44)		Xr	ı+15.	5	//
	DIF4	C09(46)		Xr	ı+15.	4	//
	DIF3	C09(29)		Хп	i+15.	3	//
	DIF2	CO9(41)		Xn	1+15.	2	"
	DIF1	C09(43)		Xn	1+15.	1	"
	DIFO	C09(45)		Xn	ı+15.	0	//

### NOTE

The machine tool builder can determine address number n.



#### NOTE

The machine tool builder can determine address number n.



#### NOTE

The machine tool builder can determine address number n. DI142 to DI140 are assigned to two connector pins each.



#### NOTE

The machine tool builder can determine address number n.

The common voltage for DI177 to DI170 can be selected from +24 V and 0 V by the wiring on the machine. The above figure shows the connection when the +24 V common voltage is used. The common voltage is common to DI177 to DI170. It is therefore not possible to use a signal with the +24 V common voltage and another signal with the 0 V common voltage.



#### NOTE

The machine tool builder can determine address number m.

The common voltages for DO85 to DO80 are connected in connection unit 2 (COM19). The common voltages for DO96 to DO94 are connected in connection unit 2 (COM26).



#### NOTE

The machine tool builder can determine address number m.



#### NOTE

The machine tool builder can determine address number m.

The common voltages for DOA1, DOA0, and DOB7 to DOB0 are connected in connection unit 2 (COM32).

The common voltages for DOD7 to DOD4 are connected in connection unit 2 (COM34).



### NOTE

The machine tool builder can determine address number m.

The common voltages for DOA2 and DOE7 to DOE0 are connected in connection unit 2 (COM35).

The common voltages for DOA3 and DOF7 to DOF0 are connected in connection unit 2 (COM36).



#### NOTE

The machine tool builder can determine address number m.

The common voltages for DOC7 to DOC0 and DOD3 to DOD0 are connected in connection unit 2 (COM33).

## 6.8.5 External View of the Connection Unit



## 6.9 CONNECTION OF OPERATOR'S PANEL CONNECTION UNIT

The operator's panel connection unit (A16B–2200–0660, 0661) is connected to the Series 15i/150i control unit through the FANUC I/O Link and is used for interfacing with the machine operator's panel. The electric interface and pin layout of the connectors CM1 to CM4 are fully compatible with those for Series 15–A/B. There are two units available depending on the number of I/O points.

Specification	Input	Output
A16B-2200-0660	96	64
A16B-2200-0661	64	32



Power supply input specification Voltage: 24 VDC ± 10% Capacity:500 + 7.3 × n mA n: number of inputs ON simultaneously

Use a 30/0.18 (0.75 mm<sup>2</sup>) wire or thicker for the power cable. Grounding of the operator's panel connection unit



6.9.1 Input Signal Regulations for the	Input signals for the operator's panel connection unit conform to a non-insulation type interface. The input type is direct current input signal A.
Operator's Panel Connection Unit	(1) Direct current input signal A Direct current input signal A is a signal sent to the CNC from the machine, e.g., from a button, limit switch, relay contact, or proximity switch.
	<ul><li>(a) The contacts on the machine must meet the following requirements:</li><li>Contact capacity: 30 VDC, 16 mA or more</li></ul>

Leakage current between contacts when the circuit is open: 1 mA or less (Voltage: 26.4 V)

Voltage drop between contacts when the circuit is closed: 2 V or less (Current: 8.5 mA)

(Including the voltage drop through the cable)

(b) Fig. 6.9.1 (a) shows the receiver circuit for the signal.



#### Fig. 6.9.1 (a) Receiver circuit

Fig. 6.9.1 (b) shows the time specifications for the signal.



Fig. 6.9.1 (b) Width and delay time of the input signal

## 6.9.2

Output Signal Regulations for the Operator's Panel Connection Unit The output signals from the operator's panel connection unit are used for driving lamps and light emitting diodes on the machine operator's panel. An NPN transistor is used as a driver. The output type is direct current output signal B.

(1) Direct current output signal B

The direct current output signal B is used for driving relays and light emitting diodes for indication on the machine. A transistor is used as a driver.

- (a) Ratings of the output transistor
  - (i) Maximum load current when output is ON: 200 mA (including momentary load)
  - (ii) Saturation voltage when output is ON: 1.6 V (maximum)/1.0 V (normal) (when load current is 200 mA)
     The maximum load current is limited to 1.3 A per common wire

#### NOTE

(Note).

Although a maximum load current of 200 mA is permitted when the output is ON, the load current allowed to flow through a common wire is limited to 1.3 A. Therefore, the load current of the output transistor must satisfy the following condition:

 $(N \times I)/M < 1.3 A$ 

- Where N = Number of DO points that can be turned on simultaneously
  - I = Load current that flows when output is ON
  - M = Number of common wires (one or two)
- Example: When there are 64 DO points that can be turned on simultaneously and two common wires are used, the rated load current is 40 mA, calculated as shown below:

$$(64 \times I) / 2 < 1.3 A$$

$$I < 40 \text{ mA}$$

- (iii)Withstand voltage when the output is off: 24 V + 20% or less including an instantaneous value
- (iv)Leakage current when the output is off:  $100 \,\mu$ A or less



- (c) When an inductive load such as a relay is connected to the machine, mount a spark killer as near the load as possible (20 cm or less). When a capacitive load is connected to the machine, insert a serial resistor for limiting the current so that the rated current and voltage are ensured even for an instantaneous value.
- (d) When the lamp is turned OFF, its resistance becomes extremely low. So, when the lamp is turned on directly by transistor output, surge current may flow and damage the transistor. For this reason, add a protective circuit as shown below.


## 6.9.3 Connector Layout for Sink Output Operator's Panel Connection Unit

СМ1						Address 7 6 5 4 3 2 1 0
1	DI 00	1		33		X n DI07 DI06 DI05 DI04 DI03 DI02 DI01 DI00
2	DI03		DIAL	34	DI02	
3	DI06	- 19	DIOI	- 35	DI05	Xn+1 DI17 DI16 DI15 DI14 DI13 DI12 DI11 DI10
4	DI11	20	DI04	36	DI10	
5	DI14	21	DI 0 7	37	DI13	Xn+2 DI 27 DI 26 DI 25 DI 24 DI 23 DI 22 DI 21 DI 20
6	DI 17	22	DI12	38	DI 1 6	
7	DI 2 2	23	DI 1 5	39	DI 21	Xn+3 D137 D136 D135 D134 D133 D132 D131 D130
8	DI 25	24	DI 20	40	DI 24	Xn+4 DI47 DI46 DI45 DI44 DI43 DI42 DI41 DI40
9	DI 27	25	DI 2 3	41	DI 26	
10	DI 32	26	DI 30	42	DI 31	Xn+5 DI57 DI56 DI55 DI54 DI53 DI52 DI51 DI50
11	DI 3 5	27	DI 3 3	43	DI 34	
12	DI 4 0	28	DI 36	44	DI 37	
13	DI 4 3	29	DI41	45	DI 4 2	
14	DI 4 6	30	DI44	46	DI 4 5	
15	DI 51	31	DI 4 7	47	DI 50	
16	DI 5 4	32	DI 52	48	DI 5 3	
17	DI 56			49	DI 5 5	
18 (	COM1	1		50	DI 5 7	
<u> </u>				L		1
	DIGO	1		22		
2	DI 63			34	DI62	Xn+6 D167 D166 D165 D164 D163 D162 D161 D160
3	DI66	19	DI 6 1	35	DI65	$X_{n}$ + 7 DI 77 DI 76 DI 75 DI 74 DI 73 DI 72 DI 71 DI 70
4	DI 7 1	20	DI64	36	DI 70	
5	DI 7 4	21	DI 67	37	DI 73	Xn+8 DI87 DI86 DI85 DI84 DI83 DI82 DI81 DI80
6		22	DI 7 2	38	DI 75	
7		23	DI 7 5	30		Xn+9 DI97 DI96 DI95 DI94 DI93 DI92 DI91 DI90
8	D185	24	DI 80	40	DIGI	
9	DI 87	25	DI 8 3	41	DI86	
	DI92	26	DI 9 0	12		Xn+11DIB7 DIB6 DIB5 DIB4 DIB3 DIB2 DIB1 DIB0
	DI95	27	DI 9 3	43	DIGA	
12	DIAO	28	DI 96	43		Note) D180 to D1B/ can be used only for the A16B-2200-0660.
13	DIA3	29	DIA1	45	DIAO	L
		30	DIA4	16	DIAS	
		31	DIA7	40		
16		32	DIB2	47	DIBO	
1 101	DID4			48	DIB3	
	DIDC				D T D	
17 I	DIB6			49	DIB5	

NOTE

Address No. n can be decided by machine tool builders.

6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

C M 3

1

3

4

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6

8

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10

11

12 13

14

15 16

17

18

CM4

1

2

3

4

5

6

7

COM 3

DO 6 1

DO 6 4

DO 6 7

DO 7 2

DO 7 5

COM4

8

9

10

11

12

13

DO62

DO 6 5

DO70

DO 7 3

DO76

					Address		6	5	4	3	2	1	0
DO 0 0			33	+ 5 N	Yn	DO07	DO06	DO05	DO04	DO03	DO02	DO01	DO00
DO 0 3	19	DO 0 1	34	DO 0 2		<b></b>	2010	D015	<b>DO 1</b>	0010	2010		<b></b>
0006	20		35	DO 0 5	Yn+1	10017	D016	DO15	D014	DO13	1012	DOLL	D010
011	20	D004	36	DO 1 0	Vn+2	m27	D026	DO25	DO24	D023	D022	DO21	D020
014	21		37	DO 1 3	11172		1020	1025	1024	1023	1022	10021	10020
017	22	DO12	38	DO16	Y n+3	DO37	DO36	DO35	DO34	DO33	DO32	DO31	DO30
)22	23	DOIS	39	DO 2 1									
25	24	D020	40	DO 2 4	Yn+4	DO47	DO46	DO45	DO44	DO4 3	DO42	DO41	DO40
27	25	DO 2 3	41	DO 2 6	1								
32	26	DO 3 0	42	DO 3 1	$  Y_n+5  $	DO57	DO56	DO55	DO54	DO53	DO52	DO51	DO50
35	27	DO 3 3	43	DO 3 4	1:								
40	28	DO36	44	DO 3 7									
43	29	DO41	45	DO 4 2	11								
46	30	DO 4 4	46	DO 4 5									
51	31	DO4 7	47	DO 5 0	11								
 	32	DO 5 2	10	0053	ť								
J 3 4	-		40	0033	4i 👘								
)56			49	DO 5 5	1								

	NOTE	
--	------	--

50

14

15

16

17

18

19

20

DO 5 7

DO 6 0

DO 6 3

DO 6 6

DO 7 1

DO74

DO 7 7

Address No. n can be decided by machine tool builders.

Yn+6 D067 D066 D065 D064 D063 D062 D061 D060

Yn+7 D077 D076 D075 D074 D073 D072 D071 D070

\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_

. 1

Note) DO40 to DO77 can be used only for the

A16B-2200-0660.

# 6.9.4

Details of the Connection between the Sink Output Operator's Panel Connection Unit and the Machine



#### NOTE

# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE



# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE (\*)

The machine tool builder can determine address number q.

The common voltages for DO57 to DO00 are connected in the operator's panel connection unit (COM3).

+5 V output for supplying the power to the light emitting diode on the operator's panel. The output voltage is +5 VDC and the current is 300 mA. The power capacity is not enough to drive the lamp. A separate regulated power supply is necessary for the lamp. The load capacity of the output driver refer to 6.9.2.

# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE

The machine tool builder can determine address number q. The common voltages for DO57 to DO00 are connected in the operator's panel connection unit (COM3).



#### NOTE

The machine tool builder can determine address number q. The common voltages for DO67 to DO70 are connected in the operator's panel connection unit (COM4).

# 6.9.5 External View of Sink Output Operator's Panel Connection Unit



Fig. 6.9.5 External view of operator's panel connection unit

The following LEDs and fuses are mounted on this printed circuit board.

[LEDs]

DB1 (GREEN PILOT): Lights when this PCB is ON. DB2 (RED ALARM) : Lights when an error occurs on this PCB or CNC.

[Fuses]

FU1 (3.2 A): For external 24 V input FU2 (5.0 A): For +5 V power supply used on this PCB Ordering specification A02B–0163–K111 (FU1/FU2 2–fuse set)

# 6.10 CONNECTION OF SOURCE OUTPUT OPERATOR'S PANEL CONNECTION UNIT

The source output operator's panel connection unit (A16B–2202–0730, or -0731) is connected to Series 15i/150i control units by the FANUC I/O Link, and functions as the interface with the machine tool operator's panel.

Output from this connection unit is source–type. Input is sink–type (24 V common). However, some connection units have DI that can be switched to source–type input (0 V common).

Two connection units are available according to the number of I/Os.

Specification	Input	Output
A16B-2202-0730	96	64
A16B-2202-0731	64	32



Power supply input specification

Voltage:  $24 \text{ VDC} \pm 10\%$ Capacity:  $500 + 7.3 \times n \text{ (mA)}$ n: number of inputs ON simultaneously

Use a 30/0.18 (0.75 mm<sup>2</sup>) wire or thicker for the power cable. Grounding of the operator's panel connection unit



# 6.10.1 Source Output Operator's Panel Connection Unit Input Signal Standard

The input signal to the source output operator's panel connection unit is input over a non-insulated interface, and is called "DC input signal A."

 DC input signal A
 DC input signal A is sent to the NC from the machine tool by pushbuttons, limit switches, relay contacts and proximity switches. Most receivers are sink types. However, some inputs can be switched

to source type. (Use of sink-type receivers is required in safety standards.)

- (a) Satisfy the machine–side contact conditions: Contact capacitance: 30 VDC, 16 mA min. Leak current between contacts in open circuit: 1 mA min. (voltage 26.4 V)
  - Voltage drop between contacts in closed circuit:
    - 2 V max. (including cable voltage drop)

(b) Input receiver circuit



Fig. 6.10.1 (a) Sink-type receiver circuit

#### B-63783EN/01



(c) Circuit of common switchable input receiver

Fig. 6.10.1 (b) Common switchable receiver circuit

Figure 6.10.1 (c) below shows the signal timing standard.



Fig. 6.10.1 (c) Width and delay time of input signal

Source–type input signals are logic "1" when the contact is open, and logic "0" when closed.

#### CAUTION

If the output signal line falls to ground when the input signal is source–type (0 V common), the state is the same when the contact is closed. For this reason, source–type input signals are not recommended for ensuring safety. By CE–marking compliancy, sink–type (+24 V common)

input signals are required.

# 6.10.2 Output Signal Standard for Source Output Operator's Panel Connection Unit

The output signal of the source output operator's panel connection unit is for driving lamps and LEDs on the machine tool operator's panel. A MOS FET is used as the driver.

(1) Direct current output signal

The DC output signal is used for driving relays and light emitting diodes for indication on the machine. A transistor is used as the driver.

(a) Output signal standard is as follows:

Maximum load current when output is ON: 200 mA (including momentary load)

Saturation voltage when output is ON: 1.0 V max.

Withstand voltage: 24 V + 20% (including momentary load) Leaking current when the output is OFF:  $100 \,\mu\text{A}$ 

Use the following power supply as the external power supply of the output signal:

Power voltage:	$+24 \text{ V} \pm 10\%$
Power current:	Sum of maximum load current including momentary current per board + 100 mA min.
Power ON timing:	Same time as or before control unit
Power OFF timing:	Same time as or after control unit

#### CAUTION

Connect the power supply that meets these specifications to power terminals DOCOM and 0 V for the output signals. The maximum current that is allowed to pass to each DOCOM terminal pin is 2.0 A, and care must be paid to prevent the sum of the load current from exceeding the current that is allowed to pass via the DOCOM terminal.

#### (b) Output signal driver

Eight signals are output from each of the output signal driver elements used on this operator's panel connection unit.

The current of each output signal is monitored in the driver element. When overcurrent is detected, output of that signal is turned OFF. Once signal output is turned OFF due to overcurrent, signal output is restored to ON as turning signal output OFF eliminates the overcurrent state. For this reason, output is repeatedly switched ON and OFF when the output signal falls to ground or when it is in an overcurrent state. This also happens when a large surge current load is connected.

The driver element also has an overheat detection circuit. When the overcurrent state is continuous due to outputs having fallen to ground and the temperature inside the element rises, output of all eight signals is turned OFF and this OFF state is held. Output is restored for each individual signal by temporarily setting output logically OFF after the temperature inside the element has dropped. Signal output can also be restored by powering OFF the system.

When the overheat detection circuit is activated on this printed circuit board, the red LEDs mounted next to the driver element light so that you can confirm activation of the overheat detection circuit. (See Note.) When the overheat detection circuit is activated, the CNC is notified of an alarm as a system alarm. (You can also disable notification to the CNC system of this alarm by closing (shorting) the short bar of setting pin CP1 mounted on this printed circuit board. When notification is disabled, this alarm is not treated as a system alarm.)

Red LED Name	DO Output Signal	Remarks
DAL1	Y q+0.0 to Y q+0.7	
DAL2	Y q+1.0 to Y q+1.7	
DAL3	Y q+2.0 to Y q+2.7	
DAL4	Y q+3.0 to Y q+3.7	
DAL5	Y q+4.0 to Y q+4.7	
DAL6	Y q+5.0 to Y q+5.7	
DAL7	Y q+6.0 to Y q+6.7	
DAL8	Y q+7.0 to Y q+7.7	

Correspondence between red LED and DO output signal

#### NOTE

Lighting of the red LEDs and transfer alarm to CNC function are supported on printed circuit board 03B onwards.

If the CNC diagnoses that output does not turn ON even though it is ON, a probable cause is that overloading of that output or other output in the same element is causing the eight outputs of that element to stay OFF. If this is the case, power the system OFF, and remove the cause of the overload.

Driver device internal block diagram



#### (c) Output signal precautions

The figure below shows the precautions when connecting output signals. Parallel connection of output terminals shown like that shown in this figure is prohibited.



#### CAUTION

If the output signal falls to ground when the output signal is sink–type (0 V common), the output signal stays ON. For this reason, sink–type output signals are not recommended for ensuring safety.

By CE–marking compliancy, source–type (+24 V common) output signals are required.

## 6.10.3 ALARM LEDs on Source Output Operator's Panel Connection Unit

A16B-2202-0730 A16B-2202-0731	
CP1 O ALARM	
DAL8 DAL2 DAL3 DAL5	
DAL1 DAL4 DAL6	

ALARM out: Normal state ALARM lit: Alarm state (communications with CNC suspended)

The source output operator's manual connection unit is provided with a function for detecting and outputting an alarm for excessive current flowing to the output driver device caused by DO falling to ground.

When the above alarm is detected, the CNC outputs a system alarm, and the LED corresponding to the DO where the alarm occurred lights. See the following table for details on which LED lights.

You can also disable output of the output driver alarm as a CNC system alarm by the on–board setting pin "CP1".

DAL1	out: Normal state
	lit: Error occurred on DO outputs Yq+0.0 to Yq+0.7
DALZ	lit: Frror occurred on DO outputs Ya+1 0 to Ya+1 7
DAL3	out: Normal state
	lit: Error occurred on DO outputs Yq+2.0 to Yq+2.7
DAL4	out: Normal state
	lit: Error occurred on DO outputs Yq+3.0 to Yq+3.7
DAL5	out: Normal state
	nt: Error occurred on DO outputs 1q+4.0 to 1q+4.7
DALU	lit: Error occurred on DO outputs Ya+5.0 to Ya+5.7
DAL7	out: Normal state
	lit: Error occurred on DO outputs Yq+6.0 to Yq+6.7
DAL8	out: Normal state
	lit: Error occurred on DO outputs Yq+7.0 to Yq+7.7

System alarms generated by the above alarms are as follows.
For details, refer to "FANUC Series 15*i*/150*i*–MODEL A Maintenance Manual (B–63325EN)."
"NMI SLC aa(bb)" Example "NMI SLC 03(41)"
(aa: XXXXX11
Binary bits 0 and 1 are "1". Other bits are not fixed.)
(bb: X1XXXX1
Binary bit 6 is "1". Bits other than bit 0 to 4, and 6 are not fixed.)
The value obtained by subtracting "1" from the value indicated by bits 0 to 4 is the I/O group number where the error occurred.
The above example shows I/O alarms that have occurred in group O. Setting pin "CP1" settings are as follows:

Open: CNC is not notified of alarm.

Short: CNC is notified of alarm.

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

# 6.10.4

(a) Connector pin assignment

# **Connector Pin Assignment Addresses** of Source Output **Operator's Panel Connection Unit**

#### CM51

1         DI00         33         DICMN1           2         DI03         19         DI01         34         DI02           3         DI06         20         DI04         35         DI05           4         DI11         21         DI07         37         DI13           6         DI17         23         DI15         39         DI21           7         DI22         24         DI20         40         DI24           9         DI27         25         DI33         41         DI26           10         DI32         27         DI33         43         DI34           11         DI35         28         DI36         44         DI37           13         DI43         30         DI44         45         DI42           14         DI46         31         DI47         46         DI45           14         DI46         31         DI47         48         DI53           15         DI51         32         DI52         48         DI53           16         DI54         49         DI55         49         DI55           18         +24 V         <						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1	DI00	]		33	DICMN1
3         DI06         19         DI01         35         DI05           4         DI11         20         DI04         36         DI10           5         DI14         21         DI07         37         DI13           6         DI17         23         DI15         38         DI16           7         DI22         24         DI20         40         DI24           9         DI27         26         DI30         42         DI31           10         DI32         27         DI33         43         DI34           11         DI35         28         DI36         44         DI37           13         DI43         30         DI44         45         DI42           14         DI46         31         DI47         47         DI50           16         DI54         32         DI52         48         DI53           17         DI56         49         DI55         50         DI57	2	DI03	10		34	DI02
4         DI11         20         DI04         36         DI10           5         DI14         21         DI07         37         DI13           6         DI17         22         DI12         38         DI16           7         DI22         23         DI15         39         DI21           8         DI25         25         DI23         40         DI24           9         DI27         26         DI30         42         DI31           11         DI35         27         DI33         43         DI34           12         DI40         29         DI41         45         DI42           13         DI43         30         DI44         46         DI45           14         DI51         32         DI52         48         DI53           15         DI51         32         DI52         48         DI53           17         DI56         49         DI55         50         DI57           18         +24 V         V         50         DI57	3	DI06	- 19	DIUT	35	DI05
5         Dl14         21         Dl07         37         Dl13           6         Dl17         22         Dl12         38         Dl16           7         Dl22         23         Dl15         39         Dl21           8         Dl25         25         Dl23         40         Dl24           9         Dl27         26         Dl30         42         Dl31           11         Dl35         27         Dl33         43         Dl34           12         Dl40         29         Dl41         45         Dl42           13         Dl43         30         Dl44         46         Dl45           14         Dl46         31         Dl47         48         Dl53           15         Dl51         32         Dl52         48         Dl53           17         Dl56         49         Dl55         50         Dl57	4	DI11	20	DI04	36	DI10
6         DI17         22         DI12         38         DI16           7         DI22         24         DI20         39         DI21           8         DI25         24         DI20         40         DI24           9         DI27         26         DI30         41         DI26           10         DI32         27         DI33         43         DI34           11         DI35         28         DI36         44         DI37           13         DI43         29         DI41         45         DI42           14         DI46         31         DI47         46         DI45           15         DI51         32         DI52         48         DI53           17         DI56         49         DI55         155           18         +24 V         50         DI57	5	DI14	21	DI07	37	DI13
7         DI22         23         DI15         39         DI21           8         DI25         24         DI20         40         DI24           9         DI27         25         DI30         41         DI26           10         DI32         27         DI33         42         DI31           11         DI35         28         DI36         44         DI37           12         DI40         29         DI41         45         DI42           13         DI43         30         DI44         46         DI45           15         DI51         32         DI52         48         DI53           16         DI54         32         DI52         48         DI53           17         DI56         49         DI55         50         DI57	6	DI17	22	DI12	38	DI16
8         Dl25         24         Dl20         40         Dl24           9         Dl27         25         Dl23         41         Dl26           10         Dl32         27         Dl33         43         Dl34           11         Dl35         28         Dl36         44         Dl37           12         Dl40         29         Dl41         45         Dl42           13         Dl43         30         Dl44         46         Dl45           15         Dl51         32         Dl52         48         Dl53           16         Dl54         49         Dl55         49         Dl55           18         +24 V         50         Dl57         50         Dl57	7	DI22	- 23	DI15	39	DI21
0         0.120         25         D123         13         0.121           9         D127         26         D130         41         D126           10         D132         27         D133         43         D134           11         D135         28         D136         44         D137           13         D143         29         D141         45         D142           14         D146         31         D147         46         D145           15         D151         32         D152         48         D153           16         D154         49         D155         49         D155           18         +24 V         50         D157         50         D157	8	DI25	24	DI20	40	DI24
0         D121         26         D130         41         D120           10         D132         27         D133         42         D131           11         D135         28         D136         43         D134           12         D140         29         D141         45         D142           13         D143         30         D144         46         D145           14         D161         31         D147         46         D145           15         D151         32         D152         48         D153           16         D154         49         D155         49         D155           18         +24 V         50         D157         50         D157	a	DI27	25	DI23	41	DI26
10         D132         27         D133         42         D131           11         D135         28         D136         43         D134           12         D140         29         D141         45         D142           13         D143         30         D144         46         D145           14         D146         31         D147         46         D145           15         D151         32         D152         48         D153           16         D154         49         D155         49         D155           18         +24 V         50         D157         50         D157	10	DI22	26	DI30	42	DI20
11         Di35         28         Di36         43         Di34           12         Di40         29         Di41         44         Di37           13         Di43         29         Di41         45         Di42           14         Di46         30         Di44         46         Di45           15         Di51         32         Di52         48         Di53           16         Di54         49         Di55         49         Di55           18         +24 V         50         Di57         50         Di57	10	DIJZ	27	DI33	42	DIST
12         DI40         29         DI41         44         DI37           13         DI43         29         DI41         45         DI42           14         DI46         30         DI44         46         DI45           15         DI51         32         DI52         47         DI50           16         DI54         48         DI53         49         DI55           18         +24 V         50         DI57         50         DI57	11	DI35	28	DI36	43	DI34
13         DI43         29         DI41         45         DI42           14         DI46         30         DI44         46         DI45           15         DI51         31         DI47         47         DI50           16         DI54         32         DI52         48         DI53           17         DI56         49         DI55         50         DI57	12	DI40	20	DI41	44	DI37
14         Dl46         30         Dl44         46         Dl45           15         Dl51         31         Dl47         47         Dl50           16         Dl54         32         Dl52         48         Dl53           17         Dl56         49         Dl55         50         Dl57	13	DI43	23	DI41	45	DI42
15         DI51         31         DI47         47         DI50           16         DI54         32         DI52         48         DI53           17         DI56         49         DI55           18         +24 V         50         DI57	14	DI46	30	DI44	46	DI45
16         DI54         32         DI52         48         DI53           17         DI56         49         DI55           18         +24 V         50         DI57	15	DI51	- 31	DI47	47	DI50
17         DI56         49         DI55           18         +24 V         50         DI57	16	DI54	32	DI52	48	DI53
18 +24 V 50 DI57	17	DI56	1		49	DI55
	18	+24 V			50	DI57

#### CM52

1	DI60			33	0 V
2	DI63	10	DIG	- 34	DI62
3	DI66	- 19	DIGI	- 35	DI65
4	DI71	20	D164	- 36	DI70
5	DI74	21	DI67	37	DI73
6	DI77	22	DI72	- 38	DI76
7	DI82	23	DI75	- 39	DI81
8	DI85	24	D180	40	DI84
9	DI87	25	D183	41	DI86
10	DI92	26	DI90	42	DI91
11	DI95	27	DI93	43	DI94
12	DIA0	28	DI96	44	DI97
13	DIA3	29	DIA1	45	DIA2
14	DIA6	30	DIA4	46	DIA5
15	DIB1	31	DIA7	47	DIB0
16	DIB4	32	DIB2	48	DIB3
17	DIB6	-		49	DIB5
18	±24 V	-		50	DIB7
10	· 2 4 V			00	0.01

#### CMB3

1	DO00			33	0 V
2	DO03	10	D001	34	DO02
3	DO06	19	DOUT	35	DO05
4	DO11	20	D004	36	DO10
5	DO14	21	D007	37	DO13
6	DO17	22	D012	38	DO16
7	DO22	23	DO15	39	DO21
8	DO25	24	DO20	40	DO24
9	DO27	25	DO23	41	DO26
10	DO32	26	DO30	42	DO31
11	DO35	27	DO33	43	DO34
12		28	DO36	10	DO37
12	DO40	29	DO41	44	DO37
13	D043	30	DO44	45	D042
14	D046	31	DO47	40	D045
15	DO51	32	DO52	47	DO20
16	DO54			48	DO53
17	DOCOM			49	DO55
18	DICMN2			50	DOCOM

#### CMB4

1	DO61		DOCO	14	DO60
2	DO64	°	D062	15	DO63
3	D067	9	DO65	16	D066
	2001	10	DO70		2000
4	DO72	11	DO73	17	DO71
5	D075		2010	18	DO74
6	DOSE	12	DO76	10	D077
0	0030	13	DO57	19	0011
7	0 V	10	0001	20	DOCOM

#### NOTE

Connector CNB4 is not mounted on this PCB when operator's panel connection unit (DI/DO 64/32) is selected.

DICMN1, DICMN2	:	DI (input) common switching terminals. Normally, short with 0 V before use.
+24 V	:	+24 VDC (output) terminal. Do not connect to inputs other than DI signal inputs on the operator's panel connection unit.
DOCOM	:	DO driver power supply. All DOCOMs (input) are internally connected.

(b) About I/O addresses

The following table shows the PMC addresses assigned to the source output operator's panel connection unit according to the number of I/Os (DI/DO 96/64, 64/32).

```
[DI addresses]
```

			7	6	5	4	3	2	l	0
	X	р	DI07	DI06	DI05	DI04	DI03	DI02	DÍOI	DIOO
DI 96	DI 64 X	p+l	DI17	DI16	DI15	DI14	DI13	DI12	DIII	DIIO
points	<sup>points</sup> X	p+2	DI27	DI26	DI25	DI24	DI23	DI22	DI21	DI20
	X	p+3	DI37	DI36	DI35	DI34	DI33	DI32	DI31	DI30
	X	p+4	D[47	DI46	DI45	D[44	DI43	DI42	DI41	DI40
	X	p+5	D[57	DI56	DI55	DI54	DI53	DI52	DI51	DI50
	X	p+6	D[67	DI66	D165	DI64	DI63	DI62	DI61	DI60
	X	p+7	DI77	DI76	DI75	DI74	DI73	DI72	DI71	DI70
	Х	p+8	D187	DI86	DI85	DI84	DI83	DI82	DI81	DI80
	Х	p+9	DI97	DI96	DI95	DI94	DI93	DI92	DI91	DI90
	Х	p+10	DIA7	DIA6	DIA5	DIA4	DIA3	DIA2	DIA1	DIAO
	Х	p+11	DIB7	DIB6	DIB5	DIB4	DIB3	DIB2	DIB1	DIBO

- The machine tool builder can determine address number p.
- The following 20 address points are common switchable DIs.
  - Xp + 0.0, Xp + 0.1, Xp + 0.2, Xp + 0.7 Xp + 1.0, Xp + 1.1, Xp + 1.2, Xp + 1.7 Xp + 4.0 to Xp + 4.7 Xp + 11.4, Xp + 11.5, Xp + 11.7

#### [DO addresses]

		_	7	6	5	4	3	2	1	0
		Υq	D007	D006	D005	D004	D003	D002	D001	D000
DO 64	DO 32	Y q+1	D017	D016	D015	D014	D013	D012	D011	D010
points points	points	Y q+2	D027	D026	D025	D024	D023	D022	D021	D020
		Y q+3	D037	D036	DO35	D034	D033	D032	D031	D030
		Y q+4	D047	D046	D045	D044	D043	D042	DO41	D040
		Y q+5	D057	D056	D055	D054	D053	D052	D051	D050
		Y q+6	D067	D066	D065	D064	D063	D062	D061	D060
		Y q+7	D077	D076	D075	D074	D073	D072	D071	D070

For details on address assignment, refer to the "FANUC PMC–MODEL N/NA PROGRAMMING MANUAL (Ladder Language) (B–61013E)" or "FANUC PMC–MODEL NB PROGRAMMING MANUAL (Ladder Language) (B–61863E)."

### 6.10.5 Details of Machine Side Connections of Source Output Operator's Panel Connection Unit

Connection example	Control panel connection	unit Address number Bit number
	$\downarrow$	$\vee$ $\downarrow$
DI06	CM51 (03)	RV X p+0.6 BC input signal A
DI05 DI04 DI03	CM51 (35) CM51 (20) CM51 (02) CM51 (02)	- X p+0.5 - X p+0.4 - X p+0.3
DI15 DI15 DI14 DI13	CM51(38) CM51(23) CM51(05) CM51(37)	<pre>x p+1.6</pre>
DI27 DI26 DI25 DI25 DI24 DI23 DI22 DI22 DI21 DI20	CM51(09) CM51(41) CM51(08) CM51(40) CM51(25) CM51(25) CM51(07) CM51(39) CM51(24)	X p+2.7 X p+2.6 X p+2.5 X p+2.5 X p+2.4 X p+2.2 X p+2.2 X p+2.1 X p+2.0
DI37 DI36 DI35 DI35 DI34 DI33 DI32 DI31 DI30	CM51 (44) CM51 (28) CM51 (11) CM51 (43) CM51 (27) CM51 (10) CM51 (42) CM51 (26)	X p+3.7 X p+3.6 X p+3.5 X p+3.4 X p+3.2 X p+3.2 X p+3.1 X p+3.0
DI57 DI55 DI55 DI54 DI53 DI53 DI52 DI51 DI50	CM51(50) CM51(17) CM51(49) CM51(16) CM51(48) CM51(48) CM51(32) CM51(15) CM51(47)	<pre>X p+5.7 * X p+5.6 * X p+5.6 * X p+5.4 * X p+5.2 * X p+5.1 * X p+5.0 *</pre>
+24 V	CM51 (18), CM52 (18)	+ <u>24 V</u>

#### NOTE

# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

Bit number $\sqrt[]{}$ $\sqrt[]{}$ $\frac{p+6.7}{}$ DC input signal A
$\frac{1}{p+6.7} DC \text{ input} signal A$
p+6.7 DC input signal A
signal A
p+6.6 ″
p+6.5 ~ p+6.4 ~
p+6.3 ~ ¦ p+6.2 ~ ¦
p+6.0 ~
p+7.7
p+7.5 *
p+7.3 <i>*</i>
p+7.1 ~ p+7.0 ~
p+8.7 ~
p+8.6 ~   p+8.5 ~
p+8.4 ~ p+8.3 ~
p+8.2 ~ p+8.1 ~
p+8.0 ~
p+9.7 * p+9.6 *
p+9.5 *
p+9.3 " p+9.2 ·
p+9.1 ~ p+9.0 ~

#### NOTE



#### NOTE

# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE





NOTE

#### B-63783EN/01

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



#### NOTE



Details of machine side connections of source output operator's panel connection unit (DI common switchable DI)

#### NOTE

In this connection example, common is 24 V and input is sink–type input. The machine tool builder can determine address number p.

### 6.10.6 External Dimensions of Source Output Operator's Panel Connection Unit



Fig. 6.10.6 External dimensions of source output operator's panel connection unit

The following LEDs, fuses and dials are mounted on this printed circuit board.

[LEDs]	
DB1 (GREEN PILOT):	Lights when this PCB is ON.
DB2 (RED ALARM):	Lights when an error occurs on this PCB or
	CNC.
DAL1 to DAL8:	See Subsec. 6.10.3.

#### [Fuses]

FU1 (3.2 A): For external 24 V input FU2 (5.0 A): For +5 V power supply used on this PCB Ordering specification A02B–0163–K111 (FU1/FU2 2–fuse set)

#### [Setup pin]

CP1: Selects whether or not to output DO output errors to the NC as a system error. (See Subsec. 6.10.3.)

# 6.11 ADDRESS-FIXED SIGNALS

The addresses of the emergency stop signal (\*ESP), skip signal (SKIP1), and measured position reached signals (AE1 and AE2), which are input from the machine, are fixed.

Signal	Address	
Emergency stop signal	*ESP	×6.4
Skip signal	SKIP 1	×11.6
Measured position reached	AE1	×8.3
signal	AE2	×8.4

#### NOTE

- 1 If the skip signal or measured position reached signal is not provided as an option, another signal can be assigned.
- 2 When a connection unit is used, connect the connection unit by assigning signals starting from address X0.0. The skip signal is thereby received at high speed because the delay time for the receiver becomes short (the input type becomes direct current input signal B).

# 6.12 CONNECTION TO THE MACHINE OPERATOR'S PANEL

6.12.1 Overview	Machine operator's panel is connected with $i$ series CNC by I/O Link, which is composed by some following operator's panels.
	Main panel A/A1
	This operator's panel incorporated with MDI with full alphabet keys. And that has 55 keys. All key tops are detachable. MTB can customize keys and make his original key layout easily.
	Main panel B/B1
	The part of keyboard of machine operation in Main panel A.
	Sub panel A
	This operator's panel has power ON/OFF, emergency stop, program protect, and two rotary switches.
	Sub panel B
	This operator's panel has emergency stop, program protect, and rotary switch.
	Sub panel C
	This operator's panel has power ON/OFF, emergency stop, program protect, rotary switch, and MPG.
	Sub panel B1
	This operator's panel has emergency stop, program protect, two rotary switches.
	Sub panel C1
	This operator's panel has emergency stop, program protect, two rotary switches, and MPG.

#### 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE



# 6.12.2 Total Connection Diagram



#### NOTE

- 1 CNC is only possible to use the MPG interface on this operators panel. If CNC uses some I/O unit having MPG interface (ex. Dispersion type I/O module for panel) and this operator's panel, the MPG interface nearest the CNC is only available on the I/O Link connection.
- 2 MPG cannot be connected with either of JA3 and JA58.
- 3 Connect FANUC standard MDI unit in case of Main panel B/B1.
- 4 When using a CNC–dedicated LCD unit, connect the MDI unit to the LCD unit. When not using the CNC–dedicated LCD unit, connect the MDI unit to the main CPU board.

# 6.12.3 Each Connections

# 6.12.3.1 Pin assignment

CA64 (Power source)							
3	2	0V	,	1	+2	4V	
6	5	0V	,	4	+2	4V	
Recommended connector for cable: Housing : AMP 1–178288–3 (3 pins type Contact : AMP 1–175218–5							
CM6	7(ON/OFF	,Prog	rar	n pi	roteo	ct,E	SP)
A01	EON	B01		EOF	F	-	
A02	COM1	B02		CON	/12		
A03	Xm+1.4	B03	K	EYC	ОМ		
A04	*ESP	B04	E	SPC	M1	-	
A05	TR1	B05		TR	2		
Ho Co CM6	using : AMF ntact : AMF 5 (Genera	- 1782 1–17 – purp	289 52 52	i–5 18–5 se D	5 91)	1010.	
A01		B01					
A02		B02	>	(m+(	0.5		
A03	Xm+0.1	B03	>	(m+(	0.3		
A04	+24V	B04	>	(m+(	0.4		
A05	Xm+0.2	B05	>	(m+(	0.0		
Re Hir CM6	commende ose electri 8 (Genera	d conr c : HIF I–puri	nec 3B	tor f A–1 se D	or ca 0D–2 0I/D(	, able: 2.54 )	R
A01	+24V	B01		(m+	1.5		
A02	Xm+1.6	B02	>	(m+	1.7		
A03	Xm+2.0	B03	>	(m+2	2.1		
A04	Xm+2.2	B04	>	(m+2	2.3		
A05	Xm+2.4	B05	>	(m+:	2.5		
A06	TR3	B06		TR	4		
A07	TR5	B07		TR	6		
A08	Yn+5.3	B08	Ì	۲n+5	5.7		
A09	Yn+6.3	B09		∕n+€	6.7		
A10	DOCOM	B10		0V	,		
A10DOCOMB100VRecommended connector for cable: Housing : AMP 178289–8 Contact : AMP 1–175218–5							ble:

CA65 (Power magnetic cabinet)							
A01	EON	B01	EOFF				
A02	COM1	B02	COM2				
A03	*ESP	B03	ESPCM1				
A04	TR1	B04	TR2				
A05	TR3	B05	TR4				
A06	TR5	B06	TR6				
A07	TR7	B07	TR8				
A08		B08					
A09		B09					
A10		B10					

Recommended connector for cable: Hirose electric : HIF3BA–20D–2.54R

#### CM66 (General-purpose DI)

A01		B01	
A02		B02	Xm+1.3
A03	Xm+0.7	B03	Xm+1.1
A04	+24V	B04	Xm+1.2
A05	Xm+1.0	B05	Xm+0.6

Recommended connector for cable: Hirose electric : HIF3BA–10D–2.54R

#### CM69 (General-purpose DI/DO)

	1		
A01	+24V	B01	Xm+2.6
A02	Xm+2.7	B02	Xm+3.0
A03	Xm+3.1	B03	Xm+3.2
A04	Xm+3.3	B04	Xm+3.4
A05	Xm+3.5	B05	Xm+3.6
A06	Xm+3.7	B06	DICOM
A07	TR7	B07	TR8
A08	Yn+7.3	B08	Yn+7.4
A09	Yn+7.5	B09	Yn+7.6
A10	DOCOM	B10	0V

Recommended connector for cable: Housing : AMP 178289–8 Contact : AMP 1–175218–5

#### NOTE

- 1 Input/output Pins shaded by mare in pairs. Only one in each pair is usable.
- 2 Pins shaded by are those for forwarding signals. Pins with the same name are connected directly to one another.

JA3 (Manual pulse generator)				
1	HA1	11		
2	HB1	12	0V	
3	HA2	13		
4	HB2	14	0V	
5	HA3	15		
6	HB3	16	0V	
7		17		
8		18	+5V	
9	+5V	19		
10		20	+5V	

JA58 (Pendant type manual pulse generator)

1	HA1	11	Xm+1.5
2	HB1	12	0V
3	Xm+2.2	13	Xm+1.6
4	Xm+2.3	14	0V
5	Xm+2.4	15	Xm+1.7
6	Xm+2.5	16	0V
7	Yn+5.3	17	Xm+2.0
8	Xm+2.1	18	+5V
9	+5V	19	+24V
10	+24V	20	+5V

Recommended connector for cable of JA3 and JA58 When the depth of the operator's panel is 60mm min. Recommended connector for cable: Hirose electric : FI30-20S (Connector) FI-20-CV7 (Case) When the depth of the operator's panel is 80mm min. Recommended connector for cable of JA3: Hirose electric: FI40B-2015S (Connector) FI-20-CV (Case) Recommended connector for cable of JA58: Honda: PCR-E20FA (Connector) PCR-V20LA (Case) Hirose electric : FI30-20S (Connector) FI-20-CV2 (Case) Fujitsu : FCN–247J020–G/E (Connector) FCN-240C020-Y/S (Case) 52622-2011 (Connector) Molex : 52624-2015 (Case)

# 6.12.3.2 Power supply connection

To the connector CA64 (IN) shown in the figure below, connect the required power for operating the operator's panel and the power for general–purpose DI. For easier power supply branching, the power supplied from CA64 (IN) is directly output to CA64 (OUT). When power supply branching is required, use CA64 (OUT).



#### NOTE

- 1 Both connectors CA64(IN) and CA64(OUT) are same specification. And there is not indication of (IN) and (OUT) on the PCB.
- 2 Power supply for the operator's panel must not turn off at operation. If +24V is turned off at operation, CNC happen to get system alarm(Communication alarm between CNC and operator's panel). +24V for operator's panel must be supplied before or same time CNC power on.

### 6.12.3.3 MDI connection



#### NOTE

For MDI cable connector mating on the CA55 side, a simple lock mechanism is employed. Ensure that a load greater than 1kg is not applied to the connectors. Moreover, clamp the cable so that excessive force is not applied due to vibration. However, shielding and clamping are not required for a cable of up to 50 cm.
# 6.12.3.4 I/O Link connection



# 6.12.3.5 Emergency stop signal connection

A signal generated by the emergency stop switch on the machine operators panel can be sent to the power magnetic cabinet. (This signal cannot be sent to the FANUC I/O Link.)

When MTB uses the Sub panel A/B/B1/C/C1, wiring to the emergency stop switch is contained in the Sub panel A/B/B1/C/C1.



# 6.12.3.6 Power ON/OFF control signal connection

Signal generated by the power ON/OFF control switches on the machine operators panel can be sent to the power magnetic cabinet. (This signal cannot be sent to the FANUC I/O Link.)

When MTB uses the Sub panel A/C/C1, wiring to the ON/OFF control switches are contained in the Sub panel A/C/C1.



# 6.12.3.7 DI (input signal) connection



#### NOTE

Connection of Xm+0.0 to Xm+0.7, Xm+1.0 to Xm+1.4 shows when the Sub panel A is used.



#### NOTE

- 1 Xm+3.0–3.7 have a common line that is possible to select the source/sink type. If DICOM (CM69–B06pin) is connected to +24V, the DI signal logic is negative. But in this connection, if the DI signal wires happen to drop the ground level, the status of the DI signal is same as the DI signal is "ON". From the safety viewpoint, DICOM should be connected 0V.
- 2 From the safety viewpoint, Emergency Stop signal must be assigned on the address Xm+0.0–0.7 or Xm+1.0–1.7 or Xm+2.0–2.7. As refer to the 6.12.5 DI/DO mapping, assign the Emergency stop DI.
- 3 Xm+0.0–0.7, Xm+1.0–1.7 and Xm+2.0–0.7 common lines are fixed. So, if these DI pins in this address open, the status of these one stay "0". And in case of Xm+3.0–3.7 which have a selectable common line, if the DICOM(CM69–B06pin) is connected to 0V and these DI pins open, the status of these one stay "0". And if the DICOM are connected to +24V and these DI pins open, the status of these one stay "1". And if the DICOM is not connected to 0V or +24V and these DI pins open, the status of these one stay "1".

# 6.12.3.8 DO (output signal) connection



6.12.3.9 Manual pulse generator connection

(1) When only the manual pulse generator.

Example of the 3 Manual pulse Generator connection is as follows. *i* series CNC is only possible to use the MPG interface. If *i* series CNC uses some I/O unit having MPG interface (ex. Dispersion type I/O module for panel) and this operator's panel, the MPG interface nearest the CNC is only available on the I/O Link connection.



#### NOTE

Calculate the MPG cable max. Length as refer to the following calculation.

MPG needs a 5VDC power supply and the voltage must be less than 0.2V dropping.

(the 0.2V dropping includes the resistance in the cable.)

$$0.2 \ge \frac{0.1 \times R \times 2L}{m}$$
 0.1 : MPG power supply current 0.1A  
R : Resistance per wire length ( $\Omega/m$ )

- m : Wire Number(Both 0V and 5V)
- L : Cable length(m)

Because

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

Example: In case of cable A66L–0001–0286 It has 3 pairs signal wires and 6 power line wires  $(20/0.18, 0.0394\Omega/m)$ .

If the cable is used and each 3 wires are used for 0V and 5V power line, then

max. cable length is as follows.

$$L \le \frac{3}{0.0394} = 76.75(m)$$

The answer is 76.75m, if MPG unit is 1.

(But FANUC decide any cable must be less than 50m.) The answer is 38.37m, if MPG units are 2. The answer is 25.58m, if MPG units are 3.

And In case of cable A66L-0001-0284#10P

The answer is 12.88m, if MPG units are 1.

The answer is 6.44m, if MPG units are 2.

The answer is 4.29m, if MPG units are 3.

If the customer will use a some other vender's MPG ,not FANUC's MPG, the electrical condition must be as follows.

HAn, HBn signals form MPG and CNC internal pulse are as follows. A cycle of the HA/HB pulse  $T_1$  must be more than 200µsec and  $T_1/4$  must be more than 50µsec.





And the receiver circuit is as follows.

 $V_{\mbox{\scriptsize IH}}, V_{\mbox{\scriptsize IL}}$  level at Connector pin

If Vin low to high,  $V_{IH}$  must be higher than 3.7V.

If Vin high to low,  $V_{IL}$  must be lower than 1.5V.

(2) When a pendant–type manual pulse generator

When a pendant-type manual pulse generator with including axis selection and multiplier setting functions is connected.



#### NOTE

- 1 When Xm+1.5–Xm+2.5 of connector JA58 are allocated as the DIs used for the axis selection and multiplier setting, Xm+1.5–Xm+2.5 of connector CM68 cannot be used.
- 2 One DO is available for the manual pulse generator side at the user's direction. When this is used, Yn+5.3 of CM68 cannot be used, as in the case for DIs above.

# 6.12.3.10 Connector (on the cable side) specifications.

Connector	Ма	ker Specification	Order specification
JD1A, JD1B,	Stand wire	Hirose	A02B-0236-K302
JA3, JA58	press– mount type	FI30–20S (Connector)	
(Operator's panel depth=60mm min.)	mount type	FI-20-CV7 (Case)	
JD1A, JD1B,	Soldering type	Honda	A02B-0120-K301
JA58		PCR–E20FS (Connector)	
(Operator's panel depth=80mm min.)		PCR–V20LA (Case)	
		Hirose	
		FI40B–20S (Connector)	
		FI-20-CV2 (Case)	
	Stand wire	Honda	A02B-0120-K302
	press-	PCR–E20FA (Connector)	
	mount type	PCR-V20LA (Case)	
		Hirose	
		FI30–20S (Connector)	
		FI-20-CV2 (Case)	
JA3	Soldering type	Hirose	A02B-0120-K303
(Operator's panel depth=80mm min.)		FI40B–2015S (Connector)	
		FI–20–CV (Case)	
CNK1	Stand wire	Hirose	A02B-0236-K302
	press- mount type	FI30–20S (Connector)	
	mount type	FI-20-CV7 (Case)	
CA64 (IN),	AMP		A02B-0120-K324
CA64 (OUT)	1–178288–3 (Ho	busing)	
	1–175218–5 (Co	ontact)	
CM67	AMP		A02B-0236-K312
	178289–5 (Hous	sing)	
	1–175218–5 (Co	ontact)	
СМ68,	AMP		A02B-0236-K313
CM69	178289–8 (Hous	sing)	
	1–175218–5 (Co	ontact)	
СМ65,	Hirose		A02B-0236-K314
CM66	HIF3BA-10D-2.	54R	
CA65	Hirose		A02B-0120-K343
	HIF3BA-20D-2.	54R	

# 6.12.4 DI/DO Address

# 6.12.4.1 Keyboard of main panel

DI/DO address of Keyswitches and LED on the keyboard of Main panel A/B/A1/B1 are as follows.

BIT Key/LED	7	6	5	4	3	2	1	0
Xm+4/Yn+0	B4	B3	B2	B1	A4	A3	A2	A1
Xm+5/Yn+1	D4	D3	D2	D1	D4	C3	C2	C1
Xm+6/Yn+2	A8	A7	A6	A5	E4	E3	E2	E1
Xm+7/Yn+3	C8	C7	C6	C5	B8	B7	B6	B5
Xm+8/Yn+4	E8	E7	E6	E5	D8	D7	D6	D5
Xm+9/Yn+5		B11	B10	B9		A11	A10	A9
Xm+10/Yn+6		D11	D10	D9		C11	C10	C9
Xm+11/Yn+7						E11	E10	E9



# 6.12.4.2 Override signals

Table of gray code output is as follows when the Sub panel A/B/B1/C/C1 is used

Rotary switch (SA1)

%	0	1	2	4	6	8	10	15	20	30	40	50	60	70	80	90	95	100	105	110	120
Xm+0.0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Xm+0.1	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1
Xm+0.2	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1
Xm+0.3	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Xm+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Xm+0.5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

#### NOTE

Xm+0.5 is a parity bit.

Rotary switch (SA2)

%	50	60	70	80	90	100	110	120
Xm+0.6	0	1	1	0	0	1	1	0
Xm+0.7	0	0	1	1	1	1	0	0
Xm+1.0	0	0	0	0	1	1	1	1
Xm+1.1	0	0	0	0	0	0	0	0
Xm+1.2	0	0	0	0	0	0	0	0

#### NOTE

1 Xm+1.2 is a parity bit.

2 There is no Rotary switch(SA2) of Sub panel B/C.

# 6.12.5 DI/DO Mapping

I/O address map is as follows.



DI mapping should be assigned 1 group = 16 byte mapping and DO mapping should be assigned 1 group = 8 byte mapping. The reason is as follows.

MPG interface(the counter for MPG) uses Xm+12 to Xm+14 area and it is fixed. And if MPG interface will be used, Xm+12 to Xm+14 area must be assigned. therefore, in case of i series and using MPG interface, DI mapping must be assigned 16 byte mapping. MPG counter area are directly processed by CNC software. So you must not use this area by customer ladder.

It is possible to assign any address for this operator's panel. But in DI address, each CNC have some fixed address that is directly processed by CNC software. So, as refer to the following mention, assign the DI mapping.

# 6. CONNECTION OF I/O UNITS TO MACHINE INTERFACE

Directly processed address by CNC

	7	6	5	4	3	2	1	0
X0006				*ESP				
X0008				AE2	AE1			
X0011		SKIP1						

Ex. In case of 16 byte mapping start from X0006 for DI area.

X0006		*ESP Fixed signal					
X0007	General-purpose						
X0008	Di	AEn Fixed signals					
X0009							
X0010							
X0011							
X0012							
X0013	Keyboard of						
X0014	Main panel						
X0015	(Reyswitches)	In case of mapping start from X0006, AEn1 sin-					
X0016		gal which is address fixed signal can be used					
X0017		any time. And *ESP signal can be placed at					
X0018 (1st MPG)		+24V common fixed address.					
X0019 (2nd MPG)	MPG	Dut SKIPT signal can not be used.					
X0020 (3rd MPG)	1	switch input part )					
X0021	Reserve						

# 6.12.6 Specifications

# 6.12.6.1 Environmental requirement

Temperature around a unit	At operation	0 to 55°C
	Storing or transporting	-20 to 60°C
Temperature variance	Max. 0.3°C/min	
Humidity	Normally	75% or less (Relative humidity)
	Short time(Within one mon	th) 95% or less (Relative humidity)
Vibration	Operating 0.5G or l	ess
Atmosphere	Normal FA atmosphere(Co with higher degree of dust,	nsult us when using the system under environments coolant, or organic solution.)

# 6.12.6.2 Main panel A/B/A1/B1 specification

ltem	Specification	Remarks
General-purpose DI points	32 points	24VDC input signals
General-purpose DO points	8 points	24VDC output signals
Keyswitches of MDI	65 keys	Full alphabet key (Main panel A/A1)
Keyswitches of Machine op- erator's panel	55 keys	Matrix DI
LED	Color : Green	Attached to all keyswitches, Matrix DO
MPG interface	Max. 3 units	Only available for <i>i</i> series.
Interface to CNC	FANUC I/O Link connection	Max. 16 modules or total points max. 1024/1024 will be available.

# 6.12.6.3 Sub panel A/B/B1/C/C1 specification

Itom		Specific	ation of S	ub panel		Noto
nem l	Α	В	B1	С	C1	Note
Override rotary switch	2	1	2	1	2	5 bit Gray code output (with a parity bit)
Emergency stop switch	1	1	1	1	1	Number of Contact : 4 (Contact a x 2, Contact b x 2) M3.5 Screw
Program protect key	1	1	1	1	1	
ON/OFF switch	ON/OFF	Ι	-	ON/OFF	ON/OFF	
MPG	_	_	-	1	1	

# 6.12.6.4 Power supply specification

Voltage	Capacity	Note
$24VDC \pm 10\%$ (from Power connector CA64, including momentary values)	0.4A	Including all DI consumption

# 6.12.6.5 General–purpose DI signal definition

Capacity	30VDC, 16mA or more
Interconnect leakage current in closed circuit	1mA or less(at 26.4V)
Interconnect voltage drop in closed circuit	2V or less(including the voltage drop in the cables)
Delay time	Receiver delay : Max. 2ms
	Need to consider about the serial communication (I/O Link) delay between CNC and operator's panel 2ms(MAX)+Scan cycle of ladder (Scan cycle is different each CNCs).

## 6.12.6.6 General–purpose DO signal definition

Maximum load current in ON state	200mA or less
Saturation voltage in ON state	Max. 1V (When load current is 200mA)
Withstand voltage	$24V \pm 20\%$ or less
	(including momentary values)
Leakage current in OFF state	20μA or less
Delay time	Driver delay : Max. 50µs
	Need to consider about the serial communication (I/O Link) delay between CNC and operator's panel 2ms(MAX)+Scan cycle of ladder (Scan cycle is different each CNCs).

# 6.12.7 Key Symbol Indication on Machine Operator's Panel

## 6.12.7.1 Meaning of key symbols

Symbol	English	Meaning of key					
	AUTO	AUTO mode selection signal; Sets automatic operation mode.					
$\overline{2}$	EDIT	EDIT mode selection signal; Sets program edit operation mode.					
	MDI	MDI mode selection; Sets MDI mode.					
•	REMOTE	DNC operation mode; Sets DNC operation mode.					
<b>•</b> -	REF RETURN	Reference position return mode selection; Sets reference position return mode.					
	JOG	JOG feed mode selection; Sets jog feed mode.					
	INC	Step feed mode selection; Sets step feed mode.					
	JOG						
$\bigcirc$	HANDLE	Manual handle feed mode selection; Sets manual handle feed mode.					
₩.÷>	TEACH	Teach-in jog (reach-in handle) mode selection signal; Sets teach-in jog (teach-in handle) mode.					
	SINGLE	Single block signal; Executes program one by one. This key is used to check a pro-					
	BLOCK	gram.					

Symbol	English	Meaning of key						
	BLOCK DELETE	Block delete (optional block skip); Skips the execution of the blocks starting with the first block prefixed with / and ending with the end of block (;) when this button is pressed during automatic operation.						
0	PRG STOP	Program stop(output only); Turns on the LED on the button when automatic operation is stopped by M00 specified in the program.						
$\bigcirc$	OPT STOP	Optional stop; Stops automatic operation after execution of the block of a program where M01 is specified in the program.						
	RESTART	Program restart; A program may be restart at a block by specifying the sequence number of the block, after automatic operation is stopped because of a broken tool or for holidays.						
	DRY RUN	Dry run; Sets the axis feedrate to the jog feedrate instead of a programmed feedrate when automatic operation is performed by setting this button to on. This function is used to check only the movement of the tool when no workpiece is mounted.						
	MC LOCK	Machine lock; Updates only position display on the screen without making any axis movement, when automatic operation is performed by setting this button to on. This function is used to check a program.						
CYCLE Cycle start; Start automatic operation.								
	CYCLE STOP	Cycle stop; Stops automatic operation.						
x	1	Manual handle feed magnification:						
X 10		Magnification for manual handle feed.						
X1 X1	00 000	Magnified by 1, 10, 100, 1000.						
X X 4 5	7 Z 5 6	Manual feed axis selection; Axes are selected, when these buttons are set to on in the jog feed mode or step feed mode.						
+	—	Manual feed operation; Performs movement along selected axes when these buttons are set on in the jog feed mode or step feed mode.						
		Traverse; Performs jog feed at rapid traverse rate when this button is set to on.						
	SPDL CW	Positive spindle rotation direction; Rotates the spindle motor in the positive direction.						
	SPDL CCW	Negative spindle rotation direction; Rotates the spindle motor in the negative direc- tion.						
	SPDL STOP	Spindle stop; Stops the spindle motor rotation.						

# **6.12.7.2** Keyboard of machine operator's panel has 55 keys. All key tops are detachable key top detachable. MTB can customize keys and make his original key layout easily. And using transparent key top (optional), a film sheet with marking is inserted into the key.



#### NOTE

Use the oil-proof sheet in the environment which oil is used for.

# 6.12.8 Others

The keyboard of this operator's panel is a matrix composition. When three or more keys are pushed, the bypass current cause unrelated key to be available. This malfunction can be prevented with ladder program. One example is shown as follows.

(Elimination rule of malfunction)

When three keyinputs or more is input, all the keyinput since the third is made invalid.

However, when the number of all keyinput becomes two or less because keyinput was lost, all keyinputs are made effective.



(Operation of ladder program)

The example of the operation of ladder program is shown about matrix DI composed of 8bits x 8commons as follows.

(1) The number of datalines where the keyinput exists is examined. Logical add R1 of the data of all addresses is calculated. The number of bits which are "1" in the 8bits data of R1 corresponds to the number of datalines where the keyinput exists.

- 1) When the data of R1 is corresponding to 00h, there is no bit which is "1" in the data of R1.
  - Ex. State (a) :  $R1=(0000000) \rightarrow$  There is no dataline where input exists.
- 2) When the data of R1 is corresponding to the data in undermentioned datatable1., the number of bits which are "1" in the data of R1 is one. Similarly, when the data of R1 is corresponding to the data in datatable2., the number of bits which are "1" in the data of R1 is two.
  - Ex. State (b) or (c) :  $R1 = (00000100) \rightarrow$  There is one dataline where input exists.
  - Ex. State (d) or (e) :  $R1 = (00010100) \rightarrow$  There are two datalines where input exists.
- 3) If the data of R1 is not corresponding to 00h and the both datatables, the number of bits which are "1" in the data of R1 is three or more.
  - Ex. State (f) : R1 = (00110100) ? There are three datalines where input exists.

Data t	able 1.	Data table 2.					
0000001	00000010	00000011	00000110	00001100	00011000		
00000100	00001000	00110000	01100000	11000000	10000001		
00010000	00100000	00000101	00001010	00010100	00101000		
01000000	1000000	01010000	10100000	01000001	10000010		
		00001001	00010010	00100100	01001000		
		10010000	00100001	01000010	10000100		
		00010001	00100010	01000100	10001000		

- (2) Judgment 1
  - 1) If there is no dataline where the keyinput exists.
    - $\rightarrow$  Any key switch is not pushed. : Ex. State (a)
  - 2) When the keyinput exists in two datalines or less.

→ To [3]

- 3) When the keyinput exists in three datalines or more.
  - $\rightarrow$  There are three keyinputs or more.
    - It is invalid keyinput. : Ex. State (f)

(3) When the keyinput exists in two datalines or less, it is examined whether two or more keyinput exists on the same dataline. The data of all addresses is subtracted from logical add R1 and subtraction result R2 is obtained. There are no two or more keyinput on the same dataline if it is R2=00h.

Ex. When there is one dataline where input exists.

State (b) : R2 = FCh State (c) : R2 = F8hWhen there are two datalines where input exists. State (d) : R2 = 00hState (e) : R2 = FCh

- (4) Judgment 2
  - In case of R2 = 00h → There are two or less datalines where input exists, and there are no two or more keyinputs on the same dataline. In this case, the numbers of all keyinputs are one or two. It is effective keyinput.
     Ex. State (d)
  - 2) In case of R2 ≠ 00h → There are two or less datalines where input exists, and two or more keyinputs exists on the same dataline. To [5].
- (5) Judgment 3

When there is one dataline where input exists → To [6].
When there are two datalines where input exists → There are three keyinputs or more It is invalid keyinput. : Ex. State (e)

(6) Subtraction result R2 is added to logical add R1. If this addition result is 00h, the number of all keyinputs is two.

Ex. State (b) : R1 + R2 = 04h + FCh = 00hState (c) : R1 + R2 = 04h + F8h = FCh

(7) Judgment 4

In case of $R1 + R2 = 00h \rightarrow$	There is one dataline where input
	exists, and there are two keyinputs
	on this dataline. That is, because the
	numbers of all input are two keys, it is effective input. : Ex. State (b)
In case of R1+R2 $\neq$ 00h $\rightarrow$	There are three keyinputs or more on the same dataline. It is invalid keyinput. : Ex. State (c)

(8) Only when the keyinput becomes effective because of judgment 1–4, all DI data (Xm+4–Xm+11) is used by the ladder program.

# 6.12.9 Connector Locations

# 6.12.9.1 Connector locations of

main panel A/A1



# 6.12.9.2 Connector locations of main panel B/B1



# CONNECTION TO CNC PERIPHERALS

#### CAUTION

A signal or power supply may possibly be assigned to a pin currently indicated as unused in the connector signal assignment table without prior notice. Do not use any of the pins indicated as being unused.

# 7.1 LCD UNIT (DISPLAYUNIT FOR CNC EXCLUSIVE USE) INTERFACE

The following two LCD units are available. The each have the same interface.

- 9.5" STN monochrome LCD
- 10.4" TFT color LCD (for 1LCD connection)
- 10.4" TFT color LCD (for 2LCD connection)

7.1.1 Connection of 1LCD Unit

# 7.1.1.1 Connection of LCD unit (for 1LCD connection)



# 7.1.2 Connection of MDI Unit (with CNC–Only Display Used)

The following four MDI units are available. The each have the same interface.

- 56 key vertical type
- 56 key horizontal type
- 61 key (Full Key) vertical type
- 61 key (Full Key) horizontal type



#### NOTE

When two LCD units (for two–LCD connection) are used, both the first and second LCD units can be connected to MDI units, but only the MDI unit selected by the MDI switch can be used. For the MDI switch interface, see Subsection 7.1.3.



#### NOTE

As the connector on the CA55 side of the MDI cable is attached by means of a simple lock system, it should not be subjected to a force of more than 1 kg. Also, clamp the connector to prevent vibration from possibly loosening the connection. Note, however, that shielding and clamping are not required if the cable length is less than 500 mm.

# 7.1.3 MDI Unit Switch Connection (when LCD Units for Two–LCD Connection are Used)





# 7.1.5 Mounting the PCMCIA Blind Cover on an LCD Unit for Two–LCD Connection

The memory card interface of the second LCD unit cannot be used. The machine tool builder should mount a PCMCIA blind cover as shown below.



# 7.2 I/O UNIT INTERFACE

# 7.2.1 RS–232C Serial Port (JD5A, JD5B, JD5C)



# 7.2.2 RS–232C Serial Port (JD36A)



#### NOTE

This connector cannot be used on LCD units having a touch panel

Pins 18 and 20 (+5V) are provided for touch panel connection. Never use these pins for making any other connection.

+24V can be used as the power source for FANUC RS-232C equipment.

#### 7. CONNECTION TO CNC PERIPHERALS



#### NOTE

- The machine tool builder shall furnish relay connectors and relay cables.
- Use a totally shielded cable for the signal cable.
- Recommended cable material: A66L–0001–0284#10P (#28AWG  $\times$  10 pairs)
- Open all terminals other than illustrated.
- Set suitable parameters on reader/puncher interface for FANUC Handy File. The baud rate is 4800 baud.
- FANUC Handy File should be connected to one of JD5A, JD5B or JD36A. When FANUC Handy File are connected to two or more connectors, the +24V power capacity may be exceeded.

# 7.2.3 RS422 Serial Port (JD6A, JD6B)

~~				_					
	IDEP	nal ax	15	-		Exto	mal unit (D	5 422)	
PCR-	-E20MDK-S	SL-A				Exte			
1	RD	11	SD			1	FG	20	
2	*RD	12	*SD			2		21	
3		13				3		22	*SD
4		14				4	SD	23	
5	CS	15	RS		лd	5		24	*RD
6	*CS	16	*RS	$\mu$ $\mu$	ШЦ	6	RD	25	*RS
7	DR	17	ER			7	RS	26	
8	0V	18	*ER			8		27	*CS
9	*DR	19	(+24V)			9	CS	28	
10	(+24V)	20				10		29	*DR
······			4. <u></u>			11	DR	30	*ER
						12	ER	31	
						13		32	
						14		33	
						15		34	
						16		35	
						17	1	36	
						18		37	
						19	SG		

#### NOTE

- 1 In the above diagram, the interface on the external unit side is simply an example. When developing a cable, design it according to the actual external unit interface that will be used.
- 2 Do not connect anything to the +24 V pin.

#### 7. CONNECTION TO CNC PERIPHERALS



#### NOTE

Use a twisted pair common–shield cable with a wire size of 7/0.127 (0.09 mm<sup>2</sup>) or larger. Observe the pin arrangement shown above. Ground the shielding to a cable clamp. Recommended wire: A66L–0001–0284#10P
#### 7. CONNECTION TO CNC PERIPHERALS

# 7.2.4 Connection with FANUC Handy File

FANUC Handy File can be connected to the CNC via the ES–232C serial port.



# 7.3 MANUAL PULSE GENERATOR INTERFACE



Recommended cable A66L–0001–0286 (#20AWG × 6 + #24AWG × 3 pairs) length 20 max.

Recommended connector:

A02B–0120–K303 (includes the following body and housing) (Body: FI40–2015S, soldering type, from Hirose Electric Co., Ltd.) (Housing: FI40–20–CV5, from Hirose Electric Co., Ltd.)

#### NOTE

Since some pins of this connector, unlike other 20–pin connectors, have been removed, resulting in a unique pin arrangement, be careful when identifying pin numbers. See Figure 2 in Appendix B and Table C (a) in Appendix C.

#### • Manual pulse generator cable

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

 $0.2 \ge (0.1 \times R \times 2L)/m$ 

Where

- 0.1: manual pulse generator supply current 0.1 A
- R: resistance per unit cable length ( $\Omega/m$ )
- m: number of 0V and 5V wires
- L: cable length (m).

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

 $L \leq m/R$ 

In the case of the A66L–0001–0286 cable developed for the FS15/16/18 pulse coder interface, when three pairs of signal wires and six power source wires (20/0.18, 0.0394  $\Omega/m$ ) are used (three power source wires connected to 5V and the other three to 0V), the cable length is:

 $L \leq 3/0.0394 = 76.75 [m]$ 

However, the maximum pulse transmission distance for the manual pulse generator is 50m. So, the cable length may be extended to 50 m.

# 7.4 HIGH–SPEED SKIP (HDI) SIGNAL INTERFACE

The following shows the connection for the high-speed skip signal.





Absolute maximum rating

Input voltage range: Vin: -3.6V to +13.6V

Input characteristics

ltem	Symbol	Standard	Units	Remarks
High-level input voltage	VH	3.6 to 11.6	V	
Low-level input voltage	VL	0 to 1.0	V	
High-level input current	liH	2 (max)	mA	V <sub>in</sub> =5V
		11 (max)	mA	V <sub>in</sub> =10V
Low-level input current	liL	–8.0 max	mA	V <sub>in</sub> =0V
Input signal pulse width		20 min	μs	
Delay or variance of the input signal		0.02 (max)	ms	

#### NOTE

- 1 The symbols (+ or –) of lih and lil indicate the direction of current flowing to (+) and out of (–) the receiver.
- 2 The high–speed skip (HDI) signal is regarded as "1" at a low input voltage level and as "0" at a high input voltage level.

The spindle interface can be configured in one of three ways on the Series 15i/150i.

CNC Position coder JY4 JA7B SPDL&POS(JA41) SPM Spindle motor JY2 JA7A ΤВ Position coder JY4 JA7B SPM Spindle motor JY2 JA7A ΤВ

(1) Serial spindle

(2) Serial spindle + rotary tool



(3) Analog spindle



#### NOTE

For details of the connections between the spindle amplifiers and spindle motors, and between the spindle amplifiers and position codes, refer to the SPINDLE MOTOR  $\alpha i$  series Descriptions manual.

# 7.5.1 $\alpha$ Spindle Interface



For example, this applies when there is a source of strong magnetic noise, such as a welder, near the cable.

# 7.5.2 Analog Spindle Interface



100 Ω

Output impedance

# 7.5.3 Position Coder Interface



The position coder generates rectangular wave voltage signals in proportion to the angle of rotation of the spindle, and is used in feed per revolution and thread cutting.

- (1) 1 rotation of position coder with respect to 1 rotation of spindle
- (2) 1 rotation of position coder with respect to 2 rotations of spindle
- (3) 1 rotation of position coder with respect to 4 rotations of spindle
- (4) 1 rotation of position coder with respect to 8 rotations of spindle

Fig. 7.5.3 shows the timing of the signals generated by the pulse coder.



Fig. 7.5.3 Rectangular wave of position coder

#### NOTE

The differential signal is used as the feedback signal from the position coder. \*PCA, \*PCB and \*PCZ refer to each of their inverted signals.

Time rules

These are the signal rules that apply to the input pin of the input connector of the NC in the figure above.

Because the signal of this connector is in phases A and B and is a differential input, Td is of interest, which is the duration from point A when the relative potential difference between PCA and \*PCA becomes 0.5 V or higher to point B when the relative potential difference between PCB and \*PCB reduces below 0.5 V. Its minimum is:

 $Td \ge 0.65 \mu s$ 

Tp, which is the minimum of one period in each of phases A and B, is:  $Td \ge 4\mu s$ 

Phase Z signal input

The phase Z signal (one-rotation signal) requires a signal width equal to or greater than one period of the phase A or B signal.

# 7.5.4 Connection of 1 to 4 Serial Spindles

3 or 4 serial spindle can be connected on the Series 15i/15i (only on M type models) by using the serial spindle connector panel.

Serial spindle connector panel specifications: A13B-0180-B001

External dimensions of serial spindle connector panel The external dimensions of the serial spindle connector panel are the same as those for the optical I/O Link adapter (A13B–0154–B001).



Serial spindle connector panel installation conditions

- The serial spindle connector panel is not fully sealed; install it with the CNC control unit in the fully enclosed cabinet.
- Ground the case using the case installation of the serial spindle connector panel.
- The serial spindle connector panel is light, and it may not be necessary to mount it with screws. However, keep it from coming in contact with other circuits to prevent possible short-circuits. When mounting the serial spindle connector panel in a cabinet, attach it with an L-type fitting using the case fixing screws (M3) of the optical link adapter.



#### Connection examples

(When only the electrical cable is used for connection)



(When the optical cable is used for connection)



(When only the electrical cable is used for connection)

Cable connections between CNC and serial spindle connector panel (interunit connection cable (1))



#### NOTE

- 1 The +5V signals inside < > are power source signals to the optical link adapter to be used when an optical adapter is used for the connection between CNC and the spindle. Do not connect this signal when the optical cable is not used. The signals inside [] are for use when the position coder is used. These signals cannot be used jointly with the serial spindle interface on the 2nd channel.
- 2 Make a branch connection from the spindle amplifier module to connect the 2nd and 4th serial spindles.



When this cable is laid nearby power lines and other cables, the shielded lead must be connected to the earth plate. However, note that this connection is not required when the CNC and spindle amplifier module are mounted nearby.

Cable connections between the serial spindle connector panel and the spindle amplifier

(interunit connection cable (2))



- The +5V signals inside < > are power source signals to the optical link adapter to be used when an optical adapter is used for the connection between the CNC and the spindle. Do not connect this signal when the optical cable is not used.
- 2 Make a branch connection from the spindle amplifier module to connect the 2nd serial spindle.



#### NOTE

When this cable is laid nearby power lines and other cables, the shielded lead must be connected to the earth plate. However, note that this connection is not required when the serial spindle connector panel and spindle amplifier module are mounted nearby.

(Cable connection when the optical cable is used for connection) Cable connections between CNC and serial spindle connector panel (interunit connection cable (3))



— 291 —

- 1 The signals inside [] are for use when position coders are used. They cannot be used jointly with the No.2 serial spindle interface.
- 2 Make a branch connection from the spindle amplifier module to connect the 2nd and 4th serial spindles.



#### NOTE

When this cable is laid nearby power lines and other cables, the shielded lead must be connected to the earth plate. However, note that this connection is not required when the CNC and spindle amplifier module are mounted nearby.

(Cable connection between the serial spindle connector panel and optical adapter)

(interunit connection cable (4))



Make a branch connection from the spindle amplifier module to connect the 2nd and 4th serial spindles.



7.6	Serial communications using optical fiber cable is used as the servo
SERVO INTERFACE	Interface.
(FSSB)	For details on connections relating to the servo amplifier series, refer to the FANUC SERVO AMPLIFIER $\alpha i$ series Specifications (B–65282E).

# 7.6.1 Connection Example When High–Speed HRV Current Control is not Used



Recommended cable (optical fiber cable)

For detailed specifications, see Appendix. When a separate pulse coder or linear scale is used, a separate detector interface unit is required as shown in the above. The separate detector interface unit is connected as a servo interface (FSSB) unit to the control unit with an optical fiber cable. The signals input from the linear scale to the separate detector interface unit must be asserted within 500 ms after power–up.

# 7.6.2 Connection Example when High–Speed HRV Current Control is Used



# 7.6.3 Requirements for the FSSB Line

When high-speed HRV current control is to be used, amplifiers for high-speed HRV current control are required. As the separate detector interface unit, a separate detector interface unit supporting servo HRV3 must be used.



When an FSSB line uses high-speed HRV current control, servo amplifiers for up to four axes can be connected to the FSSB line, and up to five slaves including a separate detector interface unit are allowed. When high-speed HRV current control is used in a system with five or more axes, two FSSB lines are required, so a TYPE B axis control card is required. With two FSSB lines, up to eight axes can be controlled. When an axis control card supporting servo HRV3 is used, a separate detector interface unit supporting servo HRV3 is required as the separate detector interface unit even if it is attached to an FSSB line that does not use high-speed HRV current control.



- When four controlled axes are connected to an FSSB line that uses high–speed HRV current control, a separate detector interface unit must be connected at the far end of the FSSB line. When there are three controlled axes or less, however, the separate detector interface unit may be connected at any position on the line.



 In axis assignment, pairs of the first and second axes, the third and fourth axes, the fifth and sixth axes, and the seventh and eighth axes must each be connected to the same FSSB line. For example, you cannot connect the third axis to the first FSSB line, and the fourth axis to the second FSSB line. Axes to be paired must be connected to the same FSSB line.



# 7.6.4 Separate Detector Interface Unit

7.6.4.1

Separate detector interface unit

Item	Specification	
Power supply	+24VDC(±10%) 0.9A : Only use Basic 4 axes unit 1.5A : Use Basic 4 axes unit and additional 4 axes unit	
Ordering information	Basic 4 axes unit: A02B-0236-C205Additional 4 axes unit: A02B-0236-C204	
External dimensions	Refer to fig. 12 in Appendix A.	

#### NOTE

The power supply which this unit can supply to the separate detector unit is 0.35A (5V) per one. Minimum voltage for 5 V 4.95 V (min.) for the basic 4–axis unit 4.90 V (min.) for the additional 4–axis unit

# 7.6.4.2 Power source connection

Supply the power source for this unit from the servo amplifier or from an external 24VDC power source.



## 7.6.4.3 Battery connection for separate absolute detector

Separate detector interface unit Battery case JA4A (PCR-EV20MDT) 11 M3terminal 01 12 02 + 03 OV 13  $\geq$  $\supset$ +6V 0V 14 04 05 15 06 16 07 +6V 17 08 18 19 09 10 20 JA4A Battery case 7 + +6V +6V 3 — 0V 0V Recommend lead:  $\geq 0.2$  mm<sup>2</sup> (7/0.18) Recommended connectors: PCR-E20FA (Honda) F130–20S (Hirose Denki) FCN–247J020–G/E (Fujitsu) 52622-2011 (Molex)

#### NOTE

This battery for the separate absolute detector is required only when the separate absolute detector is used. If the built-in absolute pulse coder of the motor is used, the battery for the separate absolute detector is not required because the built-in battery of the amplifier is used.

This is required only when the separate absolute detector is used.

# 7.6.4.4 Linear scale interface (parallel interface)



# 7.6.4.5 Linear scale interface (serial interface)



# 7.6.4.6 Separate pulse coder interface

When absolute detection is used:





#### When incremental detection is used:

# 7.6.4.7 Input signal rules

#### (1) A, B phase signal input

When positional information is input by A and B phase signals which have a phase deviation of  $90^{\circ}$  to each other, the direction in which the B phase advances is taken as the plus direction, and the direction in which the A phase advances is taken as the minus direction. The phase is detected by these two signals.



(2) Phase difference and minimum repeat cycle



In the above figure, the minimum time of (TD) is calculated as follows:

TD  $\geq 0.15 \,\mu sec$ 

The cycle and pulse width that satisfies the above phase difference becomes the lower limit value.

(3)Z phase signal input

A signal width more than a 1/4 cycle of the A or B phase signal is required for the Z phase signal (1 rotation signal).



Relationship between	If the separate pulse coder rotates in the direction opposite to that in which
servo motor and	the servo motor rotates, change the connection of the interface cable for
separate pulse coder	the separate pulse coder as stated below:
with regard to direction	(1) Exchange signal PCA with signal PCB.
of rotation	(2) Exchange signal *PCA with *PCB.

Basic-unit connector layout

# 7.6.4.8 Connector layout

- C P 1 1 A C N.F 1 - CP11B Ш д). Д 4111/ 1-С, 76 4. 2 - JF101 781. 8 JF102 8 70 . JF103 15 78||-1#4 - JF104 28 🖌 5 — JA4A Ć ø COPIOA COPIOB

#### Additional-unit connector layout



# 7.6.4.9

Cautions for mounting separate detector interface unit

(1) Use the unit in a completely sealed cabinet.

- (2) Mount the unit on a vertical surface, and allow a space of at least 100 mm above and below the unit. Do not place any unit generating a large amount of heat under the detector interface unit.
- (3) For the dimensions of the unit, see the corresponding outline drawing in Appendix A.

#### CAUTION

This unit requires a clearance on both sides for maintenance purposes to accommodate a screwdriver inserted obliquely when the detector interface unit is mounted or removed.

As a guideline, allow a gap of at least about 20 mm between this unit and each adjacent unit if the detector interface unit is not shorter than adjacent units, and about 70 mm if it is shorter.

If this unit is mounted next to the side of the cabinet, allow a gap of at least about 70 mm between the unit and the cabinet side.



# Connection between basic and additional units

A flat cable is used to connect an additional unit to the basic unit as shown below. The flat cable is 100 mm long.



The flat cable should be ordered together with the separate detector interface unit.

When using an additional unit together with the basic unit, run the flat cable connecting the units so that it does not block the vents of the basic unit.

# Details of mounting holes



Mounting hole layout and dimensions

If both basic and additional units are to be used, separate the mounting holes by 70 to 80 mm, as shown above.



Using DIN rail for mounting

How to mount

- 1. Place the hook of the unit on the top end of the DIN rail.
- 2. Push in the unit firmly until it clicks.

How to remove

- 1. Pull down the lock on the unit using a flat–blade screwdriver or similar object.
- 2. Remove the unit by pulling bottom toward you.

#### CAUTION

To prevent damage to the lock when removing the unit, be careful not to apply excessive force to the lock. When mounting and removing the unit, whenever possible, hold the top and bottom edges. Do not apply force to the sides (where the are slits are located).

# 7.7 GENERAL-PURPOSE VOLTAGE INPUT INTERFACE

	litional avis			Analog voltage input range: -10 V to +10 Input current: 0.5 mA (minimum)
Auc				
JA6 (PC	S R–EV20MD	T)		
1	AIN0	11		
2	0V	12	(0V)	
3	AIN2	13	AIN3	
4	0V	14	0V	
5		15		
6	(0V)	16	(0V)	
7		17		
8		18		
9		19		
10	)	20		
				·

#### NOTE

Signals enclosed in parentheses cannot be used at present. Do not connect anything to pins not available for use.

Follow the signal cable connection diagram shown below.



Recommended wire: A66L–0001–0284#10P (#28AWG  $\times$  10 pairs)

# 7.8 REMOTE BUFFER INTERFACE

# 7.8.1 Serial Communication Board A1 (RS–232–C)




Cable connection example

If not using CS, connect it to RS. For protocol A and extended protocol A, however, it is used for busy control, and must be connected as shown in the figure above.

If not using DR, connect it to ER.

Be sure to connect CD to ER.

# 7.8.2 Serial Communication Board A2 (RS–422)



(1) Conceptual diagram of the signal connection relationships The figure below is a conceptual diagram showing the connection relationships between the signals of the CNC and the host. The signals except FG and SG are subject to differential signal transmission in accordance with the RS-422 standard and, therefore, use two signal lines each.





(2) RS-422 cable connection example

### NOTE

- 1 Be sure to use a twisted pair cable.
- 2 The pin position of the \*DM signal on the CNC is not regular, unlike those of the other signals. (The reason for this is to reduce the possibility of destruction when the cable is erroneously connected to another connector.)



# **CONNECTION TO OTHER NETWORKS**

The *i* Series CNC can be connected to the following networks. For an explanation of how to make the connection, refer to the manuals listed below:

Manual title	Manual code
FANUC I/O Link–II Connection Manual	B–62714EN
FANUC Data Server Operator's Manual	B–62694EN
FANUC Ethernet Board/Data Server Operator's Manual	B-63354EN
FANUC Fast Ethernet Board/Fast Data Server Operator's Manual	B–63644EN
FANUC Profibus-DP Board Operator's Manual	B-62924EN
FANUC DeviceNet Board Operator's Manual	B-63404EN



9.1 OVERVIEW	The high–speed serial bus (HSSB) enables the high–speed transfer of large amounts of data between a commercially available IBM PC or compatible personal computer or CNC display unit with PC functions and a CNC, by connecting them via a high–speed optical fiber. On the CNC, the HSSB interface board is installed in a minislot. On the personal computer, an appropriate interface board is installed. The HSSB can be used with a Series 15 <i>i</i> system, but not with a Series 15 <i>i</i> system.
9.2 CAUTIONS	The use of the HSSB requires an IBM PC/AT compatible computer or FANUC intelligent terminal. The machine tool builder or end user is required to procure and maintain the personal computer. To enable the use of the HSSB, Windows 95 or Windows NT must have been installed on the personal computer. FANUC owns the copyright for the HSSB device driver. The software mentioned above and the contents of the related manuals may not be used or reproduced in part or whole without the prior written permission of FANUC.
	<ul> <li>NOTE</li> <li>1 IBM is a registered trademark of IBM Corp. of the US.</li> <li>2 Windows 95/Windows NT are registered trademarks of Microsoft Corp. of the US.</li> <li>3 The company and product names montioned in this manual.</li> </ul>

3 The company and product names mentioned in this manual are trademarks or registered trademarks of the respective companies.

# 9.3 CONNECTION DIAGRAM



# 9.4 SETTING UP THE HSSB INTERFACE BOARD ON THE CNC



### • Setting/adjustment location: Rotary switch SW1 (when a PC is connected)

With the rotary switch SW1 on the board, the start sequence at power–up can be changed.

Setting of rotary switch SW1	2. Description
0	Setting for maintenance. The start menu appears, allowing you to perform boot and IPL operations from the PC.
1	Normal setting. The start menu is not displayed. You cannot perform boot and IPL operations from the PC.
2	<ul> <li>The CNC and PC start separately without handshaking.</li> <li>CNC <ul> <li>Even when the PC is not connected to the CNC or is off, just the CNC can be started and operated. (For CNC operation, a CNC–dedicated display, an MDI unit, an operator's panel, and so on are required.)</li> <li>Even when the PC is connected and is on, the start menu is not displayed.</li> </ul> </li> <li>PC <ul> <li>Even when the CNC is connected to the PC and is on, the start menu is not displayed. You cannot perform boot and IPL operations from the PC.</li> </ul> </li> <li>When an HSSB device driver supporting Windows 95/98, Windows NT 4.0, or Windows 2000 is installed in the PC, setting the rotary switch to this position allows you to turn on and off the power just to the PC or CNC. When more than one CNC is connected to a single PC, usually set the switch to this setting position.</li> </ul>

### Setting/adjustment location: Rotary switch SW1 (when an CNC display unit with PC functions is connected)

With the rotary switch SW1 on the board and the jumper plug SW5 on the CNC display unit with PC functions, the start sequence at power–up can be changed.

Setting of rotary switch SW1	Jumper plug (SW5)	Description
0	Open	Setting for maintenance. The start menu appears, allowing you to perform boot and IPL operations from the CNC display unit with PC functions.
1	Open	Normal setting. The start menu is not displayed. You cannot perform boot and IPL operations from the CNC display unit with PC functions.
2	Con- nected	<ul> <li>The CNC and the CNC display unit with PC functions start separately without handshaking.</li> <li>CNC <ul> <li>Even when the CNC display unit with PC functions is not connected to the CNC or is off, just the CNC can be started and operated. (For CNC operation, a CNC-dedicated display, an MDI unit, an operator's panel, and so on are required.)</li> <li>Even when the CNC display unit with PC functions is connected and is on, the start menu is not displayed.</li> </ul> </li> <li>CNC display unit with PC functions <ul> <li>Even when the CNC is not connected or is off, just the CNC display unit with PC functions can be started and operated.</li> </ul> </li> <li>CNC display unit with PC functions <ul> <li>Even when the CNC is not connected or is off, just the CNC display unit with PC functions can be started and operated.</li> </ul> </li> <li>The temperature management function of the CNC display unit with PC functions does not work. Before using the CNC display unit with PC functions can be started and operated.</li> <li>The temperature is within the recommended temperature range.</li> <li>Even when the CNC is connected to the CNC display unit with PC functions is on, the start menu is not displayed. You cannot perform boot and IPL operations from the CNC display unit with PC functions.</li> <li>For normal operation, this setting is prohibited. Use this setting only for maintenance.</li> </ul>

### NOTE

For the jumper plug (SW5) position on the CNC display unit with PC functions, see Section 10.7.

# 9.5 PERSONAL COMPUTER SPECIFICATION

### CAUTION

- 1 The personal computer must be purchased and maintained by the machine tool builder or end user.
- 2 FANUC is not liable for any problems resulting from the operation of users' personal computers, regardless of whether the operations are normal or abnormal.

### 9.5.1

Personal Computer Specifications Required if the ISA Bus Board is Used

- (1) The ISA personal computer interface board conforms to the ISA and can be used with IBM PC/AT machines and fully compatible machines. (The CPU must be the 486 or better.)
- (2) The FANUC high–speed serial bus type 2 (for the ISA bus) uses the 16 bytes that are based on the I/O address set by the appropriate switch for each HSSB channel. (For an explanation of how to set the address, see the section on the setting switch in the Maintenance manual.) Other functions or expansion boards that use the same resource cannot be used at the same time.
- (3) To use this board, the HSSB driver must be installed in the personal computer. The HSSB driver is contained in the "open CNC driver library disk (ordering information: A02B–0207–K730)."
- (4) Conduct a personal computer-to-CNC control unit connection test thoroughly in advance.
- (5) The power required for the operation of the personal computer interface board is as follows.

1–ch type	+5V, 1A
2–ch type	+5V, 1.5A

# 9.5.2

Personal Computer Specifications Required if the PCI Bus Board is Used

- (1) The PCI personal computer interface board can be used with the personal computer conforming to the PCI standard rev. 2.1 (5V). It supports the ISA-type slot, but not the MCA-type slot.
- (2) To use this board, the HSSB driver must be installed in the personal computer. The HSSB driver is contained in the "open CNC driver library disk (ordering information: A02B–0207–K730)." The HSSB driver supporting the PCI board is contained in the "open CNC driver library disk (ordering information: A02B–0207–K730)," Edition 1.6 or later.
- (3) Conduct a personal computer-to-CNC control unit connection test thoroughly in advance.
- (4) The power required for the operation of the personal computer interface board is as follows.

1–ch type	+5V, 0.8A	
2–ch type	+5V, 1A	

# 9.6 INSTALLATION ENVIRONMENT

#### (1) Personal computer interface boards

The same environmental conditions as those for the installation of the personal computer must be satisfied.

(2) CNC interface board

The same environmental conditions as those described earlier for the installation of the CNC control unit must be satisfied.

# 9.7 PROCEDURE FOR INSTALLING PERSONAL COMPUTER INTERFACE BOARDS

### WARNING

Before starting to mount or remove a personal computer interface board, switch off the personal computer and its peripheral devices, and disconnect their power supply cables. Otherwise, there is a serious danger of electric shock.

(1) For the ISA bus interface board, set the I/O address before installing the board. Set I/O base addresses which do not overlap the I/O address areas exclusively used by the personal computer and ISA expansion board. (See the figure below.)
When using multiple personal computer interface boards, set the I/O base addresses so that those addresses do not overlap each other. For the PCI bus board, the address need not be set.

- (2) Remove the blank panel from the expansion slot of the personal computer.
- (3) Insert the interface board. Ensure that it has been completely inserted into the ISA connector or PCI connector.
- (4) Fix the metal brackets with screws.

### CAUTION

Do NOT touch the edge terminals (the contacts that engage with a mating connector) of the interface board.



(for personal computer interface board of new type 2 (A20–B–8100–0582, –0583))

# 9.8 HANDLING PRECAUTIONS

- (1) Personal computer interface board
  - (A) Electrostatic interference

The personal computer interface board is shipped in an anti-static bag. To store or transport the interface board, always place it in the anti-static bag. Before removing the interface board from the anti-static bag, ground your body.

(B) Protection of card edge terminals

When handling the personal computer interface board, do NOT touch its card edge terminals (the gold–plated contacts which engage with a mating connector). If you accidentally touch any card edge terminal, wipe it gently with clean or ethyl alcohol–dipped tissue paper or absorbent cotton. Do not use any organic solvent other than ethyl alcohol.

(2) Optical connector and fiber cable See Appendix D.

# 9.9 RECOMMENDED CABLES



Compatible cables (optical fiber cables, used for interconnections) A66L-6001-0026#L

For an explanation of the cable length and other related information, see Appendix D.

# **10** CNC DISPLAY UNIT WITH PC FUNCTIONS

Ordering numbers of related basic units A13B-0193-B031 to -B057

10.1 OVERVIEW The CNC display unit with PC functions is a panel computer incorporating an IBM PC–compatible personal computer. The CNC display unit with PC functions can be connected to the Series 150*i* system through a high–speed optical fiber (high–speed serial bus) to build a system having personal computer capabilities.

# 10.2 ATTENTION

- The copyright of Windows 2000, Windows NT, Windows 95/98 and other software provided with the CNC display unit with PC functions is owned by Microsoft Corporation (USA), NeoMagic Inc., Phoenix Technologies Ltd., PFU Co.,Ltd, and FANUC LTD.
- No part of the software described above, or its manuals, may be used or reproduced without permission.
- No part of the software described above, or its manuals, may be sold independently of the CNC display unit with PC functions.
- The software described above, and its manual, must be used under the conditions described in the attached license agreement.
- The use of the CNC incorporating the CNC display unit with PC functions shall imply that the user agrees to the conditions of the license agreement described above.

\*Windows2000, Windows NT and Windows 95/98 is a registered trademark of Microsoft corporation, USA

\*Company name and product name mentions in this manual are (registered) trademark of each company.

### CAUTION

1 If an operation error or mishap occurs, the data on the hard disk may be lost, even if all the installation conditions are satisfied. Therefore, always maintain a backup copy of the data on the hard disk in case the stored data is lost or damaged.

Especially, the power–off on accessing the hard disk must not be done because that possibility is very high. Please concern for the end–users.

2 Be sure to finish the OS and the applications through the proper operation of shutdown before turning the power off. Without the above-mentioned operation, there is no assurance of the following action. At worst, the command of initializing the HDD will not work.

# 10.3 HARDWARE SPECIFICATIONS

Item Specification		Specification			
CPU		Pentium III 500MHz			
		Celeron 400MHz			
		MMX-Pentium	MMX–Pentium 233MHz		
Memory		32MB, 64MB o	r 128MB		
		(32MB can be	specified only in case of MMX–Pentium)		
Display	LCD	10.4" color LCE	D (640x480dots, 65536 colors) or		
Unit		12.1" color LCD (800x600dots, 65536 colors) or			
		15.0" color LCE	15.0" color LCD (1024x768 dots, 65536 colors )		
	Touch-Panel	Option	It is possible to specify both of touch-Panel and soft-key. (Soft-		
	Soft–Key	Option	Key is not available in case of 15.0" LCD)		
HDD unit		3.5" Hard Disk	Drive10GB Ultra ATA/33		
		Maximum 2 IDI	E devices can be connected. (Master/ Slave)		
		(There is limitati play unit with P0	(There is limitation of cable length. 2 IDE devices must be mounted under CNC dis- play unit with PC functions)		
		(It is mounted o	on the backside of the MDI or the FA Full-keyboard.)		
I/O	PCMCIA Card	1 port (Type I/II	, based on PCMCIA 2.1)		
Port	USB	2 ports (based on Universal Serial Bus Revision 1.0)			
	Serial Port 1	1 port (In case of Touch–Panel type, Serial 1 cannot be used.)			
	Serial Port 2	1 port			
	Full Keyboard	1 port (PS/2 compatible)			
	Mouse	1 port (PS/2 compatible)			
	Floppy disk	1 port (PC/AT compatible)			
	Parallel Port	1 port (Data tra	nsfer mode is by-directional mode)		
Connection	with CNC controller	High Speed Serial Bus (HSSB)			
PCI Extensi	on	2 slots of the short card			
(option)		based on PCI specification 2.1			
		32–bit, 33MHz, +5V			
		Maximum dimension of card: 176.41mm x 106.68mm			
Real time clo	ock	Monthly error is within 3 minutes.			
Dimension of	of Basic unit	290x220mm (10.4" LCD type)			
		340x280mm (12.1" LCD type)			
		400x320mm (15.0" LCD type)			
		Depth 60mm(without PCI extension)/125mm(with PCI extension)			
Dimension of	of MDI and FA Full-	290x220mm (for 10.4" LCD type and vertical)			
keyboard		230x220mm (fo	230x220mm (for 10.4" LCD type and horizontal) *Only MDI		
		340x220mm (for 12.1" LCD type and vertical)			
		230x280mm (for 12.1" LCD type and horizontal) *Only MDI			
		400x220mm (fo	400x220mm (for 15.0"LCD type and vertical ) *Only FA Full keyboard		

	ltem	Specification
Weight	for 10.4" LCD type	3.6kg (Intelligent Terminal)
		3.5kg (FA Full-keyboard with 3.5"HDD unit for vertical)
		2.9kg (MDI with 3.5"HDD unit for vertical)
		2.7kg (MDI with 3.5"HDD unit for horizontal)
	for 12.1" LCD type	4.3kg (Intelligent Terminal)
		3.7kg (FA Full-keyboard with 3.5"HDD unit for vertical)
		3.2kg (MDI with 3.5"HDD unit for vertical)
		3.1kg (MDI with 3.5"HDD unit for horizontal)
	for 15.0" LCD type	6.0kg (Intelligent Terminal)
		3.9kg (FA Full-keyboard with 3.5"HDD unit for vertical)

\* A MDI unit can be used in case of connecting with CNC via High Speed Serial Bus (HSSB).

# 10.4 TOTAL CONNECTION

# 10.4.1 Without Soft–Key & Touch–Panel



\*1 These devices can be used only during application development. These cannot be installed in the control unit.

\*2 A 3.5"HDD unit with a FAN unit must be mounted on the backside of a FA Full Keyboard.

# 10.4.2 With Soft–Key, Without Touch–Panel



\*1 These devices can be used only during application development. These cannot be installed in the control unit.

\*2 A 3.5"HDD unit with a FAN unit must be mounted on the backside of a MDI.

# 10.4.3 With Touch–Panel, Without Soft–Key



- \*1 Either Separate MDI or FA Full Keyboard is usable. Both cannot be used simultaneously. A 3.5"HDD unit with a FAN unit must be mounted on the backside of a FA Full Keyboard or a MDI.
- \*2 These devices can be used only during application development. These cannot be installed in the control unit.
- \*3 RS232–C channel 1 is not usable because it is used by the Touch–Panel.

### 10.4.4 With Soft–Key and Touch–Panel



- \*1 These devices can be used only during application development. These cannot be installed in the control unit.
- \*2 A 3.5"HDD unit with a FAN unit must be mounted on the backside of a MDI.
- \*3 RS232–C channel 1 is not usable because it is used by the Touch–Panel.

# 10.5 SPECIFICATION

# 10.5.1 Environment

When CNC display unit with PC functions is used, the following environmental conditions (as measured top of the CNC display unit with PC functions inside the cabinet) must be ensured for the CNC display unit with PC functions unit installation.

Ambient temperature	Operating	: +5 to +45°C
	Non-operating	: – 20 to +60°C
Change in tempera- ture	Up to 0.3°C/min	
Ambient relative	Standard	: 10 to 75% (non-condensing)
humidity	Short-term	: 10 to 90% (non-condensing)
	(within one mon	th)
Vibration	Operating	: up to 0.5G
	Non-operating	: up to 1.0G
Environment	Installed in a hermetically sealed cabinet	
Altitude	Operating	: – 60m to 3000m
	Non-operating	: – 60m to 12000m

(\*1) Ambient temperature during operation :

The temperature sensor on the CNC display unit with PC functions PCB monitors whether the temperature is within the specified range.

1) If the temperature at power-on is beyond the allowable range only CNC/PMC is started. After that if the temperature becomes to within the allowable range, CNC display unit with PC functions automatically starts.

This function is disable when Option for Non–Connecting with CNC is ordered. CNC display unit with PC functions starts up irrespective of the temperature. Therefore, the temperature around CNC display unit with PC functions should be watched by the other method.

- 2) If the temperature drifts out of the allowable range after normal activation, an error occurs when the hard disk is next accessed.
- (\*2) Vibration :

The CNC display unit with PC functions unit and built—in hard disk drive may suffer resonance at certain frequencies. Careful checking is required on the CNC display unit with PC functions unit has been mounted on a machine.

### CAUTION

If an operation error or mishap occurs, the data on the hard disk may be lost, even if all the installation conditions are satisfied. Therefore, always maintain a backup copy of the data on the hard disk in case the stored data is lost or damaged.

Especially, the power–off on accessing the hard disk must not be done because that possibility is very high. Please concern for the end–users.

Some development or maintenance options may not satisfy the above specifications.

(\*3) Measure for Noise :

Please measure for noise sufficiently referring to CNC's connection manual.

# 10.5.2 Power Specification

### 1) Power Supply Requirement

a) Specification

When the CNC display unit with PC functions is used, the following power supply is required.

Input Voltage	+24VDC ±10%
Current capacity	Max. 7A (For 10.4" and 12.1" LCD type unit)
	Max. 10A (For 15.0" LCD type unit)

### NOTE

If Handy File or other unit made by FANUC is connected to RS232C port, this value will increase by +1A.

### b) Timing

Input power can be turned on/off without relation to CNC power on/off.

Normal start is not performed when only the CNC controller is turned on without the CNC display unit with PC functions being turned on.

### 2) Power Supply

Following powers are usable for peripherals.

Check the power supply current required for each connected peripheral and then make sure that the following usage range is not exceeded.

Voltage	Equipment	Max. Current	
+5V	FDD,	4000mA	
	Keyboard, Mouse		
	HDD(secondary) or ATAPI device		
	PCI extension board		
	USB device		Max. 500mA/port
	PCMCIA card		Max. 500mA
+3.3V	PCI extension board	1000mA	
+12V	PCI extension board	1700mA	
	PCMCIA card		
	HDD(secondary) or ATAPI device		
–12V	PCI extension board	140mA	

3) Power Consumption

10.4"/12.1" LCD type : about 40W

15.0 LCD type : about 52W

Above operating includes the following devices.

 CNC display unit with PC functions, HDD Unit, FAN for HDD, FDD Unit, Full Keyboard, and Mouse.

Above operating does not include the following devices.

- PCMCIA Card, PCI Extension board, and Devices to connect by Serial or Parallel Interface.

### NOTE

Above power consumption is reference. If peripherals are connected or PCI extended boards are mounted, the power consumption will increase. Also, please consider the cabinet design and the cooling method which is most suitable to the total power consumption.

# 10.5.3 Shutdown Operation

### CAUTION

Be sure to finish the OS and the applications through the proper operation of shutdown before turning the power off. Without the above–mentioned operation, there is no assurance of the following action. At worst, the command of initializing the HDD will not work.

# 10.6 MOUNTING SPACE

The following three spaces are required around the CNC display unit with PC functions.

(a) Space for connecting cables.

Also, If you wish to exchange a battery or a fuse without removing Intelligent Terminal 3 from the machine panel, this space A is required and it is necessary to be able to access to the battery or the fuse from the rear side of the CNC display unit with PC functions.

- (b) If PCI extension board exists, this space B is required for cable connection. The dimension X depends on cables connected to the PCI Extension board.
- (c) This space is required for airflow.

CNC display unit with PC functions consumes the power described at "10.5.2" item 3). Therefore, please install cooling system in the cabinet with keeping space C.

# 10.6.1 Basic Unit 10.4" LCD Type



# 10.6.2 Basic Unit 12.1" LCD Type



# 10.6.3 Basic Unit 15.0" LCD Type





# 10.6.4 HDD Unit

The HDD unit is mounted on the backside of the MDI or the FA Full–Keyboard.

# 10.7 CONNECTION TO PERIPHERAL

# 10.7.1 Connector Location



Connector Number	Connector Name	Function	Reference	
CP5	+24V INPUT	Main Power Input	to Section	10.7.2.
JD33	232–1	Serial Port 1	to Section	10.7.3.
JD46	232–2	Serial Port 2 +USB	to Section	10.7.4.
JD9	CENTRO	Parallel Port	to Section	10.7.5.
COP7	HSSB	HSSB	to Section	10.7.6.
CD32B	MOUSE	Mouse	to Section	10.7.7.
CD32A	KEY BOARD	Full Keyboard	to Section	10.7.8.
CNH3	HDD	HDD Signal	to Section	10.7.9.
CN2B	HDD POWER	HDD Power Output	to Section	10.7.9.
CN7	HDD FAN	FAN for HDD	to Section	10.7.9.
CD34	FDD	FDD Signal	to Section	10.7.10.
CN2	FDD POWER	FDD Power Output	to Section	10.7.10.
		PCMCIA Card	to Section	10.7.12.
CNP1	PCI SLOT 1	PCI extension slot 1	to Section	10.8
CNP2	PCI SLOT 2	PCI extension slot 2	to Section	10.8

NOTE

The Soft-Key only exists in the CNC display unit with PC functions with Soft-Key.

# 10.7.2 Main Power Input



### 1) Cable Wiring



 Recommended Cable Material Use wire of AWG16 (1.3mm<sup>2</sup>) or thicker.

### NOTE

Please wire this cable separately from the other cables connected to CNC display unit with PC functions.

# **10.7.3**In case of CNC display unit with PC functions with the TOUCH–PANEL,<br/>Serial Port 1 is not available because the TOUCH–PANEL<br/>CONTROLLER uses the 1st port of RS–232–C.



### NOTE

- 1 The figure shows a sample host computer interface. Design the cable to suit the interface of the actual device to be connected.
- 2 The +24V pins of the interface for CNC display unit with PC functions shown above can be used only with the FANUC I/O unit. Do not use these pins for other purposes. Also, do not attempt to simultaneously connect two or more FANUC I/O units to one CNC display unit with PC functions. Two or more simultaneous connections may cause the +24–V power supply rating to be exceeded.

- 1) RECOMMENDED CABLE MATERIAL A66L-0001-0284#10P···0.08mm<sup>2</sup> X 10 pairs
- 2) RECOMMENDED CONNECTOR FOR CABLE and HOUSING(JD33 sideK

CONNECTOR	HOUSING	MAKER
PCR-E20FA	PCR-V20LA/PCS-E20LA	(Honda Tsushin Kogyo)
FI30-20S	FI-20-CV2/FI-20-CV7	(Hirose Electric)
FCN-247J020-G/E	FCN-240C020-Y/S	(Fujitsu)
52622–2011	52624–2015	(Molex Japan)

 3) RECOMMENDED PUNCH PANEL SPECIFICATION A02B-0236-C191 (Wire length : 1m) A02B-0236-C192 (Wire length : 2m)

A02B-0236-C193 (Wire length : 5m)

When a punch panel other than the above is used, a failure to start or another problem occurs.

# 10.7.4 Serial Port 2+USB



### NOTE

- 1 The figure shows a sample host computer interface and USB. Design the cable to suit the interface of the actual device to be connected.
- 2 The +24V pins of the interface for CNC display unit with PC functions shown above can be used only with the FANUC I/O unit. Do not use these pins for other purposes. Also, do not attempt to simultaneously connect two or more FANUC I/O units to one CNC display unit with PC functions.
- 3 Commercial USB devices cannot be guaranteed its proper work with Intelligent Terminal 3. Careful checking by the customer will be required. And please be aware that those devices in the market are not almost considered about waterproof and dustproof.

### 1) RECOMMENDED CABLE MATERIAL SPEC.

For RS232–C : A66L–0001–0284#10P···0.08mm<sup>2</sup> 10 pairs For USB : Please use special wire for USB

# 2) RECOMMENDED CONNECTOR FOR CABLE and HOUSING(JD46 sideK

CONNECTOR	HOUSING	MAKER
PCR–E20FA	PCR-V20LA/PCS-E20LA	(Honda Tsushin Kogyo)
FI30–20S	FI-20-CV2/FI-20-CV7	(Hirose Electric)
FCN–247J020–G/E	FCN-240C020-Y/S	(Fujitsu)
52622–2011	52624–2015	(Molex Japan)

3) RECOMMENDED PUNCH PANEL SPECIFICATION

A02B-0236-C191 (Wire length : 1m)

A02B-0236-C192 (Wire length : 2m)

A02B-0236-C193 (Wire length : 5m)

When a punch panel other than the above is used, a failure to start or another problem occurs.

The above punch panel does not include the USB signal.

# 10.7.5 Parallel Port



### NOTE

- 1 The figure shows a sample printer interface. Design the cable to suit the interface of the actual device to be connected.
- 2 Some kinds of Printers and other devices may not work properly with Intelligent Terminal 3, so careful checking by the customer will be required. And please be aware that I/O devices in the market are not almost considered about waterproof and dustproof.
- 1) RECOMMENDED CABLE MATERIAL SPEC. A66L-0001-0284#10P···0.08mm<sup>2</sup> 10 pairs
- 2) RECOMMENDED CONNECTOR FOR CABLE and HOUSING(JD9 sideK

CONNECTOR	HOUSING	MAKER		
PCR–E20FA	PCR-V20LA/PCS-E20LA	(Honda Tsushin Kogyo)		
FI30–20S	FI-20-CV2/FI-20-CV7	(Hirose Electric)		
FCN-247J020-G/E	FCN-240C020-Y/S	(Fujitsu)		
52622–2011	52624–2015	(Molex Japan)		

#### 10.7.6 High Speed Serial Bus (HSSB)



1) RECOMMENDED CABLEJOptical Fiber CableK

A66L-6001-0026#L1R003 $\cdot \cdot \cdot$ Cable Length = 1 m
A66L-6001-0026#L3R003 $\cdot \cdot \cdot$ Cable Length = 3 m
A66L-6001-0026#L5R003 · · · Cable Length = 5 m
A66L-6001-0026#L7R003 · · · Cable Length = 7 m
A66L-6001-0026#L10R03 · · · Cable Length = 10 m
$A66L - 6001 - 0026\#L15R03 \cdot \cdot \cdot Cable Length = 15 m$
A66I = 6001 = 0026 # 20R03 + Cable Length = 20 m
A661 = 6001 = 0026 # 120R03 + Cable Length = 20 m
A66L = 6001 = 0026#L50R05 + Cable Length = 50 m
$A00L-0001-0020\#L30R03 \cdots Cable Length = 50 In$
$A66L-6001-0026\#L100R3\cdots$ Cable Length = 100m
2) Junction–only low–loss optical fiber cables
A66L–6001–0029#L1R003: Cable length = 1m
A66L–6001–0029#L3R003: Cable length = 3m
A66L-6001-0029#L5R003: Cable length = $5m$
A66L-6001-0029#L7R003: Cable length = $7m$
A66L-6001-0029#L10R003: Cable length = $10m$
A66L-6001-0029#L15R003: Cable length = $15m$
A66L-6001-0029#L20R003: Cable length = $20m$
A = 6001 = 0029 # 30R003; Cable length = 30m
A = 6001 - 0020 # 400003; Cable length = 40m
A00L-0001-0029#L40K003. Cable length = 4011
A66L-6001-0029#L50K003: Cable length = 50m
3) Low–loss optical junction adapter
A63L-0020-0004

Refer to the following TECHNICAL REPORT that describes the HSSB and Optical Fiber Cable.

Name	Spec.
FANUC High Speed Serial Bus Type 2 Connecting and Maintenance Manual	A–73527E

#### NOTE

1 Optical fiber cable used for FANUC I/O Link, for FSSB and for Serial Spindle can not be used.

#### NOTE

2 Optical fiber cable can not be cut or joined by customer. Use one of above cables.

#### 10.7.7 Mouse



#### NOTE

- 1 Some kinds of Mouse may not work properly with CNC display unit with PC functions, so careful checking by the customer will be required. And please be aware that Mouse in the market is not almost considered about waterproof and dustproof.
- 2 The Mouse and The Touch-Panel can not be used simultaneously.

1) RECOMMENDED MOUSE

A86L–0001–0212 · · · Standard PS/2 Mouse (in the market) (Only for application development or maintenance)

### 10.7.8 Full Keyboard



#### NOTE

Some kinds of Full Keyboard may not work properly with CNC display unit with PC functions, so careful checking by the customer will be required. And please be aware that Full Keyboard in the market is not almost considered about waterproof and dustproof.

1) RECOMMENDED FULL KEYBOARD

A86L-0001-0210 : 101 type (i	in the market) Only for
application	development or maintenance
A86L-0001-0211 : 106 type (i	in the market) Only for
application	development or maintenance
A02B-0236-C131#JC : FA Full Ke	eyboard (Japanese) for 10.4"
LCD type	
A02B-0236-C131#EC : FA Full K	eyboard (English) for 10.4"
LCD type	
A02B-0236-C132#JC : FA Full Ke	eyboard (Japanese) for 12.1"
LCD type	
A02B-0236-C132#EC : FA Full Ke	eyboard (English) for 12.1"
LCD type	
A08B-0082-C150#JC : FA Full Ke	eyboard (Japanese) for 15.0
LCD type	
A08B-0082-C150#EC : FA Full Ke	eyboard (English) for 15.0"
LCD type	

#### NOTE

Refer to the below manual about FA Full Keyboard.

Name	Drawing No.
FA FULL-KEYBOARD FOR FANUC NC BOARD CONNECTION MANUAL	A–73159E

#### 10.7.9 Hard Disk Drive

- Cable Connection
   Connect HDD Signal cable to CNH3.
   Connect HDD Power cable to CN2B.
   Connect FAN cable to CN7.
   Each cables are connected to HDD unit at exfactory.
- 2) Cable Length HDD Power Cable: 50cm HDD Signal Cable: 40cm HDD FAN Cable: 65cm



#### 10.7.10 Floppy Disk Drive (Signal & Power)



#### NOTE

- This is standard interface for IBM PC. But, please pay attention to the following points.
   1) Only 2 modes J720K/1.44M bytesK are available.
  - 2) DENSEL is fixed "Low" level.
  - 3) The floppy disk drive which needs +12VDC input is not available.
- 2 Some kinds of floppy disk drive may not work properly with Intelligent Terminal 3, so careful checking by the customer will be required. And please be aware that floppy disk drives in the market are not almost considered about waterproof and dustproof.
- 3 The figure shows a sample drive interface. Design the cable to suit the interface of the actual drive to be connected.
- 4 Recommended Cable is as follows. (Cable length is 1.0m)

A02B-0207-K801

	CD34	4			J1	
		1	1	1	a) (	
	0V	2	2	2	0V	
	DENSEL	3	3	3	DENSEL	
	0V (NC)	4	4	4	00	
		5	5	5	(NC)	
	V0	6	6	6	0V (NC) 0V	
	(NC)	7	7	7		
		8	8	8		
	*INDEX	9	9	9	*INDEX	
	0V	10	10	16	00	
	*M10	11	11	15	*DS0	Panel Mount Type 3.5" Floppy Disk Unit
	00	12	12	14	0V	
	*DS1	13	13	13	*DS1	
	00	14	14	12	00	
	*DS0	15	15	11	(Reserve)	
	0V *MT1 0V *DIR 0V *STEP	16	16	10		
		17	17	17	^MIRON	
		18	18	18	00	
CNC display unit		19	19	19	- *DIR - 0V - *STEP - 0V - *WDATA	
		20	20	20		
F.C.D		21	21	21		
	0V *WDATA 0V *WE 0V *TRK0	22	22	22		
		23	23	23		
		24	24	24	0V	
		25	25	25	*WE 0V *TRK0 0V *WPRT	
		26	26	26		
		27	27	27		
	0V	28	28	28		
	*WPRI	29	29	29		
		30	30	30		
	*RDATA	31	31	31	*RDATA	(Defende the firmer of
	00	32	32	32	00	(Relef to the ligure of
	HDSEL	33	33	33	HDSEL	the nin assignments)
		34	34	34		
	*DSKCH			J	DSKCH	
			T			
			Drive B		Drive A	

1) Cable Wiring

FDD interface is standard one for IBM PC. The connecting cable which can be gotten in the market is twisted from 10th pin to 16th pin between the CNC display unit with PC functions (PC) and a Drive A. In this case, the drive number plug of FDD must be set "DRIVE 1" (Secondary Drive).

#### 2) Power Cable Wiring



#### 10.7.11 Soft–Key (CNC Display Unit with PC Functions with Soft Key)



1) Cable Length: 50 cm

#### 10.7.12 PCMCIA Card



#### NOTE

- 1 Only Type I or Type II PCMCIA card using only +5V is usable. The following card cannot be used.
  - Card-bus card
  - Dual mode card (Card-bus mode/ PCMCIA mode) with Card-bus mode
  - Type III card
  - +3.3V card
- 2 Care about the direction of the card, and insert certainly.

#### CAUTION

If the door is opened, dust or coolant would enter and might cause any troubles. Please pay attention.

### 10.8 METHOD OF MOUNTING PCI EXTENSION BOARD

#### 10.8.1 Usable Board

The size of usable board on the CNC display unit with PC functions is defined as below figure, and one or two boards can be mounting on the CNC display unit with PC functions.



#### 10.8.2 Method of Mounting PCI Extension Board

- Release vibration-proof fittings by loosening the screw at point (B).
- 2) Push the board fully into the PCI connector.
- 3) Tighten the screw at point (A).
- 4) Press down vibration–proof fittings to the PCI extension board and tighten the screw at point (B).

In the case of mounting two boards, the height of board mounted in slot 1 must be lower than the height of the board mounted in slot 2 for holding both board with each vibration–proof fittings.

If the fittings do not fit these extension boards, please change the screw (B) positions.



#### 10.8.3 Method of Mounting PCI Extension Board

(1) Environment Conditions

Refer to the specifications of PCI extension board for the environmental conditions for installation of it. If the PCI extension board specifications impose harder environmental conditions than the conditions described in "I.CONNECTION – 2.2. Environment", these environmental conditions for the PCI extension board are given priority.

#### NOTE

Fanuc does not guarantee the proper workings or maintenance of any PCI extension boards. And is not liable to any trouble or damage incurred by use of any PCI extended boards.

# EMERGENCY STOP SIGNAL

#### WARNING

Using the emergency stop signal effectively enables the design of safe machine tools.

The emergency stop signal is provided to bring a machine tool to an emergency stop. It is input to the CNC controller, servo amplifier, and spindle amplifier. An emergency stop signal is usually generated by closing the B contact of a pushbutton switch.

When the emergency stop signal (\*ESP) contact is closed, the CNC controller enters the emergency stop released state, such that the servo and spindle motors can be controlled and operated.

When the emergency stop signal (\*ESP) contact opens, the CNC controller is reset and enters the emergency stop state, and the servo and spindle motors are decelerated to a stop.

Shutting off the servo amplifier power causes a dynamic brake to be applied to the servo motor. Even when a dynamic brake is applied, however, a servo motor attached to a vertical axis can move under the force of gravity. To overcome this problem, use a servo motor with a brake.

While the spindle motor is running, shutting off the motor-driving power to the spindle amplifier allows the spindle motor to continue running under its own inertia, which is quite dangerous. When the emergency stop signal (\*ESP) contact opens, it is necessary to confirm that the spindle motor has been decelerated to a stop, before the spindle motor power is shut off.

The FANUC control amplifier  $\alpha$  series products are designed to satisfy the above requirements. The emergency stop signal should be input to the power supply module (called the PSM). The PSM outputs a motor power MCC control signal, which can be used to switch the power applied to the power supply module on and off.

The CNC controller is designed to detect overtravel by using a software limit function. Normally, no hardware limit switch is required to detect overtravel. If the machine goes beyond a software limit because of a servo feedback failure, however, it is necessary to provide a stroke end limit switch, connected so that the emergency stop signal can be used to stop the machine.

Fig. 10 shows an example showing how to use the emergency stop signal with this CNC controller and  $\alpha$  series control amplifier.



#### WARNING

To use a spindle motor and amplifier produced by a manufacturer other than FANUC, refer to the corresponding documentation as well as this manual. Design the emergency stop sequence such that, if the emergency stop signal contact opens while the spindle motor is rotating, the spindle motor is decelerated until it stops.

## APPENDIX



## UNIT EXTERNAL DIMENSION DIAGRAMS

Fig. 1 (a)	External dimensions of 2 slot control unit
Fig. 1 (b)	External dimensions of 4 slot control unit
Fig. 2 (a)	External dimensions of 10.4"/9.5" LCD unit
Fig. 2 (b)	External dimensions of 10.4" LCD unit for two LCDs connection
Fig. 3 (a)	External dimensions of MID unit, 56 key (horizontal type)
Fig. 3 (b)	External dimensions of MDI unit Full Key (61 Key) (horizontal type)
Fig. 3 (c)	External dimensions of MID unit, 56 key (vertical type)
Fig. 3 (d)	External dimensions of MDI unit Full Key (61 Key) (vertical type)
Fig. 4	External dimensions of CNC display unit with PC functions
Fig. 5	External dimensions of hard disk unit
Fig. 6 (a)	Personal computer interface card (ISA standard)
Fig. 6 (b)	Personal computer interface card (PCI standard)
Fig. 7 (a)	External dimensions of position coders A and B
Fig. 7 (b)	External dimensions of ALPHA position coder
Fig. 8 (a)	External dimensions of manual pulse generator
Fig. 8 (b)	External dimensions of pendant-type manual pulse generator
Fig. 9	External dimensions of separate detector interface unit
Fig. 10	External dimensions of battery case for separate detector absolute pulse coder
Fig. 11 (a)	External dimensions of punch panel (thin type connector with a screw lock)
Fig. 11 (b)	External dimensions of punch panel (thin type connector with a spring lock)
Fig. 12	External dimensions of FANUC Handy File
Fig. 13	External dimensions of Machine operator's Panel





## Fig. 1 (b) External dimensions of 4 slot control unit



## Fig. 2 (a) External dimensions of 10.4"/9.5" LCD unit



## Fig. 2 (b) External dimensions of 10.4" LCD unit for two LCDs connection



## Fig. 3 (a) External dimensions of MID unit, 56 key (horizontal type)



## Fig. 3 (b) External dimensions of MDI unit Full Key (61 Key) (horizontal type)



## Fig. 3 (c) External dimensions of MID unit, 56 key (vertical type)



## Fig. 3 (d) External dimensions of MDI unit Full Key (61 Key) (vertical type)



## Fig. 4 External Dimensions of CNC Display Unit with PC Functions

Name		Specification number		Remarks	Refer- ence item	
A1		A08B-0082-B001		10.4 color LCD, without Touch Panel, without Softkey		
A2	A08B-0082-B002		10.4 color LCD, without Touch Panel, with Softkey	Fig.4 1(a)		
	A3	A08B-0082-B003		10.4 color LCD, without Touch Panel, without Softkey	- Fig.4. I (a)	
CNC Display	A4	A08B-0082-B004		10.4 color LCD, without Touch Panel, with Softkey		
Unit with PC	B1	A08B-0082-B011		12.1 color LCD, without Touch Panel, without Softkey	Fig.4.1(b)	
Functions	B2	A08B-0082-B012		12.1 color LCD, without Touch Panel, with Softkey		
Basic Unit	B3	A08B-0082-B013		12.1 color LCD, with Touch Panel, without Softkey		
	B4	A08B-0082-B014		12.1 color LCD, with Touch Panel, with Softkey		
	C1	A08B-0082-B021		15.0 color LCD, without Touch Panel, without Softkey		
	C3	A08B-0082-B023		15.0 color LCD, with Touch Panel, without Softkey	⊢ıg.4.1(c)	
		A000 0000 0404	#EC	10.4 LCD, English, 220x290	Fig.4.2(a)	
		AU2B-0236-0131	#JC	10.4 LCD, Japanese,220x290		
			#EC	12.1 LCD, English, 220x340		
FA Full Keyboard		AU2B-0236-0132	#JC	12.1 LCD, Japanese,220x340	FIG.4.2(D)	
		A000 0000 0450	#EC	15.0 LCD, English,220x400		
		A08B-0082-C150	#JC	15.0 LCD, Japanse,220x400	Fig.4.2(c)	
		A02B-0261-C153	#MCR	For 150 <i>i</i> , 56 key, English, Vertical, 220x290	<b>F</b> : 4 0( )	
			#MCS	For 150 <i>i</i> , 56 key, Symbol, Vertical, 220x290	Fig.4.3(a)	
		A00D 0004 0454	#MCR	For 150 <i>i</i> , 56 key, English, Horizon, 220x230	Fig.4.3(c)	
		AU2B-0261-0154	#MCS	For 150 <i>i</i> , 56 key, Symbol, Horizon, 220x230		
		A02B-0261-C155	#MCR	For 150 <i>i</i> , 56 key, English, Vertical, 220x340	Fig.4.3(b)	
			#MCS	For 150 <i>i</i> , 56 key, Symbol, Vertical, 220x340		
		A02D 0261 0156	#MCR	For 150 <i>i</i> , 56 key, English, Horizon, 280x230	Fig.4.3(d)	
Soporata tupo MI	ור	AU2D-0201-0150	#MCS	For 150 <i>i</i> , 56 key, Symbol, Horizon, 280x230		
Separate type wit		A02D 0261 0162	#MCR	For 150 <i>i</i> , 61 key, English, Vertical, 220x290	Fig.4.3(a)	
		AU2D-U201-C103	#MCS	For 150 <i>i</i> , 61 key, Symbol, Vertical, 220x290		
			#MCR	For 150 <i>i</i> , 61 key, English, Horizon, 220x230		
		AU2D-0201-0104	#MCS	For 150 <i>i</i> , 61 key, Symbol, Horizon, 220x230	г IG.4.3(С)	
		A02D 0261 0165	#MCR	For 150 <i>i</i> , 61key, English, Vertical, 220x340	Fig.4.3(b)	
		AUZD-UZ01-C105	#MCS	For 150 <i>i</i> , 61key, Symbol, Vertical,220x340		
			#MCR	For 150 <i>i</i> , 61key, English, Horizon,280x230	- Fig.4.3(d)	
		AU2D-0201-0100	#MCS	For 150 <i>i</i> , 61key, Symbol, Horizon, 280x230		
Floppy disk drive		A02B-0207-C008			Fig.4.4	
Full Keyboard	101	A86L-0001-0210		English	Fig 4.5	
	106	A86L-0001-0211		Japanese	119.4.5	
Mouse		A86L-0001-0212			Fig.4.6	
Panel Cutouts					Fig.4.7	

#### Fig. 4.1 (a) CNC Display Unit with PC Functions (10.4" LCD Type)

Specification : A13B-0193-B031 to -B038



#### *Fig. 4.1 (b)* CNC Display Unit with PC Functions (12.1" LCD Type)

Specification : A13B-0193-B041 to -B048



### Fig. 4.1 (c) CNC Display Unit with PC Functions (15.0" LCD Type)

Specification : A13B-0193-B051 to -B057





### Fig. 4.2 (a) FA Full Keyboard (for 10.4" LCD Type)





#### Fig. 4.2 (c) FA Full Keyboard (for 15.0" LCD Type)













### Fig. 4.3 (c) MDI (for 10.4" LCD Type, Horizontally Installed)



### Fig. 4.3 (d) MDI (for 12.1" LCD Type, Horizontally Installed)

## Fig. 4.4 Floppy Disk Drive (A02B–0207–C008)







#### NOTE

Neither type 101 nor 106 keyboard is dustproof. Use them for program development. The ambient temperature must be in the range of 0 to 40  $^{\circ}$ C.
### Fig. 4.6 Mouse (A86L-0001-0212)



#### NOTE

- 1 The mouse is not dustproof. Use it for program development and maintenance only. The ambient temperature must be in the range of 0 to 40 °C.
- 2 The shape and wire length of the mouse have been changed. The wire length has been shortened from 2700 mm to 1800 mm.

#### Fig. 4.7 Panel Cutouts



# Fig. 5 External dimensions of Hard Disk Unit



## Fig. 6 (a) Personal Computer Interface Card (ISA Standard)

Drawing numbers: A20B-8001-0582 (2-ch type) A20B-8001-0583 (1-ch type)



## Fig. 6 (b) Personal Computer Interface Card (PCI Standard)

Drawing numbers: A20B-8001-0960 (2-ch type) A20B-8001-0961 (1-ch type)



#### Fig. 7 (a) External dimensions of position coders A and B





#### **Fig. 7 (b)** External dimensions of $\alpha$ position coder

Specification No.: A860–0309–T302 (Max. 10,000min<sup>-1</sup>)



## Fig. 8 (a) External dimensions of manual pulse generator

Specification No.: A860-0203-T001



## Fig. 8 (b) External dimensions of pendant-type manual pulse generator

A860-0203-T010 to T015 90 38 52 \_ ● **⊛** ×1,×10 1,×10×100 Ð 140 00 FANUC 0 0 © 8 © (\$ 37 ข้อมาย ľΤ -Π ĊΠ П Ш П

Specification No.: A860-0203-T010 to T015

### Fig. 9 External dimensions of separate detector interface unit



#### Fig. 10 External dimensions of battery case for separate detector absolute pulse coder

Specification No.: A06B-6050-K060



# Fig. 11 (a) External dimensions of punch panel (thin type connector with a screw lock)

#### Specification No.: A02B-0236-C191 to C193



#### NOTE

This punch panel cannot be used for the serial port for control.

# Fig. 11 (b) External dimensions of punch panel (thin type connector with a spring lock)



Specification No.: A02B-0210-C191 to C193

### Fig. 12 External dimensions of FANUC Handy File



## Fig. 13 External dimensions of Machine Operator's panel

Name	Specification number	Remarks	Reference item
Main panel A1	A02B-0236-C230	Symbolic key	Fig. 13.1
Main panel A1	A02B-0236-C240	English key	Fig. 13.2
Main panel A	A02B-0236-C231	With 3.5" hard disk unit for CNC display unit with PC functions	Fig. 13.3
Main panel A1	A02B-0236-C240		
Main panel B	A02B-0236-C231	Symbolic key	Fig. 13.4
Main panel B1	A02B-0236-C241	English key	Fig. 13.5
Sub panel A	A02B-0236-C232		Fig. 13.6
Sub panel B	A02B-0236-C233		Fig. 13.7
Sub panel B1	A02B-0236-C235		Fig. 13.8
Sub panel C	A02B-0236-C234		Fig. 13.9
Sub panel C1	A02B-0236-C236		Fig. 13.10

#### External dimensions table

## Fig. 13 (a) Outline of Main panel A



## Fig. 13 (b) Outline of Main panel A1



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# Fig. 13 (d) Outline of Main panel B



# Fig. 13 (e) Outline of Main panel B1



— 404 —

# Fig. 13 (f) Outline of Sub panel A



# Fig. 13 (g) Outline of Sub panel B



# Fig. 13 (h) Outline of Sub panel B1



# Fig. 13 (i) Outline of Sub panel C



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# Fig. 13 (j) Outline of Sub panel C1





### **EXTERNAL DIMENSIONS OF CONNECTORS**

Fig. title	Specification No.	Fig. No.
PCR connector (soldering type)	PCR-E20FS	Fig.1
FI40 connector	FI40-2015S	Fig.2
Connector case (HONDA PCR type)	PCR-V20LA/PCR- V20LB	Fig.3
Connector case (HIROSE FI type)	FI-20-CV	Fig.4
Connector case (FUJITSU FCN type)	FCN-240C20-Y/S	Fig.5
Connector case (HIROSE PCR type)	FI-20-CV7	Fig.6
AMP connector (1) for servo side	AMP1-178128-3	Fig.7
AMP connector (2) for servo side	AMP2-178129-6	Fig.8
AMP connector (3) for +24 V power supply	AMP1-178288-3	Fig.9
AMP connector (4) for +24 E power supply	AMP2-178288-3	Fig.10
Contact for AMP connector	AMP1-175218-2/5 AMP1-175196-2/5	Fig.11
HONDA connector (case)		Fig.12
HONDA connector (angled case)		Fig.13
HONDA connector (male)		Fig.14
HONDA connector (female)		Fig.15
HONDA connector (terminal layout)		Fig.16
Connector (Burndy Japan)(3 pins/brown)	SMS3PN-5	Fig.17
Connector (Japan Aviation Electronics) (for MDI)	LY10-DC20	Fig.18
Contact (Japan Aviation Electronics) (for MDI)	LY10-C2-3-1000	Fig.19
Punch panel connector for reader/punch interface		Fig.20
Locking plate for reader/punch interface connector		Fig.21
Connector for HIROSE flat cable	HIF3BB-50D-2.54R	Fig. 22
Honda connector (for distribution I/O connection printed circuit board)	MRH–50FD	Fig. 23
AMP connector (for loader I/O board)	AMP178214-1	Fig. 24
Faston terminal	A02B-0166-K330	Fig. 25
HIROSE connector (for DeviceNet board)	HR31-5.08P-5SC	Fig. 26
Contact to for HIROSE connector (for DeviceNet board)	HR31-SC-121	Fig. 27

## Fig. 1 PCR Connector (Soldering type)



## Fig. 2 FI40 Connector



Fig. 3 Connector case (HONDA PCR type)



## Fig. 4 Connector case (HIROSE FI type)



# Fig. 5 Connector case (FUJITSU FCN type)



# Fig. 6 Connector case (PCR type (Hirose Electric))



## Fig. 7 AMP Connector (1)



## Fig. 8 AMP Connector (2)



## Fig. 9 AMP Connector (3)



## Fig. 10 AMP Connector (4)


## Fig. 11 Contact for AMP Connector



## Fig. 12 Honda connector (Case)



## Fig. 13 Honda connector (angled-type case)



## Fig. 14 Honda connector (Male)



## Fig. 15 Honda connector (Female)



## Fig. 16 HONDA connector (terminal layout)



## Fig. 17 Connector made by FCI (3 pins, brown)



## Fig. 18 Connector (Japan Aviation Electronics)(for MDI)



## Fig. 19 Contact (Japan Aviation Electronics)(for MDI)



## Fig. 20 Reader puncher panel connector



Fig. 21 Reader puncher connector metal fitting for lock



## Fig. 22 Connector for hirose flat cable







## Fig. 24 AMP connector



## Fig. 25 Faston Terminal

Type: Use: Applicable housing:	Faston terminal Frame grounding 170604–1 manufactured by AMP Japan, Ltd. or FVDDF2–250 TYPE I (blue) manufactured by Japan Solderless terminal MFG. co.Ltd.
Dimensions:	7.62 Applicable wire 1.25 to 2.27 mm <sup>2</sup> 7.75 $21.59$

## Fig. 26 HIROSE connector (for DeviceNet Board)



## Fig. 27 Contact for HIROSE connector (for DeviceNet Board)





This section provides supplementary information about the recommended (FANUC-approved) 20-pin interface connectors used with the following target model.

## C.1 BOARD-MOUNTED CONNECTORS

## (a) Vertical-type Connectors Models: PCR-EV20MDT (Honda Tsushin) 52618-2011 (Molex Japan)

These board-mounted connectors have been specially developed to achieve the high packing density required for FANUC products. As explained in the following subsection, Honda PCR series connectors can be used as cable connectors because the mating mechanism of the newly developed connectors is compatible with that of the Honda PCR series connectors. To support this specification extensively, many connector manufacturers are now developing custom-tailored cable connectors. (Note that these cables cannot be used with screw-fixing cable connector housings.)

- (b) Straight and Right–angled Connectors (for Spring and Screw–fixing Connector Housings)
  - Models: PCR–E20MDK–SL–A (Honda Tsushin) (straight connector) PCR–E20LMDETZ–SL (Honda Tsushin) (right–angled connector)

These connectors are used for the main and option boards of the i series. As cable connectors, they are compatible with screw-fixing connector housings as well as the spring locking connector housings.

#### C. 20-PIN INTERFACE CONNECTORS AND CABLES

## C.2 CABLE CONNECTOR

The cable connector is separated into a body and a housing. The connectors available are shown below. Models marked with (\*) have been customized for FANUC; those not so marked are mass produced as standard products.



Fig. C.2 Cable connectors

#### NOTE

Use the same maker's connector body and housing to combine them.

## C.3 CABLE CONNECTORS

Strand wire press-mount connector :

With this connector, #28AWG wires are press-connected to each pin at the same time. The cost of producing a cable/connector assembly with this connector model is much lower than with connectors designed for crimping or soldering.

Also, the following connector housing has been newly developed for use with the i series.

Connector model (manufacturer)	Supplementary description
FI–20–CV7 (Hirose)	Low connector housing, more compact than conventional models. The housing can be fastened to a board–mounted connector by means of a screw lock. It is intended mainly for connecting the board–mounted connectors used on the main and option boards of the LCD–mounted type <i>i</i> series (see Section B.3.2). Note that this connector housing cannot be used for conventional board–mounted connectors.

Soldering type connector : Details of soldering type connectors and their housings are summarized below.

#### Table C.3 Details of soldering type connectors and housings

#### Connectors

Connector model (manufacturer)	Supplementary description
PCR–E20FS (Honda)	Soldering type connector for general signals. This is suitable for producing cable assemblies in small quantities, as well as on-site.
FI40–20S (Hirose)	Equivalent to Honda PCR-E20FS
FI40B–20S (Hirose) (formerly, FI40A–20S)	Has the same number of pins as the FI40–20S, but features a wider soldering pitch, facilitating soldering and enabling the use of thicker wires. Its reinforced pins allow wires as thick as #17AWG to be soldered to the FI40B–20S (wires no thicker than #20AWG can be used with the FI40A–20S). Note, however, that a thick wire, such as #17AWG, should be used with a more robust housing like the FI–20–CV6.
FI40B–2015S (Hirose) (formerly, FI40–2015S)	Features a wider soldering pitch, attained by using the space provided by thinning out some pins. Also features tougher pins, compared with its predecessor, the FI40–2015S. These pins can be soldered to wires as thick as #17AWG, provided that the cable diameter does not exceed 8.5 mm.

#### Housings

Housing model (manufacturer)	Supplementary description
FI–20–CV5 (Hirose)	Should be used with the FI40B–20S. This is a plastic housing designed for use with a cable that is $9.2 \text{ mm}$ in diameter.
FI–20–CV6 (Hirose)	Should be used with the FI40B–20S. This housing, however, can be used with a thicker cable (such as 10.25 mm) than is possible with the FI–20–CV5. Its components are die cast.

In addition to the combinations shown in Fig. B.4, Hirose soldering-type connectors can be combined with the housings listed below. Ensure that the diameter of the cable used with each housing satisfies the requirements of that housing.



## C.4 RECOMMENDED CONNECTORS, APPLICABLE HOUSINGS, AND CABLES

Table C.4 Recommended connectors, applicable housings, and cables

Connector name referenced in the Connection Manual	FANUC–approved connector (manufacturer)	FANUC–approved housing (manufacturer)	Compatible cable (cable diameter) FANUC development FANUC specification number	Remark
PCR–E20FA Strand	PCR–E20FA (Honda Tsushin)	PCR–V20LA (Honda Tsushin)	A66L-0001-0284#10P (6.2 mm in diameter)	Plastic housing
press-mount type	FI30–20S (Hirose Electric)	FI–20–CV2 (Hirose Electric)	A66L–0001–0284#10P (6.2 mm in diameter) A66L–0001–0284#10P	Plastic housing
	FCN–247J020–G/E (Fujitsu Takamizawa)	FCN–240C020–Y/S (Fujitsu Takamizawa)	(6.2 mm in diameter)	Plastic housing
	52622–2011 (Molex)	52624–2015 (Molex)	-	Plastic housing
PCR–E20FA Strand wire press–mount type	FI30–20S (Hirose Electric)	FI–20–CV7 (Hirose Electric)		Plastic housing
PCR–E20FS Soldering type	PCR-E20FS (Honda Tsushin)	PCR–V20LA (Honda Tsushin)	-	Plastic housing
	FI40–20S (Hirose Electric)	FI–20–CV2 (Hirose Electric)	-	Plastic housing
FI40B–2015S (formerly FI40–2015S) 15–pin soldering type	FI40B–2015S (formerly FI40–2015S) (Hirose Electric)	FI–20–CV (Hirose Electric)	A66L-0001-0286 (*1) A66L-0001-0402 (*1) (8.5 mm in diameter)	Plastic housing
FI40B–20S (formerly FI40A–2015S) Soldering type	FI40B–2015S (formerly FI40–2015S) (Hirose Electric)	FI–20–CV5 (Hirose Electric)	A66L–0001–0367 A66L–0001–0368 (9.2 mm in diameter)	Plastic housing
	FI40B–20S (Hirose Electric)	FI–20–CV6 (Hirose Electric)	A66L–0001–0403 (*1) (9.8 mm in diameter)	Metal housing

#### NOTE

\*1 Cable A66L-0001-0286 has been recommended for use as a pulse coder cable. It can be up to 20 m long. Two cables, A66L-0001-0402 and A66L-0001-0403, have recently been developed. A66L-0001-0402 and A66L-0001-0403 can be as long as 30 m and 50 m, respectively. (See Fig. 4 for detailed specifications.)

Both cables have the same level of oil and bending resistance (cable, 100 mm in diameter, capable of withstanding at least 10 million bending cycles) as conventional cables, and are UL- and CSA-certified.

## C.5 CABLE WIRES

Cable wires generally need to be developed or ordered by the machine tool builder for the Series 15i/150i.

FANUC has developed wires that specifically suit the interface connector of the Series 15i/150i, Series 15-B/16/18. They are listed in the table below, for your convenience when ordering from the manufacturer.

(In addition to these, a cable for moving parts is under development.)

Material	Use	Constitution	FANUC specification number	Manufacturer	Remark
10–pair cable	General use	0.08mm <sup>2</sup> 10–pair	A66L–0001–0284 #10P	Hitachi Cable, Ltd. Oki Electric Cable Co., Ltd.	
12–conductor composite cable	Pulse coder, linear scale, manual pulse generator	0.5mm <sup>2</sup> 6–conductor 0.18mm <sup>2</sup> 3–pair	A66L-0001-0286	Hitachi Cable, Ltd. Oki Electric Cable Co., Ltd.	20 m or less
		0.75mm <sup>2</sup> 6–conductor 0.18mm <sup>2</sup> 3–pair	A66L-0001-0402	Oki Electric Cable Co., Ltd.	30 m or less Usable on movable parts
		1.25mm <sup>2</sup> 6–conductor 0.18mm <sup>2</sup> 3–pair	A66L-0001-0403	Oki Electric Cable Co., Ltd.	50 m or less Usable on movable parts

#### NOTE

For the pulse coder, scale, and manual pulse generator, each of which has a +5–V power supply, wires need to be selected taking into consideration the supply voltage drop caused by the resistance of the cable.

A66L–0001–0286 has been designed for use with a cable length of 20 mm or less. If the cable length exceeds 20 m, connect A66L–0001–0286 to a cable with a lower resistance, such as A66L–0001–0157.

The number of manual pulse generators to be connected is assumed to be three. If only one generator is connected, the cable can be extended to a maximum of 50 m by connecting wires with in parallel a cross–sectional area of 0.5 mm2 for the power supply.

#### C. 20-PIN INTERFACE CONNECTORS AND CABLES

(1)10-p	air cable
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(a)	Specification	ıs
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Item		Unit	Specifications
Product No.			A66L-0001-0284#10P
Manufacturer		-	Hitachi Cable, Ltd. Oki Electric Cable Co., Ltd.
Rating		-	60°C 30 V: UL2789 80°C 30 V: UL80276
Material	Conductor	-	Stranded wire of tinned annealed copper (ASTM B-286)
	Insulator		Cross–linked vinyl
	Shield braid	_	Tinned annealed copper wire
	Sheath	_	Heat-resistant oilproof vinyl
Number of pairs		Pairs	10
Conductor	Size	AWG	28
	Structure	Conductors/ mm	7/0.127
	Outside diameter	mm	0.38
Insulator	Thickness	mm	0.1 Thinnest portion: 008 (3.1 mm)
	Outside diameter (approx.)	mm	0.58
	Core style (rating)	mm	UL1571 (80°C, 30V)
Twisted pair	Outside diameter (approx.)	mm	1.16
	Pitch	mm	20 or less
Lay		-	Collect the required number of twisted pairs into a cable, then wrap binding tape around the cable. To make the cable round, apply a cable separator as required.
Lay diameter (appro	»х.)	mm	3.5
Drain wire		Conductors/ mm	Hitachi Cable: Not available Oki Electric Cable: Available, 10/0.12
Shield braid	Element wire diameter	mm	0.12
	Braid density	%	85 or more
Sheath	Color		Black
	Thickness	mm	1.0
	Outside diameter (approx.)	mm	6.2
Standard length		m	200

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#### C. 20-PIN INTERFACE CONNECTORS AND CABLES

Item		Unit	Specifications
Packing method			Bundle
Electrical performance	Electric resistance (at 20°C)	Ω/km	233 or less
	Insulation resistance (at 20°C)	MΩ–km	10 or more
	Dielectric strength (AC)	V/min.	300
Flame resistance		_	Shall pass flame resistance test VW–1SC of UL standards.

#### (b) Cable structure



Fig. C.5 (a) Cable made by Hitachi Cable



Fig. C.5 (b) Cable made by Hitachi Cable

(2) Composite	12–core cable
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(a) Specifications (AOOL $-0001-028$	(a) Spec	ification	s (A66L-	-0001-	-0286	)
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ltem		Unit	Specifications	
Product No.		_	A66L-0001-0286	
Manufacturer		_	Oki Cable, Ltd. Hitachi Electric Cable Co., Ltd.	
Rating			80°C, 30 V	
Material Conductor, braid–shielded wire, drain wire		—	Strand wire of tinned annealed copper (JIS C 3152)	
	Insulator		Heat-resistant flame-retardant vinyl	
Sheath			Oilproof, heat-resistant, flame-retardant vinyl	
Number of wires (wire nos.)		Cores	6 (1 to 6)	6 (three pairs) (7 to 9)
Conductor	Size	mm <sup>2</sup>	0.5	0.18
	Structure	Conductors/ mm	20/0.18	7/0.18
	Outside diameter	mm	0.94	0.54
Insulator	Standard thickness (The minimum thickness is at least 80% of the standard thickness.)	mm	0.25	0.2
	Outside diameter	mm	1.50	0.94

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#### C. 20-PIN INTERFACE CONNECTORS AND CABLES

Item		Unit	Specifications	
Twisted pair	Outside diameter	mm		1.88
	Direction of lay			Left
	Pitch	mm		20 or less
Lay		_	Twist the wires at an appropriate pitch so the outermost layer is right-twisted, and wrap tape around the outermost layer. Apply a cable separator as required.	
Lay diameter		mm	5.7	
Drain wire	Size	mm <sup>2</sup>	0.	3
	Structure	Wires/mm	12/0	).18
	Outside diameter	mm	0."	72
Shield braid	Element wire diameter	mm	0.	12
	Thickness	mm	0.3	
	Braid density	%	70	
	Outside diameter	mm	6.3	
Sheath Color —		Bla	ack	
	Standard thickness (The minimum thickness is at least 85% of the standard thickness.)	mm	1.1	
	Outside diameter	mm	8.5 Max. 9	9.0 (Note)
Standard length		m	100	
Packing method		_	Bundle	
Electrical performance	Electric resistance (at 20°C) (wire nos.)	Ω/km	39.4 (1 to 6)	113 (7 to 9)
	Insulation resistance (at 20°C)	MΩ–km	1	5
	Dielectric strength (AC)	V/min.	500	
Flame resistance		—	Shall pass flame resistance test VW–1SC of UL standards.	

#### NOTE

The maximum outside diameter applies to portions other than the drain wire.



(b) Cable structure (A66L–0001–0286) The cable structure is shown below.

#### C. 20-PIN INTERFACE CONNECTORS AND CABLES

Item		Specification				
FANUC specification number		A66L-0001-0402		A66L-0001-0403		
Manufacturer		Oki Electric Cable Co., Ltd.				
		A-conductor	B-conductor	A-conductor	B-conductor	
Conductor	Constitution Number of conductors/mm	16/0.12 (0.18mm <sup>2</sup> )	3/22/0.12 (0.75mm <sup>2</sup> )	16/0.12 (0.18mm <sup>2</sup> )	7/16/0.12 (1.25mm <sup>2</sup> )	
	Typical outside diameter (mm)	0.55	1.20	0.55	1.70	
Insulation	Color	White, red, black	Red, black	White, red, black	Red, black	
(polyester)	Typical thickness (mm)	0.16	0.23	0.16	0.25	
	Typical outside diameter (mm)	0.87	1.66	0.87	2.20	
Pair twisting	Constitution	White–red, white–black, and black–red		White–red, white–black, and black–red		
	Direction of twisting	Left Typical pitch: 20 mm		Left Typical pitch: 20 mm		
Assembling by twisting	Number of strands or conductors	3	6	3	6	
	Direction of twisting	Left		Le	eft	
	Taping	Twisting is wrapped with washi, or Japanese paper, tape.		Twisting is wrapped with washi, or Japanese paper, tape.		
	Typical outside diameter (mm)	5.	7	6.	9	
Braided shielding	Typical strand diameter (mm)		0.	14		
	Typical density (mm)	80				
	Drain	A 12/0.18 m	m wire is roughly w	rapped under braide	ed shielding.	
	Typical outside diameter (mm)	6.	4	7.	6	
Sheath	Color	Black (matted)				
(polyurethane)	Typical thickness (mm)	1.05		1.1		
	Vertical taping	Vertically taped with washi under sheathing.			ng.	
	Outside diameter (mm)	8.5±	= 0.3	$9.8\pm0.3$		
Finished	Typical length (m)		10	00		
assembly	Short size	Basically n		ot approved.		

#### (c) Specifications (A66L-0001-042, 0403)

#### C. 20-PIN INTERFACE CONNECTORS AND CABLES

Item		Specification			
FANUC specification number		A66L-0001-0402 A66L-0001-0403			
Manufacturer		Oki Electric Cable Co., Ltd.			
		A-conductor	B-conductor	A-conductor	B-conductor
Finished	Rating	80°C 30V			
performance	Standard	Shall comply with UL STYLE 20236 and CSA LL43109 AWM I/II A 80°C 30' FT–1.			VM I/II A 80°C 30V
	Flame resistance		Shall comply with	VW-1 and FT-1.	
Electrical performance	Conductor resistance Ω/km (20°C)	103 or lower	25.5 or lower	103 or lower	15.0 or lower
	Insulation resistance MΩ/km (20°C)		1 or 1	higher	
	Dielectric strength V–min		Α. (	2 500	
Insulation performance	Tensile strength N/mm <sup>2</sup>	9.8 or higher			
	Elongation %		100 or higher		
	Tensile strength after aging %	At least 70% of that before aging			
	Elongation after aging %	At least 65% of that before aging			
	Aging condition	For 168 hours at 113°C			
Sheathing performance	Tensile strength N/mm <sup>2</sup>	9.8 or higher			
	Elongation %	100 or higher			
	Tensile strength after aging %	At least 70% of that before aging			
	Elongation after aging %		At least 65% of	that before aging	
	Aging condition		For 168 ho	urs at 113°C	
Cable cross section	Tape Braided shielding			9_	
	Solid wire B Sheath				

# OPTICAL FIBER CABLE

The *i* Series CNC uses optical fiber cables for the following interfaces. This table lists the usable combinations.

Interface	Recommended optical cable	Maximum allowable transmission distance	Applicable junc- tion adapter	Remark
Serial spindle interface	A66L-6001-0026#L~	100 m	None	
	A66L-6001-0029#L~	55 m	A63L-0020-0004	For junction only
I/O Link interface	A66L-6001-0026#L~	200 m	A63L-0020-0002	
High–speed serial bus (HSSB) interface (Note)	A66L-6001-0026#L~	100 m	None	
	A66L-6001-0029#L~	55 m	A63L-0020-0002	For junction only
Serial servo bus (FSSB)	A66L-6001-0023#L~	10 m	None	
interrace	A66L-6001-0026#L~	100 m	None	
CNC–Display unit inter-	A66L-6001-0026#L~	100 m	None	
	A66L-6001-0029#L~	55 m	A66L-0020-0024	For junction only

# Notes on the specifications of optical fiber cable C

1. Supported optical fiber cables

(1) Internal cord type cable	: A66L–6001–0023#L R
Cable length	: 0.15 to 10 m
Code diameter	: 2.2 mm $\times$ 2 cords
Tensile strength	: Optical fiber cord : 7 kg per cord
Between optical fiber co	ord and connector : 2 kg
Minimum bending radiu	is of optical fiber cord: 25 mm
Operating temperature	: -20 to 70°C









Fig. D (b) External dimensions of external cable Unit: mm

Internal cor	d type cable	External cable		
A66L-6001-0023#		A66L60010026# A66L60010029#		
Specification	Length	Specification	Length	
L150R0	0.15 m	L1R003	1.0 m	
L300R0	0.3 m	L2R003	2.0 m	
L500R0	0.5 m	L3R003	3.0 m	
L1R003	1.0 m	L5R003	5.0 m	
L2R003	2.0 m	L7R003	7.0 m	
L3R003	3.0 m	L10R03	10.0 m	
L5R003	5.0 m	L15R03	15.0 m	
L7R003	7.0 m	L20R03	20.0 m	
L10R03	10.0 m	L30R03	30.0 m	
		L50R03	50.0 m	
		L00R03 (Note)	100.0 m	

Table D(a) Standard cable length

Note) Only for A66I-6001-0026

- 2. Cable selection
  - Always use an external cable (A66L–6001–0026#) when the cable is to be laid outside the power magnetics cabinet or main unit cabinet, where it may be pulled, rubbed, or stepped on.
  - Use an external cable when part of the cabling is to be subject to movement. For example, when connecting a <u>portable</u> operation pendant box to the power magnetics cabinet, the use of an external cable is desirable because the cable is likely to be bent, pulled, or twisted repeatedly even though frequent system operation is not expected. However, the force likely to be applied when the cable is installed or moved for maintenance purposes does not need to be taken into consideration.
  - Use an external cable in locations where sparks or flame are a danger. Although the internal cord type cable (A66L–6001–0023#) is covered by nonflammable resin, the cover, if exposed to frame for a long time, may melt, allowing the fiber cable inside to burn.
  - Use an external cable when the cable is expected to be pulled with considerable force during installation (the force applied to the cable must be within the specified tensile strength limit at all times). For example, even though installing a cable in a cable duct can be regarded as internal cabling, a cable of the appropriate type must be selected according to the tensile force to be applied to the cable during installation.
  - Both the internal cord type and external cables have the same oil and heat resistance properties.

#### 3. Procuring the cable

All the optical fiber cables mentioned above are special cable products with optical connectors, which are designed, produced, and tested to ensure the required system performance and reliability. It is technically impossible for users to produce these cables or process (cut and reconnect) them after purchase. Users are requested to purchase cables of the necessary length from an appropriate supplier. Cables are available from either FANUC or any of the FANUC–approved manufacturers listed in Table D(b).

## Table D(b) FANUC–approved cable manufacturers and cable model numbers (retail)

Manufacturer	Model number	Remarks
Japan AMP, Co., Ltd.	*–353373–*	
Japan Aviation Electronics Industry, Ltd.	PF-2HB209-**M-F-1	** indicates the cable length (m).
Hirose Electric Co., Ltd.	H07–P22–F2VCFA-**	** indicates the cable length (m).

(1) Internal cord type cable:	AA66L-6001-0023#L R
-------------------------------	---------------------

(2) External cable: A66L–6001–0026#L R

Manufacturer	Model number	Remarks
Japan AMP, Co., Ltd.	*–353199–*	
Japan Aviation Electronics Industry, Ltd.	CF-2HB208-**M-F-1	** indicates the cable length (m).
Hirose Electric Co., Ltd.	H07-P22-F2NCFA-**	** indicates the cable length (m).
Oki Electric Cable Co., Ltd.	OPC201HPXF-**MB	** indicates the cable length (m).

#### 4. Handling precautions

(1) Protection during storage

When the electrical/optical conversion module mounted on the printed circuit board and the optical fiber cable are not in use, their mating surfaces must be protected with the lid and caps with which they are supplied. If left uncovered, the mating surfaces are likely to become dirty, possibly resulting in a poor cable connection.



Fig. D (c) Protection of electrical/optical conversion module and optical fiber cable (when not in use)

(2) Optical fiber cable

- Although the reinforcing cover of the external cable has sufficient mechanical strength, be careful not to drop heavy objects on the cable.
- Grasp the optical connector firmly when connecting or disconnecting the cable. Do not pull on the optical fiber cord itself. (The maximum tensile strength between the fiber cord and connector is 2 kg. Applying greater force to the cord is likely to cause the connector to come off, making the cable unusable.)
- Once connected, the optical connector is automatically locked by the lock levers on its top. To remove the connector, release the lock levers and pull the connector.
- Although optical connectors cannot be connected in other than the correct orientation, always take note of the connector's orientation before making the connection.

• Before installing an external cable, fix either a wire with a hook or a tension member to the reinforcing cover of the optical connector and pull the wire or tension member, as shown in Fig. D(d). This is done to prevent a tensile force from being applied between the fiber cord and connector. If no tensile force is applied between the fiber cord and connector when installing the cable, you can hold the reinforcing cover of the connector directly and pull it.

In the case of an internal cord, which does not have a reinforcing cover, apply the same protective measures, as instructed in Fig. D(d), for that portion of the cable where the two cords are bound together, in order to prevent a tensile force from being applied between the fiber cord and connector.

In the same way as for an external cable, if no tensile force is applied between the fiber cord and connector during installation, you can hold the shielded part of the cable directly and pull it. Because the combined tensile strength of the two cords is only 14 kg, however, avoid applying too great a force to the cable during installation, regardless of whether you have taken the protective measures.



Fig. D (d) Prior to installing a cable

• Take care to keep both parts of the optical connector (cable side and PCB side) clean. If they become dirty, wipe them with tissue paper or absorbent cotton to remove dirt. The tissue paper or absorbent cotton may be moistened with ethyl alcohol. Do not use any organic solvent other than ethyl alcohol. • Fix the reinforcing cover of the external cable or the cord binding portion of the internal cord type cable by using a cable clamp, as shown in Fig. D(e), to prevent the weight of the optical fiber cable from being applied directly to the connecting part of the optical connector.

(Recommended cable clamp):

Recommended cable clamps are listed below. Use a clamp that grasps the optical cable lightly; the clamp should not apply excessive pressure to the cable.

For an external cable:

CKN-13SP (with sponge)(Kitagawa Industry Co., Ltd.) For an internal cord type cable:

MN-1 (Kitagawa Industry Co., Ltd.)



#### Fig. D (e) Fixing the cable with a clamp

- Any superfluous portion of the cable may be wound into a loops. Should this prove necessary, make sure the diameter of each loop is at least 150 mm (for an external cable) or at least 100 mm (for an internal cord type cable). Winding the cable into smaller loops may produce sharp curves that exceed the specified bending radius limit without the user being aware. Such bending can result in a greater transmission loss, ultimately leading to a communication failure.
- When using a nylon band (cable tie) as a cable clamp, follow the instructions given below. Also, take care not to apply a bending force to one particular part of the cable when fixing it with a clamp. Failing to clamp the cable correctly may cut or damage it.

#### External cable:

Do not clamp the uncovered portion of the cable with a nylon band. When clamping the cable by the reinforcing cover, the clamping force is not an important factor to consider. However, ensure that the clamping force is as small as possible to ensure that the reinforcing cover is not deformed by the clamping. If possible, the clamping force should be 5 kg or less.

Internal cord type cable:

Lightly clamp the optical cable with a nylon band so that the cable shield is not deformed. If possible, the clamping force should be 1 or 2 kg (make sure that no force is applied to the cable). Due care is required when clamping the internal cord type cable because its cable shield is weaker than the reinforcing cover of the external cable.

5. Optical fiber cable relay

When used for the FANUC I/O Link application, optical fiber cables can be connected by using an optical fiber adapter, as follows.



(a) External view of an optical fiber adapter


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

#### NOTE

Up to one relay points are permitte.

- 6. Optical fiber cable relay for FANUC High speed serial bus When used for the FANUC High speed serial bus, optical fiber cables can be relayed by using an optical fiber adapter with low-loss optical junction and by connecting an exdusive low-loss optical fibercable, as follows.
- (a) External view of an optical fiber adapter with low-loss optical junction





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

#### NOTE

Up to one relay points are permitte.

- 7. Precautions for connection with low-loss optical junction adapter
  - Features of and handling precautions for low-loss optical junction adapter (A63L-0020-0004)

When optical connectors for a conventional optical junction adapter (A63L–0020–0002) are jointed, the facing ferrules(Note 1) are located about 60 um from each other. This is because the optical fiber of conventional PCF (plastic clad silica fiber) cables (A66L–6001–0008, –0009, –0026) may protrude from the tip of the ferrules (by up to about several um), resulting in the fiber protrusion being damaged when the ferrules are butted against each other.

In the low–loss optical junction adapter, the ferrules are butted against each other, thus greatly reducing the reduction in repeater loss. Therefore, the two optical cables used with the low–loss optical junction adapters must be dedicated to the adapters.

If a conventional PCF (plastic clad silica fiber) cable (A66L–6001–0008, –0009, –0026) is used as even one of the two optical fiber cables for joining the low–loss optical junction adapter, both cables may be damaged, resulting in deteriorated characteristics.

#### NOTE

Ferrule: Movable metal at the tip of an optical connector; the fiber is bonded to the ferrule.



- Features of low-loss optical cable (A66L-6001-0029) A low-loss optical cable is selected from conventional PCF optical cables (A66L-6601-0026). The selected cable offers low loss, and its connector section is given special treatment; the fiber ends are provided with a depression so that the ferrules can be butted against each other. The two optical cables used with the low-loss optical junction adapter must be of low-loss type.
- Appearance of the low-loss optical junction adapter and cable (how to distinguish them from conventional types) The body of the conventional optical junction adapter is black, but that of the low-loss optical junction adapter is blue. In addition, the protective cover(Note 1) of the conventional PCF optical cable is black, but that of the low-loss optical cable is blue.
- 8. Installing the optical fiber junction adapter The optical fiber junction adapter should be installed within a cabinet, as a rule. If it is impossible to avoid installing it within a cabinet, protect the adapter and the optical cable portions (such as connectors and cords) not covered with reinforcement coating from the outside air by, for example, covering them with packing.
- 9. Environmental resistance of the optical fiber junction adapter
  - The optical fiber junction adapter is not waterproof. Even when optical cables are attached to both ends of the adapter, there are very small gaps in the linked portions, so water resistance can not be expected.
  - When optical cables are attached to both ends of the junction adapter installed in a normal environment (such as within a cabinet), it is unlikely that dust will penetrate between the adapter and optical fiber to the degree that it may hamper normal optical linkage. If one or both ends of the adapter are left open, dust and dirt may accumulate even when the adapter is in a normal environment (such as within a cabinet). The dust and dirt on the adapter ends is likely to hamper normal optical linkage when the optical cables are attached. In such a case, clean the junction adapter cleaning method described below.

• Do not allow cutting fluid to splash over the adapter or those optical cable portions (such as connectors and cords) that are not covered with reinforcement coating. If the inside of the adapter and fiber end surfaces are contaminated with cutting fluid, a malfunction may occur.

#### 10.Cleaning

If the optical fiber junction adapter, optical-to-electrical conversion module, or optical cable are soiled, clean them according to the following procedures.

• Cleaning the optical fiber junction adapter and optical-to-electrical conversion module

First, clean the entire housing by wiping it with a cloth moistened with, or by washing it in, ethyl alcohol or HCFC141B (alternative CFC; High Shower spray can DS–2168, manufactured by Sun Hayato). Similarly, wash the two sleeves in the adapter or wipe them with a cotton swab or the like.

• Cleaning optical cables

For the optical cables, it is important to clean the connectors at their ends. Any soiling on the optical fiber end surfaces will hamper optical transmission, resulting in a malfunction. Wipe the optical fiber end surfaces (that is, the ferrule end surfaces) thoroughly with a soft, clean cloth (like gauze) moistened with ethyl alcohol or HCFC141B, in the same way as described above. The use of cotton swabs may prove convenient. The fiber end surfaces of low–loss optical cables are lower than the ferrules. To remove any soiling from the fiber end surfaces completely, push the cotton swab or gauze into the depressions all the way through while rotating the ferrule. If the ferrules and optical connectors are contaminated with oily substances, and they may extend over a cleaned fiber end surface when it is attached to the optical-to-electrical conversion module, it is a good idea to wash them before wiping the optical fiber end surfaces, using the procedure stated above.

11. Compatibility with previous models of FANUC optical fiber cables FANUC has offered other types of optical cables for different applications (see Table D(c)).

Note that the optical cables for FANUC I/O Link and FANUC high–speed serial bus applications cannot be used for the servo interface application. On the other hand, however, the external optical cable for the servo interface application can be used in place of previous cables types, as shown in Table D(d). (The external optical cable for the servo interface application is designed to offer a level of performance equivalent to that of the previous cables.)

	System application	FANUC specification No.	Specification
	FANUC I/O Link interface	A66L-6001-0008#L ~	Internal cable/fixed type
Previous optical fiber	Serial spindle interface	A66L-6001-0009#L ~	External cable/fixed type
cables	FANUC high-speed	A66L-6001-0021#L ~	External cable/fixed type
	serial bus interface	A66L-6001-0022#L ~	External cable/fixed type
New optical	Serial ser-	A66L-6001-0023#L ~	Internal cable/fixed type
fiber cables	fiber cables interface	A66L-6001-0026#L ~	External cable/fixed or portable type

Table D(c) FANUC optical fiber cables

# Table D(d) Previous optical fiber cables that can be replaced by the new external cable (A66L-6001-0026#L)

Optical cable _		Replaceable optical fiber cables
-	<b></b>	FANUC I/O Link: A66L-6001-0009#L ~
External cable for serial servo-bus – interface		FANUC high–speed serial bus: A66L–6001–0021#L ~
A66L-6001-0026#L ~_	>	FANUC high–speed serial bus: A66L–6001–0022#L ~

# LIQUID CRYSTAL DISPLAY (LCD)

Brightness of the monochrome LCD When the ambient temperature is low, the brightness of the LCD decreases. (The LCD screen is dark particularly immediately after the power is turned on.) This phenomenon is not a failure but is a property specific to the LCD. When the ambient temperature increases, the LCD screen becomes brighter. The monochrome LCD has a brightness control function.

#### LCD with a touch panel

The touch panel is operated by directly touching the LCD screen. For this operation, be sure to use a FANUC–supplied pen (A02B–0236–K111) dedicated to the touch panel. If a sharp–pointed pen is used, for example, to touch the LCD screen, the LCD surface may be flawed or damaged. Moreover, do not touch the LCD screen directly with a finger. Otherwise, the operability of the LCD may deteriorate, and the LCD screen may get dirty.

# Protection sheet for the touch panel

A protection sheet is attached the face of an LCD with a touch panel to protect the thin film of the touch panel and LCD.

Na	Name	
Protection sheet for the	For 10.4" LCD	A02B-0236-K130
	For 12.1" LCD	A02B-0236-K118
	For 15" LCD	A02B-0082-K020

#### **Replacing procedure**

- <1> First, remove the old protection sheet.
- <2> Wipe moisture, dust, and grease on the surface of the LCD.
- <3> Peel off the white film attached on the back (facing the LCD) of the new protection sheet.
- <4> Attach the protection sheet so that it is to the lower–left of the replacement tab. At this time, align the overhang edge at bottom of the escutcheon with the corresponding part of the protection sheet. In addition, prevent dust from entering between the LCD and protection sheet.



- <5> Attach the four sides while pushing out air between the touch panel and protection sheet.
  - Do not pull the protection sheet to correct its position with the part of the sheet kept stuck to the touch panel.
- <6> Press the adhesive parts of the four sides, and attach the sheet completely.
  - Check that the four corners and four sides of the protection sheet do not float.

# MEMORY CARD INTERFACE

#### **Overview**

Compatible and

incompatible cards

Using the memory card interface located on the left side of the LCD, input/output of data inside the CNC and remote diagnosis using a modem card can be performed. This appendix describes the memory card interface for data input/output. For an explanation of remote diagnosis using a modem card, see the related document.

#### SRAM card

- JEIDA (4.0 or later) Type 1 and Type 2
- PCMCIA (2.0 or later) Type 1 and Type 2
- PC Card Standard

SRAM cards conforming to any of the above standards can be used. However, SRAM cards operating only on a power supply voltage of 3.3 V cannot be inserted physically. Such SRAM cards cannot be used. The operation of the following FANUC–recommended SRAM cards has

been confirmed by FANUC:

256KB SRAM card	Fujitsu	MB98A90823-20
512KB SRAM card	Fujitsu	MB98A90923-20
1MB SRAM card	Fujitsu	MB98A91023-20
2MB SRAM card	Fujitsu	MB98A91123-20

Flash memory card

With the *i* Series incorporating personal computer functions, no flash memory card can be used. With the *i* Series, Intel series 2 flash memory cards (or equivalent) can be used. However, flash memory cards operating only on a power supply voltage of 3.3 V cannot be inserted physically. Such flash memory cards cannot be used.

Basically, flash memory cards with non–Intel on–chip flash memories cannot be used. However, such flash memory cards, if formatted or written by a personal computer, may be read with the *i* Series. The operation of the following FANUC–recommended flash memory card has been confirmed by FANUC:

4MB flash memory card	Fujitsu	IMC004FLSA
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#### — 464 —

Memory card capacity	The capacity of a memory After formatting, the us card with a capacity lar stored needs to be prepar Example: When the size A memory car When a flash memory car is used as a buffer area, so 128KB.	ry card usually indicates able capacity decreases ger than the size of data ared. of data to be stored is 5 rd with a capacity of 1M eard is used, the last 128 so that the usable space d	an unformatted capacity. slightly. So, a memory a and programs actually 512KB IB or more is required. KB of the memory card lecreases additionally by
Memory card formatting	The BOOT SYSTEM f FAT file system. The f also supported. Howev not compatible with eac used.	ormats a memory card ormatting method called er, the FAT file system a h other, and the read and	using method called the I the flash file system is and flash file system are I list functions cannot be
File operation with a flash memory card	<ul> <li>Flash memory cards do r on a flash memory card r the following operations</li> <li>Deletion of an existi</li> <li>Renaming of a file</li> <li>Overwriting of a file</li> </ul>	not allow individual files need to be deleted at the s s cannot be performed: ng file	to be deleted; all the files same time. Accordingly,
Notes on formatting a flash memory card with CardPro	CardPro uses the flash f card. When using Card boot system, use the fol A:CPFORMA	ile system as standard to Pro to format a flash me lowing command to for T drive–name:/F:FLAS	o format a flash memory mory card used with the mat the card. HFAT/NOCIS
Using a flash memory card formatted with the BOOT SYSTEM on other		Ramzo	CardPro

BOOT SYSTEM on other systems

#### Using a flash memory card formatted with other systems on the BOOT SYSTEM

	Ramzo	CardPro
Reading of files	0	0
Addition of files	0	×
Listing of files	0	0

 $\bigcirc$ 

No file addition function

is available.

 $\bigcirc$ 

 $\bigcirc$ 

 $\times$ 

0

#### NOTE

Reading of files

Addition of files

Listing of files

- 1 Ramzo is a memory card reader/writer manufactured by Adtech System Science.
- 2 CardPro is a memory card reader/writer manufactured by Data IO.

# Names and functions of components





#### Inserting a memory card

A memory card has an insertion guide to protect against reverse insertion. Pay attention to the orientation of the memory card. The front of the memory card must face the LCD of the i Series.

Battery

The batteries used with FANUC–supplied SRAM memory cards were of the CR2325 and BR2325 types.

These batteries were difficult to obtain, so the CR2025 battery was introduced to replace these batteries in May, 1997.

By replacing the battery holder, the user can use SRAM memory cards that used the previous batteries (CR2325 and BR2325) with the new battery (CR2025).

#### SRAM memory cards

1) A87L-0001-0150#

Manufacturer's model: MB98A9 33-20

#### **Battery type**

- 1) Before the change: CR2325 or BR2325
  - Indication on the side of the memory card: 9 33–20 S000 9
- 2) After the change: CR2025 or equivalent (common battery intended for use in electronic calculators)
  - Indication on the side of the memory card: 9 33–20 9157

**Battery replacement** 

#### **Battery holder replacement**

- 1) By replacing the battery holder, the user can use SRAM memory cards that used the previous batteries (CR2325 and BR2325) with the new battery (CR2025).
- 2) The battery holder set for CR2025 is available from shops handling Fujitsu electronic devices.
  - Ordering code: MB98XXX-holder set-09146
  - Contents of the set: Battery holder (1), battery (CR2025) (1), manual (1)

#### (1) While pressing down the fixing claw, pull out the battery case.



#### (2) Replace the battery with a new one.

Match the + mark of the battery with the + mark on the battery case.



(3) Return the battery case to its original position, then check that the battery operates normally.



#### ATA CARD

#### 1. Overview

Series 15/150*i* enable output and input of data to and from the flash ATA card (which operates on 5 V).

The flash ATA card has a built–in controller together with a memory device and, therefore, has the advantage that it can output and input data to and from a PCMCIA–interface–installed personal computer without the use of a special PC card writer.

2. Flash ATA card specifications

The flash ATA card must conform to the following standard and must have the following shape.

Not all ATA cards that conform to this standard are guaranteed to operate normally. It is recommended to use those cards that have been verified to operate normally.

2-1 Card standard

PCMCIA (Personal Computer Memory Card International Association) The card must conform to PC Card standard Release 2.1 and

The card must conform to PC Card standard Release 2.1 and PCMCIA PC Card ATA Release 1.02.

2–2 Card shape

PCMCIA TYPE I or Type II

2-3 Card operating mode

PC-ATA specifications

2-4 Card operating voltage

The card may operate on a single voltage of 5V or on 5 V/3.3 V (automatically switched).

- 3. Note
  - The flash ATA card is in quick format.

A flash ATA card that has not been formatted must be formatted on the personal computer.

# G

# TERMINAL MODULE

#### G.1 OVERVIEW

#### G.2 TOTAL CONNECTION

#### G.3 CONNECTION OF EACH PART

G.3.1 Pin Assignment
G.3.1.1 Connector Pin Assignment of Connector Panel I/O Module
G.3.1.2 Connector-terminal Block Pin Assignment of Terminal Module
G.3.2 Connection of 24VDC Power Supply and Signals
G.3.2.1 24VDC Power Supply Connection
G.3.2.2 DI (Input Signal) Connection
G.3.2.3 DO (Output Signal) Connector

#### G.4 MOUNTING TERMINAL MODULE

#### **G.5 SPECIFICATIONS**

G.5.1 Installation Specifications G.5.2 Ordering Specifications

- G.5.3 Module Specifications
- G.5.4 Power Voltage
- G.5.5 DI/DO (Input/output Signal Specification)

# G.1 OVERVIEW

The terminal module is connected by connector panel I/O module and a cable. It is the terminal module that a input/output signal (DI 24 points/DO 16 points) from the machine side can be relayed with the terminal block.

# G.2 TOTAL CONNECTION



#### NOTE

The terminal module can't be connected with connector panel I/O output 2A module.

# G.3 CONNECTION OF EACH PART

# G.3.1 Pin Assignment

#### G.3.1.1 Connector Pin Assignment of Connector Panel I/O Module

	CB150 (	HO	NDA MR-:	50R1	MA)	
33	+24E	]		01	+24E	
34	Yn+0.0	10	0)/	02	Yn+1.0	
35	Yn+0.1	19	00	03	Yn+1.1	
36	Yn+0.2	20	00	04	Yn+1.2	
37	Yn+0.3	21	00	05	Yn+1.3	
38	Yn+0.4	22	00	06	Yn+1.4	
39	Yn+0.5	23	00	07	Yn+1.5	
40	Yn+0.6	24	DICOMO	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	1		17	Xm+2.7	
50	+24V	]		18	+24V	
				Ľ		

#### NOTE

For detailed allocation of DI/DO address, refer to connection manual of connector panel I/O module.

# G.3.1.2

**Connector**-terminal **Block Pin Assignment of** Terminal Module

>	KP150 (HIF	ROSEH	HF3CB-5	0PA-2.54DSA)
A1	+24E	B1	Yn+1.0	7
A2	+24E	B2	Yn+0.0	
A3	0V	B3	0V	-
A4	Yn+1.1	B4	Yn+1.2	
A5	Yn+0.1	B5	Yn+0.2	-
A6	0V	B6	0V	-
A7	Yn+1.3	B7	Yn+1.4	
A8	Yn+0.3	B8	Yn+0.4	-
A9	0V	B9	DICOM	0
A10	Yn+1.5	B10	Yn+1.6	
A11	Yn+0.5	B11	Yn+0.6	
A12	Xm+1.0	B12	Xm+1.1	
A13	Yn+1.7	B13	Xm+2.0	7
A14	Yn+0.7	B14	Xm+0.0	7
A15	Xm+1.2	B15	Xm+1.3	5
A16	Xm+2.1	B16	Xm+2.2	2
A17	Xm+0.1	B17	Xm+0.2	2
A18	Xm+1.4	B18	Xm+1.5	5
A19	Xm+2.3	B19	Xm+2.4	F]
A20	Xm+0.3	B20	Xm+0.4	F]
A21	Xm+1.6	B21	Xm+1.7	, ,
A22	Xm+2.5	B22	Xm+2.6	5
A23	Xm+0.5	B23	Xm+0.6	5
A24	Xm+2.7	B24	+24V	7
A25	Xm+0.7	B25	+24V	7
XT15	0A (YOSH	IDA PX	(7–32A)	XT150
1	0V	10	+24E	1
2	DICOM	10	DICOM Vm ( 0, 0	2
3	Xm+0.2	19	Xm+0.0	3
4	Xm+0.3	20	Xm+0.1	4
5	DICOM	21	DICOM	5
6	Xm+0.6	22	Xm+0.4	6
7	Xm+0.7	23	×III+0.5	7
8	+24E	24	+24E	8
9	Xm+1.2	25	Xm+1.0	9
10	Xm+1.3	26	Xm+1.1	10
11	+24E	21	+24E	11

Xm+1.4

Xm+1.5

+24E

Xm+2.0

Xm+2.1

28

29

30

31

32

12 Xm+1.6

13 Xm+1.7

16 Xm+2.3

+24E

Xm+2.2

14

15

#### 0B (YOSHIDA PX7-32A)

	.045	17	+24E
1	+24E	18	Xm+2.4
2	Xm+2.6	19	Xm+2.5
3	Xm+2.7	20	0\/
4	0V	20	Varioo
5	Yn+0.2	21	¥n+0.0
6	Vn±0.3	22	Yn+0.1
7	01/	23	0V
/	00	24	Yn+0.4
8	Yn+0.6	25	Vn±0.5
9	Yn+0.7	20	0\/
10	0V	20	00
11	Yn+1.2	27	Yn+1.0
12	Vn+1 3	28	Yn+1.1
12	01/	29	0V
13	00	30	Yn+1.4
14	rn+1.6	31	Yn+1.5
15	Yn+1.7	33	1241/
16	0V	52	+240

## G.3.2 Connection of 24VDC Power Supply and Signals

G.3.2.1	24VDC power supply into 2 system of control power supply +24V for
24VDC Power Supply	connector panel I/O module and +24E for machine side input/output
Connection	signal, and it can be supplied.
	Of course, one power supply unit can supply to both the $+24V$ and $+24E$ .

## G.3.2.2 DI (Input Signal) Connection

·	CB150	XP150	24VDC powe
+2	$\frac{4V}{2}$ (18)	(B24)	XT150B supply
	(10)		$-\frac{(32)}{\sqrt{14504}}$ V+ 0V
Bit number		+24 C (b23)	DV (17)
		•	-0.00
	(42)	(B14)	(18)
	(42)	(117)	
	••••		$-\frac{1}{1}\frac{(20)}{(2)}$
Xm+0.2	(44)	(B17)	(3)
Xm+0.3	(45)	(A20)	(4)
			(21)
Xm+0.4 RV	(46)	(B20)	(22)
Xm+0.5	(47)	(A23)	(23)
	(40)	(P22)	
	••••		
Xm+0.7	(49)	(A25)	(7)
•		XB2	NV J
DICOM0	<b>–</b> (24)		(24)
Xm+1.0	(25)	(A12)	-(25)
	(26)	(P12)	
RV			-(20)
Xm+1.2 RV	(27)	(A15)	(9)
Xm+1.3	(28)	(B15)	(10)
			(27)
Xm+1.4 RV	(29)	(A18)	$- \varphi^{(28)}$
Xm+1.5	(30)	(B18)	(29)
Xm+1.6	(31)		$-\gamma(11)$
			$-\phi^{(12)}$
Xm+1.7	(32)	(B21)	(13)
•	(19),(20),	(A03),(B03)	XT150A,XT150B
	(23)	(A09)	(1) (16)
•	- <b>-</b>	( <b>■^ ′</b> <u> </u>	
/// <i>T</i>		0	



#### NOTE

Xm+0.0 through Xm+0.7 are DI pins for which a common voltage can be selected.

That is, set up a setting pin XB1 on "0V" side, set up a setting pin XB2 on "+24" side, by connecting the DICOM0 to the +24V power supply, a DI signal can be input with its logical state reverse. If, however, a cable is connected to ground, it has the same effect as inputting an ON state DI signal.

To prevent this from occurring, set up a setting pin XB1 on "+24" side, set up a setting pin XB2 on "0V" side, the connection of the DICOM0 to the 0V power supply is recommended wherever possible.

It is set up as follows at the time of factory shipping.

Setting pin XB1 : "+24" side Setting pin XB2 : "0V" side

### G.3.2.3 DO (Output Signal) Connector

Connector panel I/O module	1	Terminal module	7
Address number Bit number DOCOM	CB150	₩ XP150 + (A01),(A02)	XT150B (20)
Yn+0.0	(34)	(B02)	
Yn+0.1	(35)	(A05)	
Yn+0.2 DV	(36)	(B05)	(5)
Yn+0.3 DV	(37)	(A08)	(6) (23)
Yn+0.4	(38)	(B08)	(23) (24)
<u>Yn+0.5</u> DV	(39)	(A11)	(25)   (7)
Yn+0.6	(40)	(B11)	(8) 
<u>Yn+0.7</u> DV	) <del>(41)</del> (	(A14)	(9) 
Yn+1.0 DV	(02)	(B01)	(26) ♀ (27)
Yn+1.1 DV	(03)	(A04)	(28) ♀ (10)
Yn+1.2 DV	(04)	(B04)	(11)
<u>Yn+1.3</u> DV	(05)	(A07)	(12)   (29)
Yn+1.4 DV	(06)	(B07)	Y (30)
Yn+1.5 DV	(07)	(A10)	(31) (13) (14)
Yn+1.7	(09)	(A13)	(15)

# G.4 MOUNTING TERMINAL MODULE

As for the mounting of the terminal module, a screw or DIN rail mounting is possible.



# G.5 SPECIFICATIONS

## G.5.1 Installation Specifications

Ambient	Atoperation	0°C to 55°C
temperature	Storing or transporting	-20°C to 60°C
	g	
Temperature	Max. 0.3°C/min	
change		
Relative humidity	Normally	75% or less (Relative humidity)
	Short time (Within one month)	95% or less (Relative humidity)
Vibration	Operating 0.5G or less	
Environment	Normal FA atmosphere (The e the system under environmen ant, or organic solution.)	examination is necessary when using ts with higher degree of dust, cool-
Other requirements	Use this module in a cabinet the	hat is always completely closed.

# G.5.2 Ordering Specifications

		ſ
ltem	Specification	Remarks
Terminalmodule	A03B-0815-C020	
Connection cable	A03B-0815-K020	0.3m
and terminal module.)	A03B-0815-K021	1m
	A03B-0815-K022	2m

# G.5.3 Module Specifications

	ltem	Specification	Remarks
DI points		24 points	Terminal block connection
DO points		16 points	Terminal block connection
Terminal	Ratedvoltage	250V	Screw up type
DIOCK	Rated thermal current	10A	
	Adaptation wire	1.25mm <sup>2</sup>	
	Tighteningtorque	0.5 to 0.75N · m	

G.5.4	$24$ VDC $\pm$ 10% is supplied from terminal block XT150A and XT150B
Power Voltage	(The $\pm$ 10% tolerance includes momentary and ripple currents.) For detailed power supply rating of connector panel I/O module, refer to connection manual of connector panel I/O module.
G.5.5 DI/DO (Input/output Signal Specification)	For detailed input/output signal specifications, refer to connection manual of connector panel I/O module.

# TERMINAL MODULE A

#### H.1 OVERVIEW

H.2 TOTAL CONNECTION

H.3 CONNECTION OF EACH PART

H.3.1 Pin Assignment
H.3.2 Connection of 24VDC Power Supply and Signals
H.3.2.1 24VDC Power Supply Connection
H.3.2.2 DI (Input Signal) Connection
H.3.2.3 DO (Output Signal) Connector
H.3.3 Connection of Basic and Extension Modules

#### H.4 MOUNTING THE TERMINAL MODULE A

#### **H.5 SPECIFICATIONS**

H.5.1 Installation Specifications

- H.5.2 Ordering Specifications
- H.5.3 Module Specifications
- H.5.4 Power Voltage
- H.5.5 DI/DO (Input/output Signal Specification)

# H.1 OVERVIEW

The Terminal Module A is connected by the Connector Panel I/O Module directly. It is the Terminal Module A that a input/output signal (DI 24 points/DO 16 points) from the machine side can be relayed with the terminal block. And output signal (DO 16 points) are also relayed by a connector.

# H.2 TOTAL CONNECTION



#### NOTE

- 1 Terminal Module A cannot be connected with the Connector Panel I/O Output 2A Module.
- 2 Terminal Module A can be connected with the Relay Module(A20B–1006–0760).

# H.3 CONNECTION OF EACH PART

# H.3.1 Pin Assignment

Terminal and Connector pin assignment of the Terminal Module

+24E 17 0V 1 DICOM 18 2 DICOM 19 Xm+0.0 3 Xm+0.2 20 Xm+0.1 Xm+0.3 4 21 DICOM DICOM 5 22 Xm+0.4 6 Xm+0.6 23 Xm+0.5 7 Xm+0.7 24 +24E 8 +24E 25 Xm+1.0 9 Xm+1.2 26 Xm+1.1 Xm+1.3 10 27 +24E 11 +24E 28 Xm+1.4 12 Xm+1.6 29 Xm+1.5 13 Xm+1.7 30 +24E 14 +24E 31 Xm+2.0 15 Xm+2.2 32 Xm+2.1 16 Xm+2.3

XT150A (YOSHIDA PX7-32A)

1	124E	17	+24E
1	+24E	18	Xm+2.4
2	Xm+2.6	19	Ym⊥25
3	Xm+2.7	10	AIII+2.5
4	0V	20	00
5	Vn±0.2	21	Yn+0.0
5	11110.2	22	Yn+0.1
6	Yn+0.3	23	0V
7	0V	20	Vie i O 4
8	Yn+0.6	24	Yn+0.4
0	Vn+0.7	25	Yn+0.5
9	111+0.7	26	0V
10	00	27	Yn+1.0
11	Yn+1.2	21	
12	Yn+1.3	28	Yn+1.1
12	0\/	29	0V
13	Valle	30	Yn+1.4
14	rn+1.6	31	Vn+1.5
15	Yn+1.7		11171.5
16	0V	32	+24V

#### X150 (HIROSE HIF3CB-50PA-2.54DSA)

A1		B1		
A2		B2		
A3		B3 Yn+0.		
A4	Yn+0.6	B4	Yn+0.0	
A5	Yn+1.0	B5	Yn+0.1	
A6	Yn+1.2	B6	Yn+0.3	
A7	Yn+0.5	B7	Yn+0.7	
A8	Yn+1.1	B8	Yn+1.3	
A9	Yn+1.4	B9	Yn+1.4	
A10	Yn+1.5	B10	Yn+1.5	
A11	Yn+1.6	B11	Yn+1.6	
A12	Yn+1.7	B12	Yn+1.7	
A13		B13		
A14		B14		
A15		B15		
A16		B16		
A17		B17		
A18	Yn+0.4	B18		
A19		B19		
A20		B20		
A21		B21		
A22		B22		
A23		B23		
A24	0V	B24	0V	
A25	0V	B25		

A connector specification of flat cable side is  $\rm HIF3BA-20D-2.54R$ 

#### NOTE

- 1 For detailed allocation of DI/DO address, refer to connection manual of Connector Panel I/O Module.
- 2 Output Pins shaded by are in pairs. Only one in each pair is usable.

## H.3.2 Connection of 24VDC Power Supply and Signals

H.3.2.1	24VDC power supply into 2 system of control power supply $+24V$ for the
24VDC Power Supply Connection	connector panel I/O module and +24E for machine side input/output signal, and it can be supplied.
	Also one power supply unit can supply to both the $+24V$ and $+24E$ .

### H.3.2.2 DI (Input Signal) Connection

<u>+</u>	CB150 24V (18) (50)			XT150B (32)	24VDC Power Supply
Address Nu	mber	+24	KB1 ■ ○ 0V	XT150A (17)	0 V+ 0V 0
<u>Xm+0.0</u> RV	(42)		•	(18) (19)	
Xm+0.1	(43) <b>(</b> 43)			(20)	
Xm+0.2 RV	∫(44) ●●		•	-> (2) -> (3)	Ň
Xm+0.3 RV	(45)			$\begin{array}{c} (4) \\ (21) \end{array}$	
Xm+0.4 RV	(46)			Y (22)	
Xm+0.5 RV	(47) (48)			. (23) . (5)	
Xm+0.6 RV	(48) (49)			(6)	
•-W-	(24)	+24 0	(B2 ○■○ 0V		
DICOM0 Xm+1.0 RV	(25)	•		(24) (25)	
Xm+1.1	(26)			(26) (7) (8)	
Xm+1.2 RV	(27)	+		(9)	
Xm+1.3 RV	(28)			(10) (27)	
Xm+1.4 RV	(29)			(28)	
Xm+1.5 RV		•		↓ (29) ↓ (11) ↓ (12)	
Xm+1 7				(12)	
RV +	(19),(20),				3
	(23)			(1) (16)	, 
		-24E	2		



#### NOTE

Xm+0.0 through Xm+0.7 are DI pins for which a common voltage can be selected. That is, set up a setting pin XB1 on "0V" side, set up a setting pin XB2 on "+24" side, by connecting the DICOM0 to the +24V power supply, a DI signal can be input with its logical state reverse. If, however, a cable is connected to ground, it has the same effect as inputting an ON state DI signal. To prevent this from occurring, set up a setting pin XB1 on "+24" side, set up a setting pin XB2 on "0V" side, the connection of the DICOM0 to the 0V power supply is recommended wherever possible.

### H.3.2.3 DO (Output Signal) Connector



#### NOTE

At Connection parts of the Terminal Module, — means the terminal "XT150B", — means the connector "X150".

# H.3.3 Connection of Basic and Extension Modules

Connect I/O modules mounted on the Terminal module A 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.



#### NOTE

Make the length of the flat cable more than 100mm in consideration of wiring to the terminal blocks on the terminal module A. But, the maximum length of the total extension of the flat cable is 300mm.

To ensure adequate ventilation, install the modules in such a way that the flat cables lie on top of them. The basic module has a vent at the top (as indicated by the dotted lines in the above figure). When connecting modules, install extension modules so that the flat cables do not cover the vent, as shown in the above figure. Therefore, for direct connection to the Terminal module A, expansion modules are installed to the right of the basic module on the installation plane.

As for the mounting of the Terminal Module A, a screw or DIN rail mounting is possible.



#### NOTE

When mounting the Terminal Module by screw, remove spacers.


## H.5 SPECIFICATIONS

#### H.5.1 Installation Specifications

Ambient temperature	At operation Storing or transporting	0°C to 55°C –20°C to 60°C
Temperature change	Max. 0.3°C/min	
Relativehumidity	Normally	75% or less (Relative humidity)
	Short time (Within one month)	95% or less (Relative humidity)
Vibration	Operating 0.5G or less	
Environment	Normal FA atmosphere (The examination is necessary when using the system under environments with higher degree of dust, cool- ant, or organic solution.)	
Other Requirements	Use this module in a cabinet that is always completely closed.	

### H.5.2 Ordering Specifications

ltem	Specification	Remarks
Terminal module A	A03B-0815-C021	
Inter-module flat cable	A03B-0815-K101	Length 100mm

### H.5.3 Module Specifications

	ltem	Specification	Remarks
DI points		24 points	Terminal Block connection
DO points		16 points	Terminal Block or Connector Connection
Terminal	Rated Voltage	250V	Screw up type
BIOCK	Rated Thermal Current	10A	
	Adaptation Wire	1.25mm <sup>2</sup>	
	Tightening Torque	0.5 to 0.75N · m	

H.5.4 Power Voltage	$24$ VDC $\pm$ 10% is supplied from the terminal block XT150A and XT150B (The $\pm$ 10% tolerance includes momentary and ripple currents.) For detailed power supply rating of Connector Panel I/O Module, refer to connection manual of Connector Panel I/O Module.
H.5.5 DI/DO (Input/output Signal Specification)	For detailed input/output signal specifications, refer to connection manual of Connector Panel I/O Module.

## **RELAY MODULE A**

I.1 OVERVIEW

I.2 TOTAL CONNECTION

I.3 CONNECTION OF EACH PART I.3.1 Pin Assignment I.3.2 Connection of the Relay Module A

I.4 OUTLINE OF THE RELAY MODULE A

#### **I.5 SPECIFICATIONS**

- I.5.1 Installation Specifications
- I.5.2 Ordering Specifications
- I.5.3 Module Specifications

## I.1 OVERVIEW

Relay Module A has 10 relays and is used when driving the load of the exceeding the rated current of the Connector Panel I/O Module's DO. This module is connected to the Terminal module A "A03B–0815–C021" which the Connector Panel I/O Module is mounted on with a flat cable. And connect one more this module when all of the Connector Panel I/O Module's 16 points of DO are used.

## I.2 TOTAL CONNECTION



#### NOTE

- The first Relay Module A drives 10 relays by 10 points of DO. And the second Relay module A drives 10 relays by 6 points of DO. (In 2 relays, 1 relay is driven by 1 point of DO. In other 8 relays, 2 relays are driven by 1 point of DO.)
- 2 Don't connect the DO used in the Relay module A to Terminal module A side.

## I.3 CONNECTION OF EACH PART

### I.3.1 Pin Assignment

Terminal and Connector pin assignment of the Relay Module A.

Х٦	[1]

2	0014	1	KA1A
2		3	KA1C
4	COMI	5	KA2A
6	COM1	7	KA2C
8	COM2	a	COM2
10	COM2	11	KV3V
12	COM3	10	KASA
14	COM3	13	KA34C
16	COM4	15	KA4A
18	COM4	17	KA5A
20		19	KA56C
20		21	KA6A
22	COIVIS	23	COM5
24	COM6	25	KA7A
26	COM6	27	KA7C
28	COM6	29	KA8A
30	COM7	21	KASC
32	COM7	22	KAGO
26	COM8	33	KAOO
28	COM8	35	KA9C
30	COM8	37	KA10A
32	±24E	39	KA10C
02	TZHL		

XT1 connecting wire Solid : 0.2–6.0mm<sup>2</sup> Stranded : 0.2–4.0mm<sup>2</sup> AWG : AWG24–10 Stranded with ferrules : 0.5–4.0mm<sup>2</sup> (without/with plastic collar) Stripping length : 8mm

XP1			
A01	+24E	B01	+24E
A02		B02	
A03		B03	Yn+0.2
A04	Yn+0.6	B04	Yn+0.0
A05	Yn+1.0	B05	Yn+0.1
A06	Yn+1.2	B06	Yn+0.3
A07	Yn+0.5	B07	Yn+0.7
A08	Yn+1.1	B08	Yn+1.3
A09	Yn+1.4	B09	Yn+1.4
A10	Yn+1.5	B10	Yn+1.5
A11	Yn+1.6	B11	Yn+1.6
A12	Yn+1.7	B12	Yn+1.7
A13		B13	
A14		B14	
A15		B15	
A16		B16	
A17		B17	
A18	Yn+0.4	B18	
A19		B19	
A20		B20	
A21		B21	
A22		B22	
A23		B23	
A24	0V	B24	0V
A25	0V	B25	

XP2			
A01	+24E	B01	+24E
A02		B02	
A03		B03	Yn+1.4
A04	Yn+1.6	B04	Yn+1.2
A05	Yn+1.7	B05	Yn+1.3
A06		B06	Yn+1.4
A07	Yn+1.5	B07	Yn+1.6
A08	Yn+1.7	B08	
A09		B09	
A10		B10	
A11		B11	
A12		B12	
A13		B13	
A14		B14	
A15		B15	
A16		B16	
A17		B17	
A18	Yn+1.5	B18	
A19		B19	
A20		B20	
A21		B21	
A22		B22	
A23		B23	
A24	0V	B24	0V
A25	0V	B25	

XP1, XP2 connector specification of flat cable side is HIF3BA–20D–2.54R

#### I.3.2 Connection of the Relay Module A



#### NOTE

- 1 About Connection of the DI, refer to connection manual of Connector Panel I/O Module.
- 2 At Connection parts of the Terminal Module A, —○ means the terminal "XT150B", —■ means the connector "X150".



#### NOTE

An above figure shows the connection when two Relay module A are used.

		XT1
24E		KA1A 🔶 (1)
i i i	KA1	COM1 (2)
		KA1C (3)
	-	COM1 (4)
		KA2A (5)
	KAD	COM1 (6)
		KA2C (7)
		COM2 (8)
		COM2 (9)
		COM3 (10)
		KA3A (11)
		COM3 (12)
		KA34C (13)
	κΔı	COM3 (14)
		KA4A (15)
	K \ 5	COM4 (16)
		KA5A (17)
	-	COM4 (18)
		KA56C (19)
	KVE	COM4   (20)
		KA6A 🕺 (21)
	_	COM5 (22)
		COM5 (23)
	_	COM6 (24)
		KA7A (25)
	KA7	COM6 (26)
		KA7C (27)
		COM6 (28)
		KA8A (29)
	KA8 –	COM7[ (30)
		KA8C (31)
		COM7 (32)
		KA9A (33)
	KA9 –	COM8(34)
		KA9C∬ (35)
		COM8(36)
		KA10A (37)
	KA10	COM8(38)
		KA10C (39)
		+24E _ (40)

## I.4 OUTLINE OF THE RELAY MODULE A



## I.5 SPECIFICATIONS

#### I.5.1 Installation Specifications

Ambient Temperature	At operation Storing or transporting	0°C to 55°C −20°C to 60°C
Temperature Change	Max. 0.3°C/min	
Relative Humidity	Normally	75% or less (Relative humidity)
	Short time (Within one month)	95% or less (Relative humidity)
Vibration	Operating 0.5G or less	
Environment	Normal FA atmosphere (The examination is necessary when using the system under environments with higher degree of dust, cool- ant, or organic solution.)	
Other Requirements	Use this module in a cabinet that is always completely closed.	

#### I.5.2 Ordering Specifications

ltem	Specification	Remarks
Relay Module A	A20B-1006-0760	

## I.5.3 Module Specifications

ltem		Specification	Remarks
Output Poir	nts	10 points	
Relay coil	Coil resistance	1100Ω	Rated voltage 24VDC
	On voltage	Less than 70% of rated voltage	
	Off voltage	More than 15% of rated voltage	
	Max.permissible voltage	110% of rated voltage	23°C
Relay	Number of contact	1a contact × 10	
contact	Rated load current	250VAC 3A,30VDC 3A	
	Min. load current	5VDC, 100mA	
Terminal	Connection wire	Solid : 0.2 – 6.0mm <sup>2</sup>	
		Stranded : 0.2 – 4.0mm <sup>2</sup>	
		AWG : AWG24–10	
		Stranded with ferrules : 0.5 – 4.0mm <sup>2</sup>	without/with plastic collar
	Strippinglength	8mm	
	Tightening Torque	0.5-0.6Nm	

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