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

MAINTENANCE MANUAL

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Should you wish to export or re-export these products, please contact FANUC for advice.

In this manual we have tried as much as possible to describe all the various matters.

However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.

Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

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SAFETY PRECAUTIONS

This section describes the safety precautions related to the use of CNC units. It is essential that these precautions be observed by users to ensure the safe operation of machines equipped with a CNC unit (all descriptions in this section assume this configuration).

CNC maintenance involves various dangers. CNC maintenance must be undertaken only by a qualified technician.

Users must also observe the safety precautions related to the machine, as described in the relevant manual supplied by the machine tool builder.

Before checking the operation of the machine, take time to become familiar with the manuals provided by the machine tool builder and FANUC.

Contents

DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the maintenance personnel (herein referred to as the user) and preventing damage to the machine. Precautions are classified into Warnings and Cautions 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.

WARNINGS RELATED TO CHECK OPERATION

⚠ **WARNING**

1.   When checking the operation of the machine with the cover removed
     (1) The user's clothing could become caught in the spindle or other components, thus presenting a danger of injury. When checking the operation, stand away from the machine to ensure that your clothing does not become tangled in the spindle or other components.

(2) When checking the operation, perform idle operation without workpiece. When a workpiece is mounted in the machine, a malfunction could cause the workpiece to be dropped or destroy the tool tip, possibly scattering fragments throughout the area. This presents a serious danger of injury. Therefore, stand in a safe location when checking the operation.

2. When checking the machine operation with the power magnetics cabinet door opened

(1) The power magnetics cabinet has a high-voltage section (carrying a ⚠ mark). Never touch the high-voltage section. The high-voltage section presents a severe risk of electric shock. Before starting any check of the operation, confirm that the cover is mounted on the high-voltage section. When the high-voltage section itself must be checked, note that touching a terminal presents a severe danger of electric shock.

(2) Within the power magnetics cabinet, internal units present potentially injurious corners and projections. Be careful when working inside the power magnetics cabinet.

3. Never attempt to machine a workpiece without first checking the operation of the machine. Before starting a production run, ensure that the machine is operating correctly by performing a trial run using, for example, the single block, feedrate override, or machine lock function or by operating the machine with neither a tool nor workpiece mounted. Failure to confirm the correct operation of the machine may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

4. Before operating the machine, thoroughly check the entered data.
Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

5. Ensure that the specified feedrate is appropriate for the intended operation. Generally, for each machine, there is a maximum allowable feedrate. The appropriate feedrate varies with the intended operation. Refer to the manual provided with the machine to determine the maximum allowable feedrate. If a machine is run at other than the correct speed, it may behave unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

6. When using a tool compensation function, thoroughly check the direction and amount of compensation. Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

WARNINGS RELATED TO REPLACEMENT

⚠ **WARNING**

1. Always turn off the power to the CNC and the main power to the power magnetics cabinet. If only the power to the CNC is turned off, power may continue to be supplied to the serve section. In such a case, replacing a unit may damage the unit, while also presenting a danger of electric shock.

2. When it touches the printed-circuit board or the unit, and the cable is connected, consider the appropriate precaution as installs the list bands to prevent damage by static electricity.
The electric circuit might be damaged by static electricity from the human body.

3. When a heavy unit is to be replaced, the task must be undertaken by two persons or more. If the replacement is attempted by only one person, the replacement unit could slip and fall, possibly causing injury.

4. After the power is turned off, the servo amplifier and spindle amplifier may retain voltages for a while, such that there is a danger of electric shock even while the amplifier is turned off. Allow at least twenty minutes after turning off the power for these residual voltages to dissipate.

5.   When replacing a unit, ensure that the new unit has the same parameter and other settings as the old unit. (For details, refer to the manual provided with the machine.) Otherwise, unpredictable machine movement could damage the workpiece or the machine itself, and present a danger of injury.

WARNINGS RELATED TO PARAMETERS

⚠ **WARNING**

1.   When machining a workpiece for the first time after modifying a parameter, close the machine cover. Never use the automatic operation function immediately after such a modification. Instead, confirm normal machine operation by using functions such as the single block function, feedrate override function, and machine lock function, or by operating the machine without mounting a tool and workpiece. If the machine is used before confirming that it operates normally, the machine may move unpredictably, possibly damaging the machine or workpiece, and presenting a risk of injury.

⚠ **CAUTION**

2.   The CNC and PMC parameters are set to their optimal values, so that those parameters usually need not be modified. When a parameter must be modified for some reason, ensure that you fully understand the function of that parameter before attempting to modify it. If a parameter is set incorrectly, the machine may move unpredictably, possibly damaging the machine or workpiece, and presenting a risk of injury.

WARNINGS, CAUTIONS, AND NOTES RELATED TO DAILY MAINTENANCE

⚠ **WARNING**

1.   Memory backup battery replacement
      When replacing the memory backup batteries, keep the power to the machine (CNC) turned on, and apply an emergency stop to the machine. Because this work is performed with the power on and the cabinet open, only those personnel who have received approved safety and maintenance training may perform this work.
      When replacing the batteries, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover).
      Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

NOTE

The CNC uses batteries to preserve the contents of its memory, because it must retain data such as programs, offsets, and parameters even while external power is not applied.
If the battery voltage drops, a low battery voltage alarm is displayed on the machine operator's panel or CRT screen.
When a low battery voltage alarm is displayed, replace the batteries within a week. Otherwise, the contents of the CNC's memory will be lost.
To replace the battery, see the procedure described in Section 2.8 of this manual.

> ⚠ **WARNING**

2.   Absolute pulse coder battery replacement
     When replacing the memory backup batteries, keep the power to the machine (CNC) turned on, and apply an emergency stop to the machine. Because this work is performed with the power on and the cabinet open, only those personnel who have received approved safety and maintenance training may perform this work.
     When replacing the batteries, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover).
     Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

> **NOTE**

The absolute pulse coder uses batteries to preserve its absolute position.
If the battery voltage drops, a low battery voltage alarm is displayed on the machine operator's panel or CRT screen.
When a low battery voltage alarm is displayed, replace the batteries within a week. Otherwise, the absolute position data held by the pulse coder will be lost.
To replace the battery, see the procedure described in Section 2.10 of this manual.

> ⚠ **WARNING**

3.   Fuse replacement
     Before replacing a blown fuse, however, it is necessary to locate and remove the cause of the blown fuse.
     For this reason, only those personnel who have received approved safety and maintenance training may perform this work.
     When replacing a fuse with the cabinet open, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover).
     Touching an uncovered high-voltage circuit presents an extremely dangerous electric shock hazard.

> **NOTE**

Liquid-crystal display
     The liquid-crystal display was fabricated using a very precise processing technology. However, please note in mind that it may have dead and always-on pixels because of its characteristics and this is not a failure.

PREFACE

The manual consists of the following chapters:

Description of this manual

1. **DISPLAY AND OPERATION**
    This chapter covers those items, displayed on the screen, that are related to maintenance. A list of all supported operations is also provided at the end of this chapter.

2. **LCD-MOUNTED TYPE CNC HARDWARE**

3. **STAND-ALONE TYPE CNC HARDWARE**

4. **MATTERS COMMON TO BOTH LCD-MOUNTED TYPE AND STAND-ALONE TYPE (HARDWARE)**
    This chapter describes the configuration of the hardware, lists the hardware units, and explains how to replace printed-circuit boards.

5. **INPUT AND OUTPUT OF DATA**
    This chapter describes the input/output procedures for data, including programs, parameters, and tool compensation data.

6. **INTERFACE BETWEEN CNC AND PMC**
    This chapter describes the PMC specifications, the system configuration, and the signals used by the PMC.

7. **EMBEDDED ETHERNET FUNCTION**
    This chapter describes the embedded Ethernet.

8. **DIGITAL SERVO**
    This chapter describes the servo tuning screen and how to adjust the reference position return position.

9. **AC SPINDLE**
    This chapter describes the spindle tuning screen.

10. **TROUBLESHOOTING**
    This chapter describes the procedures to be followed in the event of certain problems occurring, for example, if the power cannot be turned on or if manual operation cannot be performed. Countermeasures to be applied in the event of alarms being output are also described.

11. **MOTOR/DETECTOR/AMPLIFIER PREVENTIVE MAINTENANCE**
    This chapter describes the basic information about the preventive maintenance of motors, detectors, and amplifiers.

APPENDIX
-   A. ALARM LIST
-   B. LIST OF MAINTENANCE PARTS
-   C. BOOT SYSTEM
-   D. MEMORY CARD SLOT
-   E. LED DISPLAY
-   F. MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)
-   G. IPL MONITOR
-   H. MEMORY CLEAR

This manual does not provide a parameter list. If necessary, refer to the separate PARAMETER MANUAL.

Applicable models

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

Model name	Abbreviation			
FANUC Series 0i -TD	0i -TD	Series 0i -D	0i -D
FANUC Series 0i -MD	0i -MD		
FANUC Series 0i Mate -TD	0i Mate -TD	Series 0i Mate -D	0i Mate -D
FANUC Series 0i Mate -MD	0i Mate -MD		

NOTE
1 For explanation purposes, these models may be classified as shown below:
   - T series: 0i -TD / 0i Mate -TD
   - M series: 0i -MD / 0i Mate -MD
2 Some function described in this manual may not be applied to some products.
   For details, refer to the DESCRIPTIONS manual (B-64302EN).
3 The 0i -D / 0i Mate -D requires setting of parameters to enable part of basic
   functions. For the parameters to be set, see Section 4.51, "PARAMETERS OF 0i
   -D / 0i Mate -D BASIC FUNCTIONS" in the PARAMETER MANUAL
   (B-64310EN).

Related manuals of Series 0*i* -D, Series 0*i* Mate -D

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

Table 1 Related manuals of Series 0*i*-D, Series 0*i* Mate-D

Manual name	Specification number	
DESCRIPTIONS	B-64302EN	
CONNECTION MANUAL (HARDWARE)	B-64303EN	
CONNECTION MANUAL (FUNCTION)	B-64303EN-1	
USER'S MANUAL (Common to Lathe System/Machining Center System)	B-64304EN	
USER'S MANUAL (For Lathe System)	B-64304EN-1	
USER'S MANUAL (For Machining Center System)	B-64304EN-2	
MAINTENANCE MANUAL	B-64305EN	*
PARAMETER MANUAL	B-64310EN	
START-UP MANUAL	B-64304EN-3	
Programming		
Macro Executor PROGRAMMING MANUAL	B-64303EN-2	
Macro Compiler PROGRAMMING MANUAL	B-64303EN-5	
C Language Executor PROGRAMMING MANUAL	B-64303EN-3	
PMC		
PMC PROGRAMMING MANUAL	B-64393EN	
Network		
PROFIBUS-DP Board CONNECTION MANUAL	B-64403EN	
Fast Ethernet / Fast Data Server OPERATOR'S MANUAL	B-64414EN	
DeviceNet Board CONNECTION MANUAL	B-64443EN	
FL-net Board CONNECTION MANUAL	B-64453EN	
Dual Check Safety		
Dual Check Safety CONNECTION MANUAL	B-64303EN-4	
Operation guidance function		
MANUAL GUIDE *i* (Common to Lathe System/Machining Center System) OPERATOR'S MANUAL	B-63874EN	
MANUAL GUIDE *i* (For Machining Center System) OPERATOR'S MANUAL	B-63874EN-2	
MANUAL GUIDE *i* Set-up Guidance OPERATOR'S MANUAL	B-63874EN−1	
MANUAL GUIDE 0*i* OPERATOR'S MANUAL	B-64434EN	
TURN MATE *i* OPERATOR'S MANUAL	B-64254EN	
CNC Screen Display function		
CNC Screen Display Function OPERATOR'S MANUAL	B-63164EN	

Related manuals of SERVO MOTOR α*i*s/β*i*s/α*i*/β*i* series

The following table lists the manuals related to SERVO MOTOR α*i*s/β*i*s/α*i*/β*i* series

Table 2 Related manuals of SERVO MOTOR α*i*s/β*i*s/α*i*/β*i* series

Manual name	Specification number
FANUC AC SERVO MOTOR α*i* series DESCRIPTIONS	B-65262EN
FANUC AC SPINDLE MOTOR α*i* series DESCRIPTIONS	B-65272EN
FANUC AC SERVO MOTOR β*i* series DESCRIPTIONS	B-65302EN
FANUC AC SPINDLE MOTOR β*i* series DESCRIPTIONS	B-65312EN
FANUC SERVO AMPLIFIER α*i* series DESCRIPTIONS	B-65282EN
FANUC SERVO AMPLIFIER β*i* series DESCRIPTIONS	B-65322EN
FANUC AC SERVO MOTOR α*i*s series FANUC AC SERVO MOTOR α*i* series FANUC AC SPINDLE MOTOR α*i* series FANUC SERVO AMPLIFIER α*i* series MAINTENANCE MANUAL	B-65285EN
FANUC SERVO MOTOR β*i*s series FANUC AC SPINDLE MOTOR β*i* series FANUC SERVO AMPLIFIER β*i* series MAINTENANCE MANUAL	B-65325EN
FANUC AC SERVO MOTOR α*i* series FANUC AC SERVO MOTOR β*i* series FANUC LINEAR MOTOR L*i*S series FANUC SYNCHRONOUS BUILT-IN SERVO MOTOR D*i*S series PARAMETER MANUAL	B-65270EN
FANUC AC SPINDLE MOTOR α*i* series FANUC AC SPINDLE MOTOR β*i* series BUILT-IN SPINDLE MOTOR B*i* series PARAMETER MANUAL	B-65280EN

This manual mainly assumes that the FANUC SERVO MOTOR α*i* series of servo motor is used. For servo motor and spindle information, refer to the manuals for the servo motor and spindle that are actually connected.

Related manuals of FANUC PANEL *i*

The following table lists the manuals related to FANUC PANEL *i*.

Table 3 Related manuals of FANUC PANEL *i*

Manual name	Specification number
FANUC PANEL *i* CONNECTION AND MAINTENANCE MANUAL	B-64223EN

TABLE OF CONTENTS

APPENDIX

1   DISPLAY AND OPERATION

This chapter describes how to display various screens by the function keys.
The screens used for maintenance are respectively displayed.

1.1   FUNCTION KEYS AND SOFT KEYS

Operations and soft key display status for each function key are described below:

1.1.1   Soft Key Structure

The function keys are used to select the type of screen (function) to be displayed. When a soft key
(section select soft key) is pressed immediately after a function key, the screen (section) corresponding to
the selected function can be selected.

1.1.2   General Screen Operations

-   Procedure
1   By pressing a function key on the MDI panel, the chapter selection soft keys that belong to the
    function are displayed.
    Example 1)

Operation selection key

Chapter selection soft keys   Continuous menu key
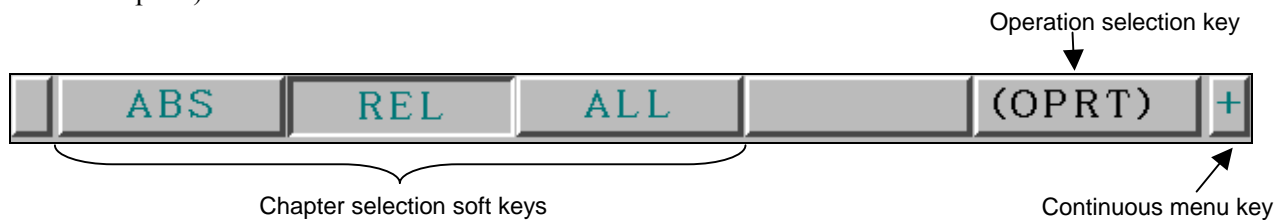
2   When one of the chapter selection soft keys is pressed, the screen of the chapter is displayed.   If the
    soft key of a desired chapter is not displayed, press the continuous menu key.
    In a chapter, a further choice may be made from multiple chapters.

3   When the screen of a desired chapter is displayed, press the operation selection key to display
    operations (operation selection soft keys).   If address/numeric keys are used, operation selection
    soft keys may be displayed automatically.

Example 2)

```
((  PRESET    ORIGIN                        PTSPRE   RUNPRE       ))
```

↑
Return menu key   Operation selection soft keys

4   Select a desired operation with the operation selection soft key.
    Depending on the operation to be executed, an auxiliary menu of soft keys is displayed.   Perform
    an operation according to the indications on the auxiliary menu.

Example 3)

```
((                           ALL-AX                  EXEC         ))
```

Auxiliary menu

5   To return to the display of chapter selection soft keys, press the return menu key.

A general screen display procedure is provided above.
The actual display procedure varies from one screen to another.
For details, see each description of operation.

- Button design change depending on soft key state

The soft keys to be displayed depend on the object to be selected.
- Chapter selection soft keys
- Operation selection soft keys
- Auxiliary menu of operation selection soft keys

Depending on the state, the button images of the soft keys change.
From the button images, which state the soft keys are assuming can be known.

Example 1)
    For the 8.4-inch LCD display unit
    Chapter selection soft keys

```
       ABS      REL      ALL               (OPRT)  +
```

    Operation selection soft keys

```
   ((PRESET   ORIGIN             PTSPRE   RUNPRE     ))
```

    Operation selection keys, auxiliary menu

```
   ((                  ALL-AX             EXEC      ))
```

Example 2)
    For the 10.4-inch LCD display unit
    Chapter selection soft keys

```
   ABSOLU RELATI  ALL   HANDLE (OPRT) +
   TE     VE
```

    Operation selection soft keys

```
   PRESET ORIGIN            PTSPRE RUNPRE
```

Operation selection keys, auxiliary menu

		ALL AXIS		EXEC	

1.1.3   Function Keys

Function keys are provided to select the type of screen to be displayed. The following function keys are provided on the MDI panel:

Press this key to display the position screen.

Press this key to display the program screen.

Press this key to display the offset/setting screen.

Press this key to display the system screen.

Press this key to display the message screen.

Press this key to display the graphics screen.
For the small MDI unit, press [image].

Press this key to display the custom screen 1 (conversational macro screen or C language executor screen).
For the small MDI unit, press [image].

Press this key to display the custom screen 2 (conversational macro screen or C language executor screen).
For the small MDI unit, there is no key that corresponds to this key.

1.1.4   Soft Keys

By pressing a soft key after a function key, the corresponding screen of the function can be displayed.

The chapter selection soft keys of each function are described below.
The four keys on the right-hand side are assigned to chapter selection soft keys.   When multiple pages are used for chapter selection soft keys, [+] is displayed on the continuous menu key (rightmost soft key). Press the continuous menu key to switch between chapter selection soft keys.

> **NOTE**
> 1   Press function keys to switch between screens that are used frequently.
> 2   Some soft keys are not displayed depending on the option configuration or parameter setting.

For the 10.4-inch LCD display unit, when pressing other than function key [⊞ POS] indicates positional display on the left side of the screen, the left half of the soft keys are shown below.

| < | ABSOLU TE | RELATI VE | ALL | HANDLE | |

or

| < | ABSOLU TE | RELATI VE | ALL | HANDLE | MONITO R |

As for the soft key [MONITOR], refer to the Section III-12.8 in User's Manual (Common to Lathe System/Machining Center System).
Refer to the next page for other soft keys.

Position display screen

The chapter selection soft keys that belong to the function key [⊞ POS] and the function of each screen are described below.

	(1)	(2)	(3)	(4)	(5)	
Page 1	ABS	REL	ALL	HNDL	(OPRT)	+

	(6)	(7)	(8)	(9)	(10)	
Page 2	MONI				(OPRT)	+

Table 1.1.4 (a)   Position display screen

No.	Chapter menu	Description
(1)	ABS (ABSOLUTE)	Selects the absolute coordinate display screen.
(2)	REL (RELATIVE)	Selects the relative coordinate display screen.
(3)	ALL (ALL)	Selects the overall coordinate display screen.
(4)	HNDL (HANDLE)	Selects the operation screen for manual handle operation.
(6)	MONI (MONITOR)	Selects the screen for displaying the servo axis load meter, serial spindle load meter, and speedometer. (Bit 5 (OPM) of Parameter No.3111 = 1 / See Section 1.5)

*   The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

Program screen

The chapter selection soft keys that belong to the function key [PROG] and the function of each screen are described below.

In the MEM/RMT mode

	(1)	(2)	(3)	(4)	(5)	
Page 1		PROGRM	CHECK	CURRENT	NEXT	(OPRT)	+

	(6)	(7)	(8)	(9)	(10)	
Page 2		RESTART	DIR			(OPRT)	+

In the MDI mode

	(1)	(2)	(3)	(4)	(5)	
Page 1		PROGRM	MDI	CURRENT	NEXT	(OPRT)	+

	(6)	(7)	(8)	(9)	(10)	
Page 2		RESTART	DIR			(OPRT)	+
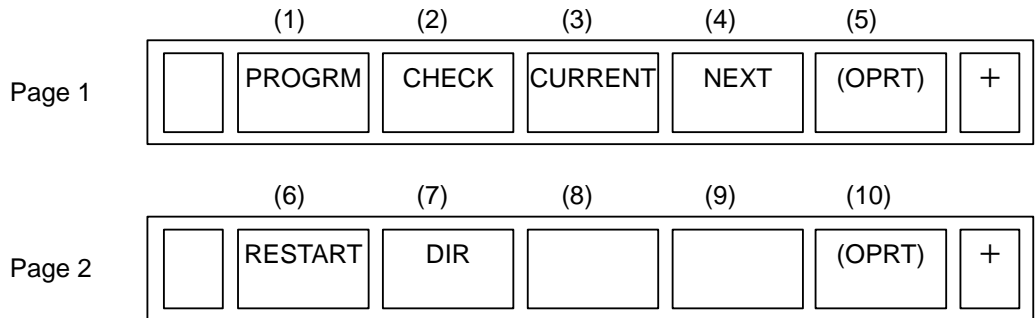
In the EDIT/TJOG/THND mode

	(1)	(2)	(3)	(4)	(5)	
Page 1		PROGRM	DIR		C.A.P	(OPRT)	+

In the JOG/HND/REF mode

	(1)	(2)	(3)	(4)	(5)	
Page 1		PROGRM		CURRENT	NEXT	(OPRT)	+

	(6)	(7)	(8)	(9)	(10)	
Page 2		RESTART	DIR			(OPRT)	+

- 5 -
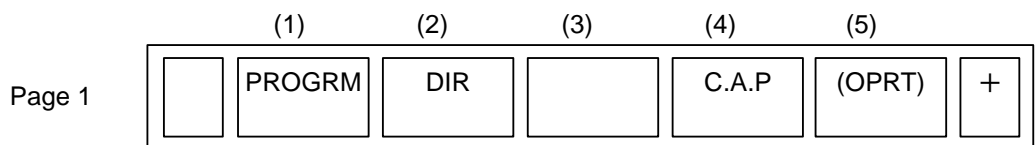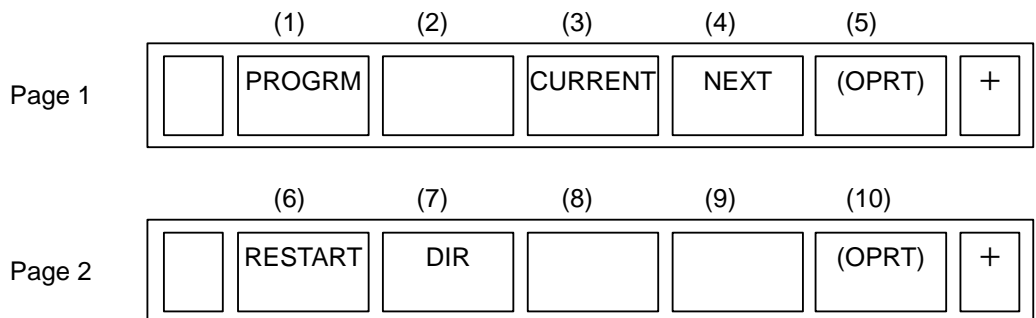
Table 1.1.4 (b)   Program

No.	Chapter menu	Description
(1)	PROGRM (PROGRAM)	Selects the screen for displaying a list of part programs currently registered.
(2)	CHECK	Selects the program check screen for displaying program and axis positions and modal command values. (Only for the 8.4- or 10.4-inch display unit used for simultaneous 2-path displays)
(2)	MDI (MDI)	Selects the screen for editing and displaying a program in the MDI mode. (Only in the MDI mode)
(3)	CURRENT	Selects the screen for displaying the modal command value and the command value of the block currently being executed from command values. (Only for the 8.4-inch display unit)
(4)	NEXT (NEXT BLOCK)	Selects the screen for displaying the command value of the block currently being executed and the command value of the block to be executed next from command values.
(4)	C.A.P (C.A.P)	Selects the screen for figure conversational input or the screen of MANUAL GUIDE 0*i*. (Displayed only in the EDIT mode.)
(6)	RESTART (RESTART)	Selects the operation screen for restarting an interrupted program operation.
(2) (7)	DIR (DIR)	Selects the screen for displaying a list of part programs currently registered.

*   The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

Offset/setting screen

The chapter selection soft keys that belong to the function key [OFS] and the function of each screen are described below.

Page 1 — (1) OFFSET (2) SETTING (3) WORK (4) (5) (OPRT) +

Page 2 — (6) MACRO (7) MENU (8) OPR (9) TOOLLF (10) (OPRT) +

Page 3 — (11) OFST.2 (12) W.SHFT (13) (14) BARRIER (15) (OPRT) +

Page 4 — (16) (17) PR-LEV (18) (19) (20) (OPRT) +

	(21)	(22)	(23)	(24)	(25)

Page 5   [ ] [ ] [LANG.] [PROT.] [GUARD] [(OPRT)] [+]
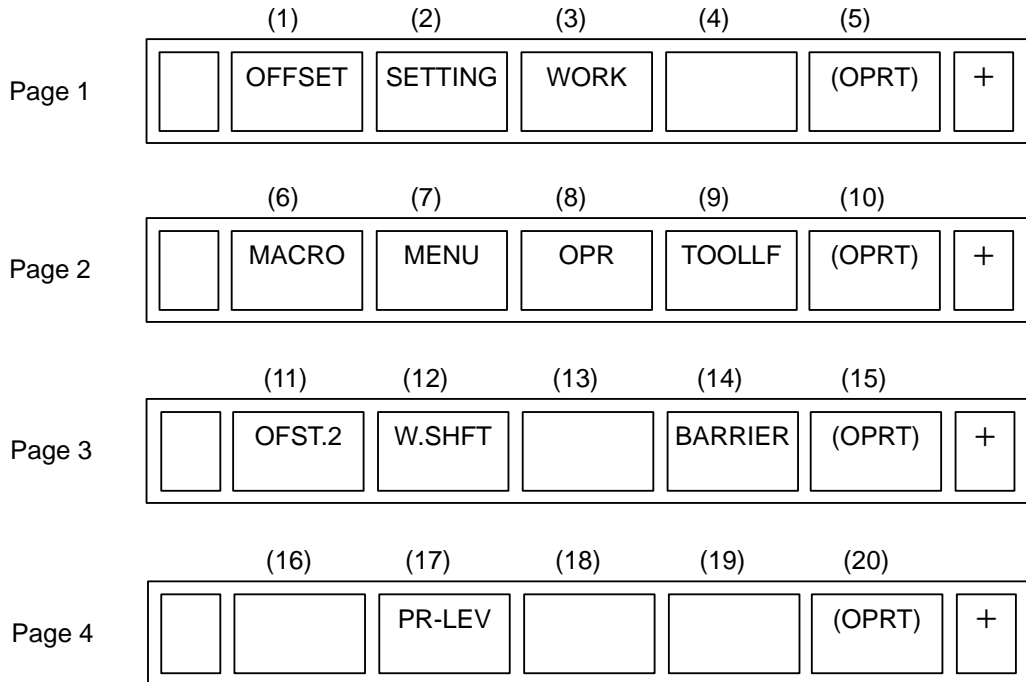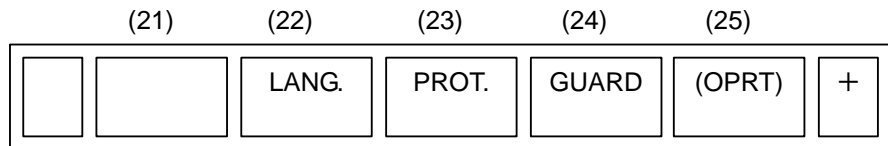
Table 1.1.4 (c)   Offset

No.	Chapter menu	Description
(1)	OFFSET (OFFSET)	Selects the screen for setting tool offset values.
(2)	SETTING (SETTING)	Selects the screen for setting the setting parameters.
(3)	WORK (WORK)	Selects the screen for setting a workpiece coordinate system offset.
(6)	MACRO (MACRO)	Selects the screen for setting macro variables.
(7)	MENU (PATTERN MENU)	Selects the screen for setting pattern data. (Pattern data input)
(8)	OPR (OPERAT PANEL)	Selects the screen for operating part of the operation switches on the machine operator's panel as soft switches on the CNC screen. (Software operator's panel)
(9)	TOOLLF (TOOL LIFE)	Selects the screen for setting tool life data.
(11)	OFST.2 (Y OFFSET)	Selects the screen for setting Y-axis offsets. (Only for the T series)
(12)	W.SHFT (WORK SHIFT)	Selects the screen for setting workpiece coordinate system shift values. (Only for the T series)
(14)	BARRIER (BARRIER)	Selects the chuck tail stock barrier screen. (Only for the T series)
(17)	PR-LEV (PRECI LEVEL)	Selects the screen for setting precision levels. (Machining condition selection function)
(22)	LANG. (LANGUAGE)	Selects the screen for setting a display language.
(23)	PROT. (PROTECT)	Selects the screen for setting 8-level data protection.
(24)	GUARD (GUARD)	Selects the screen for setting wrong operation prevention.

*   The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

System screen

The chapter selection soft keys that belong to the function key [⬨ SYSTEM] and the function of each screen are described below.

	(1)	(2)	(3)	(4)	(5)

Page 1   [ ] [PARAM] [DGNOS] [ ] [SYSTEM] [(OPRT)] [+]

	(6)	(7)	(8)	(9)	(10)

Page 2   [ ] [ ] [PITCH] [SV.SET] [SP.SET] [(OPRT)] [+]

	(11)	(12)	(13)	(14)	(15)	
Page 3		W.DGNS	ALL IO		OPEHIS		+

	(16)	(17)	(18)	(19)	(20)	
Page 4		PMCMNT	PMCLAD	PMCCNF	PM.MGR	(OPRT)	+

	(21)	(22)	(23)	(24)	(25)	
Page 5		COLOR	MAINTE	M-INFO		(OPRT)	+

	(26)	(27)	(28)	(29)	(30)	
Page 6			FSSB	PRMSET		(OPRT)	+

	(31)	(32)	(33)	(34)	(35)	
Page 7		EMBED	PCMCIA	ETHBRD	FL-net	(OPRT)	+

	(36)	(37)	(38)	(39)	(40)	
Page 8		RMTDIAG	M-TUN			(OPRT)	+

	(41)	(42)	(43)	(44)	(45)	
Page 9		ID-INF		MEMORY		(OPRT)	+

	(46)	(47)	(48)	(49)	(50)	
Page 10		PROF.M	PROF.S	DNET M	DNET S	(OPRT)	+
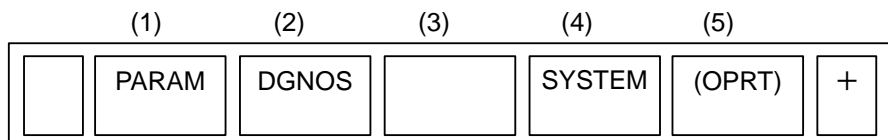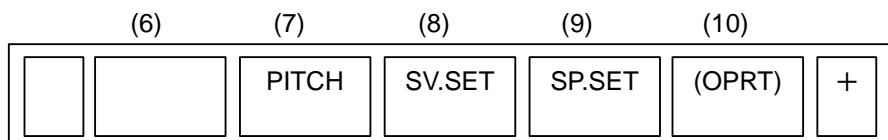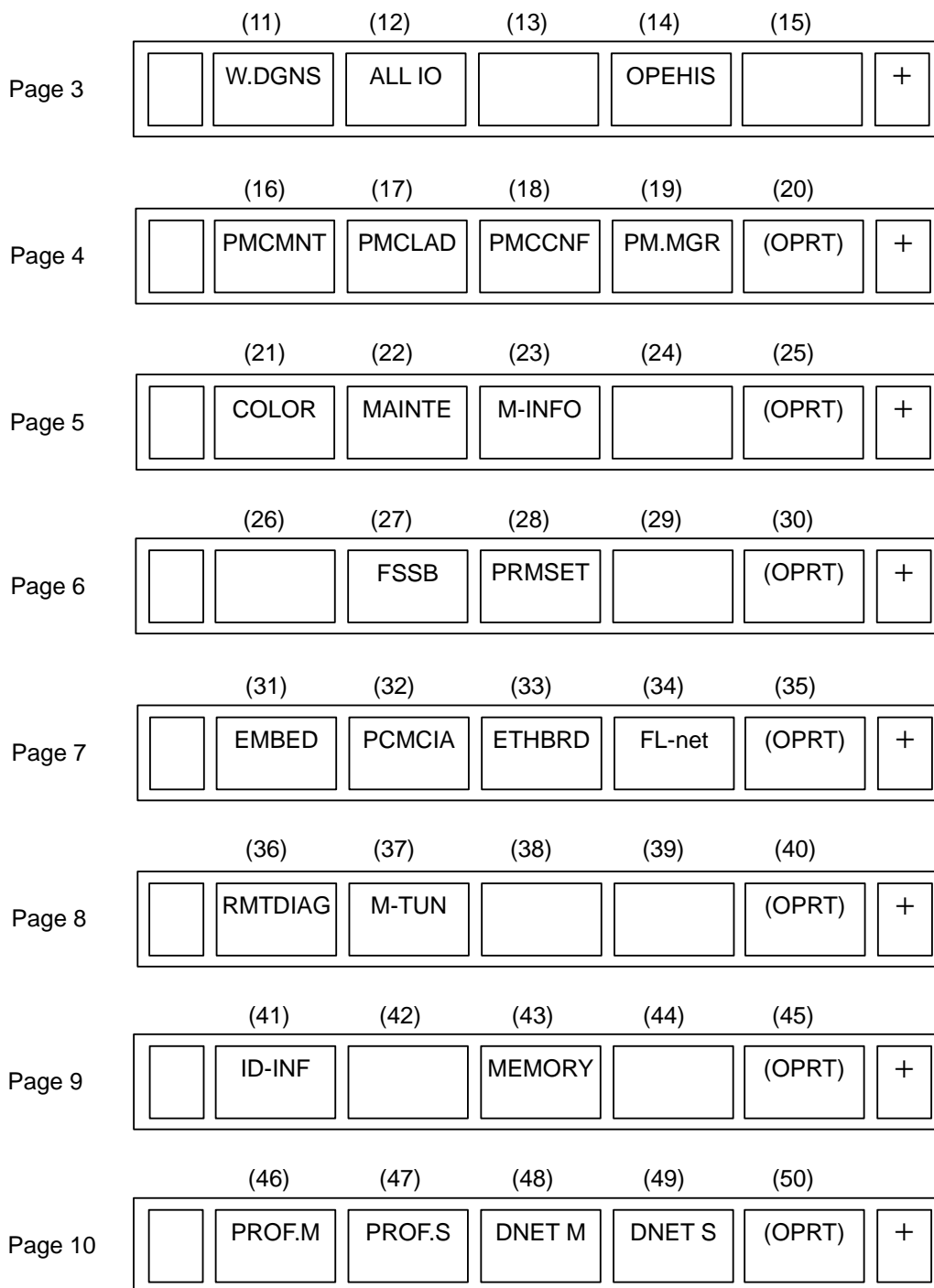
Table 1.1.4 (d)   System

No.	Chapter menu	Description
(1)	PARAM (PARAMETER)	Selects the screen for setting parameters.
(2)	DGNOS (DIAGNOSIS)	Selects the screen for displaying CNC state. (See Section 1.3)
(4)	SYSTEM (SYSTEM)	Selects the screen for displaying the current system status.
(7)	PITCH (PITCH ERROR)	Selects the screen for setting pith error compensation.

No.	Chapter menu	Description
(8)	SV.SET (SERVO SETTING)	Selects the screen for setting the servo-related parameters. (See Section 8.3)
(9)	SP.SET (SPINDLE SETTING)	Selects the screen for spindle-related setting. (See Section 9.1.2)
(11)	W.DGNS (WAVE DIAG)	Selects the screen for displaying data such as servo positional deviation values, torque values, machine signals, and so forth as graphs. (See Section 1.6)
(12)	ALL IO (ALL IO)	Selects the screen for inputting or outputting data.
(14)	OPEHIS (OPERAT HISTRY)	Selects the screen for displaying the history of operations performed by the operator and issued alarms.
(16)	PMCMNT (PMC MAINTE)	Selects the screen related to PMC maintenance such as PMC signal state monitoring and tracing, and PMC parameter display/editing. (See Section 6.4)
(17)	PMCLAD (PMC LADDER)	Selects the screen related to ladder display/editing. (See Section 6.5)
(18)	PMCCNF (PMC CONFIG)	Displays the screen for displaying/editing data other than ladders that makes up a sequence program and for setting the PMC function.
(19)	PM.MGR (P.MATEMGR.)	Select the screen of Power Mate CNC Manager. (See Section 1.8)
(21)	COLOR (COLOR)	Selects the screen for setting colors to be used on the screen. (See Section 1.7)
(22)	MAINTE (PERIOD MAINTE)	Selects the screen for setting maintenance items to be managed periodically.
(23)	M-INFO (MAINTE INFO)	Selects the screen for displaying information about maintenance performed. (See Section 1.9)
(27)	FSSB (FSSB)	Selects the screen for making settings related to the high-speed serial servo bus (FSSB: Fanuc Serial Servo Bus). (See Section 8.2)
(28)	PRMSET (PARAMETER)	Selects the screen for setting parameters necessary for start-up and tuning.
(31)	EMBED (EMBED PORT)	Selects the screen for making settings related to the embedded Ethernet (embedded port).
(32)	PCMCIA (PCMCIA LAN)	Selects the screen for making settings related to the embedded Ethernet (PCMCIA Ethernet card).
(33)	ETHBRD (ETHER BOARD)	Selects the screen for making settings related to the fast Ethernet/fast data server.
(34)	FL-net (FL-net)	Selects the screen for making settings related to FL-net.
(36)	RMTDIAG (REMOTE DIAG)	Selects the screen for making settings related to remote diagnosis.
(37)	M-TUN (MCHN TUNING)	Displays the screen for setting the parameter set for emphasis on speed (LV1) or emphasis on precision (LV10).
(43)	MEMORY (MEMORY)	Selects the screen for displaying the contents of memory.
(46)	PROF.M (PROFI MASTER)	Selects the screen for making settings related to the Profibus master function.
(47)	PROF.S (PROFI SLAVE)	Selects the screen for making settings related to the Profibus slave function.
(48)	DNET M (DEVNETMASTER)	Selects the screen for making settings related to the DeviceNet master function.
(49)	DNET S (DEVNETSLAVE)	Selects the screen for making settings related to the DeviceNet slave function.

*   The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

Message screen

The chapter selection soft keys that belong to the function key [?] MESSAGE and the function of each screen are described below.

	(1)	(2)	(3)	(4)	(5)
Page 1		ALARM	MSG	HISTRY			+

	(6)	(7)	(8)	(9)	(10)
Page 2			MSGHIS				+

	(11)	(12)	(13)	(14)	(15)
Page 3		EMB LOG	PCM LOG	BRD LOG	FL-net		+
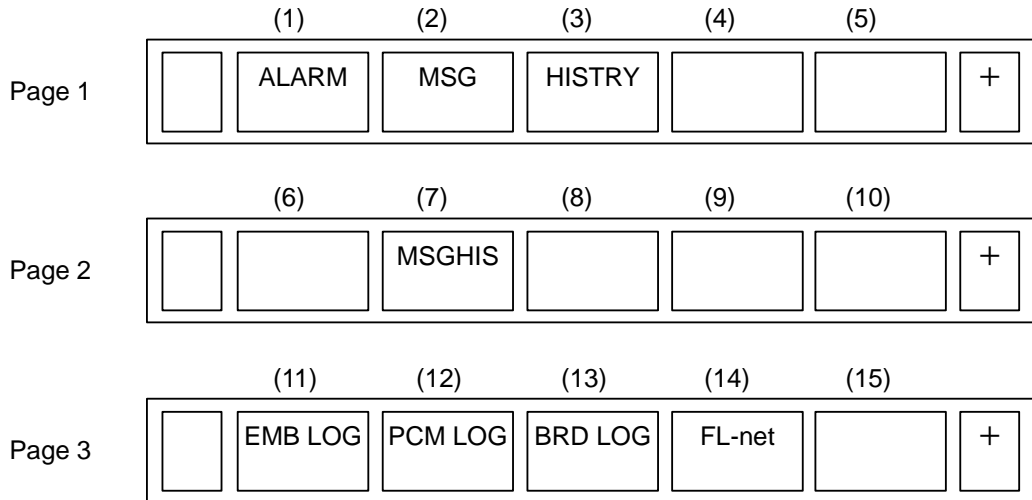
Table 1.1.4 (e)   Message

No.	Chapter menu	Description
(1)	ALARM (ALARM)	Selects the alarm message screen. (See Appendix A, "ALARM LIST")
(2)	MSG (MESSAGE)	Selects the operator message screen.
(3)	HISTRY (HISTRY)	Selects the screen for displaying the details of alarms issued so far.
(7)	MSGHIS (MESAGE HISTRY)	Selects the external operator message screen. (Bit 2 (OMH) of Parameter No.3112)
(11)	EMB LOG (EMBED LOG)	Selects the screen for displaying error messages related to the embedded Ethernet (embedded port).
(12)	PCM LOG (PCMCIA LOG)	Selects the screen for displaying error messages related to the embedded Ethernet (PCMCIA Ethernet card).
(13)	BRD LOG (BOARD LOG)	Selects the screen for displaying error messages related to the fast Ethernet/fast data server.
(14)	FL-net (FL-net MSG)	Selects the screen for displaying error messages related to the FL-net.

* The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

Graphic screen

The chapter selection soft keys that belong to the function key [GRAPH] and the function of each screen are described below.

When the graphic display function is enabled:

	(1)	(2)	(3)	(4)	(5)
		PARAM	GRAPH	GRAPH	LARGE	(OPRT)	
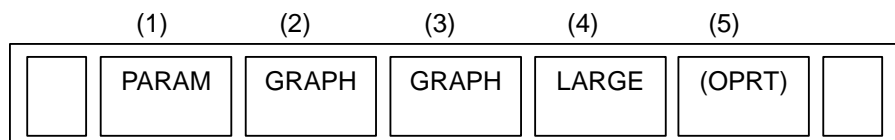
Table 1.1.4 (f)   Graphic

No.	Chapter menu	Description
(1)	PARAM (PARAMETER)	Selects the screen for setting graphic parameters.
(2)	GRAPH (GRAPH)	Selects the screen for performing the graphic display of tool paths. (For the M series system)
(3)	GRAPH (GRAPH)	Selects the screen for performing the graphic display of tool paths. (For the T series system)
(4)	LARGE (LARGE)	Displays the soft key for setting the scaling factor of graphic display.

*   The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

When the dynamic graphic display function is enabled

M series :

	(1)	(2)	(3)	(4)	(5)	
	PARAM	EXEC	EXEC	POS	(OPRT)	+

	(6)	(7)	(8)	(9)	(10)	
	PARAM	3-PLN			(OPRT)	+

T series :

	(6)	(7)	(8)	(9)	(10)	
	PARAM		GRAPH	LARGE	(OPRT)	
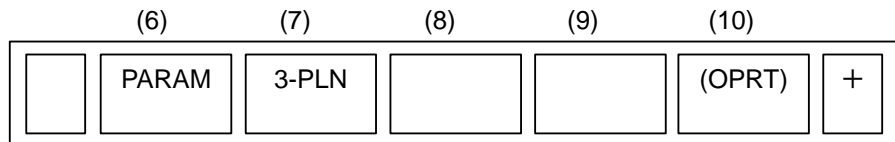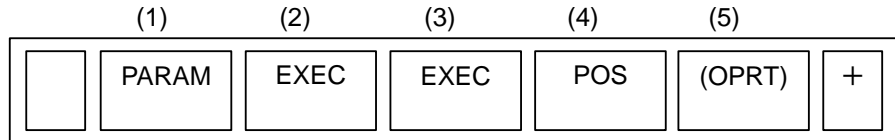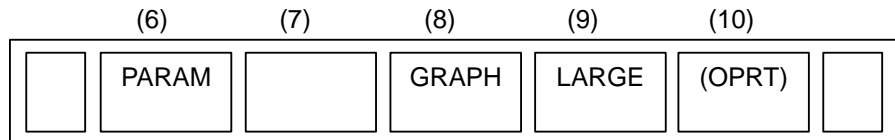
Table 1.1.4 (g)   Graphic (for dynamic graphic)

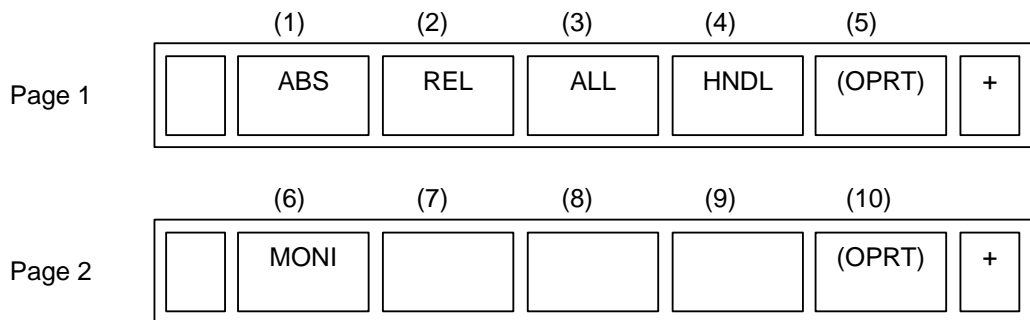| No.	Chapter menu	Description
(1) (6) (11)	PARAM (PARAMETER)	Selects the screen for setting drawing parameters.
(2)	EXEC (EXEC)	Selects the screen for drawing tool paths.
(3)	EXEC (EXEC)	Selects the screen for drawing animation.
(4)	POS (POSITION)	Selects the screen for displaying tool positions on tool paths during drawing tool paths.
(7)	3-PLN (3-PLN)	Selects the screen for displaying 3-plane drawings in animated simulation.
(13)	GRAPH (GRAPH)	Selects the screen for performing the graphic display of tool paths.
(14)	LARGE (LARGE)	Displays the soft key for setting the scaling factor of graphic display.

*1   The items enclosed by parentheses on the second line under "Chapter menu" are displayed in the 10.4-inch display unit.

*2   Item (2) and item (3) are displayed alternately each time function key ⌨ is pressed.

1.2   SYSTEM CONFIGURATION SCREEN

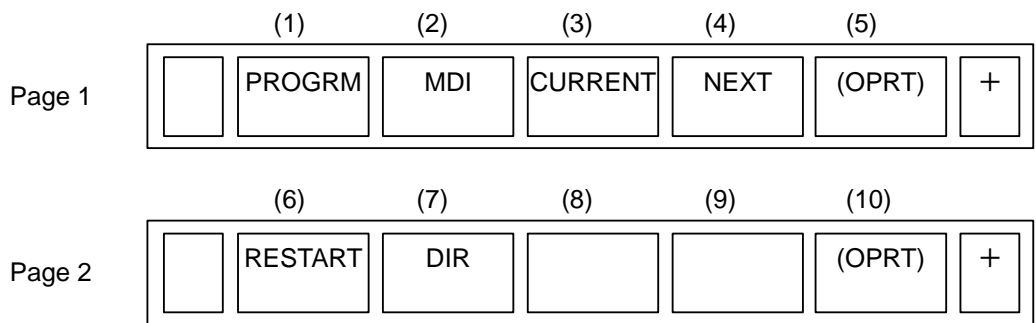After the system has started normally, you can find the types of installed hardware and software types by displaying a system configuration screen.

1.2.1   Display Method

1   Press the function key [SYSTEM] to display the screen for parameters and other data.
2   Pressing the soft key [SYSTEM] causes a system configuration screen to appear.
3   Two types of system configuration screen, the hardware configuration screen and software configuration screen, are provided, and you can switch between these screens by using the [PAGE↑] [PAGE↓] page keys.

When all information cannot be displayed on one page of the screen, you can switch to the next page by using the [PAGE↑] [PAGE↓] keys.

1.2.2   Hardware Configuration Screen

- **Screen display**

```
SYSTEM CONFIG/HARD              O0000 N00000

       NAME        ID-1      ID-2   SLOT
MAIN BOARD
MAIN BOARD     00429 80 0 70000203
SERVO CARD     0014B 30 0
FROM/SRAM      C3/04
OPTION BOARD
ETHER/DTSVR    00701 30 1              1
DISPLAY
DISP ID        1011
OTHERS
MDI ID         14
POWER SUPPLY   10
```

- **Displayed information**

The following explains the displayed information:
1.   NAME
     MAIN BOARD
     •   Displays information on the main board, and cards and modules on the main board.
     OPTION BOARD
     •   Displays information on the board installed in the option slot.
     DISPLAY
     •   Displays information on the display unit.
     OTHERS
     •   Displays information on other components (such as an MDI and a basic unit).
2.   ID-1, ID-2
     •   Displays the ID of each hardware component. For the details of the hardware ID, see section 2.5 or section 3.5.
3.   SLOT
     •   Displays the number of the slot in which the option board is inserted.

1.2.3   Software Configuration Screen

- **Screen display**

```
SYSTEM CONFIG/SOFT                    N00000

     SYSTEM       SERIES  EDITION
 CNC(BASIC)       D4F1    01.0
 CNC(OPT A1)      D4F1    01.0
 CNC(OPT A2)      D4F1    01.0
 CNC(OPT A3)      D4F1    01.0
 CNC(MSG ENG)     D4F1    01.0
 CNC(MSG JPN)     D4F1    01.0
 CNC(MSG DEU)     D4F1    01.0
 CNC(MSG FRA)     D4F1    01.0
 CNC(MSG CHT)     D4F1    01.0
 CNC(MSG ITA)     D4F1    01.0
 CNC(MSG KOR)     D4F1    01.0
 CNC(MSG ESP)     D4F1    01.0
```

- **Displayed information**

The following explains the displayed information:

  SYSTEM :   Software type
  SERIES: Software series
  EDITION: Software edition

- **Displayed systems and corresponding software types**

The following lists the correspondence between displayed systems and software:

System	Software type
CNC(BASIC)	CNC basic software
CNC(OPT A1)	Option assembly A1
CNC(OPT A2)	Option assembly A2
CNC(OPT A3)	Option assembly A3
CNC(MSG ENG)	Language indication (English)
CNC(MSG JPN)	Language indication (Japanese)
CNC(MSG DEU)	Language indication (German)
CNC(MSG FRA)	Language indication (French)
CNC(MSG CHT)	Language indication (Chinese (traditional characters))
CNC(MSG ITA)	Language indication (Italian)
CNC(MSG KOR)	Language indication (Korean)
CNC(MSG ESP)	Language indication (Spanish)
CNC(MSG NLD)	Language indication (Dutch)
CNC(MSG DAN)	Language indication (Danish)
CNC(MSG PTG)	Language indication (Portuguese)
CNC(MSG PLK)	Language indication (Polish)
CNC(MSG HUN)	Language indication (Hungarian)
CNC(MSG SVE)	Language indication (Swedish)
CNC(MSG CSY)	Language indication (Czech)
CNC(MSG CHS)	Language indication (Chinese (simplified characters))
CNC(MSG RUS)	Language indication (Russian)
CNC(MSG TRK)	Language indication (Turkish)
BOOT	Boot system
PMC(SYSTEM)	PMC function
PMC(LADDER1)	PMC ladder
SERVO	Digital servo software

System	Software type
SPINDLE-1	Spindle 1
SPINDLE-2	Spindle 2
SPINDLE-3	Spindle 3
GRAPHIC	Graphic function
MACRO EXE1	Macro executor 1
MACRO EXE2	Macro executor 2
MACRO EXE3	Macro executor 3
MACRO EXE4	Macro executor 4
MACRO EXE5	Macro executor 5
MACRO EXE6	Macro executor 6
MACRO MGI-M	MANUAL GUIDE i (macro executor for M series)
MACRO MGI-T	MANUAL GUIDE i (macro executor for T series)
MACRO MG0ME	MANUAL GUIDE 0i (macro executor for M series execution macro)
MACRO MG0MC	MANUAL GUIDE 0i (macro executor for M series conversation macro)
MACRO MG0TE	MANUAL GUIDE 0i (macro executor for T series execution macro)
MACRO MG0TC	MANUAL GUIDE 0i (macro executor for T series conversation macro)
MG0ILIB	Library for MANUAL GUIDE 0i
MG0IAPL	Application for MANUAL GUIDE 0i
MACRO TMITE	TURN MATE i (macro executor)
TMILIB	Library for TURN MATE i
TMIAPL	Application for TURN MATE i
CEXELIB	Library for C executor
CEXEAPL	Application for C executor
MGILIB	Library for MANUAL GUIDE i
MGIAPL	Application for MANUAL GUIDE i
NET CONTROL	Communication management software
EMBED ETHER	Control software for embedded Ethernet function
PROFI SOFT	Software for PROFIBUS function
PROFI MASTER	Control software for PROFIBUS master function
PROFI SLAVE	Control software for PROFIBUS slave function
ETHER/DTSVR	Control software for Fast Data Server
DEVNT SOFT	Software for DeviceNet function
FL-NET	Software for FL-net function
FL-NET SOFT	Control software for FL-net Server

- Display of macro executor
  The series and edition are displayed for each number specified at the time of P-CODE macro creation.
  Up to 6 types of macro executor are displayed.

1.2.4   **Outputting System Configuration Data**

Data displayed on the system configuration screen can be output to an input/output device.

(1) Press function key ⬨⃞SYSTEM .

(2) Press the EDIT switch on the machine operator's panel.

(3) Press soft key [SYSTEM] to display the system configuration screen.

(4) Press soft key [(OPRT)] and select soft key [F OUTPUT].

(5) Press soft key [EXCE].

(6) Data is output to the output device selected by parameter No. 0020.

Data is output to a file named SYS_CONF.TXT.

1.3 DIAGNOSIS FUNCTION

1.3.1 Displaying Diagnosis Screen

(1) Press function key [SYSTEM].

(2) Press soft key [DGNOS], then a diagnosis screen is displayed.

1.3.2 Contents Displayed

Causes when the machine does not travel in spite of giving a command

Diagnosis	**0**	**CNC internal state 1**

[Data type] Bit

NAME	Internal state when "1" is displayed
INPOSITION CHECK	In-position check is being done.
FEEDRATE OVERRIDE 0%	Feedrate override is 0%.
JOG FEED OVERRIDE 0%	Jog feedrate override is 0%.
INTER/START LOCK ON	Interlock/start lock is on.
SPEED ARRIVAL ON	The system is waiting for the speed arrival signal to turn on.
WAIT REVOLUTION	The system is waiting for the spindle one-rotation signal in threading.
STOP POSITION OCDER	The system is waiting for the rotation of the position coder in spindle feed per revolution.
FEED STOP	A feed stop was made.

Diagnosis	**8**	**CNC internal state 2**

[Data type] Bit

NAME	Internal state when "1" is displayed
FOREGROUND READING	Data is being input in the foreground.
BACKGROUND READING	Data is being input in the background.

Reader/puncher interface output state

Diagnosis	**10**	**Reader/puncher interface output state**

When data is being output through the reader/puncher interface, "1" is indicated.

State of TH alarm

Diagnosis	**30**	**TH alarm character count (foreground edit)**

[Data type] 2-word

The position where the TH alarm occurred in foreground input is indicated by the number of characters from the beginning of the block.

Diagnosis	**31**	**TH alarm character code (foreground edit)**

[Data type] Bit

The character code of the character at which the TH alarm occurred in foreground input is indicated.

Diagnosis	**32**	**TH alarm character count (background edit)**

[Data type] 2-word

The position where the TH alarm occurred in background input is indicated by the number of characters from the beginning of the block.

- 15 -

Diagnosis	33	TH alarm character code (background edit)

[Data type] Bit

The character code of the character at which the TH alarm occurred in background input is indicated.

Display language of the CNC screen

Diagnosis	43	Number of the current display language of the CNC screen

[Data type] Byte

The number of the current display language of the CNC screen is indicated.

The correspondence between languages and numbers is show below.

0 : English
1 : Japanese
2 : German
3 : French
4 : Chinese (traditional characters)
5 : Italian
6 : Korean
7 : Spanish
8 : Dutch
9 : Danish
10 : Portuguese
11 : Polish
12 : Hungarian
13 : Swedish
14 : Czech
15 : Chinese (simplified characters)
16 : Russian
17 : Turkish

Details of serial Pulsecoder

	#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis 200	OVL	LV	OVC	HCA	HVA	DCA	FBA	OFA

#0 **OFA** Overflow alarm
#1 **FBA** Disconnection alarm
#2 **DCA** Discharge alarm
#3 **HVA** Overvoltage alarm
#4 **HCA** Abnormal current alarm
#5 **OVC** Over current alarm
#6 **LV** Insufficient voltage alarm
#7 **OVL** Overload alarm

	#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis 201	ALD	PCR		EXP				

#4 **EXP**
#7 **ALD**

	ALD	EXP	Description
Overload alarm	0	-	Motor overheat
	1	-	Amplifier overheat
Disconnection alarm	1	0	Built-in Pulsecoder (hard)
	1	1	Disconnection of separated type Pulsecoder (hard)
	0	0	Disconnection of Pulsecoder (software)

#6 **PCR** The one-rotation signal of the position detector was caught before a manual reference position return is performed. Since the manual reference position return grid was established, a manual reference position return is enabled.

> **NOTE**
> This bit is valid only when the operation of the manual reference position return mode is started.

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	202		CSA	BLA	PHA	RCA	BZA	CKA	SPH

#0 SPH Serial Pulsecoder or feedback cable is faulty.
Counting of feedback cable is erroneous.
#1 CKA Serial Pulsecoder is faulty.
Internal block stopped.
#2 BZA Battery voltage became 0.
Replace the battery and set the reference position.
#3 RCA Serial Pulsecoder is faulty.
The speed was incorrectly counted.
#4 PHA Serial Pulsecoder or feedback cable is erroneous.
Counting of feedback cable is erroneous.
#5 BLA Battery voltage is low (warning)
#6 CSA Hardware of serial Pulsecoder is abnormal

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	203	DTE	CRC	STB	PRM				

#4 PRM A parameter failure was detected on the digital servo side.   See the cause and measure described in diagnosis No. 352.
#5 STB Communication failure of serial Pulsecoder.
Transferred data is erroneous.
#6 CRC Communication failure of serial Pulsecoder.
Transferred data is erroneous.
#7 DTE Communication failure of serial Pulsecoder.
There is no response for communication.

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	204		OFS	MCC	LDA	PMS			

#3 PMS Feedback is not correct due to faulty serial Pulsecoder C or feedback cable.
#4 LDA Serial Pulsecoder LED is abnormal
#5 MCC Contacts of MCC of servo amplifier is melted.
#6 OFS Abnormal current value result of A/D conversion of digital servo

Details of separate serial Pulsecoder alarms

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	205	OHA	LDA	BLA	PHA	CMA	BZA	PMA	SPH

#0 SPH A soft phase data error occurred in the separate Pulsecoder.
#1 PMA A pulse error occurred in the separate Pulsecoder.
#2 BZA The battery voltage for the separate Pulsecoder is zero.
#3 CMA A count error occurred in the separate Pulsecoder.
#4 PHA A phase data error occurred in the separate linear scale.
#5 BLA A low battery voltage occurred in the separate Pulsecoder.
#6 LDA An LED error occurred in the separate Pulsecoder.
#7 OHA Overheat occurred in the separate Pulsecoder.

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	206	DTE	CRC	STB					

#5 STB A stop bit error occurred in the separate Pulsecoder.
#6 CRC A CRC error occurred in the separate Pulsecoder.

#7   DTE   A data error occurred in the separate Pulsecoder.

Details of invalid servo parameter alarms (on the CNC side)

When servo alarm SV0417 is issued, and diagnosis No. 203#4 = 0, its cause is indicated.
When diagnosis No. 203#4 = 1, see diagnosis No. 352.

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	280				DIR	PLS	PLC		MOT

#0   MOT   The motor type specified in parameter No. 2020 falls outside the predetermined range.

#2   PLC   The number of velocity feedback pulses per motor revolution, specified in parameter No. 2023, is zero or less. The value is invalid.

#3   PLS   The number of position feedback pulses per motor revolution, specified in parameter No. 2024, is zero or less. The value is invalid.

#4   DIR   The wrong direction of rotation for the motor is specified in parameter No. 2022 (the value is other than 111 or -111).

Position error amount

Diagnosis	300	Individual-axis positional deviation difference displayed in detection units

$$\text{Position error} = \frac{\text{Feed rate [mm/min]} \times 100}{60 \times \text{servo loop gain [1/sec]}} \times \frac{1}{\text{Detection unit}}$$

Machine position

Diagnosis	301	Distance from reference position of an axis in detection unit

Distance from the end of the deceleration dog to the first grid point

Diagnosis	302	Distance from the end of the deceleration dog to the first grid point

[Data type] Real axis
[Unit of data] Machine unit
[Valid data range] 0 to ±99999999

> **NOTE**
> For the reference position setting without a dog, the distance from the beginning of the reference position setting without a dog to the first grid point is assumed.

Reference counter

Diagnosis	304	Reference counter amount in each axis

[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] –99999999 to 99999999

Angular axis control / Machine coordinates in the Cartesian coordinate system

Diagnosis	306	Machine coordinates on the angular axis in the Cartesian coordinate system

Diagnosis	307	Machine coordinates on the perpendicular axis in the Cartesian coordinate system

[Data type] Real number
[Unit of data] Machine unit

Machine coordinates in the Cartesian coordinate system are displayed in arbitrary angular axis control. Bit 7 (ADG) of parameter No. 8201 can be used to change the display order.

Motor temperature information

Diagnosis	308	Servo motor temperature (°C)

[Data type] Byte axis
[Unit of data] °C
[Valid data range] 0 to 255

The temperature of the coil of the servo motor is indicated. When the temperature reaches 140°C, a motor overheat alarm is issued.

Diagnosis	309	Pulsecoder temperature (°C)

[Data type] 2-word axis
[Unit of data] °C
[Valid data range] 0 to 255

The temperature of the printed circuit board in the Pulsecoder is indicated. When the temperature reaches 100°C (approximately 85°C for the temperature of atmosphere in the Pulsecoder), a motor overheat alarm is issued.

NOTE
1 Temperature information has the following error:
- 50°C to 160°C ±5°C
- 160°C to 180°C ±10°C
2 The temperature at which an overheat alarm is issued has an error of up to 5°C.

Cause that sets bit 4 (APZ) of parameter No. 1815 to 0

You can find the cause that sets bit 4 (APZ) of parameter No. 1815 to 0 by checking diagnosis Nos. 310 and 311.

Once diagnosis No. 310 or 311 is set to 1, this setting is kept unchanged until the zero point of the absolute position detector of the corresponding axis is set again. Possible causes that set APZ to 0 are as follows:

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	310		DTH	ALP	NOF	BZ2	BZ1	PR2	PR1

#0 PR1 One of the following parameters was changed:
No.1803#7, No.1815#1, No.1820, No.1821, No.1822, No.1823, No.1850, No.1874, No.1875, No.2022, No.2084, No.2085

#1 PR2 Bit 1 (ATS) of parameter No. 8303 was changed. Alternatively, when bit 7 (SMA) of parameter No. 8302 was set to 1, APZ of the axis to be synchronized together was set to 0.

#2 BZ1 A battery voltage of 0 V was detected. (Inductosyn)

#3 BZ2 A battery voltage of 0 V was detected. (Separate position detector)

#4 NOF The Inductosyn did not output offset data.

#5 ALP The zero point was set by MDI when the α*i* pulse coder had not rotate one or more turns.

#6 DTH An axis detach operation was performed by the controlled-axis detach signal DTCH <G0124> or by setting bit 7 (RMV) of parameter No. 0012.

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	311		DUA	XBZ	GSG	AL4	AL3	AL2	AL1

#0 AL1 An SV alarm (SV0301 to SV0305) was issued.

#1 AL2 Broken-wire alarm SV0445 or SV0447 was detected.

#2 AL3 A battery voltage of 0 V was detected. (Serial Pulsecoder)

#3 AL4 Rotation count abnormality alarm RCAL was detected.

#4 GSG The status of broken-wire alarm ignore signal NDCAL <0G202> changed from 1 to 0.

#5 XBZ A battery voltage of 0 V or a count error was detected. (Separate serial position detector)

#6 DUA The difference in error between the semi-closed loop and closed loop became too large when the dual position feedback function was being used.

Details of invalid servo parameter setting alarms (on the servo side)

Diagnosis	352	Detail number for invalid servo parameter setting alarm

Indicates information that can be used to identify the location (parameter) and cause of an invalid servo parameter setting alarm (servo alarm SV0417).

This diagnosis information is valid when the following conditions are satisfied.

- Servo alarm No. 417 has occurred.
- Bit 4 of diagnosis No. 203 (PRM) = 1

See the following table for the displayed detail numbers and the corresponding causes. For further detail information that could be used to take measures, refer to FANUC AC Servo Motor $\alpha is/\alpha i/\beta is$ series Parameter Manual (B-65270EN).

● **Detailed descriptions about invalid servo parameter setting alarms**

Detail number	Parameter number	Cause	Measure
0233	2023	A value specified as the number of velocity pulses is greater than 13100 when initialization bit 0 = 1.	Decrease the value specified as the number of velocity pulses to within 13100.
0243	2024	A value specified as the number of position pulses is greater than 13100 when initialization bit 0 = 1.	Decrease the value specified as the number of position pulses to within 13100. Use the position feedback pulse conversion coefficient (No. 2185).
0434 0435	2043	The internal value of the velocity loop integration gain has overflowed.	Decrease the value specified in the velocity loop integration gain parameter.
0444 0445	2044	The internal value of the velocity loop proportional gain has overflowed.	Use a function (No.2200#6) for changing the internal format of the velocity loop proportional gain. Alternatively, decrease the setting of this parameter.
0474 0475	2047	The internal value of the observer parameter (POA1) has overflowed.	Change the setting to: (-1) $\times$ (desired setting)/10
0534 0535	2053	The internal value of the dead zone compensation parameter has overflowed.	Decrease the setting until the invalid parameter setting alarm will not occur any longer.
0544 0545	2054	The internal value of the dead zone compensation parameter has overflowed.	Decrease the setting until the invalid parameter setting alarm will not occur any longer.
0694 0695 0696 0699	2069	The interval value of the velocity feed forward coefficient has overflowed.	Decrease the velocity feed forward coefficient.
0754 0755	2075	The setting of the parameter listed at the left has overflowed.	This parameter is presently not in use. Specify 0 in it.
0764 0765	2076	The setting of the parameter listed at the left has overflowed.	This parameter is presently not in use. Specify 0 in it.
0843	2084	No positive value has been set for the flexible feed gear numerator. Alternatively, the following condition exists: Feed gear numerator > denominator $\times$ 16	Specify a positive value as the flexible feed gear numerator. Alternatively, satisfy the following condition: Feed gear numerator $\leq$ denominator $\times$ 16 (except for phase A-/B-specific stand-alone type detector).
0853	2085	No positive value has been set as the flexible feed gear denominator.	Specify a positive value as the flexible feed gear denominator.
0884 0885 0886	2088	The internal value of the machine velocity feedback coefficient has overflowed.	Decrease the machine velocity feedback coefficient. Alternatively, use the damping control function, which has an equivalent effect.

Detail number	Parameter number	Cause	Measure
0883	2088	A value of 100 or greater was specified in the machine velocity feedback coefficient for an axis with a serial stand-alone type detector.	The maximum allowable value for the machine velocity feedback coefficient for axes with a serial stand-alone type detector is 100. Decrease the setting to within 100.
0996	2099	The internal value for suppressing N pulses has overflowed.	Decrease the setting of the parameter listed at the left.
1033	2103	The retract distance related to an abnormal load differs between the L and M axes (if the same-axis retract function is in use).	Set the same value for both the L and M axes.
1182	2118 2078 2079	No dual position feedback conversion coefficient is set.	Set an AMR conversion coefficient.
1284 1285	2128	If the value specified as the number of velocity pulses is small, the internal value of the current control parameter overflows.	Decrease the value for the parameter listed at the left to within a range where no alarm will occur any longer.
1294 1295	2129	If the value specified as the number of velocity pulses is large, the internal value of the current control parameter overflows.	Reset "a" to a smaller value when the setting of the parameter listed at the left is broken up into: $a \times 256 + b$
1493	2149	A value greater than 6 is set in this parameter.	A value not greater than 6 is permitted to be set in this parameter. Correct the setting with a value not greater than 6.
1503	2150	A value greater than or equal to 10 is set.	The setting must be less than 10.
1793	2179	A negative value or a value greater than the setting of parameter No. 1821 is set.	Set a positive value smaller than the setting of parameter No. 1821.
1853	2185	A negative value or a value greater than the setting of parameter No. 2023 is set.	Set a positive value smaller than the setting of parameter No. 2023.
8213	1821	No positive value has been set in the reference counter capacity parameter.	Specify a positive value in the parameter listed at the left.
10016 10019	2200#0	The internal value of a parameter used to detect runaway has overflowed.	Do not use the runaway detection function (specify bit 0 = 1).
10062	2209#4	The amplifier in use does not support the HC alarm avoidance function.	If you want to use this amplifier, reset the function bit listed at the left to 0. If you want to use the HC alarm avoidance function, use an amplifier that supports it.

Diagnosis	355	Communication alarm ignore counter (separate type)

Diagnosis	356	Link processing counter (built-in type)

Diagnosis	357	Link processing counter (separate type)

The number of times a communication error occurred during serial communication with the detector is indicated.

Data transmitted during communication is guaranteed unless another alarm occurs. However, if the counter value indicated in this diagnosis information increases in a short period, there is a high probability that serial communication is disturbed by noise.   So, take sufficient measures to prevent noise.

*   For details, refer to a relevant manual on FANUC SERVO MOTOR α*i* series.

Diagnosis	358	V ready-off information

This information is provided to analyze the cause of the V ready-off alarm (alarm SV0401).

Convert the indicated value to a binary representation, and check bits 5 to 14 of the binary representation.

When amplifier excitation is turned on, these bits are set to 1 sequentially from the lowest bit, which is bit 5.   If the amplifier is activated normally, bits 5 to 14 are all set to 1.

Therefore, check the bits sequentially from the lowest bit to find the first bit that is set to 0. This bit indicates that the corresponding processing could not be completed and so the V ready-off alarm was caused.

#15	#14	#13	#12	#11	#10	#09	#08
	SRDY	DRDY	INTL		CRDY		

#07	#06	#05	#04	#03	#02	#01	#00
	*ESP						

#06	*ESP	Converter emergency stop state released
#10	CRDY	Converter ready
#12	INTL	DB relay released
#13	DRDY	Amplifier ready (amplifier)
#14	SRDY	Amplifier ready (software)

* For details, refer to a relevant manual on FANUC SERVO MOTOR α*i* series.

Diagnosis	359	Communication alarm neglect counter (built-in type)

The diagnosis information is the same as that of diagnosis No. 355.
See the descriptions in diagnoses No.355 to 357.

Diagnosis	360	Cumulative value of specified pulses (NC)

[Data type] 2-word
[Unit of data] Detection unit
[Valid data range] -99999999 to 99999999

Cumulative value of move commands distributed from the CNC since power-on is indicated.

Diagnosis	361	Compensation pulses (NC)

[Data type] 2-word
[Unit of data] Detection unit
[Valid data range] -99999999 to 99999999

Cumulative value of compensation pulses (backlash compensation, pitch error compensation, and so on) distributed from the CNC since power-on is indicated.

Diagnosis	362	Cumulative value of specified pulses (SV)

[Data type] 2-word
[Unit of data] Detection unit
[Valid data range] -99999999 to 99999999

Cumulative value of move pulses and compensation pulses received by the servo system since power-on is indicated.

Diagnosis	363	Cumulative feedback (SV)

[Data type] 2-word
[Unit of data] Detection unit
[Valid data range] -99999999 to 99999999

Cumulative value of positional feedback pulses the servo system received from the pulse coder since power-on is indicated.

Diagnosis data related to the Inductosyn absolute position detector

Diagnosis	380	Difference between the absolute position of the motor and offset data

[Data type] 2-word axis
[Unit of data] Detection unit

$$\frac{M \text{ (absolute position of the motor)} - S \text{ (offset data)}}{\lambda \text{ (pitch interval)}}$$

The remainder resulting from the division is displayed.

Diagnosis	381	Offset data from the Inductosyn

[Data type] 2-word axis
[Unit of data] Detection unit

Off set data is displayed when CNC calculates the machine position.

Diagnosis data related to the serial spindles

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	400	LNK							

#7 LNK Communication with the spindle control side has been established.

Diagnosis	403	Temperature of spindle motor

[Data type] Byte spindle
[Unit of data] °C
[Valid data range] 0 to 255

The temperature of the winding of the spindle motor is indicated.
This information can be used to determine the overheat alarm of the spindle.
(The temperature that causes an overheat alarm varies from motor to motor.)

> **NOTE**
> 1 Temperature information has the following error:
>   - 50°C to 160°C ±5°C
>   - 160°C to 180°C ±10°C
> 2 The indicated temperature and the temperature causing an
>   overheat alarm have the following error:
>   - For lower than 160°C   5°C maximum
>   - For 160 to 180°C   10°C maximum

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	408	SSA		SCA	CME	CER	SNE	FRE	CRE

   #0 CRE A CRC error occurred (warning).
   #1 FRE A framing error occurred (warning).
   #2 SNE The sender or receiver is not correct.
   #3 CER An abnormality occurred during reception.
   #4 CME No response was returned during automatic scanning.
   #5 SCA A communication alarm was issued on the spindle amplifier side.
   #7 SSA A system alarm was issued on the spindle amplifier side.
        (The above conditions are major causes of alarm SP0749. These conditions are caused mainly by noise, a broken wire, a momentary failure of power, and so on.)

Diagnosis	410	Spindle load meter indication [%]

[Data type] Word spindle
[Unit of data] %

Diagnosis	411	Spindle speed meter indication [min⁻¹]

[Data type] Word spindle
[Unit of data] min^{-1}

Diagnosis	417	Spindle position coder feedback information

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	418	Positional deviation of spindle in position loop mode

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	425	Spindle synchronization error

[Data type] 2-word spindle
[Unit of data] Detection unit

When the spindles are in synchronization mode, the absolute value of the synchronization error when each spindle is set as the slave axis is indicated.

Diagnosis	445	Spindle position data

[Data type] Word spindle
[Unit of data] Pulse
[Valid data range] 0 to 4095

For the serial spindle, position coder signal pulse data from the one-rotation signal is indicated as the position data of the spindle.
This data is valid when bit 1 of parameter No. 3117 is set to 1.
To display spindle position data, spindle orientation must be performed once.

Diagnosis data related to rigid tapping

Diagnosis	450	Spindle position error during rigid tapping

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	451	Spindle distribution during rigid tapping

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	452	Difference in error amount between spindle and tapping axis during rigid tapping (momentary value)

[Data type] 2-word spindle
[Unit of data] %

Diagnosis	453	Difference in error amount between spindle and tapping axis during rigid tapping (maximum value)

[Data type] 2-word spindle
[Unit of data] %

Diagnosis	454	Accumulated spindle distribution during rigid tapping (cumulative value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	455	Difference in spindle-converted move command during rigid tapping (momentary value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	456	Difference in spindle-converted positional deviation during rigid tapping (momentary value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	457	Width of synchronization error during rigid tapping (maximum value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	458	Tapping axis distribution amount during rigid tapping (cumulative value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	459	Selected spindle number during rigid tapping

[Data type] 2-word path

Diagnosis	460	Difference in spindle-converted move command during rigid tapping (maximum value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	461	Difference in spindle-converted machine position during rigid tapping (momentary value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis	462	Difference in spindle-converted machine position during rigid tapping (maximum value)

[Data type] 2-word spindle
[Unit of data] Detection unit

Diagnosis data related to the small-hole peck drilling cycle (M series)

Diagnosis	520	Total number of times a retraction operation has been performed during drilling since G83 was specified

Diagnosis	521	Total number of times a retraction operation has been performed in response to the reception of the overload torque detection signal during drilling since G83 was specified

The total numbers of times output in Nos.520 and 521 are cleared to zero by a G83 command issued after the small-hole peck drilling cycle mode is entered.

Diagnosis	522	Coordinate value of the drilling axis at which retraction operation starts (least input increment)

Diagnosis	523	Difference between the coordinate value of the drilling axis at which the previous retraction operation started and the coordinate value of the drilling axis at which the current retraction operation starts (least input increment: previous value minus current value)

Diagnosis data related to the dual position feedback function

Diagnosis	550	Closed loop error

[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] -99999999 to +99999999

Diagnosis	551	Semi-closed loop error

[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] -99999999 to +99999999

Diagnosis	552	Error between semi-closed and closed loops

[Data type] Word axis
[Unit of data] Detection unit
[Valid data range] -32768 to +32767

Diagnosis	553	Amount of dual position compensation

[Data type] 2-word axis

[Unit of data] Detection unit

[Valid data range] -99999999 to +99999999

The data items displayed on the diagnosis screen are obtained at the following positions:
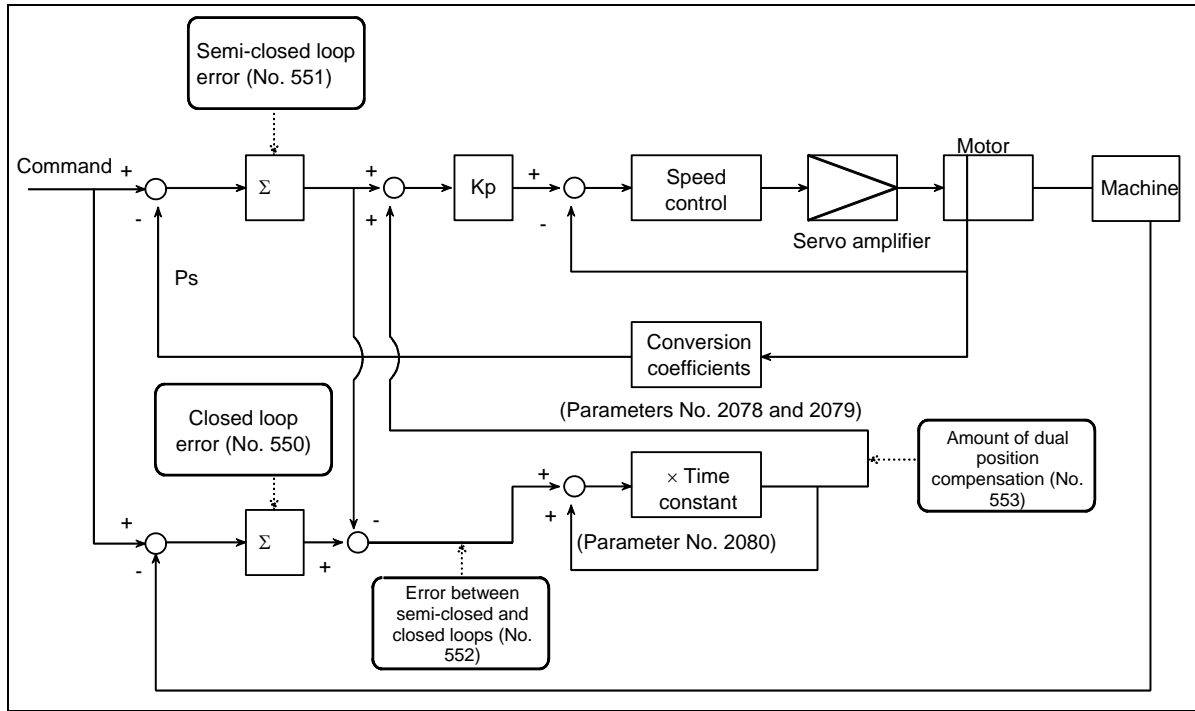
Automatic alteration of tool position compensation (T series)

Diagnosis	0560	Manual tool compensation state number

[Data type] Byte

[Unit of data] None

[Valid data range] 0 to 255

When incomplete operation was performed in manual tool compensation, one of the following numbers is used for notification.

0 : Manual tool compensation was completed normally.
1 : The data of T code command falls outside the allowable range.
2 : The offset value falls outside the range.
3 : The offset number falls outside the range.
4 : Automatic operation or axis movement is being performed in the CNC.
5 : The CNC is in the tool-nose radius compensation mode.
6 : The CNC is in a mode other than the JOG mode, HNDL (INC) mode, and REF mode.
7 : A CNC parameter is illegal.

State of high-speed HRV current control

Diagnosis	700	#7	#6	#5	#4	#3	#2	#1	#0
								HOK	HON

[Data type] Bit axis

The state of high-speed HRV current control is displayed.

#0 HON The motor is controlled in the high-speed HRV current control mode.

#1 HOK This bit is set to 1 when high-speed HRV current control is enabled.

High-speed HRV current control is enabled when the following conditions are satisfied:

- Bit 0 (HR3) of parameter No. 2013 is set to 1.
- Servo software, servo modules, and servo amplifiers suitable for high-speed HRV current control are used.

- When a separate detector interface unit is used, the separate detector interface unit is suitable for high-speed HRV current control.

Spindle error and warning states

Diagnosis	710	Spindle error state

[Data type] Word spindle

Diagnosis	712	Spindle warning state

[Data type] Word spindle

When an error (yellow LED ON + error number indication) or a warning occurs in a spindle amplifier (SP), the number is indicated on the diagnosis screen.
If neither error nor warning occurs, 0 is indicated.

For spindle errors, refer to "FANUC SERVO MOTOR α*i* series Maintenance Manual" (B-65285EN).
For warnings, see Subsection 9.1.4, "Spindle Warning Interface" in this manual.

OVC level

Diagnosis	750	OVC level

[Data type] Word axis
[Unit of data] %

The proportion of soft thermal (OVC) in the alarm issuance level is indicated.

・ Reset state

			#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	1010						RST	ERS	RRW	ESP

[Data type] Bit
  #0 **ESP** In the emergency stop state
  #1 **RRW** Reset & rewind signal set to 1.
  #2 **ERS** External reset signal set to 1.
  #3 **RST** RESET key pressed.

・ Cause that turned the cycle start LED off

			#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	1011		HLD	STP	MOD	ALM	RST	ERS	RRW	ESP

[Data type] Bit

The cause that turned the cycle start LED off is indicated.
  #0 **ESP** In the emergency stop state
  #1 **RRW** Reset & rewind signal
  #2 **ERS** External reset signal
  #3 **RST** Reset key
  #4 **ALM** Alarm
  #5 **MOD** Change to another mode
  #6 **STP** Single block stop
  #7 **HLD** Feed hold

Automatic data backup

			#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	1016		ANG	ACM			DT3	DT2	DT1	AEX

[Data type] Bit

The execution state of backup is indicated.
  #0 **AEX** Automatic data backup is being performed.
  #1 **DT1** Data 1 was updated in the previous backup.

#2 **DT2** Data 2 was updated in the previous backup.
#3 **DT3** Data 3 was updated in the previous backup.
#6 **ACM** Automatic data backup was performed.
#7 **ANG** An error occurred in automatic data backup.

Spindle revolution number history function

Diagnosis	1520	Spindle total revolution number 1

Diagnosis	1521	Spindle total revolution number 2

[Data type] 2-word spindle
[Unit of data] 1000 min^{-1}
[Valid data range] 0 to 999999999
The number of revolutions of the spindle is counted and the total number of revolutions is indicated.

Detector battery exhaustion

	#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis 3019			EXP	INP	ABP			

[Data type] Bit axis
If a detector battery low alarm is issued, the cause can be checked.
#3 **ABP** The battery of the A/B phase is low.
#4 **INP** The battery of the serial pulse coder (built-in position detector) is low.
#5 **EXP** The battery of the separate detector of serial type is low.

Diagnosis data related to axis synchronous control

Diagnosis	3500	Synchronization error amount

[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] −99999999 to +99999999
The difference in position (synchronization error amount) between the master axis and slave axis is indicated.   This data is indicated for the slave axis.

Diagnosis	3501	Synchronization error compensation value

[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] −99999999 to +99999999
Cumulative value of compensation pulses (synchronization error compensation value) output to the slave axis is indicated.   This data is indicated for the slave axis.

Diagnosis data related to synchronous/composite control (T series)

Diagnosis	3502	Indication of synchronization error amount for each axis

[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] −99999999 to +99999999
When synchronization deviation is detected (SERx of parameter No. 8162 is set to 1), the positional deviation difference of the slave axis from the master axis is indicated.
The positional deviation difference is:
(Positional deviation of master axis)
± (positional deviation of slave axis)
↑

{ + when mirror image is applied to synchronization command
{ − when mirror image is not applied to synchronization command

Diagnosis data related to linear scale with absolute address reference marks

Diagnosis	3545	Linear scale with absolute address reference marks Measurement point 1

Diagnosis	3546	Linear scale with absolute address reference marks Measurement point 2

Diagnosis	3547	Linear scale with absolute address reference marks Measurement point 3

Diagnosis	3548	Linear scale with absolute address reference marks Measurement point 4

    [Data type] 2-word axis
    [Unit of data] Detection unit
[Valid data range] -999999999 to 999999999

Diagnosis	3549	Linear scale with absolute address reference marks Status display

Diagnosis	3550	Linear scale with absolute address reference marks Scale value

    [Data type] 2-word axis
    [Unit of data] Detection unit
[Valid data range] -999999999 to 999999999

Diagnosis	3551	Linear scale with absolute address reference marks Scale value (High)

    [Data type] 2-word axis
    [Unit of data] Detection unit
[Valid data range] -999 to 999

                Linear scale with absolute address reference marks
                Scale value = Diagnosis No.3551 × 1,000,000,000 + Diagnosis No.3550

1.4 CNC STATE DISPLAY

- Description of each display
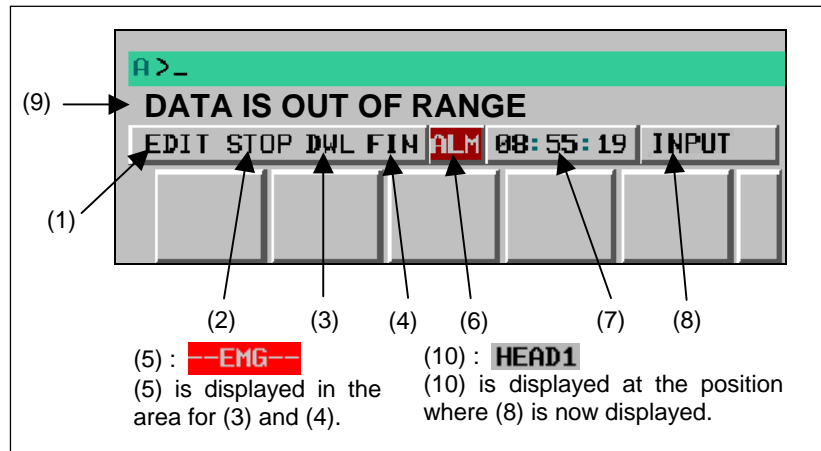
Fig. 1.4 (a)

(1) Current mode
MDI : Manual data input, MDI operation
MEM : Automatic operation (memory operation)
RMT : Automatic operation (DNC operation, or such like)
EDIT : Memory editing
HND : Manual handle feed
JOG : Jog feed
INC : Manual incremental feed
REF : Manual reference position return
**** : Modes other than the above.

(2) Automatic operation status
**** : Reset (When the power is turned on or the state in which program execution has terminated and automatic operation has terminated.)
STOP : Automatic operation stop (The state in which one block has been executed and automatic operation is stopped.)
HOLD : Feed hold (The state in which execution of one block has been interrupted and automatic operation is stopped.)
STRT : Automatic operation start-up (The state in which the system operates automatically)

(3) Axis moving status/dwell status
MTN : Indicates that the axis is moving.
DWL : Indicates the dwell state.
*** : Indicates a state other than the above.

(4) State in which an auxiliary function is being executed
FIN : Indicates the state in which an auxiliary function is being executed. (Waiting for the complete signal from the PMC)
*** : Indicates a state other than the above.

(5) Emergency stop or reset status
--EMG-- : Indicates emergency stop.(Blinks in reversed display.)
--RESET-- : Indicates that the reset signal is being received.

- 30 -

(6) Alarm status / Warning status

ALM : Indicates that an alarm is issued. (Blinks in reversed display.)
BAT : Indicates that the voltage of the lithium battery (the backup battery of the CNC) has decreased. (Blinks in reversed display.)
APC : Indicates that the voltage of the backup battery of the absolute pulse coder has decreased. (Blinks in reversed display.)
FAN : Indicates that the rotation speed of the fan has decreased. (Blinks in reversed display.)
Space : Indicates a state other than the above.

(7) Current time

hh : mm : ss - Hours, minutes, and seconds

(8) Program editing status / Operation status

INPUT : Indicates that data is being input.
OUTPUT : Indicates that data is being output.
SEARCH : Indicates that a search is being performed.
EDIT : Indicates that another editing operation is being performed (insertion, modification, etc.)
LSK : Indicates that labels are skipped when data is input.
RSTR : Indicates that the program is being restarted
COMPARE : Indicates that a data comparison is being made.
OFST : Indicates that the tool length compensation amount measurement mode is set (for the M series) or that the tool length compensation amount write mode is set (for the T series).
AICC : Indicates that operation is being performed in the AI contour control mode. (M series only, parameters Nos.3241 to 3247)
AI APC : Indicates that operation is being performed in the AI advanced preview control mode. (M series only, parameters Nos.3241 to 3247)
APC : Indicates that operation is being performed in the advanced preview control mode. (T series only, parameters Nos.3251 to 3257)
WSFT : Indicates that the workpiece coordinate system shift amount write mode is set.
RVRS : Indicates that the tool is retracing the path according to the retrace function.
RTRY : Indicates that the tool is moving forward again according to the retrace function.
RVED : Indicates that the tool terminates retrace operation according to the retrace function.
Space : Indicates other states.

(9) Warning for data setting or input/output operation

When invalid data is entered (wrong format, value out of range, etc.), when input is disabled (wrong mode, write disabled, etc.), or when input/output operation is incorrect (wrong mode, etc.), a warning message is displayed. In this case, the CNC does not accept the setting or input/output operation (retry the operation according to the message).
Example 1)
    When a parameter is entered

- 31 -
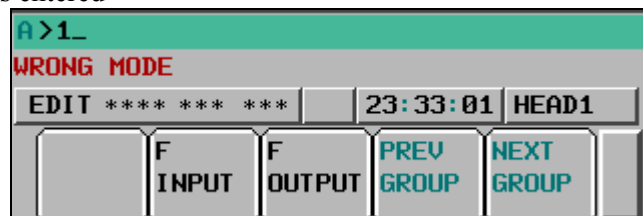
Example 2)
    When a parameter is entered

Example 3)
    When a parameter is output to an external input/output device
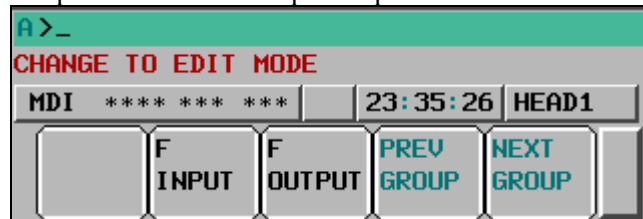
(10) Tool post name
The number of a path whose status is indicated is displayed.
HEAD1 : Indicates that the status being indicated is for path 1.
           Other names can be used depending on the settings of parameters 3141 to 3147. The path name is displayed at the position where (8) is now displayed. When a program is being edited or operated, (8) is displayed depending on the situation.

1.5   OPERATING MONITOR

Load meter of the servo axis and the serial spindle and the speed meter can be displayed.

1.5.1   Display Method

1   Set a parameter to display operating monitor. (Bit 5 (OPM) of parameter No.3111)
2   Press the [POS] key to display the position display screen.
3   Press continuous menu key ▷, then soft key [MONITOR] is displayed.
4   Press the soft key [MONITOR], then the operating monitor screen is displayed.

```
ACTUAL POSITION                        O0123 N00456
        ABSOLUTE              F              8582 MM/MIN
*X     -929.631                      PARTS COUNT        953
*Y     -258.989          RUN TIME   3H 2M CYCLE TIME  0H 0M 7S
*Z      253.174                   SERVO LOAD METER
 B        0.000          X  ████████▌         5%
 C        0.000          Y  ████████          3%
                         Z  ████████          3%
         MODAL           B  ████████          0%
G00  G49  G64  F      M  C  ████████          0%
G17  G80  G69  H
G90  G98  G15  D                   SPNDLE LOAD METER
G23  G50  G40.1     T    S  ████████          3%
G94  G67  G25  S    2000           SPNDLE SPEED METER
G21  G97  G160           S  ██▌            2000/MIN
G40  G54  G13.1
                         A>_
 SACT        1999/MIN
                         MEM  STRT MTN ***    10:57:09

   ABSOLU RELATI  ALL  HANDLE      MONITO              +
   TE     VE                       R
```

> **⚠ CAUTION**
> 1 The bar graph for the load meter shows load up to 200%.
> 2 The bar graph for the speed meter shows the ratio of the current spindle speed
>   to the maximum spindle speed (100%). Although the speed meter normally
>   indicates the speed of the spindle motor, it can also be used to indicate the
>   speed of the spindle by setting bit 6 (OPS) of parameter 3111 to 1.

1.5.2 Parameters

	#7	#6	#5	#4	#3	#2	#1	#0
3111		OPS	OPM					

[Input type] Setting input
[Data type] Bit path

#5 OPM Operating monitor
   0:   Not displayed
   1:   Displayed

#6 OPS The speedometer on the operating monitor screen indicates:
   0:   Spindle motor speed
   1:   Spindle speed

1.6   WAVEFORM DIAGNOSIS DISPLAY

The waveform diagnosis display function traces values of data such as servo positional deviation amount, torque, and machine signals and plots and displays a graph representing changes in the traced data.   This function facilitates servo motor and spindle motor adjustment and fault location when trouble has occurred.

The waveform diagnosis function can trace the following data:
(1) Servo-related data
   •   Positional deviation amount

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- • Pulse amount after distribution
- • Torque amount
- • Pulse amount after acceleration/deceleration
- • Actual speed
- • Current command value
- • Heat simulation data
- • Composite speed of all axes

(2) Spindle-related data
- • Speed of each spindle
- • Load meter
- • Spindle-converted positional deviation difference

(3) Machine signal
- • ON/OFF state of the external I/O signal specified by a signal address

Up to four servo and spindle data items or up to 32 signals can be traced at the same time.

Data can be traced under the following three conditions:
(1) Data is acquired at any point of time.
(2) Data immediately after a specified event is acquired.
(3) Data immediately before a specified event is acquired.

In condition (3), the time to end tracing can be delayed by a specified time.   This allows data before and after the occurrence of an event can be acquired.

Traced data can be output to an external input/output device.

1.6.1   Waveform Diagnosis Graph Screen

1   Press the function key [SYSTEM].

2   Pressing the [WAVE DIAG] soft key and [WAVE GRAPH] soft key displays the following screen.

3   Pressing the [(OPRT)] soft key displays the following operation selection soft keys:
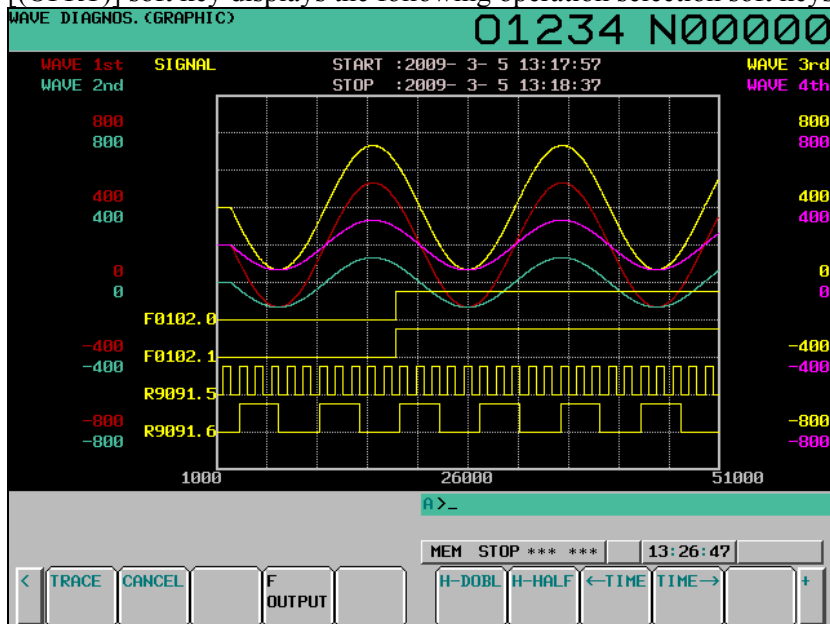
- Servo and spindle data

Each waveform is drawn in a specified color. The numbers and colors of the first and second waveforms are indicated in the upper left part, and the numbers and colors of the third and fourth waveforms are indicated in the upper right part.

- I/O signals

When waveforms for servo and spindle data are drawn with one on another, up to four waveforms are drawn on the part below the center of the screen.

In this case, the addresses of the plotted signals are indicated in the second column on the left side.

When only signal data is displayed, up to nine signals are plotted in the entire screen.

The addresses of the plotted signals are indicated in the first column on the left side.

- When displayed I/O signal data is updated

Displayed I/O signal data is updated when:

(1) The waveform diagnosis graph screen is displayed for the first time after power-on.

(2) Trace operation ends.

The displayed I/O signal data, therefore, is not updated when signal addresses are changed on the waveform diagnosis parameter screen. To reflect the changes, either of the above operations is required.

1.6.2 Waveform Diagnosis Parameter Screen

Display

1   Press the function key [SYSTEM].

2   Press the soft key [WAVE DIAG].

3   Pressing the soft key [WAVE PARAM] displays the waveform diagnosis parameter screen.
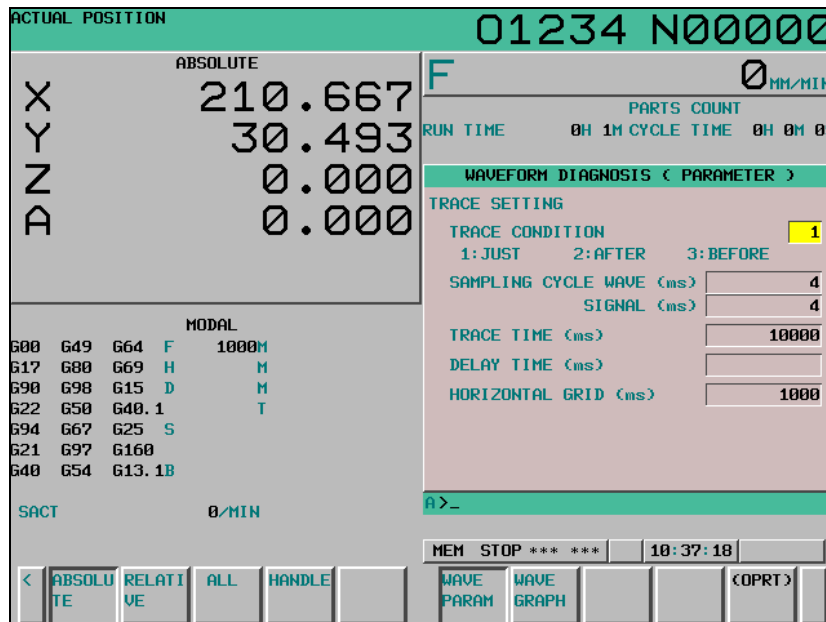
Editing

1   Follow the steps explained in "Display" to display the screen.

```
ACTUAL POSITION                          O1234 N00000
          ABSOLUTE              F                     0 MM/MIN
    X      210.667                          PARTS COUNT      1
    Y       30.493      RUN TIME   0H 1M CYCLE TIME  0H 0M 0S
    Z        0.000
    A        0.000           WAVEFORM DIAGNOSIS ( PARAMETER )
                             TRACE SETTING
                               TRACE CONDITION              1
                               1:JUST    2:AFTER   3:BEFORE
               MODAL            SAMPLING CYCLE WAVE (ms)     4
  G00 G49 G64 F   1000M                       SIGNAL (ms)   4
  G17 G80 G69 H      M
  G90 G98 G15 D      M         TRACE TIME (ms)          10000
  G22 G50 G40.1      T         DELAY TIME (ms)
  G94 G67 G25 S
  G21 G97 G160                 HORIZONTAL GRID (ms)      1000
  G40 G54 G13.1B

  SACT          0/MIN        A>_

                             MEM  STOP *** ***   10:37:43
     < ABSOLU RELATI  ALL  HANDLE     WAVE  WAVE         (OPRT)
         TE    VE                     PARAM GRAPH
```

2   Pressing the [↑] [↓] cursor keys moves the cursor on the screen.

3   Press numeric keys, then press the [INPUT] MDI key or [INPUT] soft key to set the entered value.

4   Press the [(OPRT)] soft key to display the following operation selection soft keys:

```
  INPUT                            EXPLAN  +
```

Pressing continuous menu key [+] displays the following soft keys:

```
  TRACE  WAVE  SIGNAL                      +
```

Pressing [TRACE] soft key displays the trace setting screen of the waveform diagnosis parameter screen.
Pressing [WAVE] soft key displays the waveform setting screen of the waveform diagnosis parameter screen.
Pressing [SIGNAL] soft key displays the signal setting screen of the waveform diagnosis parameter screen.

Trace setting

```
       WAVEFORM DIAGNOSIS ( PARAMETER )
    TRACE SETTING
      TRACE CONDITION                    1
      1:JUST      2:AFTER     3:BEFORE
      SAMPLING CYCLE WAVE (ms)           4
                   SIGNAL (ms)           4
      TRACE TIME (ms)                10000
      DELAY TIME (ms)
      HORIZONTAL GRID (ms)            1000
```
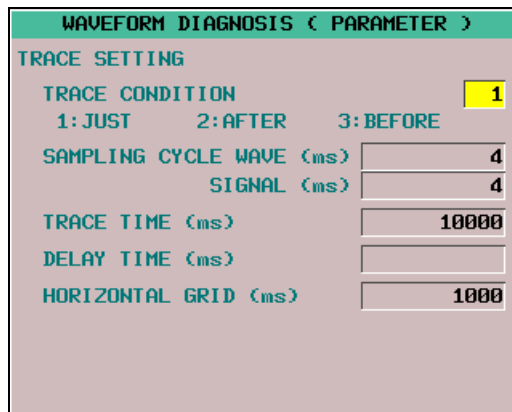
-   Trace condition
One of the following three trace conditions can be selected to start and end tracing:

- 36 -

Type 1 (1:   JUST)
Data is traced only for a specified period of time immediately after the [TRACE] soft key is pressed.
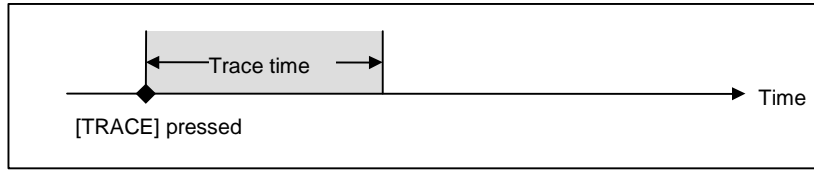
Type 2 (2:   AFTER)
When the [TRACE] soft key has been pressed, data is traced only for a specified period of time immediately after a specified trigger event occurs.
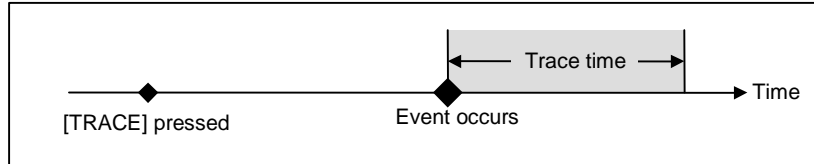
Type 3 (3:   BEFORE)
When the [TRACE] soft key has been pressed, data is traced only for a specified period of time immediately before a specified trigger event occurs.
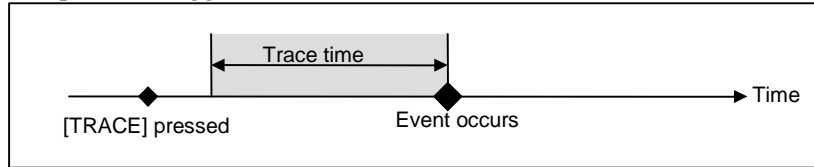
Setting	Trace condition
1	Type 1
2	Type 2
3	Type 3

- Sampling cycle
Set the sampling cycle period for waveforms and the sampling cycle for signals as follows:

Type	Setting
Waveform	Multiple of 2 ranging from 2 ms to 4096 ms
Signal	Multiple of 2 ranging from 2 ms to 4096 ms

- Trace time
Set the period for tracing data.
The trace time specifies a period of time during which tracing is to be performed for waveforms and signals. If the trace period is insufficient, increase the sampling cycle, or decrease the measurement items.
Approximately 32700 points of data can be traced.   One point is used for each sampling cycle of one channel.   For signal measurement, one channel is used regardless of the number of signals measured at the same time.
When one channel of waveform is traced with a sampling cycle of 4 ms, tracing can be performed for 130 s.
When one channel of waveform is traced with a sampling cycle of 4096 ms, tracing can be performed for 37 hours.

Valid data range: 2 to 133939200
Unit of data: msec
Example of maximum trace time determined by the sampling cycle and the number of channels

No. of channels Cycle	1ch	4ch + signal (with signals corresponding to 1 channel)
2 ms	65 s	13 s
4 ms	130 s	26 s
8 ms	261 s	52 s
4096 ms	37 hours and 12 minutes	7 hours and 26 minutes

- Delay time

When type 3 is selected as the trace condition, the end of tracing can be delayed by a specified time after the occurrence of an event.
Valid data range: 0 to 65528 (in 8-ms increments)
Unit of data: ms

NOTE
   If the input numeric value is not a multiple of 8 ms, the value is rounded off to the nearest multiple of 8 ms.

- Graduation unit on the horizontal axis

Set an increment per graduation on the horizontal axis.
Valid data range : 1 to 100000000
Unit of data : ms

Trigger setting

```
WAVEFORM DIAGNOSIS ( PARAMETER )
TRIGGER SETTING

  TRIGGER KIND                        7
     1:ALM           2:SIG ON
     3:SIG OFF       4:SIG CHG
     5:ALM+SIG ON    6:ALM+SIG OFF
     7:ALM+SIG CHG

  ALARM KIND                          6
  ALARM No.                         452
  AXIS No.                            1
  SIGNAL ADDRESS                X0000.0
```
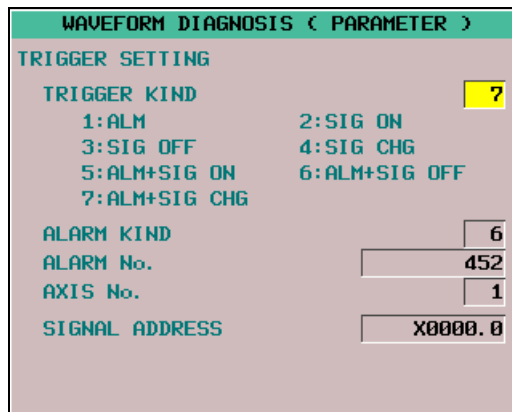
- Trigger type

If you specify the occurrence of an event as a trigger when selecting a trace condition in the trace setting of the waveform diagnosis parameter screen (2: AFTER or 3: BEFORE is specified as the trace condition), set the type of the trigger.
If 2 (AFTER) is selected as the trace condition, tracing starts when a set trigger event occurs. If 3 (BEFORE) is selected as the trace condition, tracing ends when the trigger event occurs.

Setting	Trigger type
1	Alarms only
2	A specified signal is turned on.
3	A specified signal is turned off.
4	The status of a specified signal changes.
5	An alarm is issued, or a specified signal is turned on.
6	An alarm is issued, or a specified signal is turned off.
7	An alarm is issued, or the status of a specified signal changes.

-   Alarm type

When the issuance of an alarm is specified as a trigger in the setting of the trigger type (the trigger type is set to 1, 5, 6, or 7), set the type of alarms used as a trigger as listed in the table below.   When a particular alarm type is not to be specified, use alarm signal AL as the trigger.

Setting	Alarm type
1	PW alarms
2	IO alarms
3	PS alarms
4	OT alarms
5	OH alarms
6	SV alarms
7	SR alarms
8	MC alarms
9	SP alarms
10	DS alarms
11	IE alarms
12	BG alarms
13	SN alarms
14	EX alarms
15	PC alarms

-   Alarm No.

If 6 (SV alarms) or 9 (SP alarms) is specified as the alarm type, specify the target alarm number with an integer from 1 to 9999.
To specify all alarm numbers as the alarm target, set -1.

-   Axis No.

If 6 (SV alarms) or 9 (SP alarms) is specified as the alarm type, specify the target axis for the alarm with an axis number.
To set all axes as the alarm target, set -1.

NOTE
   For 2-path control in a T series system, axes are specified using absolute axis numbers rather than relative axis numbers within the system.

-   Signal address

When use of a signal as a trigger is specified for the trigger type (the trigger type is set to 2, 3, 4, 5, 6, or 7), enter the address of the signal used as the trigger.

Waveform setting

```
┌─────────────────────────────────────────┐
│     WAVEFORM DIAGNOSIS ( PARAMETER )     │
│ TRACE WAVE SETTING                       │
│                                          │
│   WAVE 3rd                               │
│     TRACE DATA KIND               ▓3▓    │
│     AXIS No.                       3     │
│     VERTICAL GRID          [       3 ]   │
│     COLOR                  [       3 ]   │
│   WAVE 4th                               │
│     TRACE DATA KIND                4     │
│     AXIS No.                       4     │
│     VERTICAL GRID          [       4 ]   │
│     COLOR                  [       4 ]   │
│                                          │
└─────────────────────────────────────────┘
```
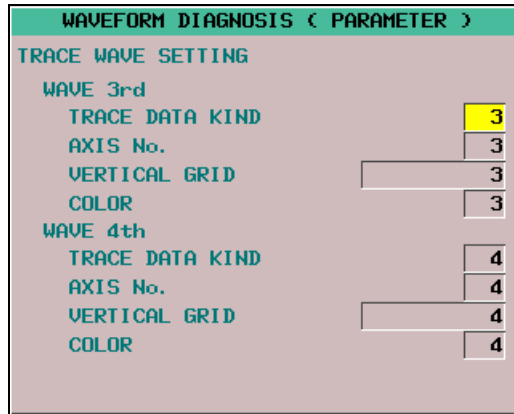
- Trace data type

Set the type number of data to be traced as listed below:

Setting	Type	Unit
0	(Not traced)	
1	Servo positional deviation	Pulse (detection unit)
2	Servo pulses after distribution	Pulse (detection unit)
3	Servo torque	%
4	Servo pulses after acceleration/deceleration	Pulse (detection unit)
5	Actual servo speed	min^{-1}
6	Servo current command value	%
7	Servo heat simulation data	%
8	Composite speed of all axes	mm/min or min^{-1}
9	Spindle speed	min^{-1}
10	Spindle load meter	%
11	Difference in spindle-converted positional deviation	Pulse (detection unit)

NOTE
> The servo torque and current command value are represented by percentages to parameter No. 2086 (rated current).

- Axis number/path number

Specify an axis number or path number according to the type of data to be traced as follows:

Type	Setting
Servo positional deviation	Controlled axis number (1 to 8)
Servo pulses after distribution	
Servo torque	
Servo pulses after acceleration/deceleration	
Actual servo speed	
Servo current command value	
Servo heat simulation data	
Composite speed of all axes	Path number (1 to 2)
Spindle speed	Controlled spindle number (1 to 3)
Spindle load meter	
Difference in spindle-converted positional deviation	

NOTE
> For 2-path control in a T series system, axes are specified using absolute axis numbers rather than relative axis numbers within the system.

- Graduation unit on the axis

Set an increment per graduation on the vertical axis.   This setting is valid for servo and spindle data.
Valid data range :   1 to 100000000

- Waveform color

Set the number of a color to be used for drawing the waveform as listed below. The numbers represent associated system colors.

Setting	Default drawing color (Associated system color)
0	Gray (Data display color)
1	Red (Alarm display color)
2	Green (Title display color)
3	Yellow (Cursor display color)
4	Deep Green (Subtitle display color)
5	Purple (Input key display color)
6	Light Blue (Color selection window bar display color)
7	White (Background color for specifiable data)

Signal setting

```
     WAVEFORM DIAGNOSIS ( PARAMETER )
 SIGNAL
   SIGNAL ADDRESS
        1   X0000.0    11    Y0000.0
        2   X9999.7    12    Y9999.7
        3   X0000.0    13
        4   X9999.7    14
        5   X0000.0    15
        6   X9999.7    16
        7              17
        8              18
        9              19
       10              20
```

```
     WAVEFORM DIAGNOSIS ( PARAMETER )
 SIGNAL
   SIGNAL ADDRESS
       21   F0000.0    31    G0000.0
       22   F9999.7    32    G9999.7
       23   F0000.0
       24   F9999.7
       25   F0000.0
       26   F9999.7
       27
       28
       29
       30
```
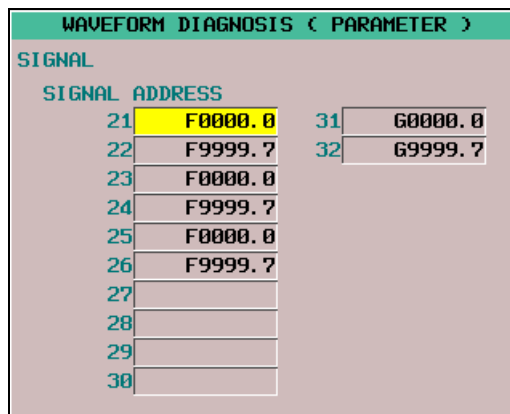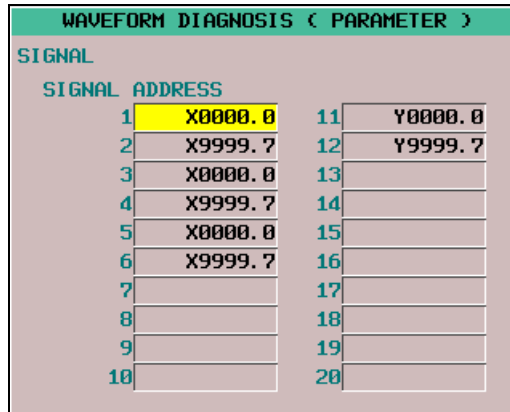
- Signal address

When the ON/OFF state of an input/output signal is to be traced, set the address of the signal.

> **NOTE**
> 1 For signal data, even when just one signal address is input in an address 1 to 32, one channel is used.
> 2 When tracing is not performed, enter 0.
> 3 Up to 32 signals can be measured at the same time.

Guide to selecting items

- Alarm type

1   When the [(OPRT)] soft key is pressed with the cursor positioned at the alarm type in the trigger setting, the [EXPLAN] soft key appears.

INPUT				EXPLAN	+

2   Pressing the [EXPLAN] soft key displays a list of alarm types.

```
    WAVEFORM DIAGNOSIS ( PARAMETER )
ALARM KIND

   1:PW alarm          2:IO alarm
   3:PS alarm          4:OT alarm
   5:OH alarm          6:SV alarm
   7:SR alarm          8:MC alarm
   9:SP alarm         10:DS alarm
  11:IE alarm         12:BG alarm
  13:SN alarm         14:EX alarm
  15:PC alarm
```
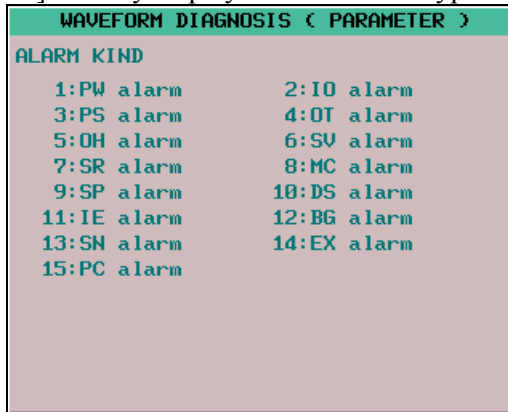
- Data type

1   When the [(OPRT)] soft key is pressed with the cursor positioned at the trace data type in the trace waveform setting, the [EXPLAN] soft key appears.
2   Pressing the [EXPLAN] soft key displays a list of trace data types.

```
    WAVEFORM DIAGNOSIS ( PARAMETER )
TRACE DATA KIND

   1:SERVO POSITION ERROR
   2:SERVO PULSE AFTER DISTRIBUTION
   3:SERVO TORQUE
   4:SERVO PULSE AFTER ACC/DEC
   5:SERVO VELOCITY
   6:SERVO ELECTRIC CURRENT COMMAND
   7:DATA DURING HEAT SIMULATION
   8:COMPOSITE SPEED FOR ALL AXIS
   9:SPINDLE SPEED
  10:SPINDLE LOAD METER
  11:SPINDLE SYNCHRONOUS ERROR
```
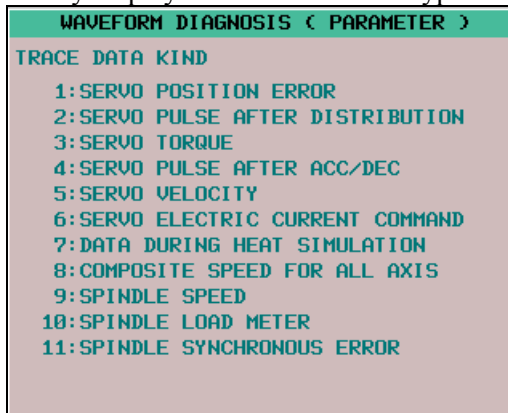
- Waveform color

1   When the [(OPRT)] soft key is pressed with the cursor positioned at the waveform color in the trace
     waveform setting, the [EXPLAN] soft key appears.
2   Pressing the [EXPLAN] soft key displays a list of waveform colors

1.6.3   Tracing Data

Starting tracing

1   Display the waveform diagnosis graph screen.
2   Press the [TRACE] soft key to start tracing.

"Now Sampling…" appears in the upper part of the screen.   When tracing ends, the indication "Now
Sampling…" disappears.
Even when the screen display is changed to another screen, tracing continues.

Canceling tracing

When the [CANCEL] soft key is pressed during tracing, tracing stops.

Moving, extending, and reducing a waveform

When [H-DOBL] or [H-HALF] soft key is pressed, the length of the time axis on one screen is extended or reduced, respectively.

When a waveform cannot fit in one screen, the time axis can be moved by pressing [←TIME] or [TIME→] soft key.
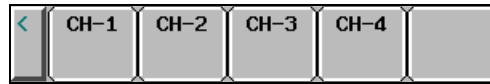
| < | CH-1 | CH-2 | CH-3 | CH-4 | |

Furthermore, pressing [CH-1], [CH-2], [CH-3], or [CH-4] soft key, following submenu appears.

| < | WAV.EX | WAV.RE | WAV. ↑ | WAV. ↓ | |

When [WAV.EX] or [WAV.RE] soft key is pressed, the length of the time axis on one screen is extended or reduced, respectively. The graduation unit on the horizontal axis, which is a parameter, also changes automatically.

The graduation unit changes from 1 to 2 to 5 to 10 to 20 to 50 to 100, and so on.

When [WAV.↑] or [WAV.↓] soft key is pressed, each waveform of servo and spindle data can be moved upward or downward.

Displaying signal data

| SIG ↑ | SIG ↓ | | | | + |

Up to 32 signals can be measured at the same time. Up to nine signals can be displayed at the same time if only signal data is displayed, or up to four signals can be displayed if signal data is displayed over waveforms.

When [SIG.↑] or [SIG.↓] soft key is pressed, the currently displayed signals are changed.

NOTE
   Signal data cannot be moved.

1.6.4   Outputting Data

Waveform diagnosis data can be output to an input/output device.

Specifying a format

When outputting data, you can select one of the two formats, which are the FS0*i*-C compatible format and the FS0*i*-D. If bit 0 (IOF) of parameter No. 10600 is set to 0, the FS0*i*-D format is selected; if bit 0 (IOF) of parameter No. 10600 is set to 1, the FS0*i*-C compatible format is selected.

Output format

Traced data is output as a text file with the following format:

-   Identifiers

Identifier word (T)	Meaning
T0/T1	Header
T60	Servo positional deviation
T61	Servo pulses after distribution
T62	Servo torque
T63	Actual servo speed
T64	Servo current command value
T65	Servo heat simulation data
T68	Measurement item
T69	Date and time (start of measurement)

Identifier word (T)	Meaning
T70	Servo pulses after acceleration/deceleration
T75	Composite speed of all axes
T80	Spindle speed
T81	Spindle load meter
T82	Difference in spindle-converted positional deviation
T90	Measurement period (waveform)
T91	Measurement period (signal)
T92	Date and time (end of measurement)
T98	Signal data

(1) Header
   FS0*i*-D format

T	1	C	W	A	V	E		D	I	A	G	N	O	S	;

   FS0*i*-C compatible format

T	0	C	W	A	V	E		D	I	A	G	N	O	S	;
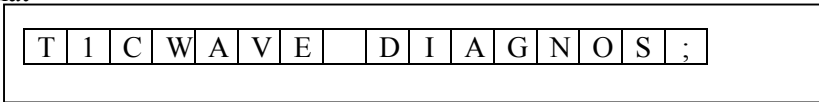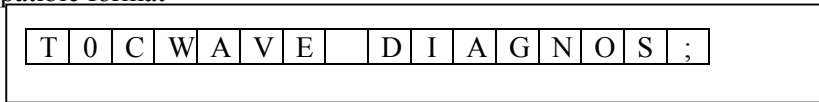
(2) Date and time of start/end of tracing
   - Starting date and time

T	6	9	D	*	*	*	*	*	*	*	*	,	*	*	*	*	*	*	;

   ├──── Year ────┼─Month─┼─ Day ─┤   ├─Hour─┼─ Min ─┼─ Sec ─

   - Ending date and time

T	9	2	D	*	*	*	*	*	*	*	*	,	*	*	*	*	*	*	;

   ├──── Year ────┼─Month─┼─ Day ─┤   ├─Hour─┼─ Min ─┼─ Sec ─
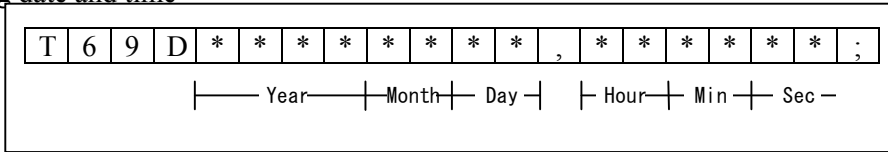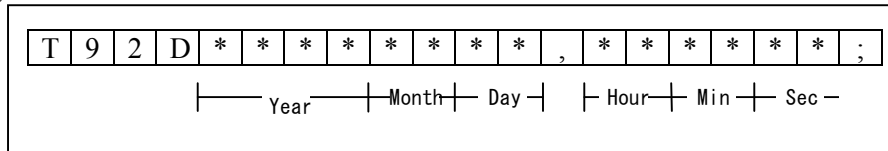
> **NOTE**
> The ending date and time is output only in the FS0*i*-D format.

(3) Waveform sampling cycle

T	9	0	D	*	*	*	*	;

   └──────► Waveform sampling cycle

(4) Signal sampling cycle

T	9	1	D	*	*	*	*	;
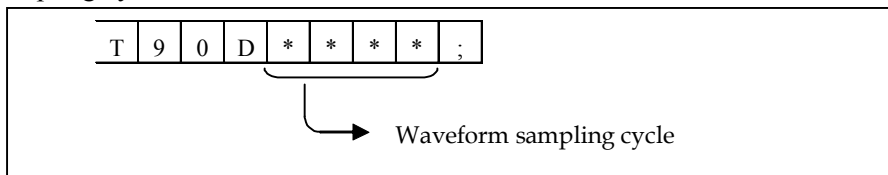
   └──────► Signal sampling peric
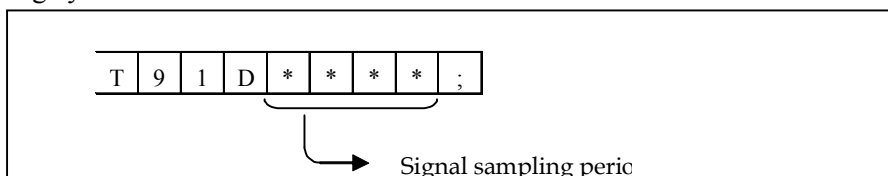
> **NOTE**
> The waveform sampling cycle and signal sampling cycle are output only in the
> FS0*i*-D format.

(5) Selection items

```
T  6  8  P  *  *  D  *  *  ,  *  *  ,  ~  *  *  ;
```

	Measurement item	Axis No./path No./signal address
P0	Servo positional deviation	Controlled axis number (1 to 8)
P1	Servo pulses after distribution	
P2	Servo torque	
P3	Actual servo speed	
P4	Servo current command value	
P5	Servo heat simulation data	
P6	Servo pulses after acceleration/deceleration	
P10	Composite speed of all axes	Path number (1 to 2)
P20	Spindle speed	Controlled spindle number (1 to 3)
P21	Spindle load meter	
P22	Difference in spindle-convert positional deviation	
P30	Signal	Signal address

NOTE
   Items P6 to P30 are output only in the FS0*i*-D format.

(6) Waveform diagnosis data

```
T  6  0  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  6  1  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  6  2  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  6  3  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  6  4  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  6  5  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  7  0  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  7  5  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  8  0  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  8  1  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  8  2  D  *  *  ,  *  *  ,  ~  *  *  ;
```

```
T  9  8  D  *  *  ,  *  *  ,  ~  *  *  ;
```

D** ~ ** : Waveform diagnosis data × No. of axes/No. of
            paths/No. of spindles/No. of signals

Blocks are output in the following order:

Block	Format
Header	(FS0*i*-C compatible/FS0*i*-D format)
Date and time (start of measurement)	(FS0*i*-C compatible/FS0*i*-D format)
Date and time (end of measurement)	(FS0*i*-D format only)
Waveform measurement period	(FS0*i*-D format only)
Signal measurement period	(FS0*i*-D format only)
Selection item	(FS0*i*-C compatible/FS0*i*-D format)
Waveform diagnosis data	(FS0*i*-C compatible/FS0*i*-D format)

> **NOTE**
> Signal data of waveform diagnosis data is output after all waveform data is output.

- **Sample file (FS0i-D format)**

```
T01WAVE DIAGNOSE                 ◀────────────── Header
T69D20040101,120125             ◀────────────── Start time
T92D20040101,120130             ◀────────────── End time
T90D2              ◀─────────────────────────── Waveform period
T91D4              ◀─────────────────────────── Signal period
T68P0D1,2              ◀──────────────────────── Measurement item/axis
T68P4D1
T68P10D1
T68P30DG0010.4,G0010.5,G0010.6   ◀───────────── Measurement item/signal
T60D643,6420          ◀────────────────────────── Waveform data
T64D270
T75D1855
T60D673,6451
T64D265
T75D1855
T60D702,6480
T64D268
T75D1855
   :
T75D1855
T98D0,0,1          ◀─────────────────────────── Signal data
T98D0,0,1
T98D0,0,1
   :
```

Outputting a file
1 Display the waveform diagnosis graph screen.
2 When the [(OPRT)] soft key is pressed, soft keys are displayed in the following operation selection state:

‹	TRACE	CANCEL		F OUTPUT	

3 Change the mode to the EDIT mode.

4   Enter a file name in the key-in buffer, and press the [F OUTPUT] soft key.   If no file name is input, the file name is assumed to be WAVE-DGN.TXT by default.

5   Press the [EXEC] soft key shown below to start outputting data:

<				CAN	EXEC

6   When data output ends, or when the [CAN] soft key is pressed, the initial operation selection state is restored.

NOTE
   While data is being traced, data output is not allowed.

Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
10600								IOF

[Input type] Parameter input
[Type of data] Bit

#0   IOF   The output format used for waveform diagnosis is:
0:   FS0*i*-D format.
1:   FS0*i*-C compatible format.

1.7   COLOR SETTING SCREEN

The coloring screen can be used to specify screen coloring.

1.7.1   Screen Display

1   Press the function key [SYSTEM].

2   Press the continuous menu key [▷] several times until the [COLOR] soft key is displayed.

3   Pressing the [COLOR] soft key displays the color setting screen.

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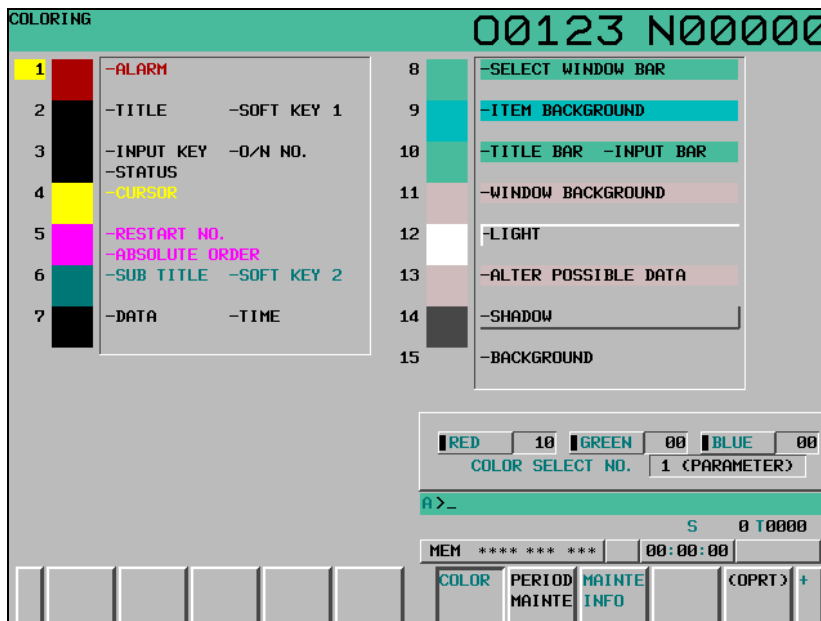
1.7.2   Operations for Color Setting

Modification to color settings (color palette values)

1   Pressing the [(OPRT)] soft key displays the following operation soft keys:

| < | RED | GREEN | BLUE | BRIGHT | DARK | | MEMORY | RECALL | COLOR1 | COLOR2 | COLOR3 | |

2   Move the cursor to a color number whose color palette values are to be modified.
     The current color palette values of the individual color elements are displayed.
3   Select a color element to be modified, with the [RED], [GREEN], or [BLUE] operation soft key.
     Multiple color elements can be selected at a time.
     Each of the [RED], [GREEN], and [BLUE] soft keys toggles between selection and deselection each time the soft key is pressed.
     (The [RED], [GREEN], and [BLUE] soft keys, when not displayed, can be displayed by pressing the rightmost soft key.)
4   By pressing the [BRIGHT] or [DARK] operation soft key, modify the brightness of the selected color element.

Storing color settings (color palette values)

Set color palette values can be stored.

1   Select a storage area by pressing the [COLOR1], [COLOR2], or [COLOR3] operation soft key.
     (The [COLOR1], [COLOR2], and [COLOR3] soft keys, when not displayed, can be displayed by pressing the rightmost soft key.)

| < | RED | GREEN | BLUE | BRIGHT | DARK | | MEMORY | RECALL | COLOR1 | COLOR2 | COLOR3 | |

Color 1: Standard color data parameters Nos. 6581 to 6595
Color 2: Parameters Nos. 10421 to 10435
Color 3: Parameters Nos. 10461 to 10475

2   Press the [MEMORY] operation soft key. The following operation soft keys are displayed:

| < | | | | CAN | EXEC | | | | | | |

3   Press the [EXEC] operation soft key. The current color palette values are stored in the selected area.
     Pressing the [CAN] operation soft key or the leftmost key does not store the current color palette values.

Calling color settings (color palette values)

1   Select an area for storing color palette values by pressing the [COLOR1], [COLOR2], or [COLOR3] operation soft key.
     (The [COLOR1], [COLOR2], and [COLOR3] soft keys, when not displayed, can be displayed by pressing the rightmost soft key.)

| < | RED | GREEN | BLUE | BRIGHT | DARK | | MEMORY | RECALL | COLOR1 | COLOR2 | COLOR3 | |

2   Press the [RECALL] operation soft key. The following operation soft keys are displayed:

| < | | | | CAN | EXEC | | | | | | |

3   Press the [EXEC] operation soft key. Color palette values are called from the selected area for modification to the color settings. This operation is invalid if no color palette values are stored.
     Pressing the [CANCEL] operation soft key or the leftmost key does not call color palette values.

1.7.3   Parameter

6581	RGB value of color palette 1

6582	RGB value of color palette 2

6583	RGB value of color palette 3

6584	RGB value of color palette 4

6585	RGB value of color palette 5

6586	RGB value of color palette 6

6587	RGB value of color palette 7

6588	RGB value of color palette 8

6589	RGB value of color palette 9

6590	RGB value of color palette 10

6591	RGB value of color palette 11

6592	RGB value of color palette 12

6593	RGB value of color palette 13

6594	RGB value of color palette 14

6595	RGB value of color palette 15

[Input type] Parameter input
[Data type] 2-word
[Valid data range] 0 to 151515
Each of these parameters sets the RGB value of each color palette by specifying a 6-digit number as described below.
rrggbb: 6-digit number (rr: red data, gg: green data, bb: blue data)
The valid data range of each color is 0 to 15 (same as the tone levels on the color setting screen). When a number equal to or greater than 16 is specified, the specification of 15 is assumed.
Example)
   When the tone level of a color is: red:1 green:2, blue:3, set 10203 in the parameter.

10421	RGB value of color palette 1 for color set 2

10422	RGB value of color palette 2 for color set 2

10423	RGB value of color palette 3 for color set 2

10424	RGB value of color palette 4 for color set 2

10425	RGB value of color palette 5 for color set 2

10426	RGB value of color palette 6 for color set 2

10427	RGB value of color palette 7 for color set 2

10428	RGB value of color palette 8 for color set 2

10429	RGB value of color palette 9 for color set 2

10430	RGB value of color palette 10 for color set 2

10431	RGB value of color palette 11 for color set 2

10432	RGB value of color palette 12 for color set 2

10433	RGB value of color palette 13 for color set 2

10434	RGB value of color palette 14 for color set 2

10435	RGB value of color palette 15 for color set 2

[Input type] Parameter input
[Data type] 2-word
[Valid data range] 0 to 151515

Each of these parameters sets the RGB value of each color palette by specifying a 6-digit number as described below.
rrggbb: 6-digit number (rr: red data, gg: green data, bb: blue data)
The valid data range of each color is 0 to 15 (same as the tone levels on the color setting screen). When a number equal to or greater than 16 is specified, the specification of 15 is assumed.
Example)
When the tone level of a color is: red:1 green:2, blue:3, set 10203 in the parameter.

10461	RGB value of color palette 1 for color set 3

10462	RGB value of color palette 2 for color set 3

10463	RGB value of color palette 3 for color set 3

10464	RGB value of color palette 4 for color set 3

10465	RGB value of color palette 5 for color set 3

10466	RGB value of color palette 6 for color set 3

10467	RGB value of color palette 7 for color set 3

10468	RGB value of color palette 8 for color set 3

10469	RGB value of color palette 9 for color set 3

10470	RGB value of color palette 10 for color set 3

10471	RGB value of color palette 11 for color set 3

10472	RGB value of color palette 12 for color set 3

10473	RGB value of color palette 13 for color set 3

10474	RGB value of color palette 14 for color set 3

10475	RGB value of color palette 15 for color set 3

[Input type] Parameter input
[Data type] 2-word
[Valid data range] 0 to 151515

Each of these parameters sets the RGB value of each color palette by specifying a 6-digit number as described below.
rrggbb: 6-digit number (rr: red data, gg: green data, bb: blue data)
The valid data range of each color is 0 to 15 (same as the tone levels on the color setting screen). When a number equal to or greater than 16 is specified, the specification of 15 is assumed.
Example)
    When the tone level of a color is: red:1 green:2, blue:3, set 10203 in the parameter.

1.7.4   Notes

(1) When the power is turned on, color 1 (parameter) is specified for the screen.   If no data is stored in color 1, the default color is used.
(2) Do not use MDI key inputs directly to change the color data parameter.   To change it, do so by performing storage operation on the coloring screen.

1.8   POWER MATE CNC MANAGER FUNCTION

When the I/O Link Option for the FANUC servo unit β*i* series (called I/O Link β*i* below) is used for CNC additional axes (slaves), the Power Mate CNC manager function can be used to display and set up various types of data of these slaves on the CNC.

The Power Mate CNC manager function enables the following display and setting operations:
(1) Current position display (absolute/machine coordinates)
(2) Parameter display and setting
(3) Alarm display
(4) Diagnosis data display
(5) System configuration screen display

Up to eight slaves can be connected to each I/O Link channel.

1.8.1   Screen Display

1   Press the function key [SYSTEM].

2   Press the continuous menu key [▷] several times until the [P.MATE MGR.] soft key is displayed.

				PMC MA INTE	PMC LA DDER	PMC CO NFIG	P.MATE MGR.	(OPRT)	+
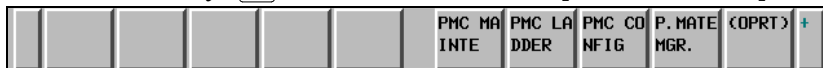
3   Pressing the [P.MATE MGR.] soft key displays the absolute coordinate screen, which is the initial screen of the Power Mate CNC manager.   On this screen, you can select each of the following items by pressing the corresponding soft key:
    [ABSOLUTE]   : Absolute coordinate display (current position display screen)

[MACHINE]   : Machine coordinate display (current position display screen)
[PARAMETER]   : Parameter screen
[MESSAGE]   : Alarm screen
[DIAGNOSIS]   : Diagnosis screen
[SYSTEM CONFIG] : System configuration screen

To select another function after one of the functions listed above is selected, press the return menu key ◁ until the soft keys appear as shown above.   Then, select the desired function.

4   To terminate the Power Mate CNC manager function, first push the return menu key ◁ once or twice.   The CNC system soft key is displayed.   Pressing this soft key lets you exit Power Mate CNC manager.

Alternatively, pressing an MDI function key (such as POS, PROG, or MESSAGE) terminates the Power Mate CNC manager function.

Selecting a slave

When slaves are connected to multiple I/O Link channels, pressing [NEXT CH.] or [PREV. CH.] soft key displayed by pressing the [(OPRT)] soft key changes the displayed channel.
In the upper section of the screen, the following information items are displayed for the connected slaves (up to eight slaves):
-    I/O Link group number (0 to 15)
-    Alarm status
The cursor is positioned at the number of the slave for which to display information (active slave). When multiple slaves are connected, pressing the [NEXT SLAVE] or [PREV. SLAVE] soft key changes the active slave.
You can display the slave status and select a slave on any screen of the Power Mate CNC manager function.

Current position display screen

The current position display screen displays the current position and actual speed of the slave.
The following current position data is displayed:
Absolute coordinate (current position in the absolute coordinate system)
Machine coordinate (current position in the machine coordinate system)

-   Display method
Press soft key [ABSOLUTE] to display the absolute coordinate screen.
Press soft key [MACHINE] to display the machine coordinate screen.
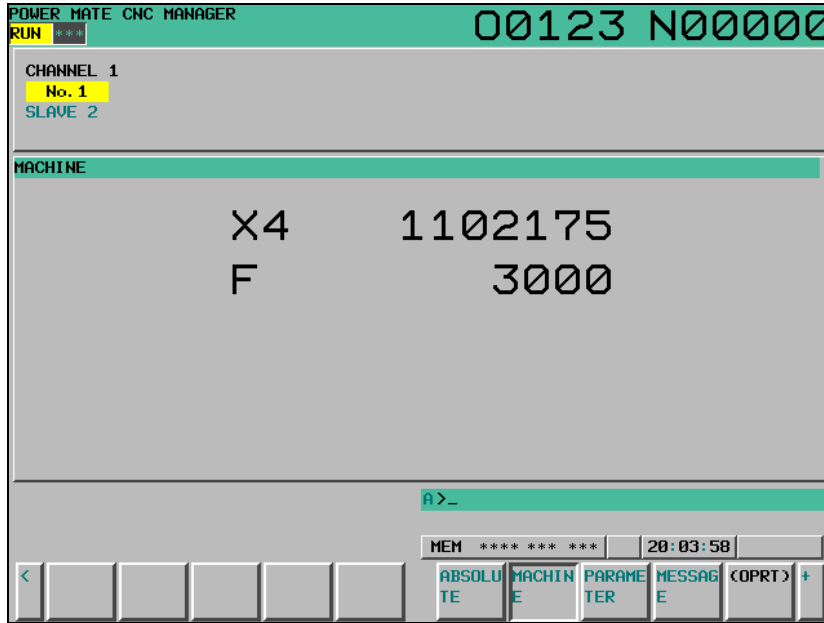
Power Mate CNC manager: Machine coordinate screen

Axis name display

Parameter Nos. 0024 and 0025 on the I/O Link β*i* side are used to set axis names.   Up to two characters can be set.   (Use the ASCII codes of 0 to 9 and/or A to Z).   When no axis name is set or the setting data is invalid, the axis name is set to 1.

This axis name is used only for position display of the Power Mate CNC manager function and irrelevant to the controlled axis on the CNC.

Parameter screen

The parameters required for the functions of the slave must be specified in advance.

Press soft key [PARAMETER] to display the parameter screen.
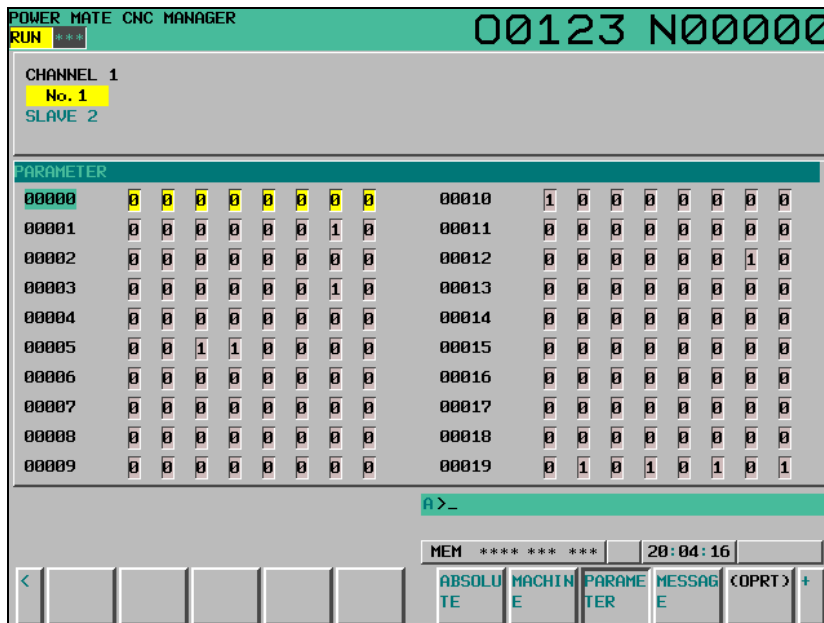
This screen displays only the bit and decimal data.   For details of the parameters, refer to FANUC SERVO MOTOR β*i* series I/O Link Option Maintenance Manual.

- Selecting and searching for a parameter
    1   Select the active slave.
    2   Press the [(OPRT)] soft key.   The following soft keys appear:

| < | NO. SRH | INPUT $\beta\to$NC | OUTPUT NC$\to\beta$ | | INPUT | NEXT SLAVE | PREV. SLAVE | | NEXT CH | PREV. CH |

    3   Enter a parameter number and press the [NO. SRH] soft key.   The search starts.
         You can also select a desired parameter number by pressing the cursor keys
         [↑] [↓] [←] [→] and page keys [↑ PAGE] [PAGE ↓] and moving the cursor.
- Setting a parameter
     You can directly set an parameter of the I/O Link β*i* slave from the CNC.
    1   Select a desired parameter using either of the above methods.
    2   Press the [(OPRT)] soft key.   The following soft keys appear:
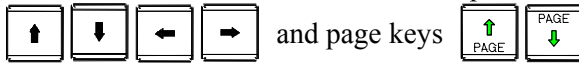
| < | NO. SRH | INPUT $\beta\to$NC | OUTPUT NC$\to\beta$ | | INPUT | NEXT SLAVE | PREV. SLAVE | | NEXT CH | PREV. CH |

    3   Enter setting data.
    4   Press the [INPUT] soft key or MDI key [⇒ INPUT].

Alarm screen

If an alarm is issued for the slave, "ALARM" is displayed in the slave status field in the upper section of the screen.
At this time, you can display the alarm screen to check the details of the alarm.
Up to 40 alarm codes are displayed on the screen.
For details of the alarms, refer to FANUC SERVO MOTOR β*i* series I/O Link Option Maintenance Manual.

- Display method

Press the [MESSAGE] soft key.   On the screen, only error codes are displayed.
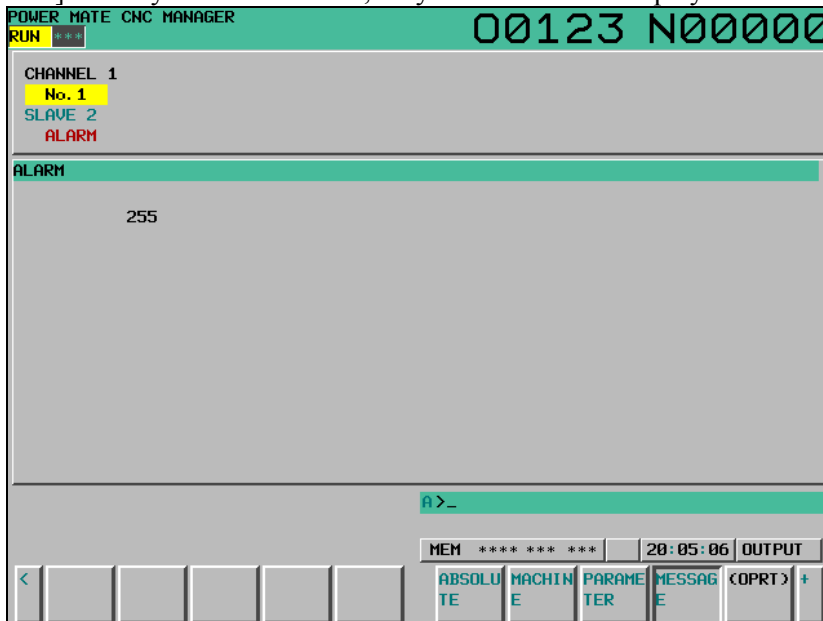
Example of displaying alarms for I/O Link β*i* of slave 2

Diagnosis screen

The diagnosis screen displays diagnosis information of the slave.
Diagnosis data is displayed in bit or integer (decimal) representation.   For details of diagnosis data, refer to FANUC SERVO MOTOR β*i* series I/O Link Option Maintenance Manual.

-   Display method

1   Press the continuous menu key $\triangleright$.
2   Press soft key [DIAGNOSIS] to display the diagnosis screen.

```
POWER MATE CNC MANAGER                         O0123 N00000
RUN ***

  CHANNEL 1
   No.1
  SLAVE 2


DIAGNOSTIC
  00000    0  0  1  0  0  1  0  1      00010    0  0  0  0  0  0  0  0
  00001    1  0  0  0  1  0  1  0      00011    0  0  0  0  0  0  0  0
  00002    0  0  0  0  0  0  0  0      00012    0  0  0  0  0  0  0  0
  00003    0  0  0  0  0  0  0  0      00013    0  0  0  0  0  0  0  0
  00004    0  0  0  0  0  0  0  0      00014    0  0  0  0  0  0  0  0
  00005    0  0  0  0  0  0  0  0      00015    0  0  0  0  0  0  0  0
  00006    0  0  0  0  0  0  0  0      00016    0  0  0  0  1  0  0  0
  00007    0  0  1  0  0  0  0  0      00017    0  1  0  0  0  0  0  0
  00008    0  0  1  1  0  0  1  1      00018    1  0  1  0  0  0  0  0
  00009    0  0  0  0  0  0  0  0      00019    0  0  0  0  0  0  0  0

                                       A>_

                                       MEM  **** *** ***    20:05:32
  <                                    DIAGNO SYSTEM              (OPRT) +
                                       SIS
```

Searching for diagnosis data

1   Select the active slave.
2   Press the [(OPRT)] soft key.   The following soft keys appear:

```
< NO. SRH INPUT  OUTPUT        INPUT  NEXT   PREV.         NEXT   PREV.
          β→NC  NC→β                 SLAVE  SLAVE          CH     CH
```

3   Enter a diagnosis number and press the [NO. SRH] soft key.   The search starts.

You can also select a desired parameter number by pressing the cursor keys ↑ ↓ and page

keys ↑ PAGE   PAGE ↓ and moving the cursor.

System configuration screen

The system configuration screen displays information on the system software of slaves.

-   Display method

1   Press the continuous menu key $\triangleright$.
2   Press the [SYSTEM] soft key to select the system configuration screen.

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```
POWER MATE CNC MANAGER                    O0123 N00000
RUN ***

    CHANNEL 1
      No. 1
    SLAVE 2


SYSTEM CONFIGURATION

    SYSTEM      SERVO AMPLIFIER UNIT β series

    SERIES      88A1

    EDITION     00K1








                                    A>_


                          MEM  **** *** ***   20:05:53

  <                         DIAGNO SYSTEM              <OPRT> +
                            SIS
```
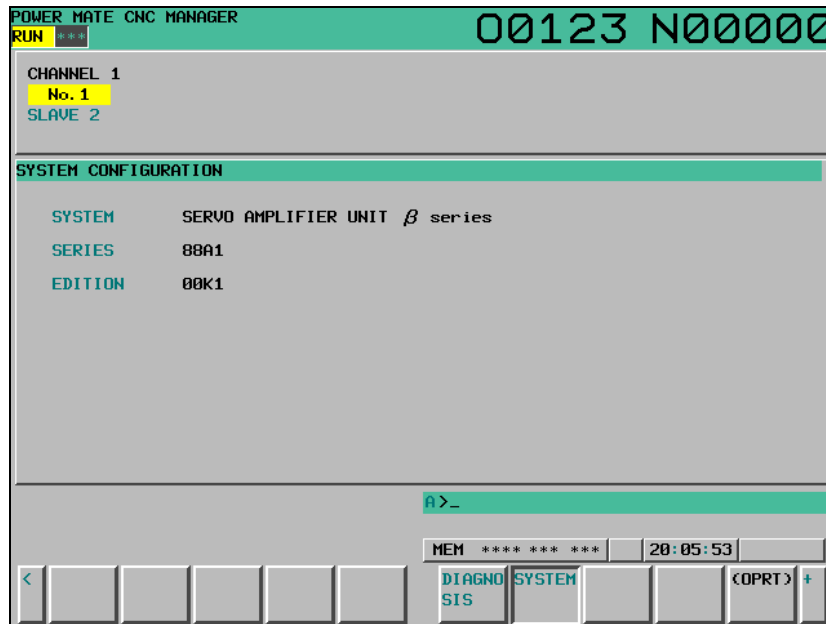
Series and edition of the I/O Link β*i* system software

1.8.2   Inputting and Outputting Parameters

Outputting parameters

Parameters are output to the CNC memory or a memory card as a data file in the program format.   Set the first registration program number in parameter No. 8760.   For each slave, program with a predetermined number is created.

When parameters are output to the CNC memory, a program with the specified program number is created.

When parameters are output to a memory card, a file is created, of which file name consists of the specified program number and an extension PMM.

Program number = setting-of-parameter (parameter No. 8760) + (m - 1) × 100 + n × 10
    m: Channel number (1 to 4)
    n: Group number
Example:
    When parameter No. 8760 is set to 8000
        Channel 1 (I/O Link β: Group 0): 8000 + 0*100 + 0*10 = 8000
        Channel 2 (I/O Link β: Group 1): 8000 + 1*100 + 1*10 = 8110

The group number is the slave number displayed in the slave status field in the upper section of the screen in reverse video.

When bit 3 (PMO) of parameter No. 0961 is set to 1, the numbers of the parameters to be output can be set only with a group number.   (No channel number is used.)

Either the CNC memory or the memory card is selected as an input/output destination device according to the settings of bits 1 (MD1) and 2 (MD2) of parameter No. 0960.

Connect a memory card or check the unused area of the CNC memory, then follow the steps below:
1   For 2-path control in T series systems, the Power Mate CNC manager screen is displayed directly from a path 1 screen.
2   Select the active slave.
3   Press the [(OPRT)] soft key.   The following soft keys appear:

```
  <  NO. SRH INPUT  OUTPUT        INPUT   NEXT  PREV.         NEXT  PREV.
            β→NC   NC→β                   SLAVE SLAVE          CH    CH
```

4   Press the [INPUT β→NC] soft key.   The following soft keys appear:

<				CAN	EXEC						

5   Press the [EXEC] soft key.
     During input, "INPUT" blinks in the message field.

NOTE
1   Parameters can be saved in other than the MEM mode or in the emergency stop status.
2   To output parameters in a memory card, if a file with the same name is found in the memory card, the parameters cannot be output.   Delete the file from the memory card or change the file name by setting parameter No. 8760.
     To save parameters in a program area, save operation is performed according to the setting of bit 2 (REP) of parameter No. 3201.
3   For 2-path control in T series systems, only the Power Mate CNC manager screen of path 1 can be used to input and output parameters, and input/output is enabled only for the CNC memory of path 1.

Inputting parameters

A data file of parameters output to the CNC memory or a memory card as a program is input to the slave determined by the program number.   The program number and device are determined as described in "Outputting parameters."

1   For 2-path control in T series systems, the Power Mate CNC manager screen is displayed directly from a path 1 screen.
2   Select the active slave.
3   Press the [(OPRT)] soft key.   The following soft keys appear:

<	NO. SRH	INPUT β→NC	OUTPUT NC→β		INPUT	NEXT SLAVE	PREV. SLAVE		NEXT CH	PREV. CH	

4   Press the [OUTPUT β→NC] soft key.   The following soft keys appear:

<				CAN	EXEC						

5   Press the [EXEC] soft key.
     During output, "OUTPUT" blinks in the message field.

NOTE
1   Parameters can be input in other than the MEM mode or in the emergency stop status.
2   For 2-path control in T series systems, only the Power Mate CNC manager screen of path 1 can be used to input and output parameters, and input/output is enabled only for the CNC memory of path 1.

1.8.3   **Parameters**

		#7	#6	#5	#4	#3	#2	#1	#0
0960					PPE	PMN	MD2	MD1	

     [Input type] Setting input
     [Data type] Bit path

#1 MD1
#2 MD2 The slave parameters are input from and output to either of the following devices:

Parameter MD2	Parameter MD1	I/O destination
0	0	Program memory
0	1	Memory card

#3 PMN The Power Mate CNC manager function is:
  0: Enabled.
  1: Disabled. (Communication with the slave is not performed.)

#4 PPE Setting slave parameters using the Power Mate CNC manager:
  0: Can always be performed regardless of the setting of PWE.
  1: Follows the setting of PWE.

	#7	#6	#5	#4	#3	#2	#1	#0
0961					PMO			

[Input type] Parameter input
[Data type] Bit

#3 PMO The O number of a program for saving and restoring the I/O Link β parameter is set based on:
  0: Group number and channel number
  1: Group number only

8760	Program number of data input/output (Power Mate CNC manager)

[Input type] Setting input
[Data type] 2-word path
[Valid data range] 0 to 9999

This parameter sets the program numbers of programs to be used for inputting and outputting slave data (parameters) when the Power Mate CNC manager function is used.
For a slave specified with I/O Link channel m and group n, the following program number is used:
Setting + (m - 1) × 100 + n × 10

If the setting is 0, the parameters of the slave specified with channel 1 and group 0 cannot be input from or output to the CNC memory because the program number is set to 0. The parameters can be input from and output to a memory card.
(Set a value with which any used program number does not exceed 9999.)

Warning
If an alarm is issued for the Power Mate CNC manager, a warning message is displayed.

Message	Description
DATA ERROR	An attempt was made to execute [PUNCH] (NC → β) for a program not found in the program area.
WRITE PROTECTED	An attempt was made to execute [READ] (β → NC) for a program area when the memory protection signal (KEY) is off.

Message	Description
EDIT REJECTED	An attempt was made to execute [READ] ($\beta \rightarrow$ NC) when the program area already contained a program with the same name as that to be created by executing [READ] ($\beta \rightarrow$ NC). An attempt was made to execute [READ] ($\beta \rightarrow$ NC) when the number of the program to be created by executing [READ] ($\beta \rightarrow$ NC) was selected. An attempt was made to execute [READ] ($\beta \rightarrow$ NC) when bit 0 (TVC) of CNC parameter No. 0000 was set to 1. (Parameters Nos. 0000 to 0019 are output, but parameter No. 0020 and subsequent parameters are not output.) An attempt was made to execute [PUNCH] (NC $\rightarrow \beta$) when a memory card did not contain any program for which [PUNCH] (NC $\rightarrow \beta$) could be executed. An attempt was made to execute [READ] ($\beta \rightarrow$ NC) for a protected memory card.
NO MORE SPACE	An attempt was made to execute [READ] ($\beta \rightarrow$ NC) when the program area did not have enough unused space.
FORMAT ERROR	Data other than digits, signs, CAN, and INPUT was entered as the setting of a parameter.
TOO MANY FIGURES	Data consisting of 9 or more digits was entered for a bit-type parameter.
DATA IS OUT OF RANGE	The setting exceeds the valid data range.

1.8.4   Notes

-   Connecting an I/O Link

When I/O Link β*i* is used as a slave of an I/O Link, the CNC assigns I/O addresses.   The slave data is input and output in 16-byte units.   Therefore, be sure to specify 128 as the number of input/output points.

Up to eight slaves can be connected.

The module name is OC02I (16-bit input) or OC02O (16-byte output).

BASE is always 0 and SLOT is always 1.

-   Function of ignoring the Power Mate CNC manager

After setting and checking data required for each slave connected, you can stop communication with the Power Mate CNC manager function to send a command from the CNC ladder to the slave.

When bit 3 (PMN) of parameter No. 0960 is set to 1, communication between the CNC and the slave via the I/O Link is all open to the ladder.   While this bit is 1, the Power Mate CNC manager function does not operate.

-   Data protection key

When the program data protection key of the CNC is on, no parameters can be input to the CNC program memory.

1.9   MAINTENANCE INFORMATION SCREEN

The maintenance information screen is provided to record the history of maintenance performed by a service person of FANUC or machine tool builder.

The screen has the following features:
- MDI alphabetical input is allowed.
  (Only in Japanese display, even the single-byte kana input mode is allowed.)
- The recording screen can be scrolled in units of lines.
- Edited maintenance information can be input and output.
- Records are stored in Flash ROM.
- Double-byte (Shift JIS) code can be displayed.

1.9.1   **Displaying the Maintenance Information Screen**

1. Press function key [SYSTEM].

2. Press continuous menu key [▷] several times until soft key [M-INFO] is displayed.

3. Press the soft key [M-INFO]. The maintenance information screen appears.

When selected, the maintenance information screen shows the latest information.
The status (mode, number of empty character spaces, current cursor line, current column number) is displayed at the bottom of the screen.
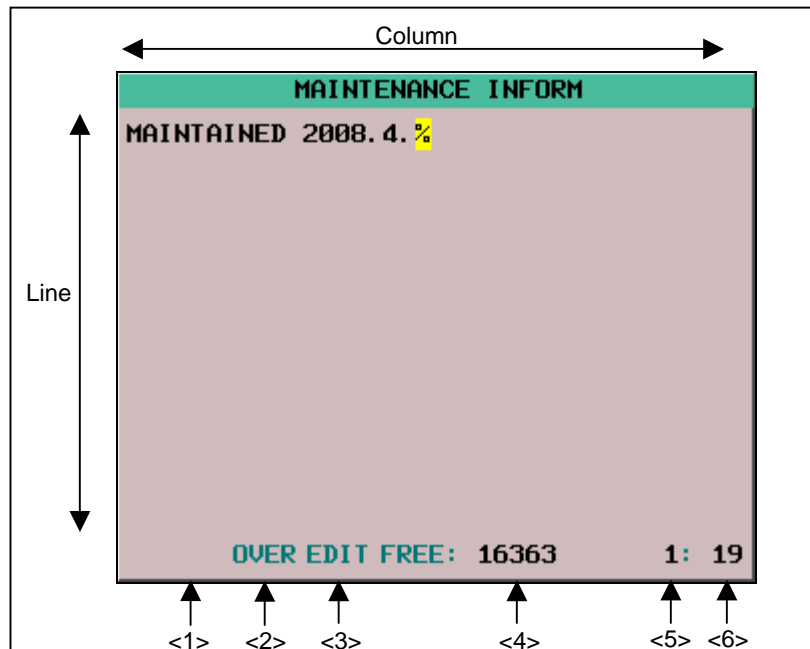
Fig. 1.9.1 (a)   MAINTENANCE INFORMATION screen

Status display
<1> Kana/alphabetic
   (Blank): English input mode (Only In the display which is not Japanese)
   ｶﾅ : Single-byte kana input mode (Only in Japanese display)
   ABC: English input mode (Only in Japanese display)
<2> OVER / INSERT
   OVER: Overwrite mode
   INST: Insert input mode.
<3> EDIT / READ
   EDIT: Edit mode / Editing allowed
   READ: View mode / Editing inhibited
<4> Number of empty character spaces
   Number of empty character spaces as single-byte characters
<5> Current cursor line
   Current cursor position on the line
<6> Current cursor column
   Current cursor position on the column

NOTE
   The numbers of lines and columns that can be displayed by each LCD are:
- 10.4" display unit: 37 characters × 12 lines
- 8.4" display unit: 38 characters × 11 lines

1.9.2   Operating the Maintenance Information Screen

The maintenance information screen has view mode and edit mode, which are selected by pressing the soft key [END] or [EDIT].
Initially, view mode is selected. To start editing, select edit mode by pressing the soft keys [(OPRT)] and [EDIT]. When the editing is completed, press the soft key [END] key. Then, select soft key [SAVE] or [QUIT].   If [SAVE] is selected, edited data is saved to FLASH-ROM.   If [QUIT] is selected, no edited data is saved to FLASH-ROM.
To scroll the screen showing the recorded information, press a cursor keys or page keys on the MDI panel.
The following keys are used for editing (character input) and viewing:

Table 1.9.2 (a)   Table of (edit) operations on the maintenance information screen

Mode	Key	Description
View	Soft key [EDIT] [JUMP]	 Allows editing. Displays the beginning or the end.
	Cursor keys	Scrolls the screen up or down.
	Page keys	Scrolls the screen up or down in units of whole screens.
Edit	Soft key [END] [ｶﾅ/ABC] [CLEAR] [I/O] [JUMP]	 Ends editing. Select whether to save the edited data. Switches between single-byte kana input and alphabetic input modes. (Japanese display only.) Clears all maintenance information. (This key is enabled when the parameter MDC (No.3116#7) is set to 1.) Performs [F INPUT] or [F OUTPUT] operation for maintenance information. Moves the cursor to the beginning or end.
	Cursor keys	Moves the cursor position up or down.
	Page keys	Scrolls the screen up or down in units of whole screens.
	Address / numeric keys	Allows alphabetical or numeric input. (See the next subsection for explanations about single-byte kana input.)
	INSERT key	Switches between insert and overwrite modes.
	DELETE key	• If the key input buffer does not contain any character, deletes the one character at the cursor position. • If the key input buffer contains characters, deletes the characters from the buffer.
	CAN key	• If the key input buffer does not contain any character, deletes the one character before the cursor. • If the key input buffer contains characters, deletes the one character from the buffer.
	INPUT key	• If the key input buffer does not contain any character, starts a new line. • If the key input buffer contains characters, outputs the characters from the buffer to the information screen.

1.9.3   Single-Byte Kana Input on the Maintenance Information Screen

By pressing soft key [ｶﾅ/ABC], you can switch between single-byte kana input and alphabetic input modes.
In single-byte kana input mode, alphabetic characters are converted in accordance with the "single-byte kana/Roman character conversion table" and resultant single-byte kana characters are displayed in the key input buffer. (Japanese display only.)

Pressing the ![INPUT] key causes the characters in the key input buffer to be output to maintenance information.

Pressing the ![DELETE] key causes the characters to be deleted from the key input buffer and the one character of the maintenance information on which the cursor is positioned to be deleted.

Pressing the ![CAN] key causes cancels conversion, and deletes one character from the key input buffer. If the key input buffer does not contain any character, the one character of the maintenance information that immediately precedes the cursor is deleted.

1.9.4 Warnings that Occurs on the Maintenance Information Screen

The following warnings occur on the maintenance information screen.

Warning message	Meaning
NO MORE SPACE	An overflow occurred in CNC memory.
ALARM	The operation could not be performed because an alarm was generated in the CNC.
BUSY	Wait for CNC processing to end or make a retry.
ILLEGAL DATA	Investigate data and correct it as required.
WRONG MODE	The CNC is in wrong mode.
COMMAND ILLEGAL USE	A corresponding CNC option cannot be found.
PARAMETER ERROR	CNC parameter settings contain an error.
EDIT REJECTED	An attempt was made to perform an edit operation on data that could not be edited.
WRITE PROTECT	Writing is prohibited.
COMMAND REJECT	The CNC rejected the execution of the processing. Check the execution conditions.

1.9.5 Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
3116	MDC							

[Input type] Setting input
[Data type] Bit path

#7 MDC Maintenance information data:
0: Cannot be erased entirely.
1: Can be erased entirely.

	#7	#6	#5	#4	#3	#2	#1	#0
3206							MIF	

[Input type] Parameter input
[Data type] Bit

#1 MIF Editing of the maintenance information screen is:
0: Not prohibited.
1: Prohibited.

	#7	#6	#5	#4	#3	#2	#1	#0
8901	MEN							

[Input type] Setting input
[Data type] Bit path

   #7 **MEN** The periodic maintenance screen is:
               0:    Displayed.
               1:    Not displayed.

1.10   CONTENTS-OF-MEMORY DISPLAY SCREEN

The contents-of-memory display screen can be used to display the contents of the CNC memory, starting at a specified address.

1.10.1   Display Method

1   Set bit 0 (MEM) of parameter No. 8950 to 1 to display the contents-of-memory display screen.

2   Press the function key [SYSTEM].

3   Press the continuous menu key [▷] and then the soft key [MEMORY] belonging to the chapter selection soft key.
    The screen shown below appears.
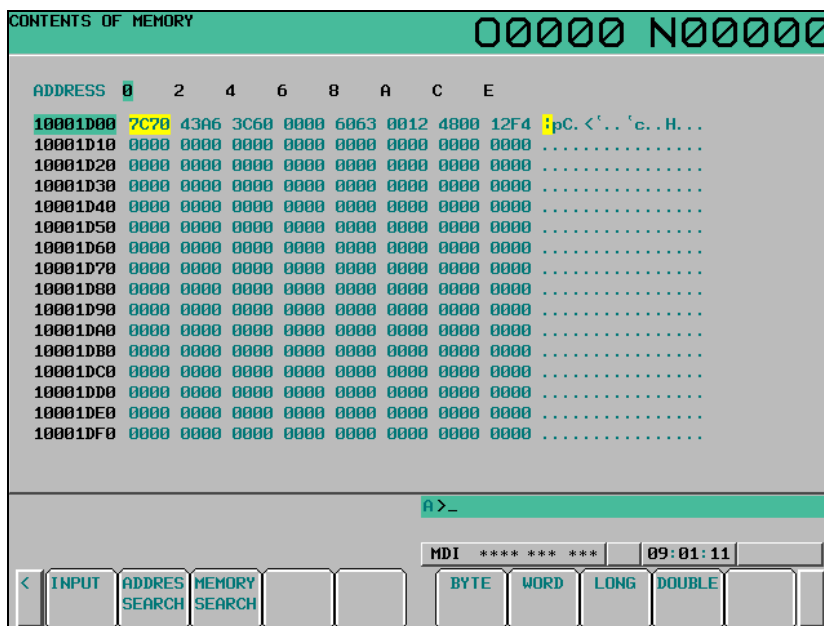
Fig. 1.10.1 (a)   Contents-of-memory display screen (10.4-inch)

4   Key in the address (hexadecimal) of a desired location and press the soft key [ADDRES SEARCH].
    256 bytes of data are displayed, starting at the specified address.
    (Example: 100000 + soft key [ADDRES SEARCH] will start displaying at 100000H.)

5   Displayed data can be switched using the page keys [PAGE↑] [PAGE↓] and the cursor keys [↑] [↓] [←] [→].

6   To select the type of data to be displayed, use the soft keys [BYTE], [WORD], [LONG], and [DOUBLE].

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1.10.2   Display Formats on Contents-of-Memory Display Screen

The format of memory content displays can be selected from the following four:

Byte display (1-byte hexadecimal display)
Word display (2-byte hexadecimal display)
Long display (4-byte hexadecimal display)
Double display (8-byte decimal display—double precision floating point display)

Up to 256 bytes of memory contents can be displayed on the screen.

NOTE
1   When specifying an address, do not suffix it with "H" to indicate a hexadecimal.
    Otherwise, an alarm is issued to notify of an illegal format.
2   If the word display format is selected, each input address is rounded to 2 bytes.
    If the long or double display is selected, each input address is rounded to 4
    bytes.

⚠ **WARNING**
1   Trying to specify the address of any memory location to which access is inhibited
    for the address search function will result in a system alarm.
    Before starting to use the address search function, confirm that the address you
    will specify is accessible, and be sure to input the address correctly.
2   This function is intended for maintenance purposes.   It should not be used by
    general users.

---

2 LCD-MOUNTED TYPE CNC HARDWARE

The FANUC Series 0i-D/0i Mate-D of the LCD-mounted type is a CNC consisting of a liquid crystal display on the back of which the CNC control unit is mounted to incorporate it. This chapter describes the functions of LCD-mounted type CNC control unit printed circuit boards and axis cards on the printed circuit boards as well as how to replace consumables.

2.1 HARDWARE CONFIGURATION

2.2 HARDWARE OVERVIEW

Main board
• CPU for controlling CNC
• Power supply
• Axis control
• Spindle interface
• LCD/MDI interface
• I/O Link
• PMC control function
• High-speed DI
• RS-232C
• Memory card interface
• Ethernet (Series 0*i* only)

Basic system

Fast Ethernet board
Data server function
Ethernet communication function

Various types of network boards
PROFIBUS-DP   master boardPROFIBUS-DP   slave board
FL-net board
Device Net master board
Device Net slave board

Options

Unit without optional slots
or
Unit having two optional slots

The control unit of the Series 0*i* Mate has no optional slots, so no option board can be inserted.
A unit with optional slots can have as many option boards as option slots.
The Fast Ethernet board can be inserted into only the slot on the LCD side.

2.3   TOTAL CONNECTION DIAGRAMS

When optional functions are provided

Optional slot

Fast Ethernet board

Memory card

Prepare the memory card recommended by FANUC.

ETHERNET(CD38R) —— Ethernet

PROFIBUS-DP master board

PROFI(CN1) —— Another NC or Profibus device

PROFIBUS-DP slave board

PROFI(CN2) —— Another NC or Profibus device

DeviceNet master board

DVNET(TBL) —— Another NC or DeviceNet device

DeviceNet slave board

DVNET(TBL) —— Another NC or DeviceNet device

FL-net board

FLNET(CD38N) —— FL-net device

Example of I/O Link connection
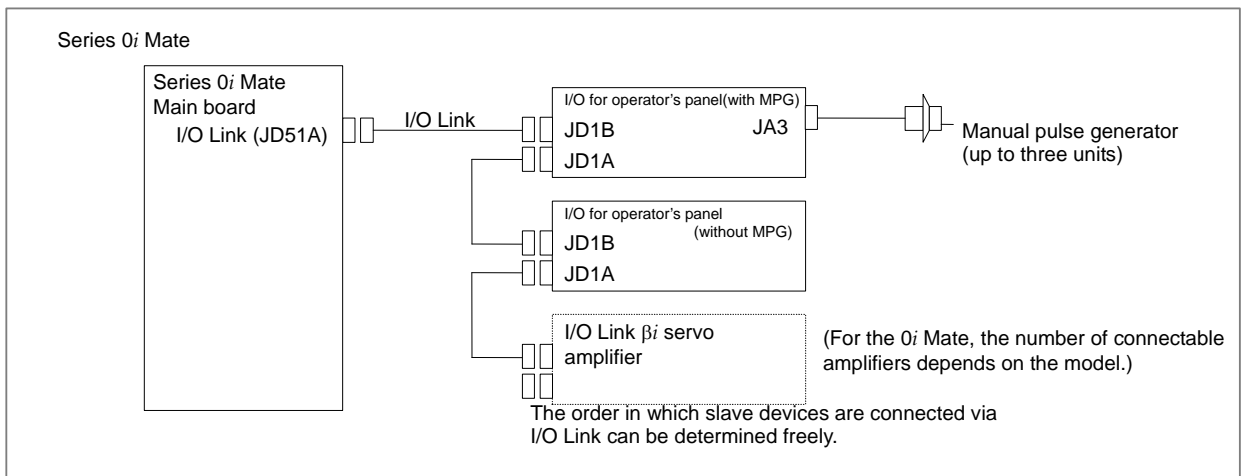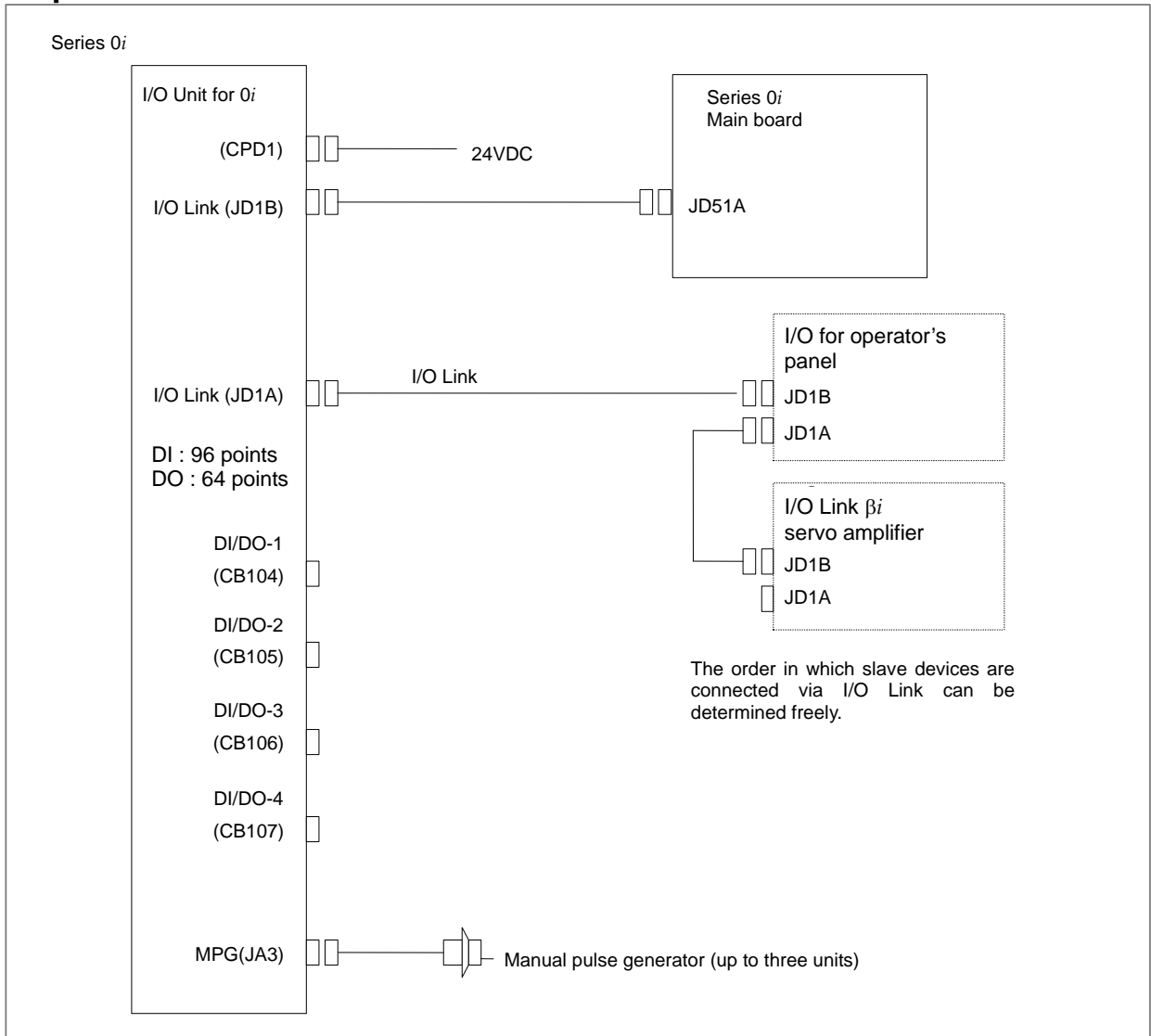
2.4 CONFIGURATION OF PRINTED CIRCUIT BOARD CONNECTORS AND CARDS

2.4.1 Main Board

- **Main board specification**

Name	CNC model	Specification
Main board A0	0*i*	A20B-8200-0540
Main board A1	0*i*	A20B-8200-0541
Main board A2	0*i*	A20B-8200-0542
Main board A3	0*i*	A20B-8200-0543
Main board A5	0*i* Mate	A20B-8200-0545

- Connector mounting location
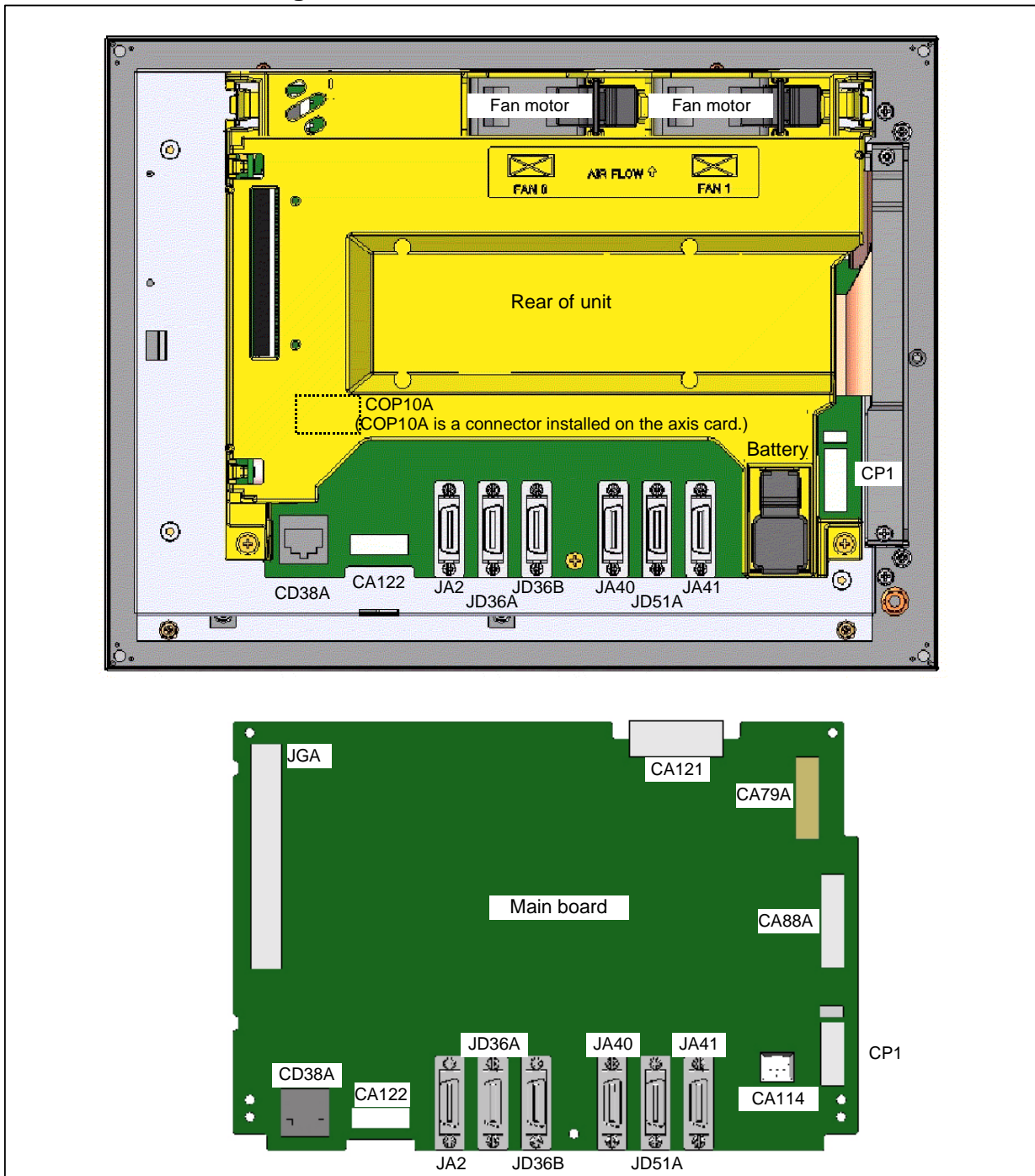
Connector number	Application
COP10A	Servo amplifier (FSSB)
JA2	MDI
JD36A	RS-232-C serial port 1
JD36B	RS-232-C serial port 2 (Note)
JA40	Analog spindle / high-speed DI
JD51A	I/O Link
JA41	Serial spindle / position coder
CP1	DC24V-IN
JGA	Back panel interface
CA79A	Video signal interface

Connector number	Application
CA88A	PCMCIA interface
CA122	Soft key
CA121	Inverter
CD38A	Ethernet

NOTE
RS-232-C serial port 2 is also used as a touch panel interface.

Axis card and power supply mounting location

No.	Name	Specification	Function	Remarks
(1)	Axis card A1	A20B-3300-0635	Path 1 control, supporting up to 2 axes	The maximum number of axes is also limited depending on the model.
	Axis card A2	A20B-3300-0638	Path 1 control, supporting up to 4 axes	
	Axis card A3	A20B-3300-0637	Path 1 control, supporting up to 5 axes	
	Axis card B2	A20B-3300-0632	Path 2 lathe control, supporting up to 6 axes	
	Axis card B3	A20B-3300-0631	Path 2 lathe control, supporting up to 8 axes	
(2)	Power supply (no slot)	A20B-8200-0560	No slot	
	Power supply (2 slots)	A20B-8200-0570	2 slots	

- **FROM/SRAM module mounting location**

No.	Name	Specification	Function	Remarks
①	FROM/SRAM module A1	A20B-3900-0242	FROM 64MB SRAM 1MB	The FROM stores various control software programs, user software programs, and so forth. The SRAM is a battery-backed memory module.
	FROM/SRAM module B1	A20B-3900-0240	FROM 128MB SRAM 1MB	
	FROM/SRAM module B2	A20B-3900-0241	FROM 128MB SRAM 2MB	

- **Block diagram**

- LED display

(2) Ethernet status

COM	LINK
(yellow)	(green)

LOWV | (1) Alarm (red)

(3) 7-segment LED

ALM1 ALM2 ALM3 | (1) Alarm (red)

(1) Alarm LED (red) indication at system alarm occurrence

If any of these LEDs lights, it is likely that the hardware is defective.

No.	Alarm LED 1	2	3	Meaning
1	□	■	□	Low battery voltage. The battery may be is running out.
2	■	■	□	Software detected an error and stopped the system.
3	□	□	■	Hardware detected a failure in the system.
4	■	□	■	An alarm was issued with the axis card. The axis card or servo amplifier may be faulty, or the FSSB may be broken.
5	□	■	■	An error was detected in the data of the SRAM on the FROM/SRAM module. The FROM/SRAM module may be faulty, the battery voltage may have dropped, or the main board may be faulty.

No.	Alarm LED 1 2 3	Meaning
6	■ ■ ■	Abnormal power supply operation. The cause may be noise or a power supply failure.

■ : On □ : Off

LED Name	Meaning
LOWV	The main board (CPU circuit) may be faulty.

(2) Ethernet status LED

LED Name	Meaning
LINK (green)	Turned on when a connection is made with the hub correctly
COM (yellow)	Turned on when data is transferred

(3) 7-segment LED

See Appendix E, "LED Display".

Inverter

	Name	Specification
Inverter	For 8.4" color LCD	A20B-8002-0703
	For 10.4" color LCD	A20B-8002-0702

Location of the inverter
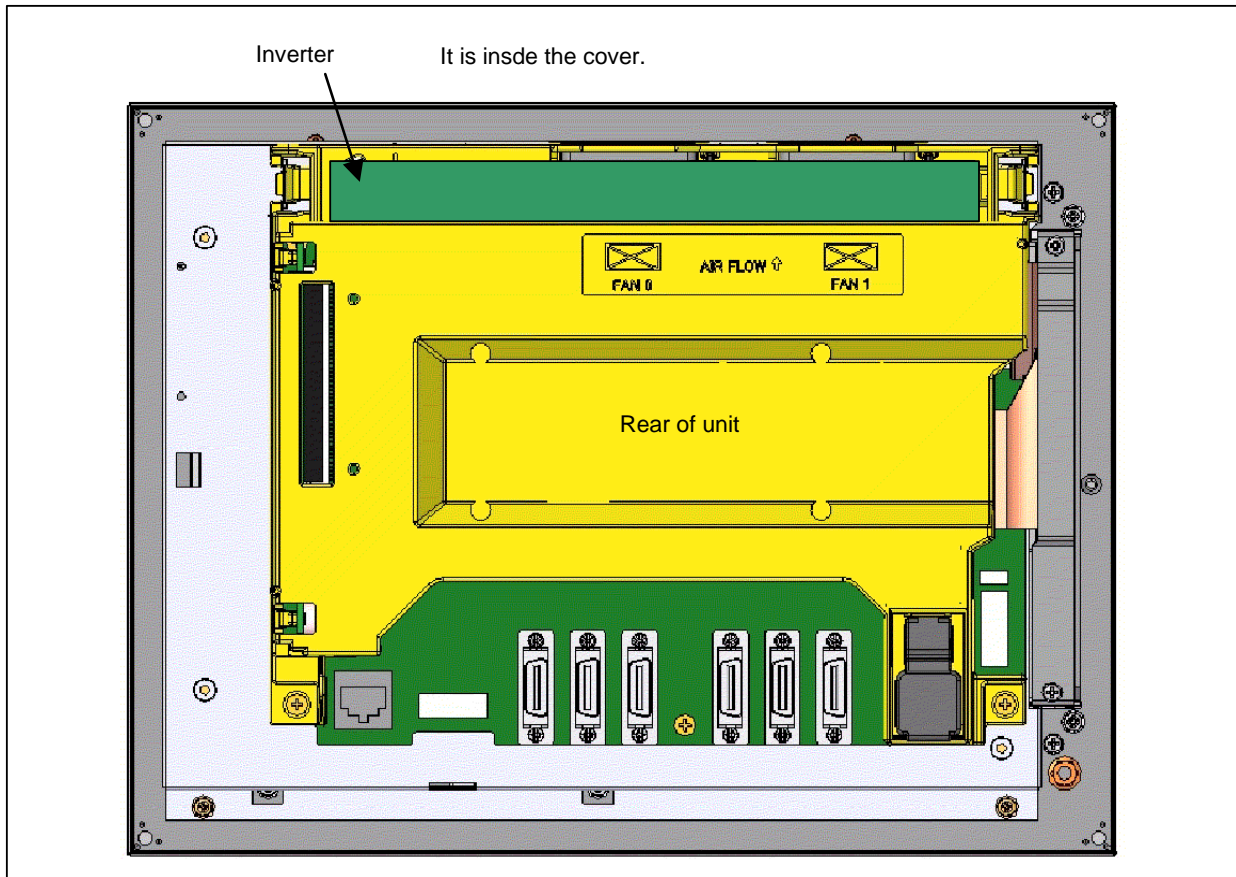
2.5   LIST OF UNITS AND PRINTED CIRCUIT BOARDS

2.5.1   Basic Unit

CNC model	Name	Drawing number	Remarks
0*i*	Basic Unit (No slot)	A02B-0319-B500	
	Basic Unit (2 slots)	A02B-0319-B502	
0*i* Mate	Basic Unit (No slot)	A02B-0321-B500	
		A02B-0321-B510	

CNC model	Name	Drawing number	Remarks
0*i* 0*i* Mate	Cover Case (No slot)	A250-0921-X010	
0*i*	Cover Case (2 slots)	A250-0921-X012	

2.5.2   Display Unit

CNC model	Name	Drawing number	LCD ID	MDI ID	Remarks
0*i*	10.4" LCD unit	A02B-0319-D510	1010		
	10.4" LCD unit (with touch panel)	A02B-0319-D511			
0*i* 0*i* Mate	8.4" color LCD/MDI unit	A02B-0319-D514#T	1011	14	Horizontal- type MDI for T series
		A02B-0319-D514#M		14	Horizontal- type MDI for M series
		A02B-0319-D515T		18	Vertical-type MDI for T series
		A02B-0319-D515#M		18	Vertical-type MDI for M series
	8.4" color LCD/MDI unit (with touch panel)	A02B-0319-D518#T	1011	14	Horizontal-type MDI for T series
		A02B-0319-D519#T		18	Vertical-type MDI for T series

2.5.3   MDI Unit

CNC model	Name	Drawing number	MDI ID	Remarks
0*i*	MDI unit (for 10.4" LCD unit)	A02B-0319-C125#T	12	Horizontal- type MDI for T series
		A02B-0319-C125#M		Horizontal- type MDI for M series
		A02B-0319-C126#T		Vertical-type MDI for T series
		A02B-0319-C126#M		Vertical-type MDI for M series
		A02B-0303-C120#T	04	Small- type MDI for T series
		A02B-0303-C120#M	08	Small- type MDI for M series

2.5.4   Printed Circuit Boards

Name	Drawing number	ID	Remarks
Main board A0	A20B-8200-0540	00428	
Main board A1	A20B-8200-0541	00429	
Main board A2	A20B-8200-0542	0042A	
Main board A3	A20B-8200-0543	0042B	
Main board A5	A20B-8200-0545	0042C	
Axis card A1	A20B-3300-0635	00146	
Axis card A2	A20B-3300-0638	0014B	
Axis card A3	A20B-3300-0637	0014A	
Axis card B2	A20B-3300-0632	0014D	

Name	Drawing number	ID	Remarks
Axis card B3	A20B-3300-0631	0014E	
FROM/SRAM module A1 (FROM 64MB, SRAM 1MB)	A20B-3900-0242	FROM: E3 SRAM: 03	
FROM/SRAM module B1 (FROM 128MB, SRAM 1MB)	A20B-3900-0240	FROM: E4 SRAM: 03	
FROM/SRAM module B2 (FROM 128MB, SRAM 2MB)	A20B-3900-0241	FROM: E4 SRAM: 04	
Fast Ethernet board	A20B-8101-0030	00701	
PROFIBUS-DP master board	A20B-8101-0050	00704	
PROFIBUS-DP slave board	A20B-8101-0100	00705	
FL-net board	A20B-8101-0031	00702	
DeviceNet master board	A20B-8101-0220	00706	
DeviceNet slave board	A20B-8101-0330	00708	
Power supply (0 slots)	A20B-8200-0560	01	
Power supply (2 slots)	A20B-8200-0570	10	
Inverter (for 8.4" color LCD)	A20B-8002-0703	–	
Inverter (for 10.4" color LCD)	A20B-8002-0702	–	
Touch panel control printed circuit board	A20B-8002-0312	–	

* See Chapter 4, "MATTERS COMMON TO BOTH LCD-MOUNTED TYPE AND STAND-ALONE TYPE (HARDWARE)" for optional boards.

2.5.5 I/O

Name	Drawing number	Remarks
I/O Unit for 0*i*	A02B-0309-C001	DI/DO: 96/64 with MPG interface
Distributed I/O operator's panel I/O module A1	A20B-2002-0470	DI/DO: 72/56 DI=general 16, matrix 56, with MPG interface
Distributed I/O operator's panel I/O module B1	A20B-2002-0520 A20B-2003-0750	DI/DO: 48/32 with MPG interface
Distributed I/O operator's panel I/O module B2	A20B-2002-0521	DI/DO: 48/32
Distributed I/O connector panel I/O basic module	A03B-0815-C001	DI/DO: 24/16
Distributed I/O connector panel I/O expansion module A	A03B-0815-C002	DI/DO: 24/16 with MPG interface
Distributed I/O connector panel I/O expansion module B	A03B-0815-C003	DI/DO: 24/16
Distributed I/O connector panel I/O expansion module C	A03B-0815-C004	DO: 16 (2A output)
Distributed I/O connector panel I/O expansion module D	A03B-0815-C005	Analog input
I/O module type-2 for connector panel: basic module B1	A03B-0815-C040	DI/DO:48/32 with MPG interface
I/O module type-2 for connector panel: basic module B2	A03B-0815-C041	DI/DO:48/32 without MPG interface
I/O module type-2 for connector panel: expansion module E1	A03B-0815-C042	DI/DO:48/32
Terminal type I/O module: basic module	A03B-0823-C001	DI/DO:24/16 with I/O Link I/F
Terminal type I/O module: expansion module A	A03B-0823-C002	DI/DO:24/16 with MPG interface
Terminal type I/O module: expansion module B	A03B-0823-C003	DI/DO:24/16 without MPG interface

Name	Drawing number	Remarks
Terminal type I/O module: expansion module C	A03B-0823-C004	DO: 16 (2A output)
Terminal type I/O module: expansion module D	A03B-0823-C005	Analog input
Main panel A machine operator's panel	A02B-0319-C242	Alphabetic MDI with keys labeled in both alphabetic characters and symbols; supporting simultaneous push-down of 3 keys
Main panel B machine operator's panel	A02B-0319-C243	Keyboard labeled in both alphabetic characters and symbols; supporting simultaneous push-down of 3 keys
Sub panel A machine operator's panel	A02B-0236-C232	
Sub panel B machine operator's panel	A02B-0236-C233	
Sub panel B1 machine operator's panel	A02B-0236-C235	
Sub panel C machine operator's panel	A02B-0236-C234	
Sub panel C1 machine operator's panel	A02B-0236-C236	
Small machine operator's panel	A02B-0299-C152#M	
Small machine operator's panel B	A02B-0309-C151#M	
Operator's panel connector unit (Source type output A)	A16B-2202-0731	DI/DO: 64/32
Operator's panel connector unit (Source type output B)	A16B-2202-0730	DI/DO: 96/64
Handy machine operator's panel	A02B-0259-C221#A	
Interface unit for handy machine operator's panel	A02B-0259-C220	
I/O Link connected unit A	A20B-2000-0410	Electrical-optical
I/O Link connected unit B	A20B-2000-0411	Electrical-electrical
I/O Link connected unit C	A20B-2000-0412	Optical-optical
FANUC I/O Link-AS-i converter (For AS-I Ver.2.0)	A03B-0817-C001	
FANUC I/O Link-AS-i converter (For AS-I Ver.2.1)	A03B-0817-C002	
I/O Link distributed adapter (2ch)	A20B-1007-0680	
I/O Link distributed adapter (3ch)	A20B-1008-0360	

2.5.6   Other Units

Name	Drawing number	Remarks
Separate detector interface unit (basic 4 axes)	A02B-0303-C205	
Separate detector interface unit (additional 4 axes)	A02B-0236-C204	
Analog input separate detector interface unit (basic 4 axes)	A06B-6061-C201	
Optical I/O Link adapter (standard type)	A13B-0154-B001	
Optical I/O Link adapter (high-speed type)	A13B-0154-B004	
Optical adapter	A13B-0154-B003	For serial spindle
Spindle distributed adapter	A13B-0180-B001	

2.6   REPLACING THE MAIN BOARD

> ⚠ **WARNING**
> Only those personnel who have received approved safety and maintenance training may perform this replacement work.
> When opening the cabinet and replacing the board, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover).
> Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

> ⚠ **CAUTION**
> Before replacing a printed circuit board, be sure to read Section 4.11,
> "CAUTIONS IN REPLACING PCB'S," to confirm the procedure.
> Before starting replacement work, back up the contents (such as parameters
> and programs) of the SRAM memory of the CNC. Otherwise, the contents of the
> SRAM memory may be lost during replacement work. See Chapter 5, "INPUT
> AND OUTPUT OF DATA" or Appendix C, "BOOT SYSTEM" for explanations
> about how to save the contents of the SRAM memory.

Replacement procedure

<1> Remove the 2 screws fastening the case.

(Before starting replacement, detach any cable from the option card.)

<2> Pull out the case while unlatching the claw from the base metal plate on either side of the upper
section of the case.

The case can be pulled out together with the back panel, fan, and battery attached to it.
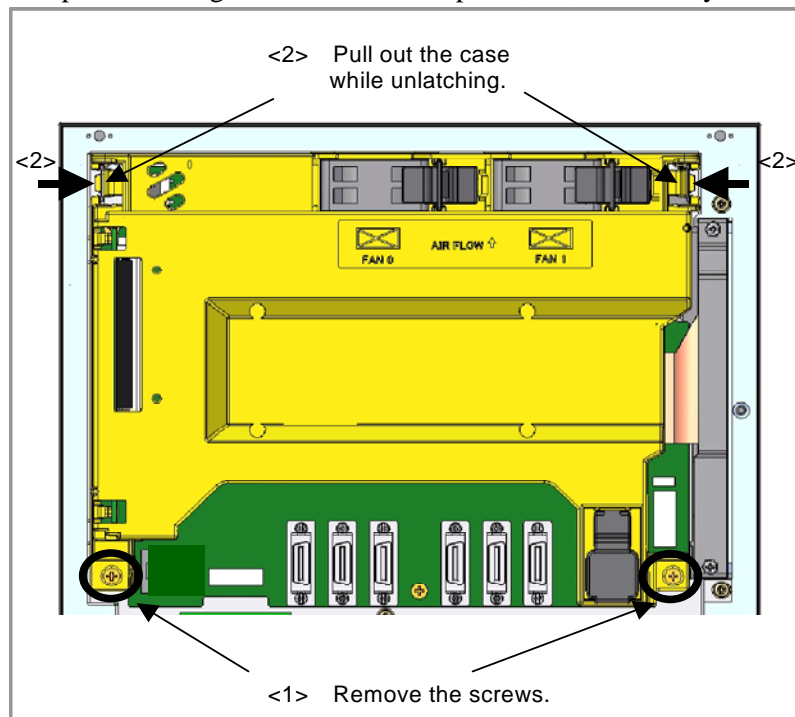
<3> Connectors on the main board

First, detach the cables from the following connectors:

CA88A (PCMCIA interface connector)

CA79A (video signal interface connector)

CA122 (connector for soft keys)

Next, remove the screws fastening the main board.   The main board is connected directly to the
inverter PCB with connector CA121.   So, slide down the main board when detaching it.

<3> Remove the screws (3 places).
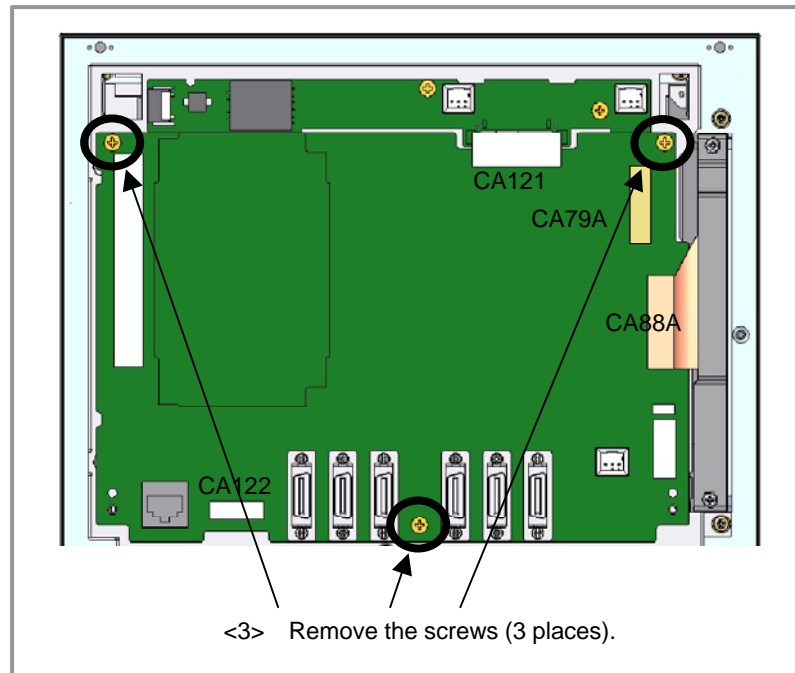
<4> Replace the main board.
<5> Align each cover screw with the corresponding latch, and slowly engage them with each other. Attaching the cover causes the power supply printed circuit board on the cover to be connected to the main board because their connectors are engaged with each other. Exercise caution so that no excessive force is applied to the boards, and make sure that the connectors are attached to each other securely.
<6> After confirming that the cover is latched securely, tighten the cover screws. Press down the fan and battery lightly to confirm secure connection. (Attach the option card cable if it has been detached.)

2.7   REPLACING FUSE ON CONTROL UNIT

⚠ **WARNING**
Before replacing a blown fuse, locate and remove the cause of the blown fuse. For this reason, only those personnel who have received approved safety and maintenance training may perform this replacement work.
When opening the cabinet and replacing a fuse, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover).
Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

Fuse mounting location

FUSE1 (transparent)
for 24 VDC input

Fuse ordering information

Marking	Application	Ordering information	Rating	Individual specification
FUSE1	For 24 VDC power input	A02B-0236-K100	5A	A60L-0001-0290#LM50C

2.8   REPLACING BATTERY

Offset data, and system parameters are stored in SRAM in the control unit.   The power to the SRAM is backed 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. This battery can maintain the contents of memory for about a year.

When the voltage of the battery becomes low, alarm message "BAT" blinks on the display and the battery alarm signal is output to the PMC.   When this alarm is displayed, replace the battery as soon as possible. In general, the battery can be replaced within two or three weeks, however, this depends on the system configuration.

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 to occur because the contents of memory are lost.   Clear the entire memory and reenter data after replacing the battery.

FANUC thus recommends that the battery be replaced periodically, once a year, regardless of whether a battery alarm is issued.

The following two kinds of batteries can be used.

- Lithium battery built into the CNC control unit.
- Two alkaline dry cells (size D) in the external battery case.

> **NOTE**
> A lithium battery is installed as standard at the factory.

When a lithium battery is used
- Replacement procedure

Prepare a new battery unit (ordering code: A02B–0309–K102).
(1) Turn on the power to the CNC. After about 30 seconds, turn off the power.
(2) Extract the old battery unit from the lower right of the rear of the CNC unit. (Hold the latch of the battery unit, and extract the unit upward while releasing the claw from the case.)

Extract the unit while holding this portion.
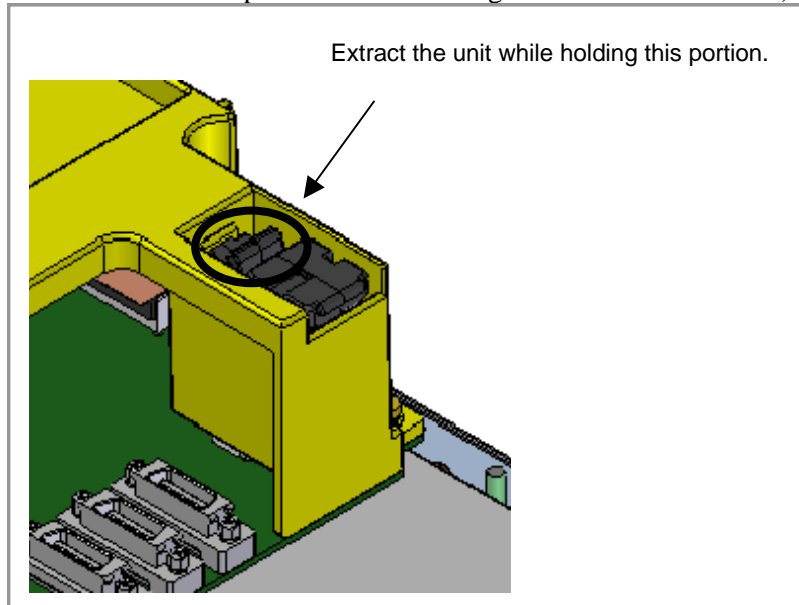
(3) Mount the new battery unit. (Push the battery unit in until the claw is latched into the case.) Ensure that the latch is engaged securely.

Push the unit in until the claw is latched into the case.
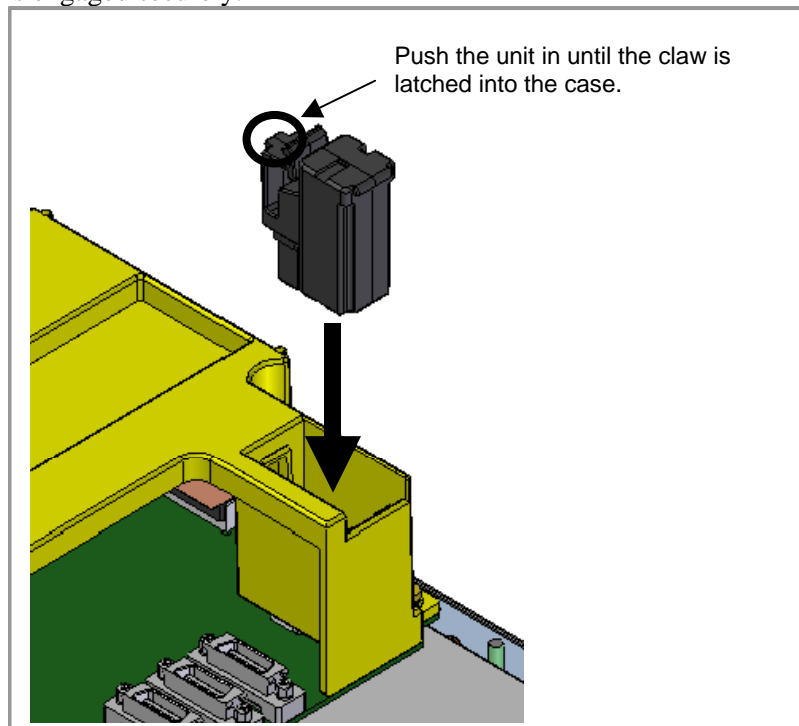
> **⚠ WARNING**
> Using other than the recommended battery may result in the battery exploding.
> Replace the battery only with the specified battery (A02B-0309-K102).

> **⚠ CAUTION**
> Steps 1 to 3 should be completed within 30 minutes.   Do not leave the control unit without a battery for any longer than the specified period. Otherwise, the contents of memory may be lost.
> If steps 1 to 3 may not be completed within 30 minutes, save all contents of the SRAM memory to the memory card beforehand.   Thus, if the contents of the SRAM memory are lost, the contents can be restored easily.
> See Chapter 5, "INPUT AND OUTPUT OF DATA" or Appendix C, "BOOT SYSTEM" for explanations about how to save the contents of the SRAM memory.

When discarding a battery, observe the applicable ordinances or other rules of your local government. In addition, cover the exposed pins with tape or other insulation materials to prevent a short circuit before discarding the battery.

When alkaline dray cells (size D) are used
-   Replacing the battery
(1)   Prepare two new alkaline dry cells (size D).
(2)   Turn on the power of the control unit.
(3)   Remove the battery case cover.
(5)   Replace the batteries, paying careful attention to their orientation.
(6)   Replace the battery case cover.

> **⚠ CAUTION**
> To replace the battery when the power is off, follow the same procedure as that for the replacement of a lithium battery, described above.
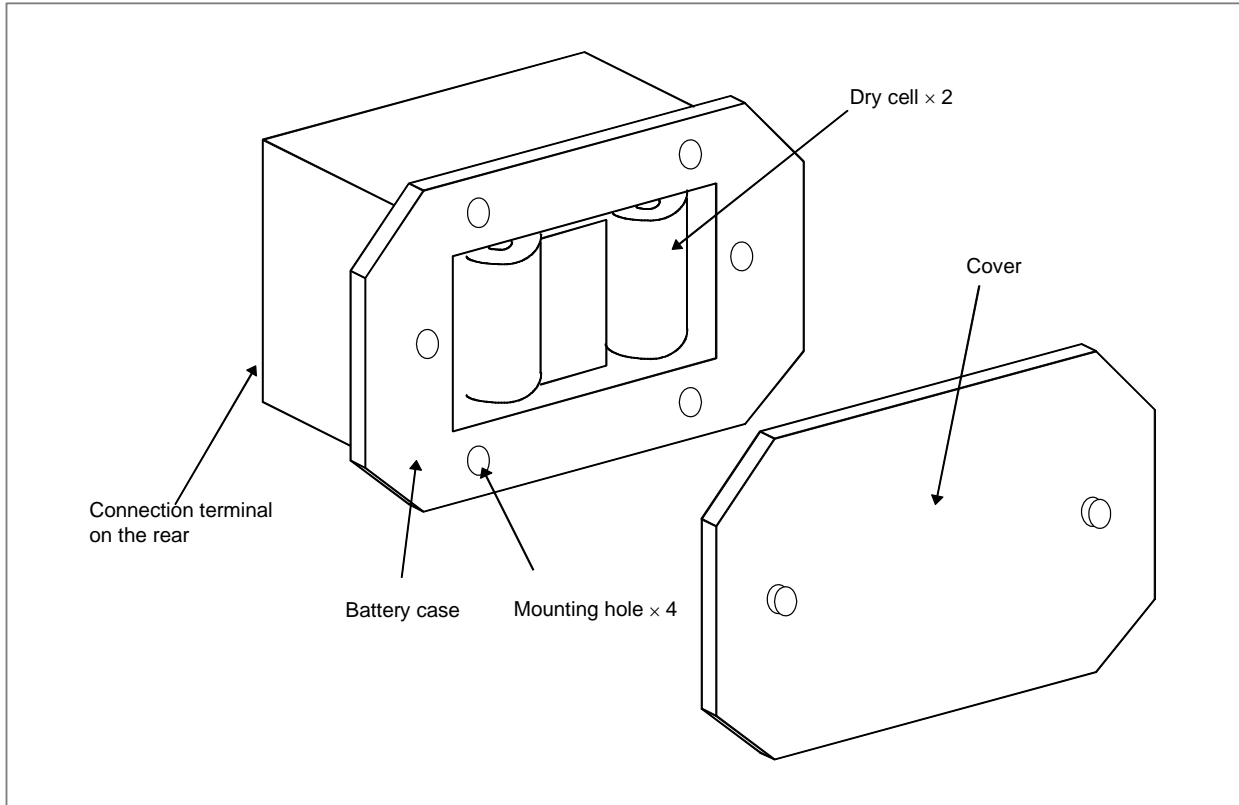
2.9   REPLACING FAN MOTORS

⚠ **WARNING**
   When opening the cabinet and replacing a fan motor, be careful not to touch the
   high-voltage circuits (marked ⚠ and fitted with an insulating cover).
   Touching the uncovered high-voltage circuits presents an extremely dangerous
   electric shock hazard.

-   Fan ordering information

	Ordering code	Mounting location	Required quantity
Unit with no option slot	A02B-0309-K120	FAN1(right)	1
	A02B-0309-K120	FAN0(left)	1
Unit with 1 slot or 2 option slots	A02B-0309-K120	FAN1(right)	1
	A02B-0309-K121	FAN0(ft)	1

Replacement procedure
   <1> Before replacing a fan motor, turn off the power to the CNC.
   <2> Extract the fan motor to be replaced. (Hold the latch of the fan unit, and extract the unit upward
       while releasing the claw from the case.)

Extract the unit while holding this portion.
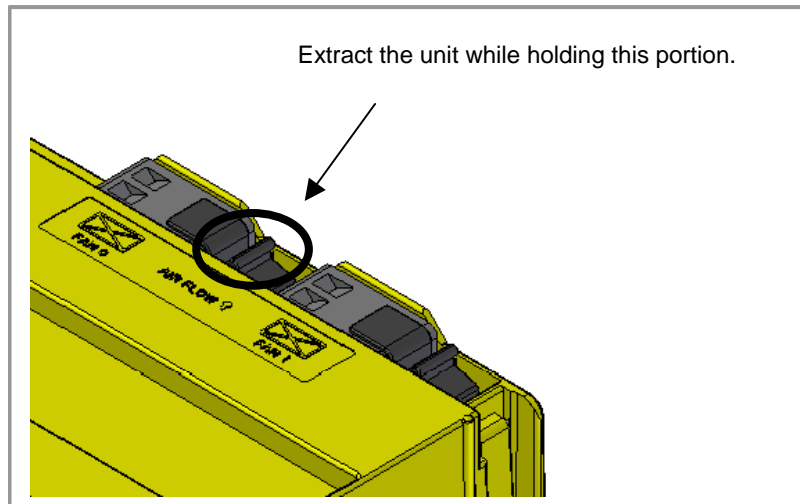
<3> Mount a new fan unit. (Push the fan unit in until the claw is latched into the case.)

Push the unit in until the claw is latched into the case.
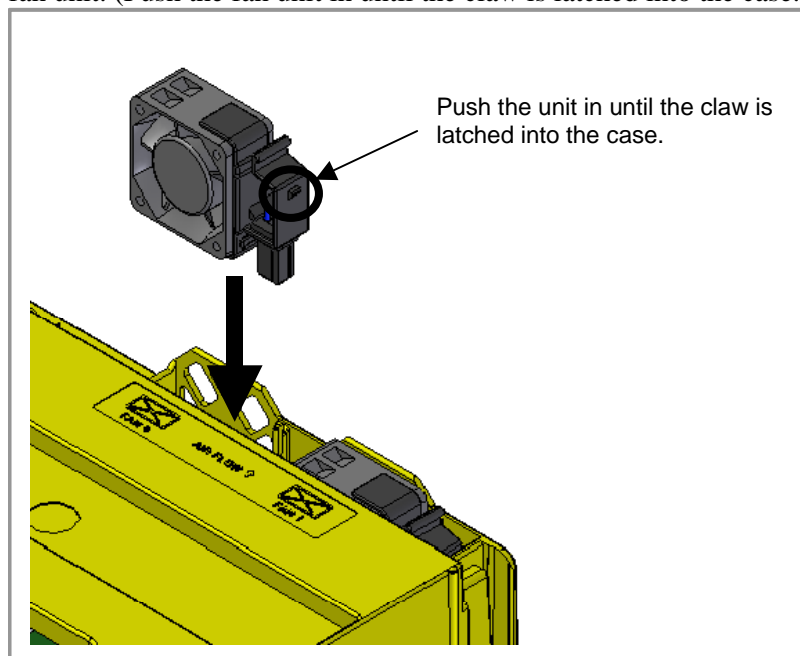
2.10   MOUNTING AND DEMOUNTING LCD/MDI UNIT

Some LCD units, MDI units and LCD/MDI units for this CNC are fastened with screws with M4 nuts from the rear side; others are fastened with M3 screws from the front side.   For some of the units fastened from the front side, the screws are hidden under screw caps.

Unit fastened with M4 nuts from the rear side
• 8.4-inch color LCD/MDI unit

Units fastened with M3 screws from the front side
• MDI unit (vertical type or horizontal type) (without screw caps)
• 10.4-inch LCD unit (with screw caps)
• MDI unit (small type) (with screw caps)

2.10.1   Mounting or Demounting a 10.4" LCD Unit

The 10.4" LCD unit is fastened with screws from the front side.   They are hidden under screw caps.

2.10.1.1 Demounting
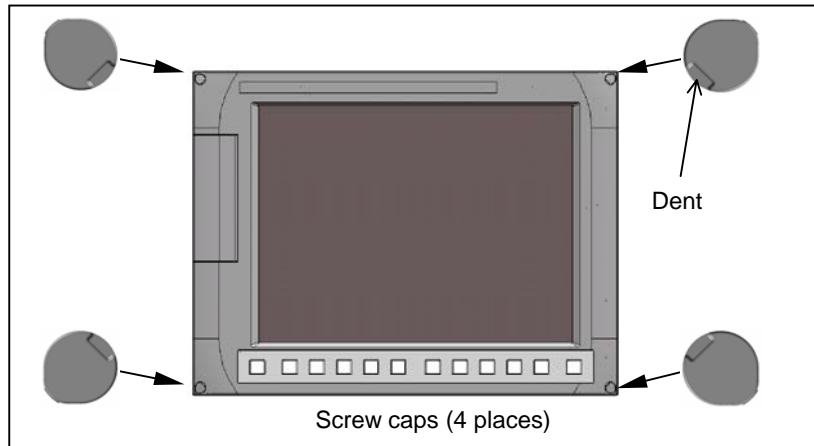
Screw caps (4 places)

<1> To remove a screw cap, insert the tip of a small flat-blade screwdriver or the like into the dent in it and pull it out.
<2> To detach the unit, rotate each screw after the screw caps are removed.

2.10.1.2 Mounting
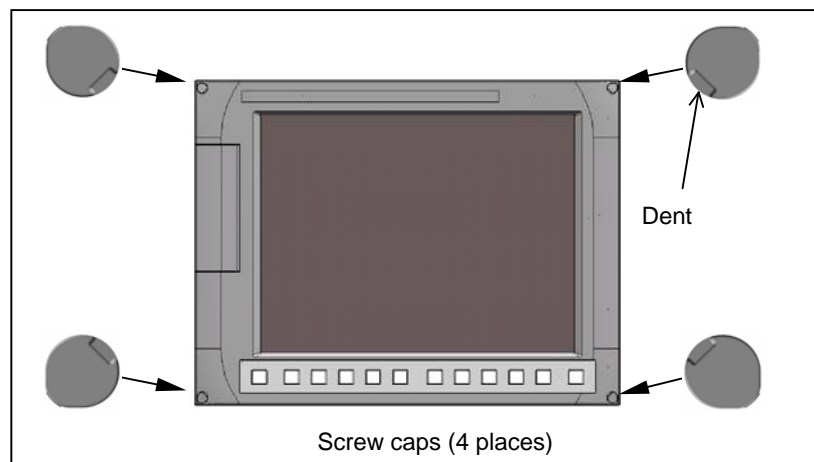
Screw caps (4 places)

<1> Fasten the unit at its four corners with screws.
<2> While paying attention to the orientation of each screw cap, push them in until their surfaces become flush with the unit surface.

NOTE
   In case a screw cap is lost or damaged, order replacements according to the
   following ordering information.

   A02B-0319-K190:   Pack of 100 screw caps
   A02B-0319-K191:   Pack of 5 screw caps

2.10.2 Mounting or Demounting an MDI Unit (Small Type)

The MDI unit (small type) is fastened with screws from the front side.   They are hidden under screw caps.

2.10.2.1 Demounting
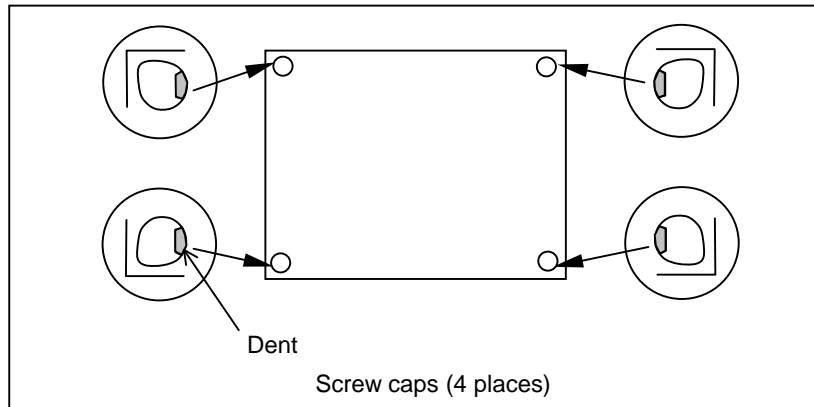
Dent

Screw caps (4 places)

<1> To remove a screw cap, insert the tip of a small flat-blade screwdriver or the like into the dent in it and pull it out.
<2> To detach the unit, rotate each screw after the screw caps are removed.

2.10.2.2 Mounting

Only A has a protrusion
(to distinguish A from B)
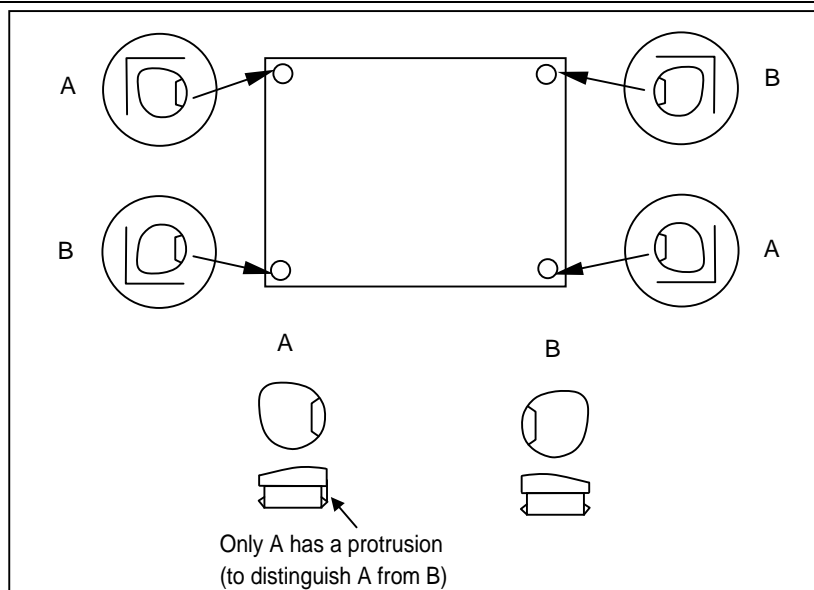
<1> Fasten the unit at its four corners with screws.
<2> There are two types of screw caps.   Mount them as shown in the figure.   While paying attention to the orientation of each screw cap, push them in until their surfaces become flush with the unit surface.

NOTE
In case a screw cap is lost or damaged, order replacements according to the following ordering information.
A02B-0303-K190:   A set of 100 type-A screw caps and 100 type-B screw caps
A02B-0303-K191:   A set of 80 type-A screw caps and 100 type-B screw caps

---

2.11   LIQUID CRYSTAL DISPLAY (LCD)

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. If the protection sheet is damaged, it can be replaced. (The protection sheet is a consumable part.)

Replacing the protection sheet

-   Materials used
(1)   Protection sheet
      A02B-0309-K132 : For 8.4" LCD with touch panel
      A02B-0236-K110 : For 10.4" LCD with touch panel
(2)   Neutral detergent (detergent that can clean oily dirt off = detergent for kitchen can be used)
(3)   Soft cloth (such as towel)

-   Replacement procedure
(1)   Before replacement
      <1> Turn off the power to the machine.
      <2> Peel off the old protection sheet from the surface of the touch panel.
      <3> Wipe off adhesive residue if any on the screen surface with alcohol.
      <4> Use the detergent to remove oil or dirt stuck to the surface of the touch panel.
      <5> With a soft, damp cloth, wipe off detergent completely.
          ☞   If the touch panel surface becomes cloudy, oil is still left on the surface. Remove oil
              completely.
          ☞   If oil or detergent is left on the surface of the touch panel, the protection sheet cannot
              adhere to the panel completely and will sometimes peel off easily.
      <6> With a dry soft cloth, wipe off moisture completely.

(2)   Applying the protection sheet
      <1> Fold the tab over the front side (the side opposite to the backing sheet).
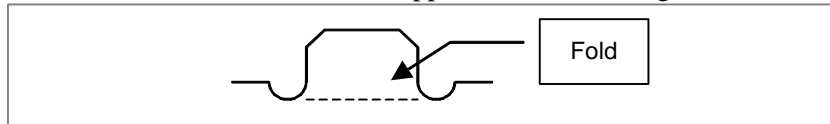
      <2> Peel off the backing sheet.
      <3> Position the sheet, then attach the upper and lower sides of the sheet first. Check that the sides
          of the protection sheet do not touch the escutcheon.
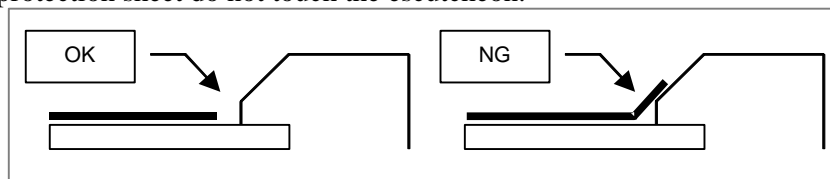
      <4> Attach the right and left sides of the protection sheet while pushing out air between the touch
          panel and protection sheet.
          ☞   With part of the protection sheet kept stuck to the touch panel, do not attempt to correct
              the position of the protection sheet by pulling the sheet.

<5> Press the adhesive parts of the four sides, and attach the entire sheet completely.
  ☞   Check that the four corners and four sides of the protection sheet do not float.

(3)   Checks after replacement
   <1> Check that there is no wrinkle on the surface of the protection sheet.
   <2> After power-on, check that there is no touch panel portion kept pressed.
   <3> Press the touch panel, and check that correct operation takes place.

Touch panel calibration
-   Conditions that require calibration
Touch panel calibration is needed under the following conditions:
(1)   The LCD unit was replaced.
(2)   The touch panel was replaced.
(3)   The touch panel control printed-circuit board was replaced.
(4)   Memory all clear was performed.

-   Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
3113			DCL					

[Input type] Parameter input
[Data type] Bit

 # 5   **DCL** The touch panel compensation screen is:
       0:   Disabled.
       1:   Enabled.
       Set this parameter to 0 usually. Touch panel compensation becomes necessary only when
       the panel is replaced or memory all clear operation is performed. Set this parameter to 1
       only when performing touch panel compensation. Upon completion of compensation, set
       this parameter to 0.

-   Calibration method
Calibration procedure
<1> Enable the touch panel calibration screen.(Set bit 5 (DCL) of parameter No. 3113 to 1.)

<2> Press function key [⬦ SYSTEM].

<3> Press the continuous menu key [▷] several times. The [TOUCH PANEL] soft key is displayed.

<4> Press the [TOUCH PANEL] soft key then the [(OPRT)] soft key. The [TP CAL] soft key is displayed.

```
CALIBRATION OF TOU            O0000 N00000

  START CALIBRATION OF TOUCH PANEL
  JUST AS [TP CAL] SOFTKEY IS PUSHED.




A ) _

                              S     0 L    0%

MDI   **** *** ***   |  12:09:15  |
《 TP  CAL  |       |       |       |       |
```
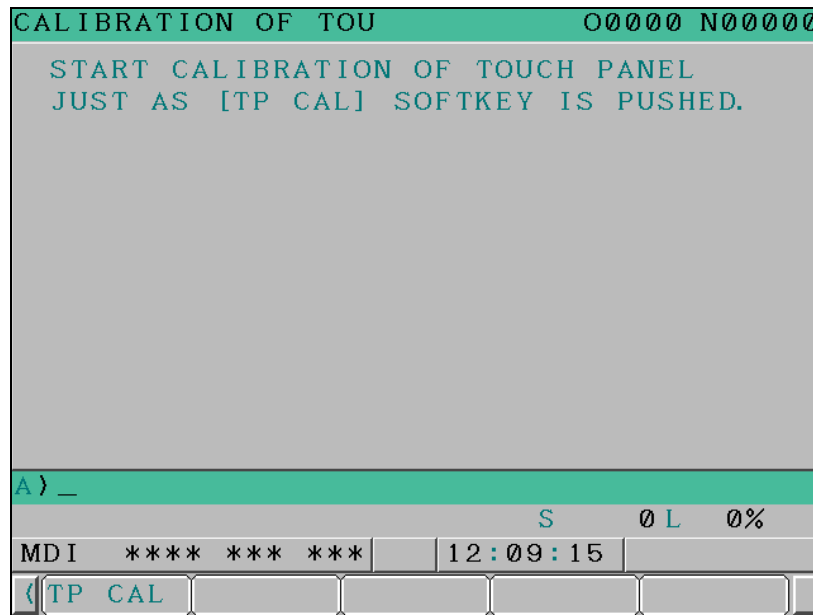
<5> Pressing the [TP CAL] soft key causes a full-screen touch panel calibration screen to appear.

```
+                       +                       +

    TOUCH PANEL CALIBRATION

        PLEASE TOUCH CALIBRATED POINTS ('+' OF 9 POINTS)
        IF CALIBRATION IS ENDED, PUSH INPUT KEY.
        IF CALIBRATION IS CANCELED, PUSH CANCEL KEY.




+                       +                       +




+                       +                       +
```
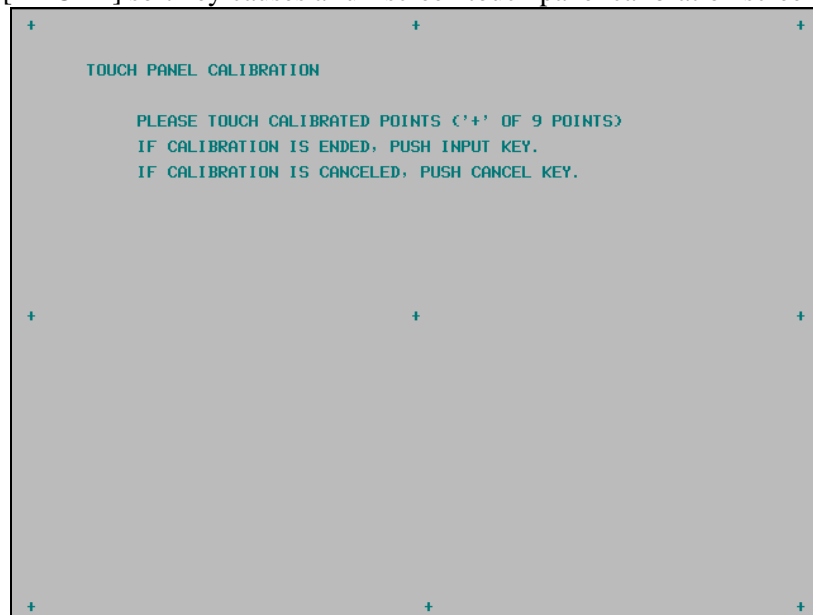
<6> Click the 9 calibration points with a stylus pen.   The marker of a normally clicked point changes from "+" to "o".   If you fail to click right on a "+" mark, the message "Your stylus pen is not right on a "+" mark.   Click again." appears.

<7> After clicking all 9 calibration points, clicking the ⬦INPUT key completes calibration.   To quit or retry calibration, click the ⬦CAN key.   The previous screen appears again.   Before clicking 9 calibration points, clicking the ⬦INPUT key aborts calibration.

<8> When calibration ends normally, the message "Calibration ended" appears.

<9> After completing calibration, disable the touch panel calibration screen (by resetting the bit 5 (DCL) of parameter No. 3113 to 0) to prevent operation mistake.

3 STAND-ALONE TYPE CNC SERIES HARDWARE

The FANUC Series 0*i*-D of the stand-alone type is a CNC whose control and display units are separated. (The FANUC Series 0*i* Mate-D of the stand-alone type is not provided.)   For the stand-alone type Series 0*i* -D, the FANUC PANEL *i* or a commercially available IBM PC compatible personal computer is used as a display unit.   A CNC consisting of a control unit incorporated display unit is called the LCD-mounted type and a CNC whose control and display units are separated is called the stand-alone type below.

This chapter describes the functions of the stand-alone type CNC control unit printed circuit boards and card PCBs on the printed circuit boards as well as how to replace consumables.

For the maintenance of the FANUC PANEL *i*, refer to the FANUC PANEL *i* Connection and Maintenance Manual (B-64223EN).

3.1   HARDWARE CONFIGURATION

Display unit
PANEL *i* or commercially available personal computer
(An HSSB board is required for a commercially
available personal computer.)

MDI unit

(The MDI unit can be connected only to the
PANEL *i*.)

Control unit

Servo motor

Servo amplifier

Optical cable

Distributed I/O, I/O unit MODEL-A

I/O Link

Machine operator's panel, power magnetic circuit, etc.

3.2 HARDWARE OVERVIEW

2-slot rack

Main board

Slot 1

Slot 2

Option（slot 1 to 2）
Fast Ethernet board
Data server function Ethernet communication function
Various types of network boards
PROFIBUS-DP master board PROFIBUS-DP slave board FL-net board DeviceNet master board DeviceNet slave board

Basic system
Main board
• CPU for controlling CNC • Power supply • Axis control • Spindle interface • DISPLAY interface • I/O Link • PMC control function • High-speed DI • RS-232C • Memory card interface • Ethernet

3.3 TOTAL CONNECTION DIAGRAMS

When optional functions are provided

Optional slot

Fast Ethernet board

Memory card

Prepare the memory card recommended by FANUC.

ETHERNET(CD38R) — Ethernet

PROFIBUS-DP master board

PROFI(CN1) — Another NC or Profibus device

PROFIBUS-DP slave board

PROFI(CN2) — Another NC or Profibus device

DeviceNet master board

DVNET(TBL) — Another NC or DeviceNet device

DeviceNet slave board

DVNET(TBL) — Another NC or DeviceNet device

FL-net board

FLNET(CD38N) — FL-net device

Connection example to I/O Link

For Series 0*i*

I/O Unit for 0*i*

(CP1) —— DC24V

I/O Link (JD1B) ————— JD51A

Series 0*i*
main board

I/O Link (JD1A) —— I/O Link ————— JD1B / JD1A

I/O for operator's panel
JD1B
JD1A

DI : 96 points
DO : 64 points

DI/DO-1
(CB104)

DI/DO-2
(CB105)

DI/DO-3
(CB106)

DI/DO-4
(CB107)

I/O Link β*i*
servo amplifier
JD1B
JD1A

The order in which slave devices are
connected via I/O Link can be
determined freely.

MPG(JA3) —— Manual pulse generator (up to 3 units)
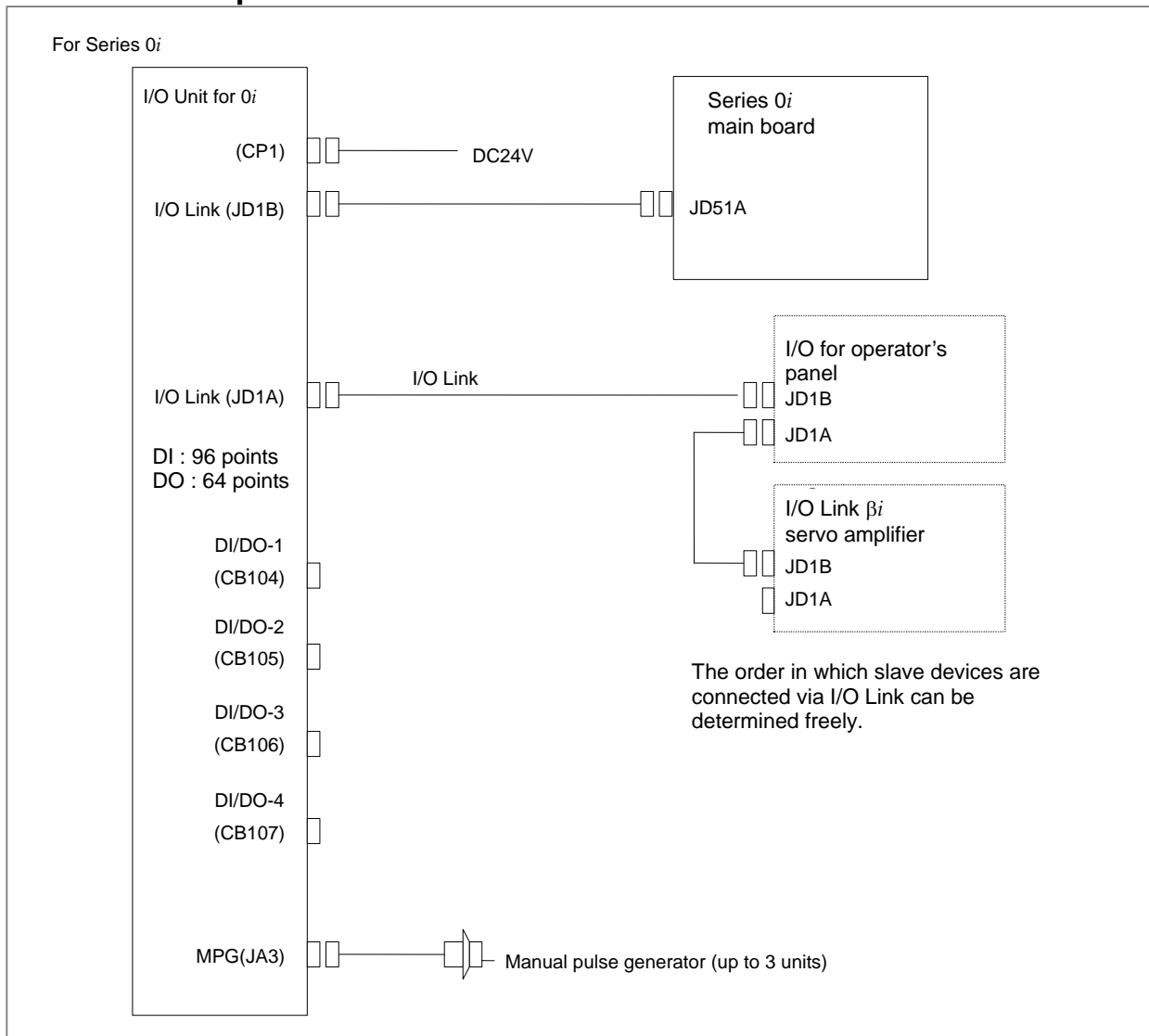
3.4 CONFIGURATION OF PRINTED CIRCUIT BOARD CONNECTORS AND CARDS

· Main board specification

Item	Model	Ordering code
Main board B0	0*i*	A16B-3200-0700
Main board B1	0*i*	A16B-3200-0701
Main board B2	0*i*	A16B-3200-0702
Main board B3	0*i*	A16B-3200-0703

・ Mounting positions of connectors, LEDs, etc.
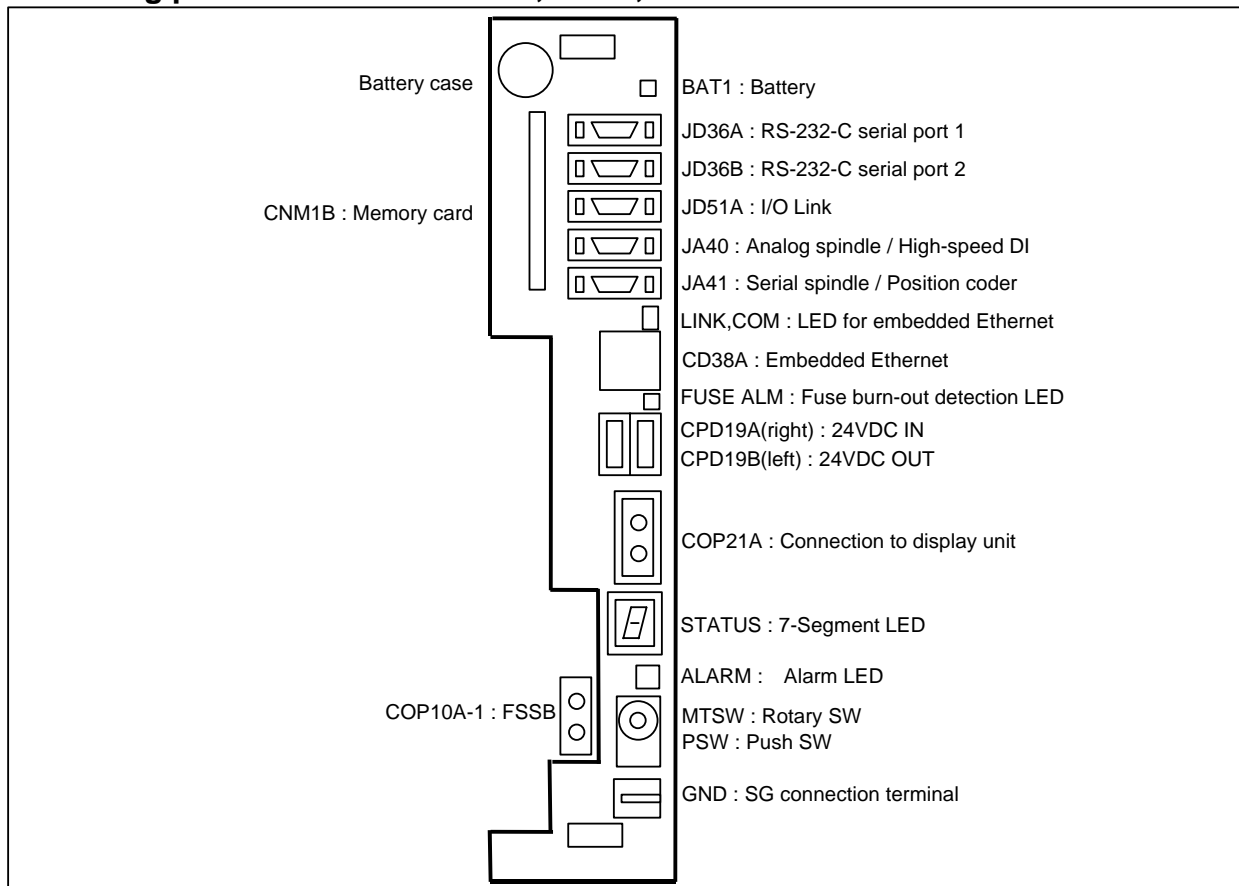
STATUS 7-segment LED:
    This LED usually indicates the state of the CNC. This LED is used also for setting and maintenance using the rotary switch MTSW and the push switch PSW.
MTSW rotary switch:
    This rotary switch is used for setting and maintenance operations, in combination with the STATUS 7-segment LED and the PSW push switch.
PSW push switch:
    This push switch is used for setting and maintenance operations, in combination with the STATUS 7-segment LED and the MTSW rotary switch.

· Mounting positions of cards and DIMM modules

No.	Item	Ordering code	Function	Remarks
(1)	Axis card A1	A20B-3300-0635	Path 1 control, supporting up to 2 axes	The maximum number of axes is also limited depending on the model.
	Axis card A2	A20B-3300-0638	Path 1 control, supporting up to 4 axes	
	Axis card A3	A20B-3300-0637	Path 1 control, supporting up to 5 axes	
	Axis card B2	A20B-3300-0632	Path 2 lathe control, supporting up to 6 axes	
	Axis card B3	A20B-3300-0631	Path 2 lathe control, supporting up to 8 axes	
(2)	Power supply	A20B-8101-0011		
(3)	FROM/SRAM module A1	A20B-3900-0242	FROM 64MB SRAM 1MB	The FROM stores various control software programs, user software programs, and so forth. The SRAM is a battery-backed memory module.
	FROM/SRAM module B1	A20B-3900-0240	FROM 128MB SRAM 1MB	
	FROM/SRAM module B2	A20B-3900-0241	FROM 128MB SRAM 2MB	

· **Block diagram**

・ **LED display**

(1) Alarm LED (red) display when a system alarm occurs
     If any of these LEDs lights, it is likely that the hardware is defective.

No.	Alarm LED 3 2 1	Meaning
1	☐ ■ ☐	Low battery voltage. The battery may be running out.
2	☐ ■ ■	Software detected an error and stopped the system.
3	■ ☐ ☐	Hardware detected a failure in the system.
4	■ ☐ ■	An alarm was issued with the servo card on the main board. The servo card or servo amplifier may be faulty, or the FSSB may be broken.
5	■ ■ ☐	An error was detected in the data of the SRAM on the DIMM module. The DIMM module may be faulty, the battery voltage may have dropped, or the main board may be faulty.
6	■ ■ ■	Abnormal power supply operation. The cause may be noise or a power supply failure.

■ : On ☐ : Off

Alarm LED	Meaning
4 (LOW)	The main board (CPU circuit) may be faulty.

(2) Ethernet status LED

Alarm LED	Meaning
LINK (green)	Turned on when a connection is made with the hub correctly
COM (yellow)	Turned on when data is transferred

(3) 7-segment LED

Dot
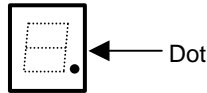
Alarm LED	Meaning
Dot	Turned on when the display unit is not connected to connector COP21A. If this LED is turned on when the display unit is connected, it is probable that the optical cable is broken, the display unit is not powered on, or the display unit is faulty.

See Appendix E "LED Display" for others.

· Replacing the main board

⚠ **WARNING**

Only those personnel who have received approved safety and maintenance training may perform this replacement work.
When opening the cabinet and replacing the card PCB, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover). Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

⚠ **CAUTION**

Before replacing a printed circuit board, be sure to read Section 4.11, "CAUTIONS IN REPLACING PCB'S," to confirm the procedure.
Before starting replacement work, back up the SRAM data of the CNC. Otherwise, the SRAM data may be lost during replacement work. See Section 3.9, "MAINTENANCE OF STAND-ALONE TYPE UNIT", Chapter 5, "INPUT AND OUTPUT OF DATA" or Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)" for explanations about how to save the contents of the SRAM memory.

Demounting procedure
(1) The structure is designed so that the main board is fastened on the control unit with the fan unit. For this reason, when the fan unit is mounted on the control unit, the main board cannot be demounted.
Be sure to demount and mount the main board when the fan unit is detached. For the method of detaching the fan unit, refer to Section 3.8, "REPLACING A FAN UNIT."
(2) Disconnect the cables other than the battery cable. (The battery is mounted on the face plate of the main board, so the cable is not required to be disconnected.)
(3) Pinch handles A and B for extraction.
(4) While pushing the hook of handle A down and the hook of handle B up, extract the printed circuit board.

Mounting procedure
(1) Pinch handles A and B for extraction, then insert the board into the control unit slowly until the board is engaged into the connector on the back panel. Confirm that the hook of each of handles A and B is engaged with the case.
(2) Connect the disconnected cables again correctly.

(3) Attach the fan unit.   The fan unit cannot be attached if the main board is not engaged on the back panel firmly.

Handle A
With a hook on the top

Handle B
With a hook on the bottom
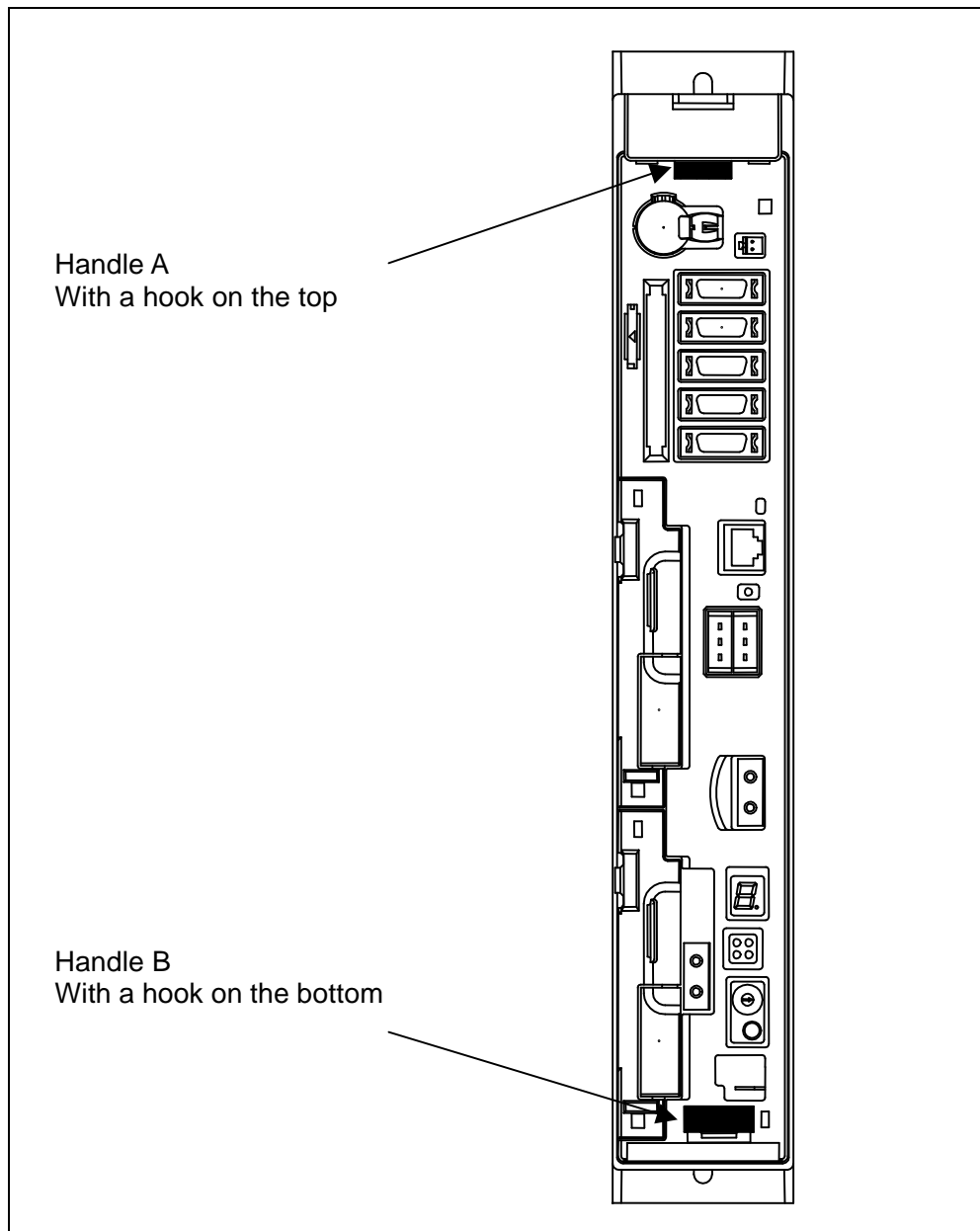
3.5   LIST OF UNITS AND PRINTED CIRCUIT BOARDS

3.5.1   List of Basic Units

Model	Item	Ordering code	Remarks
0*i*	Basic unit with 2 slots	A02B-0319-B802	

3.5.2   List of Printed Circuit Boards

Item	Ordering code	ID	Remarks
Main board A0	A16B-3200-0700	00448	
Main board A1	A16B-3200-0701	00449	

Item	Ordering code	ID	Remarks
Main board A2	A16B-3200-0702	0044A	
Main board A3	A16B-3200-0703	0044B	
Axis card A1	A20B-3300-0635	00146	
Axis card A2	A20B-3300-0638	0014B	
Axis card A3	A20B-3300-0637	0014A	
Axis card B2	A20B-3300-0632	0014D	
Axis card B3	A20B-3300-0631	0014E	
FROM/SRAM module A1 (FROM 64MB, SRAM 1MB)	A20B-3900-0242	FROM: E3 SRAM: 03	
FROM/SRAM module B1 (FROM 128MB, SRAM 1MB)	A20B-3900-0240	FROM: E4 SRAM: 03	
FROM/SRAM module B2 (FROM 128MB, SRAM 2MB)	A20B-3900-0241	FROM: E4 SRAM: 04	
Fast Ethernet board	A20B-8101-0030	00701	
PROFIBUS-DP master board	A20B-8101-0050	00704	
PROFIBUS-DP slave board	A20B-8101-0100	00705	
FL-net board	A20B-8101-0031	00702	
DeviceNet master board	A20B-8101-0220	00706	
DeviceNet slave board	A20B-8101-0330	00708	
Backpanel (2 slots)	A20B-2003-0580	01	
Fan connection board	A20B-9002-0350	–	
Power supply	A20B-8101-0011	–	

* See Chapter 4 for a optional board.

3.5.3 I/O

The same I/O components as for the LCD-mounted type are available. See Subsection 2.5.5.

3.5.4 Other Units

The same units as for the LCD-mounted type are available. See Subsection 2.5.5.

3.6 REPLACING THE FUSE OF THE CONTROL UNIT

> ⚠ **WARNING**
> Before starting the replacement of a fuse, remove the cause of the fuse burn-out.
> Accordingly, the replacement should be performed by a person fully trained in maintenance and safety.   If the cabinet is opened to replace the fuse, take extreme care not to touch any high-voltage area (marked with ⚠ and covered by a shock prevention cover). If the area is uncovered, direct contact with this area will result in an electric shock.

· Mounting position of the fuse of the control unit
The fuse of the control unit is mounted on the main board.

Main board

Fuse

Fuse alarm LED

24V connector
CPD19A
CPD19B
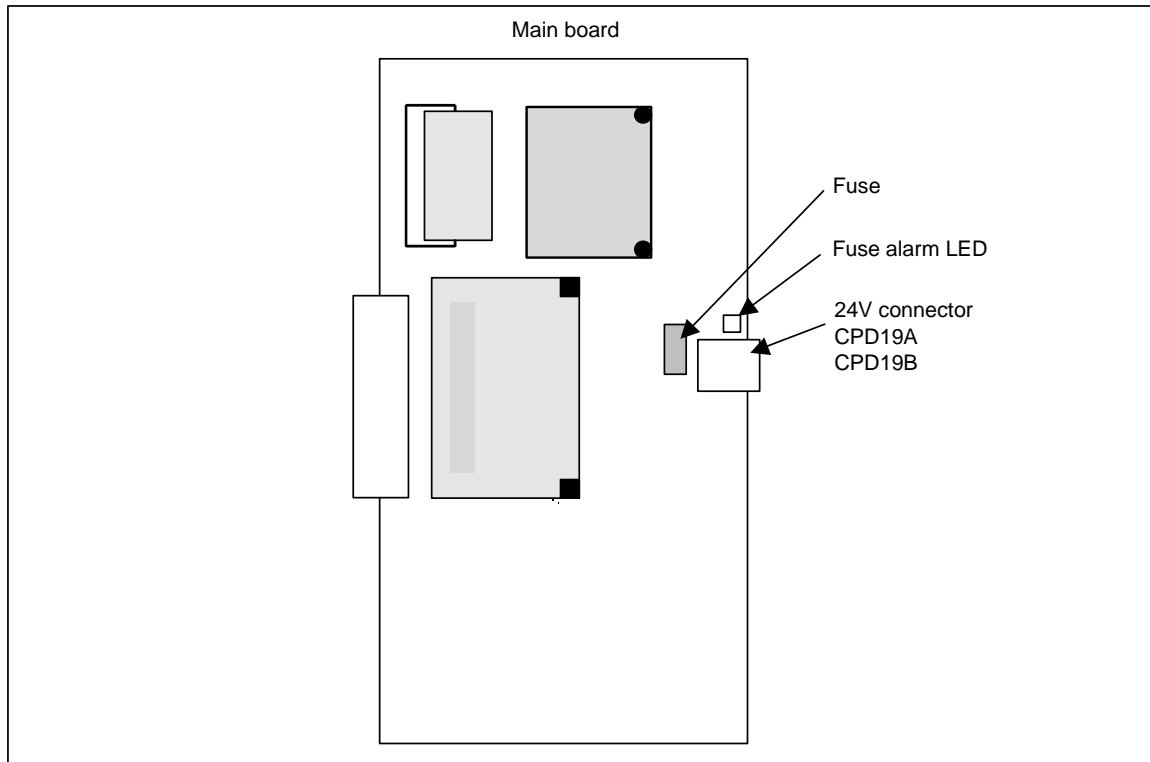
· **Ordering code of the fuse**

Ordering code	Rating	Individual information
A02B-0319-K100	5A	A60L-0001-0046#5.0

3.7   REPLACING THE BATTERY

Offset data, and system parameters are stored in SRAM in the control unit. The power to the SRAM is backed 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. This battery can maintain the contents of memory for about a year.

When the voltage of the battery becomes low, alarm message "BAT" blinks on the display and the battery alarm signal is output to the PMC. When this alarm is displayed, replace the battery as soon as possible. In general, the battery can be replaced within one or two weeks, however, this depends on the system configuration.

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 to occur because the contents of memory are lost. Clear the entire memory and reenter data after replacing the battery.
The following two kinds of batteries can be used.
- Lithium battery built into the CNC control unit.
- Two alkaline dry cells (size D) in the external battery case.

NOTE
A lithium battery is installed as standard at the factory.

When using a lithium battery
-   Replacement procedure
If a lithium battery is used, have A02B-0200-K102 (FANUC internal code: A98L-0031-0012) handy.
1   Turn the CNC on.   About 30 seconds later, turn the CNC off.
2   Remove the battery from the top area of the CNC unit.
     Disconnect the connector first.   Then, remove the battery from the battery case.   The connector is
     not latched.   Simply pulling the cable detaches the connector.
     The battery case is provided in the top area of the face plate of the main board.
3   Replace the battery, then connect the connector.
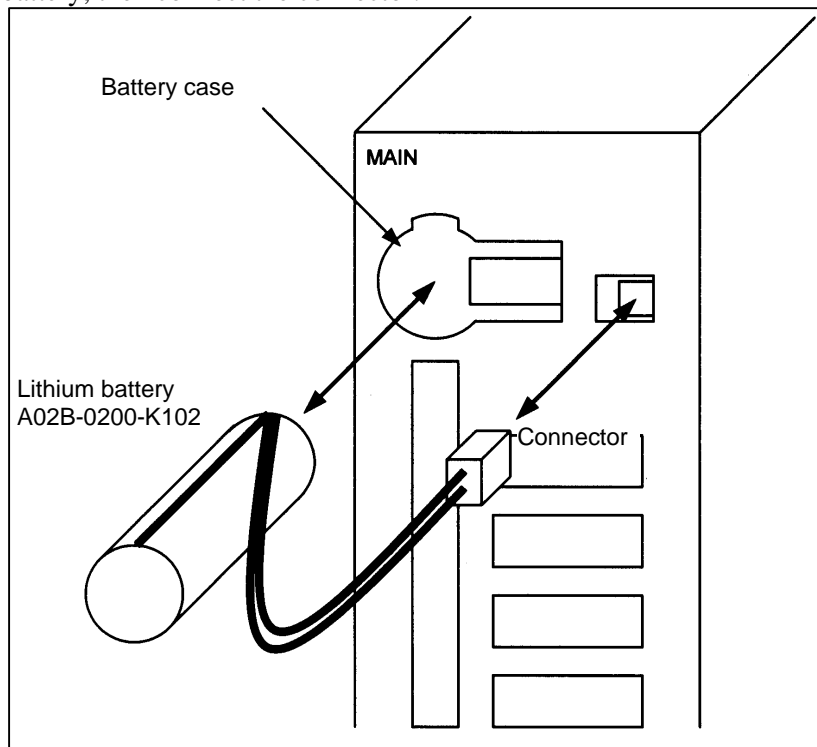

```
        ⚠ WARNING
           The incorrect mounting of the battery may cause an explosion. Avoid using any
           battery other than the one specified here (A02B-0200-K102).
```

```
        ⚠ CAUTION
           Complete steps 1 to 3 within 30 minutes.
           If the battery is left removed for a long time, the SRAM would lose the contents.
           If there is a danger that the replacement cannot be completed within 30 minutes,
           save the whole contents of the SRAM to a memory card.   The contents of the
           memory can be easily restored with the memory card in case the memory loses
           the contents.
```

Discard the dead battery, observing appropriate municipal rules and regulations. When discarding the
battery, insulate the terminal with a tape so that no short-circuit would occur.

When using commercial D-size alkaline dry cells
-   Replacing the battery
1   Have commercial D-size alkaline dry cells handy.
2   Turn the CNC on.
3   Remove the lid from the battery case.
4   Replace the old dry cells with new ones.   Mount the dry cells in a correct orientation.

5   Replace the lid on the battery case.

> ⚠ **CAUTION**
> In the power-off state, the battery should be replaced as in the case of the
> lithium battery, which is descried above.
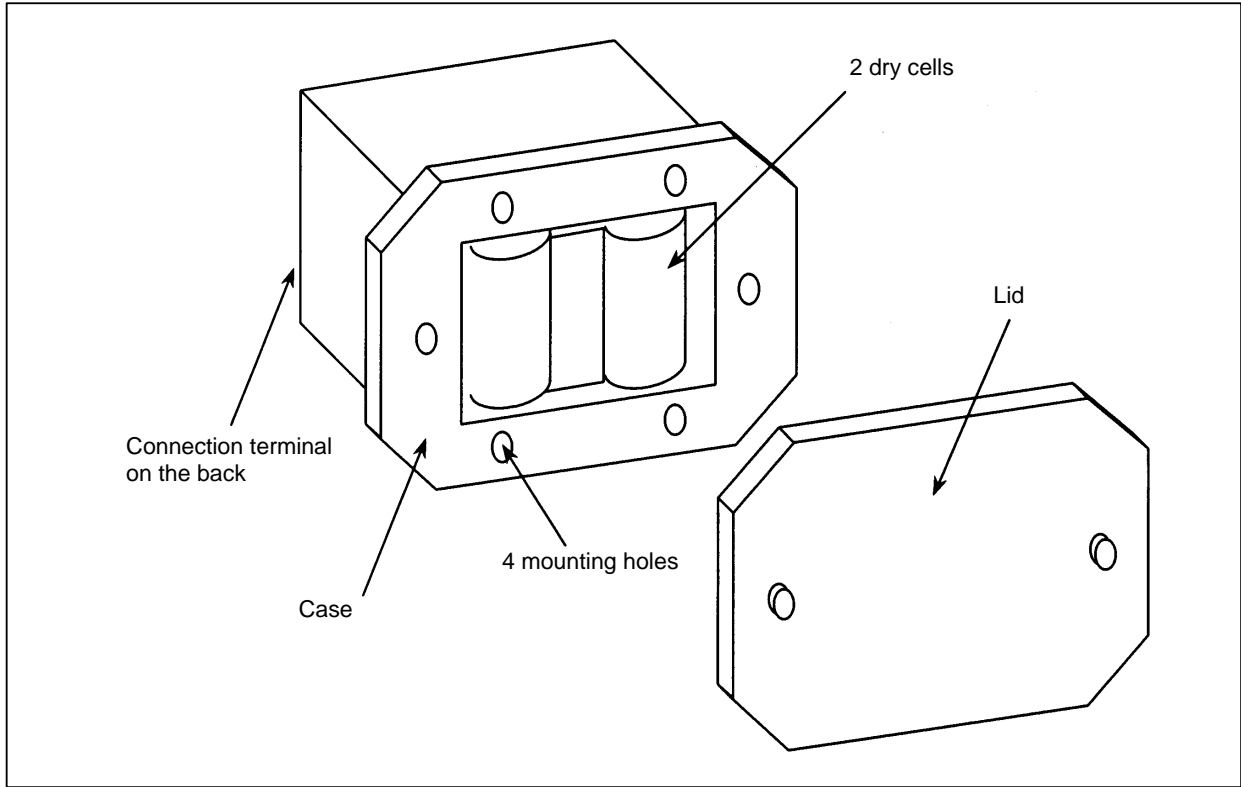
3.8   REPLACING A FAN UNIT

When a reduction in the speed of the fan motor is detected, the FAN warning message blinks on the LCD screen. If a fault such as the stoppage of the fan motor is detected, an overheat alarm is also issued. When the FAN warning message is displayed, replace the fan unit as soon as possible.

> ⚠ **WARNING**
> If the cabinet is opened to replace a fan unit, take extreme care not to touch any
> high-voltage area (marked with ⚠ and covered by a shock prevention cover).
> If the area is uncovered, direct contact with this area will result in an electric
> shock.

·   **Ordering code of fan units**

	Ordering code	Quantity
For 2-slot rack	A02B-0303-C101	1

-    **Replacing a fan unit**
Detaching a fan unit
<1> When replacing the fan motor, be sure to turn off the power to the machine (CNC).
<2> Push up the latch at the top of the unit until the latch is disengaged.

Push up the latch.

Latched

Unlatched
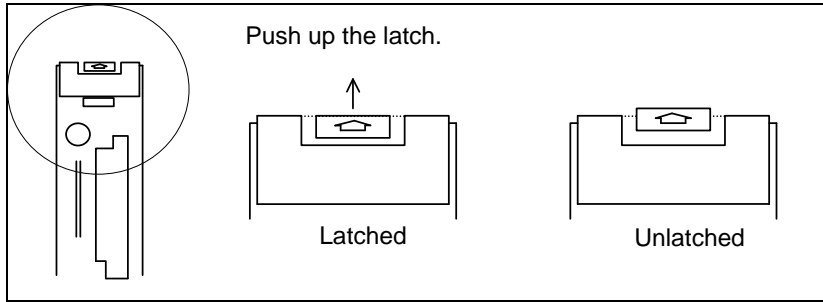
> ⚠ **CAUTION**
>   Just disengage the latch.   Do not push up the latch after the latch is
>   disengaged.   If you continue pushing up the latch forcibly, the latch can break.

<3> Place a finger at the bottom of the front of the fan unit then push up the fan unit.
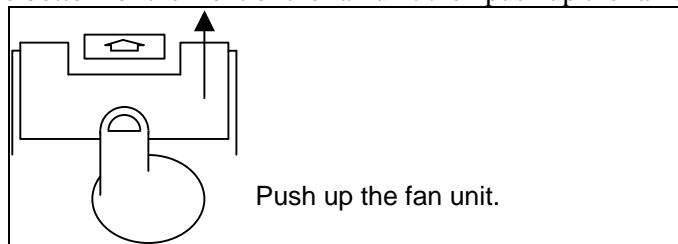
Push up the fan unit.

<4> Push up the fan unit until the fan unit is slanted by about 30 degrees.
<5> Pull out the fan unit toward you in the slanted direction.

<4> Push up the fan unit until
     it is slanted by about 30
     degrees.

<5> Pull out the fan unit toward
     you in the slanted direction.
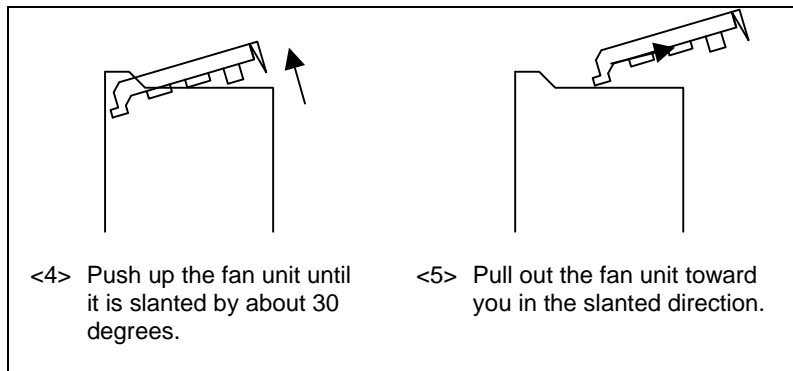
Attaching a fan unit
<1> Insert a fan unit deeply into the main unit at a slanted angle of about 30 degrees until the fan unit
     touches the wall of the main unit.
<2> Lower the fan unit slowly on the main unit.
<3> Push down the fan unit on the near side to couple the fan unit with the top of the main unit.

<1> Insert the fan unit at
     an angle of about
     30 degrees.

<2> Lower the fan unit.

<3> Push down the fan unit to
     couple it with the main
     unit.
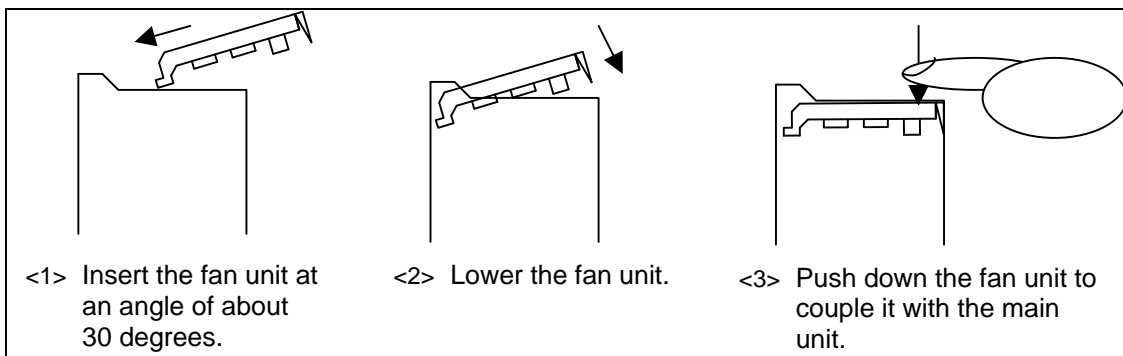
> **⚠ CAUTION**
> The fan unit and main unit are coupled directly with each other by a connector.
> The coupling section of the connector can break if the units are coupled
> incorrectly.

<4> Push down the latch at the top of the fan unit for latching.
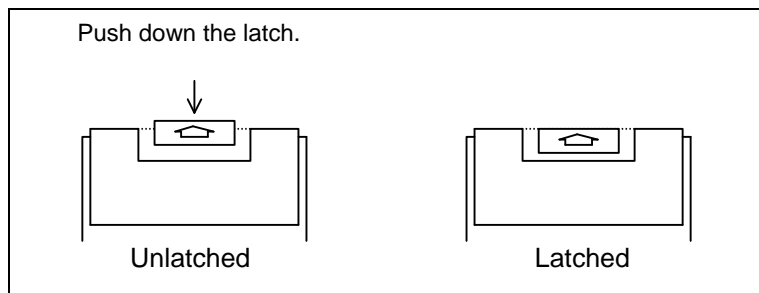
<5> Turn on the power, then check that no fan alarm is issued and that both fans are rotating.

> **NOTE**
> 1 If the power is turned on when the fan unit and the main unit are not coupled
>   correctly, the fans do not rotate or a fan alarm is issued even through the fans
>   are rotating.
> 2 When a large amount of force is required to couple the fan unit with the main
>   unit, check if pins of the connector of the main board are bent and if the main
>   board is inserted correctly.

3.9   MAINTENANCE OF STAND-ALONE TYPE UNIT

3.9.1   Overview

Overview

The FANUC Series 0*i*-D of stand-alone type has a 7-segmentL ED, rotary switch, and push switch.
When there is a display unit (PANEL *i* or personal computer) cannot be used due to a malfunction,
battery backed-up data can be saved or restored if the rotary switch and push switch are operated.

> **NOTE**
> When the display unit (PANEL *i* or personal computer) is available, perform
> maintenance operation described in Appendix F, "MAINTENANCE OF OPEN
> CNC (BOOT-UP AND IPL)."

Layout of the 7-segment LED and switches

The 7-segment LED, the rotary switch, and the push switch are located as shown in the following photo:

7-segment LED (STATUS)

Rotary switch (MTSW)

Push switch (PSW)
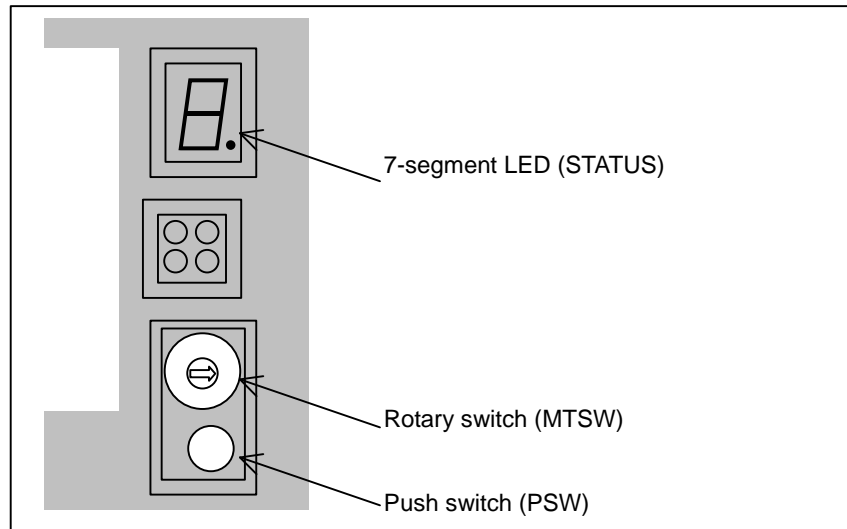
3.9.2   Operation

Operation before power-on

Before turning on the power, select a function number by using the rotary switch. When the power is turned on after the selection with the rotary switch, the number corresponding to the selected function number is indicated on the LED. The indication blinks at intervals of about one second.

Function number

Each function is assigned a number. This number is called a function number hereinafter in this manual. The function numbers that can be selected with the rotary switch are listed below. Do not set the reserved function numbers.

Function number	Explanation
0	Normal state.
1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	Clears all data in memory.
6	Reserved
7	Reserved
8	Saves battery backed-up main board data in a memory card at a time.
9	Reserved
A	Restores battery backed-up main board data from a memory card at a time.
B	Reserved
C	Reserved
D	Reserved
E	Reserved
F	Performs maintenance work.

> **NOTE**
> See Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)" for the function number F.

3.9.3   Operation of Each Function

Function number 5
This function clears all the battery backed-up SRAM data.

⚠ **WARNING**
1 This operation enables the CNC system to start up solely (initial state).
   Accordingly, to recover various functional operations, the cleared data needs to
   be set again.
2 This operation can be performed by those personnel who received the training of
   maintenance and safety.

---

(1)   Check that number 5 blinks on the LED, and press the push switch.
(2)   Number 5 is displayed on the LED. Press the push switch.
(3)   Display of the LED changes in the order: "-", "F", and "0".
(4)   After all-clear operation terminates normally, the LED display stops changing at number 0.
(5)   Turn off the power, return the rotary switch to the original position, and turn on the power again.

Function number 8
This function saves battery backed-up main board data in a memory card at a time. Data saved using this function can be restored at a time using function number A or SRAM operation on the BOOT screen.
(1)   Inset a memory card with enough free space into the memory card slot (MEMORY CARD CNM1B)
      of the main body.
(2)   Check that number 8 blinks on the LED, and press the push switch.
(3)   Number 8 is displayed on the LED. Press the push switch.
(4)   While data is saved in the memory card, display of the LED is rotating clockwise.
(5)   If the data cannot fit in one memory card, number 3 blinks. Replace the memory card with another
      one, and press the push switch.
(6)   If the data cannot be written to the memory card, number 2 blinks on the LED. Replace the
      memory card with another one and press the push switch.
(7)   When the data has been saved normally, number 0 is displayed on the LED. If the data cannot be
      saved normally, number 1 is displayed on the LED.
(8)   If the data cannot be backed up because it is illegal, number 1 blinks on the LED.   In this case, it is
      impossible to save the data at a time. Back up individual data items one by one, then perform
      all-clear operation.

Function number A
This function restores battery backed-up main board data from a memory card at a time.
(1)   Insert the memory card in the memory card slot (MEMORY CARD CNM1B) of the control unit.
(2)   Check that A blinks on the LED, and press the push switch.
(3)   When letter A is displayed on the LED, press the push switch.
(4)   While data is being restored from the memory card, the LED indication turns counterclockwise.
(5)   If the entire data cannot be restored from the single memory card, number 3 blinks. Replace the
      memory card with the next memory card, and press the push switch.
(6)   If the memory card cannot be recognized correctly, number 2 blinks on the LED. Check the memory
      card status, and press the push switch.
(7)   When the data has been restored normally, number 0 is displayed on the LED. If the data cannot be
      restored normally, number 1 is displayed on the LED.

4 MATTERS COMMON TO BOTH LCD-MOUNTED TYPE AND STAND-ALONE TYPE (HARDWARE)

This chapter describes printed-circuit boards and units common to LCD-mounted and stand-alone types. It also explains conditions for installing them and how to replace their consumable parts.

4.1 OPTIONAL BOARD

4.1.1 Fast Ethernet Board

- **Specification**

Item	Ordering code
Fast Ethernet board	A20B-8101-0030

- **Connector mounting location**
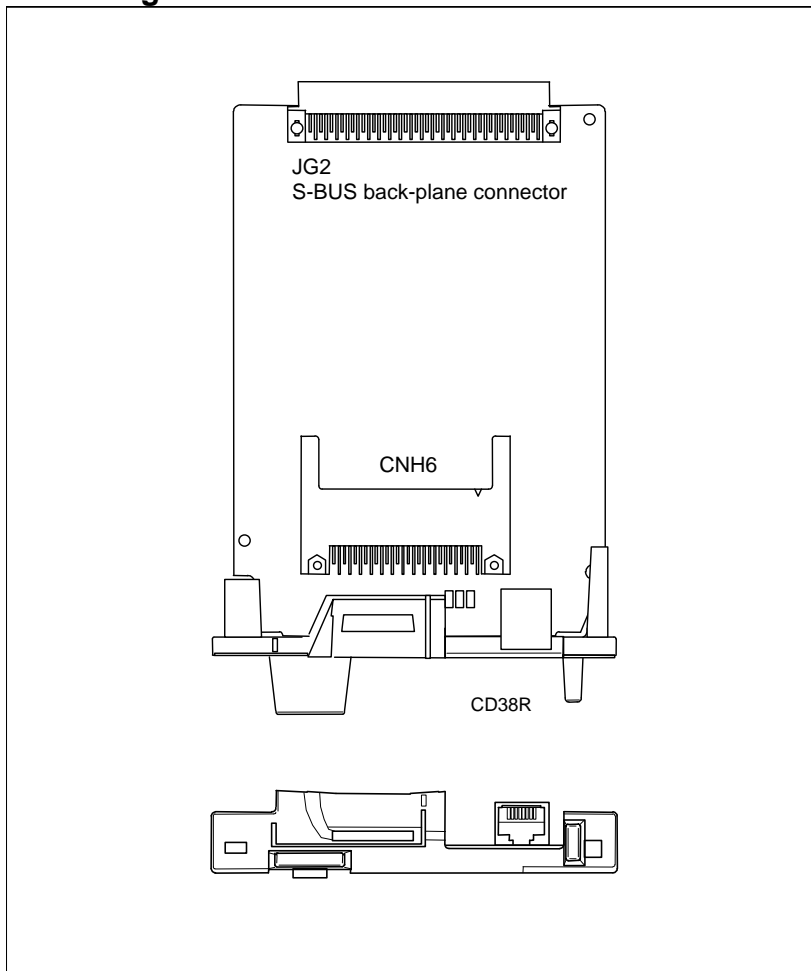
Connector number	Use
CNH6	ATA card interface
CD38R	100BASE-TX Ethernet interface

- LED indications

The board incorporates the following LEDs: Four green STATUS LEDs and one red ALARM LED for indicating the status. Two green LEDs, one yellow LED, and one red LED for indicating the communication status. The figure below shows the locations of these LEDs. The table below explains the LED lighting states.

In the following explanations, the LED lighting states are expressed as follows:

□: Off   ■: On   ☆: Blinking   ◊: Don't care

Detailed view of LEDs

ALM (red)
COM (yellow)
4(STASUS) (green)
3(STATUS) (green)
2(STATUS) (green)
1(STATUS) (green)
LIL (green)
COL (red)
BTX (green)

CD38R
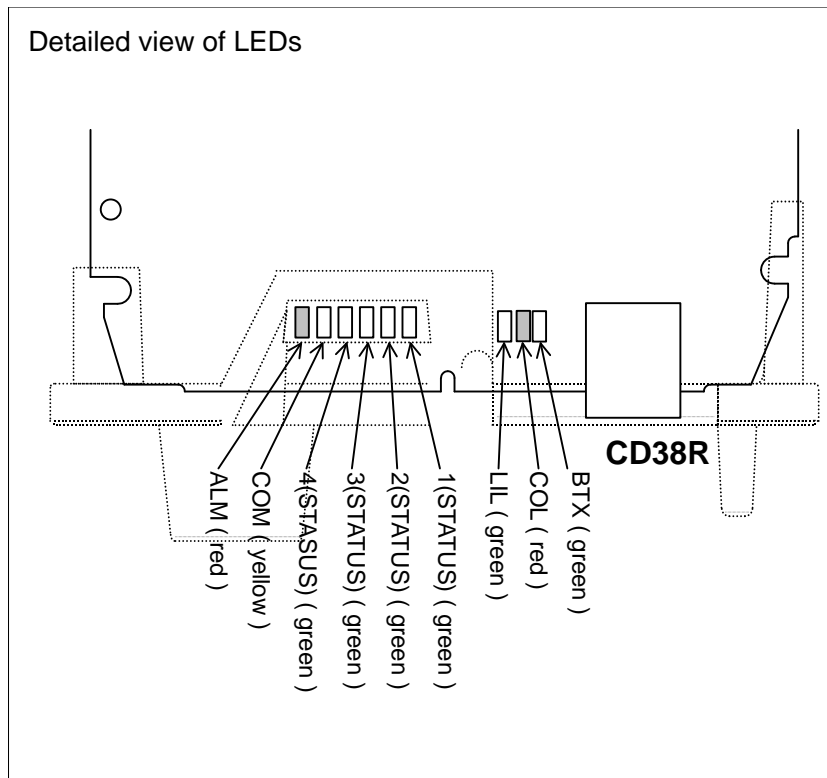
NOTE
The face plate is indicated with dotted line.

LED indication transition for LED1, LED2, LED3, and LED4 (during power-on)

LED indication L4L3L2L1	Status	Meaning
□□□□	Power-off	
■■■■	Immediately after power-on	Initial state entered immediately after power-on. If the board is stopped in this condition, the cause is one of the following: ✓ The firmware is not stored in the Flash ROM of the CNC. ✓ The board is defective.
■■■□	Start of board	The board has started. If the board is stopped in this condition, the board may be defective.
■■□□	Completion of firmware downloading	The firmware has been downloaded to the board. If the board is stopped in this condition, the board may be defective.

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LED indication L4L3L2L1	Status	Meaning
■□□□	Firmware OS started.	The firmware OS has started. If the board is stopped in this condition, the cause is one of the following: ✓ The firmware stored in the Flash ROM of the CNC is destroyed. ✓ The board is defective.
□■■■	Completion of firmware OS initialization	Initialization of the firmware OS is completed. If the board is stopped in this condition, the cause is one of the following: ✓ The firmware stored in the Flash ROM of the CNC is destroyed. ✓ The board is defective.
□■■☆	Completion of parameter reading	The Ethernet parameters have been read. If the board is stopped in this condition, the cause is one of the following: ✓ The Ethernet option or Data Server option is not installed. ✓ The IP address or subnet mask is not set.
□□□☆	Start completion	The board has started normally.

LED indication for LED1, LED2, LED3, and LED4 (during normal operation)

LED indication L4L3L2L1	Status	Meaning
□□□☆	Normal status	The board is operating normally.

LED indication for BTX, LIL, COM, and ALM (during normal operation)

LED indication	Status	Meaning
BTX ■	100BASE-TX connection in progress	The communication rate is 100BASE-TX.
BTX □	10BASE-T connection in progress	The communication rate is 10BASE-T.
LIL ■	Connected to hub	The board is connected to the hub.
COM ■	Transmission/reception in progress	Data is being transmitted or received.
ALM □	No alarm	No alarm is issued

LED indication for LED1, LED2, LED3, and LED4 (when abnormality occurs)
The STATUS LEDs are turned on and off repeatedly with long on-time and short on-time.

LED indication [Long on-time] 4 3 2 1	LED indication [Short on-time] 4 3 2 1	Status	Description
■■□□	□□□■	Error on another board	A defect on another board or a problem on another board was detected.
■■□□	□□■□	Bus error	Software has a problem, or the board is defective.
■■□□	□□■■	Parity alarm	The board is defective.
■□■□	□□□□	Illegal general instruction	Software has a problem, or the board is defective.
■□■□	□□□■	Illegal slot instruction	Software has a problem, or the board is defective.
■□■□	□■□□	CPU address error	Software has a problem, or the board is defective.

> **NOTE**
> If an error occurs with the LEDs turned on and off with long on-time and short
> on-time in a manner not indicated above, contact FANUC.

LED indication for COL, LIL, and ALM (when abnormality occurs)

LED indication		Status	Description
COL	■	Collision occurs.	The LED is on or blinks at short intervals when the Ethernet
COL	☆	(Data collision occurs.)	communication traffic (communication amount) is high or
			ambient noise is high.
LIL	□	Not connected to hub	The board is not connected to the hub properly. The LIL LED
			stays off also when the power to the hub is off.
			Check whether the board is connected to the hub properly.
ALM	■	Parity error occurs.	A parity error occurred in memory on the board. The board is
			defective.

4.1.2   PROFIBUS-DP Board

-   Specification

Item	Ordering code	Remarks
PROFIBUS-DP master board	A20B-8101-0050	
PROFIBUS-DP slave board	A20B-8101-0100	

-   Connector mounting location
Master board
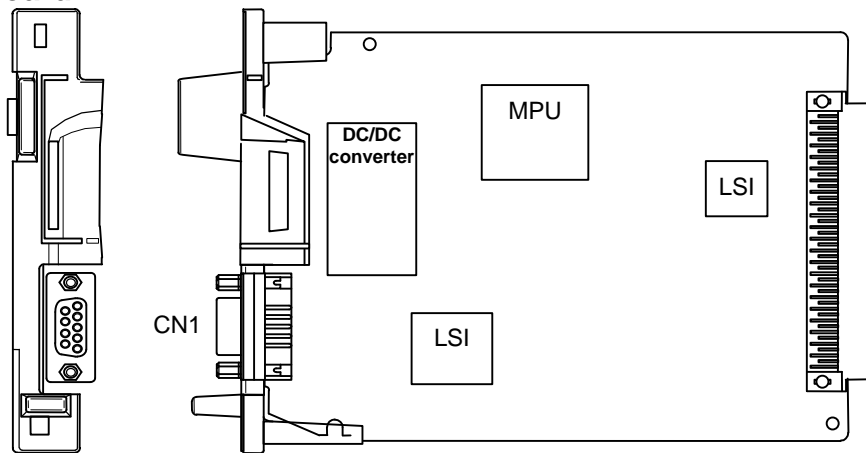
Slave board
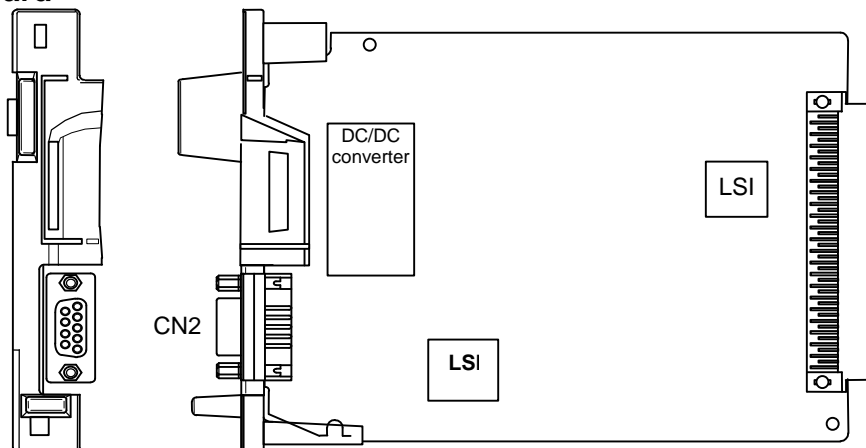
・ **LED indicators and their meanings**

・ **Master board**

NOTE
The face plate is indicated by the broken line.

LED name	Color	Description
LED1	Green	Indicates that the CPU on this board has started running. ON: RESET has been released, allowing the CPU to start running. The LED is turned off when the power is turned on.
LED2	Green	Indicates whether communication is being normally carried out. ON: Communication is being normally carried out. OFF: Communication is not being carried out. The LED is turned off when the power is turned on.

・ **Slave board**

NOTE
The face plate is indicated by the broken line.

LED name	Color	Description
LED1	Green	Indicates that the CPU on this board has started running. ON: RESET has been released, allowing the CPU to start running. The LED is turned off when the power is turned on.
LED2	Green	Indicates that communication has started. ON: Communication has started. The LED is turned off when the power is turned on or if: - No parameter data and configuration data have been received. - Invalid parameter data and configuration data have been received.
LED3	Green	Indicates whether communication is being normally carried out. ON: Communication is being normally carried out. OFF: Communication is not being carried out. The LED is turned off when the power is turned on.
LEDB	Red	Indicates that a RAM parity alarm condition has occurred on this board. ON: A RAM parity alarm condition has occurred. The LED is turned off when the power is turned on. Once it has been turned on, it stays on until the power is turned off.

4.1.3 DeviceNet Board

Specification

Item	Ordering code	Remarks
DeviceNet master board	A20B-8101-0220	
DeviceNet slave board	A20B-8101-0330	

Connector and LED mounting location
- Master board
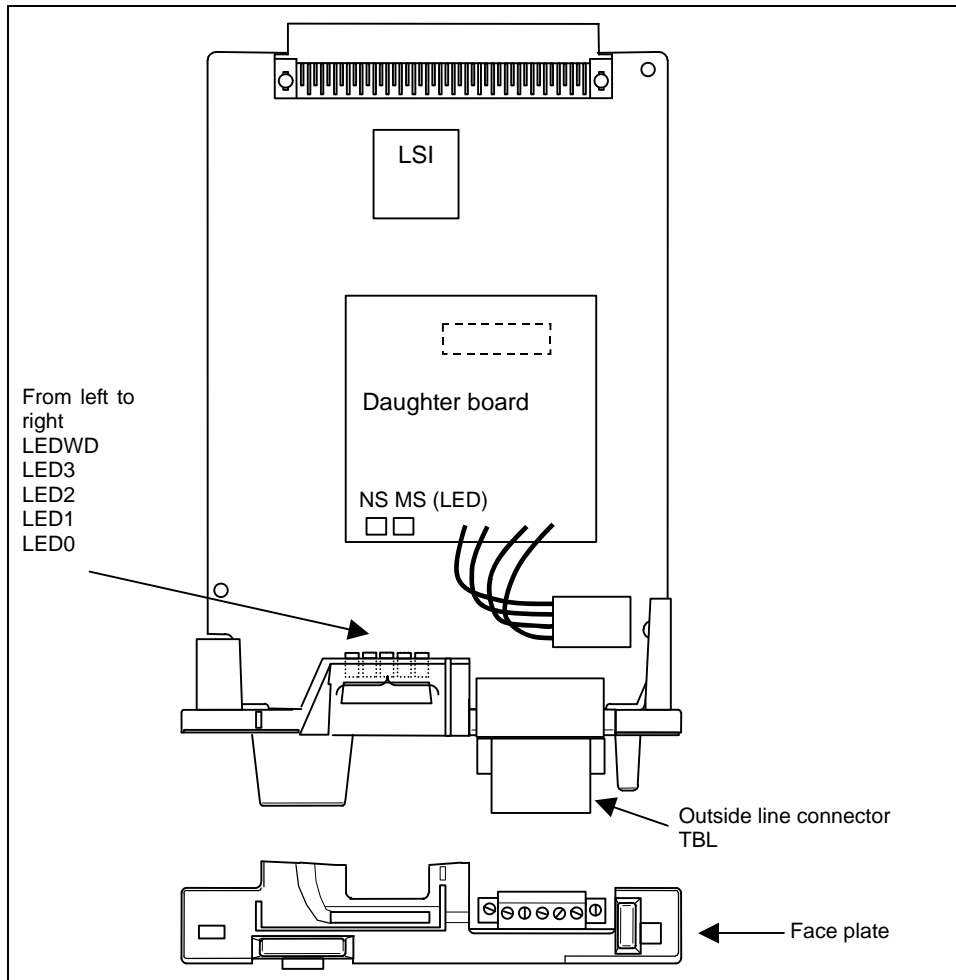
From left to right
LEDWD
LED3
LED2
LED1
LED0

LSI

Daughter board

NS MS (LED)

Outside line connector TBL

Face plate

・ **Slave board**
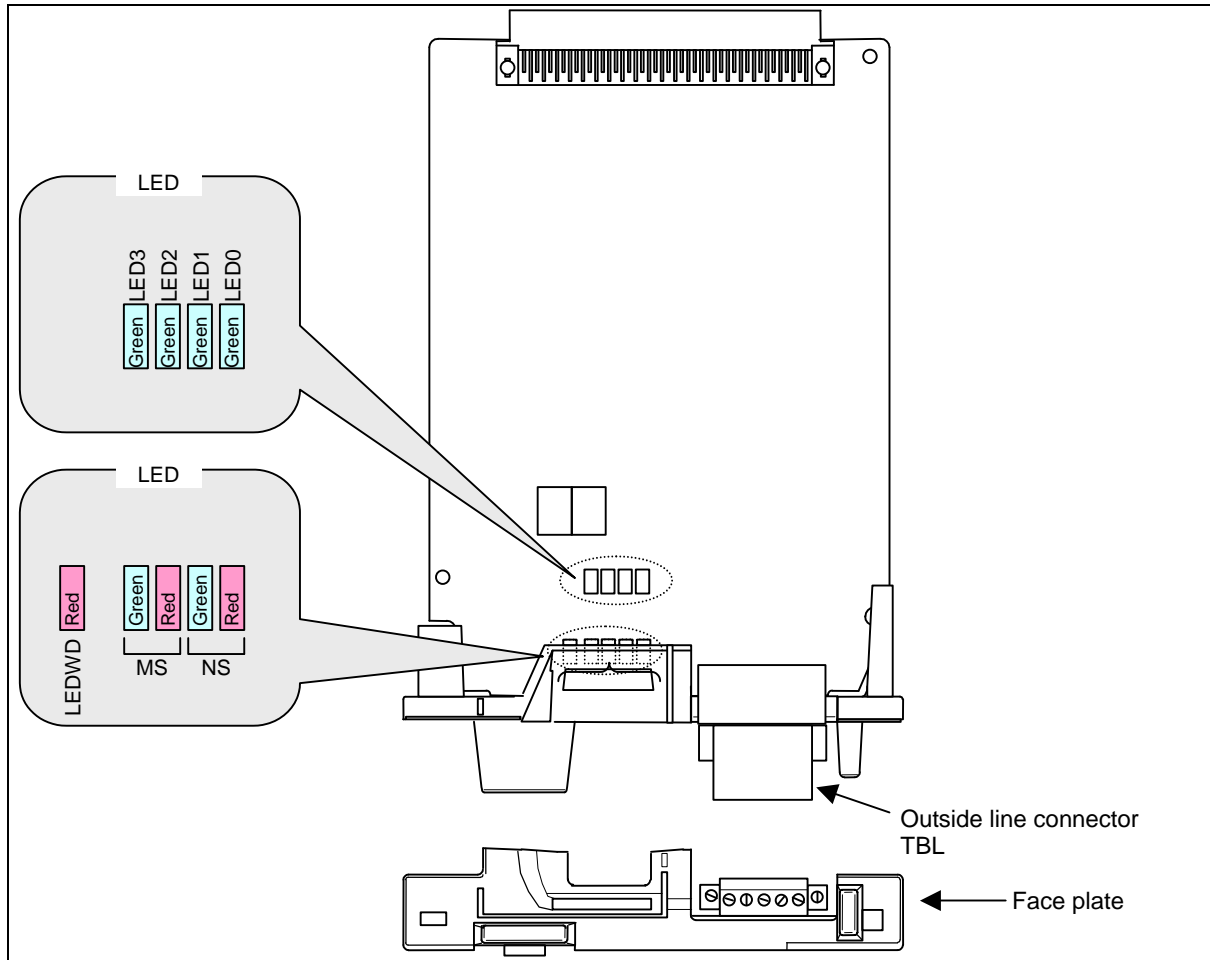
LED indicators and their meanings

・ **Master board**

This board provides four green LEDs and one red LED for status indication.
In addition, the internal daughter board has two LEDs that emit red and green light.

LED name	Color	Meaning
LED0〜3	Green	Indicates the activation state of the DeviceNet application software.
LEDWD	Red	Indicates an error on the daughter board.
MS	Red／Green	MS (Module Status) indicates the states of nodes.
NS	Red／Green	NS (Network Status) indicates the state of the network.

In the following explanations, the LED lighting states are expressed as follows:
□: Off　■: On　☆: Blinking　◊: Don't care

LED indication transition for LED0, LED1, LED2, and LED3 (during power-on)

LED indication L3L2L1L0	State and cause when stopped after power-on	Action when stopped after power-on
□□□□	Power-off	
■■■■	After power-on, the DeviceNet application software does not start.	Store the DeviceNet application software in the Flash ROM of the CNC.
□□□□	Initializing the firmware on the daughter board.	Replace the DeviceNet master board.
□□□■	Checking memory on the daughter board.	
□□■□	Recognizing the firmware on the daughter board.	
□□■■	Reading DeviceNet parameters.	Enable the DeviceNet master function (software option).
□■□□	Verifying that DeviceNet parameter "NETWORK" is set to "ONLINE."	Set DeviceNet parameter "NETWORK" to "ONLINE."
□■□■	Setting the bus parameter in DeviceNet parameters.	Replace the DeviceNet master board.
□■■□	Setting the slave parameter in DeviceNet parameters.	Set the slave parameter in DeviceNet parameters correctly. Or, replace the DeviceNet master board.
□■■■	Checking duplicate MAC IDs.	Check duplication with the MAC ID of a slave device. Check if cables are connected correctly. Check if power for communication is correctly supplied. Check if slave devices are turned on.
■□□□	The DeviceNet application software has been initialized and I/O communication starts.	

LED indication of LEDWD

LED indication	Status	Meaning
■	Daughter board failure	The daughter board failed. Replace the DeviceNet master board.

LED indication of MS and N (during normal operation)

LED indication	Status	Meaning
MS □ NS □	Immediately after power-on	The MPU on the daughter board is being reset.
MS ☆ Green NS □	Initializing	The firmware on the daughter board is making a initialization.
MS ■ Green NS □	Checking duplication of MAC IDs	The firmware on the daughter board is checking duplicated MAC IDs.
MS ■ Green NS ☆ Green	I/O communication stopped	The firmware on the daughter board is stopping I/O communication.
MS ■ Green NS ■ Green	I/O communication in advance	The firmware on the daughter board is successfully performing I/O communication.

LED indication of MS and NS (when abnormality occurs)

LED indication	Status	Error and action
MS ☆ Red NS ◇	Daughter board failure	The daughter board failed. Replace the DeviceNet master board.
MS ■ Red NS □	Daughter board failure	The daughter board failed. Replace the DeviceNet master board.

LED indication	Status	Error and action
MS ◇ NS ■ Red	Duplicate MAC IDs	MAC IDs are duplicate. Verify the following: → MAC IDs are not duplicate by check the MAC IDs of all nodes.
	Busoff detection	Communication stopped because a communication error occurred frequently. Verify the following: → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.
MS ◇ NS □	Network power failure	Power for communication is not supplied. Verify the following: → Power for communication is properly supplied.
	Transmission error	Transmission is not completed successfully. Verify the following: → All slaves are turned on. → There is no other master on the network. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.
MS ◇ NS ☆ Red	Slave not present	No slaves are present. Verify the following: → The slave is turned on. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.
	Slave I/O size mismatch	The slave I/O size setting does not match the setting of the actual slave. Verify the following: → The slave I/O size setting matches the setting of the actual slave.
	I/O communication error	I/O communication timed out. Verify the following: → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.

Slave board

This board provides four green LEDs (LED0 to LED3) and one red LED (LEDWD) for status indication.
In addition, there are two LED sets (MS and NS) that consist of one red LED and one green LED.

LED name	Color	Meaning
LED0〜3	Green	Indicates the activation state of the DeviceNet application software.
LEDWD	Red	Indicates an error on the board.
MS	Green	Indicates the unit status, which is the status of the local node.
	Red	
NS	Green	Indicates the network status, which is the status of the entire network including the local node.
	Red	

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In the following explanations, the LED lighting states are expressed as follows:
□: Off　■: On　☆: Blinking　◊: Don't care　?: Undefined

LED indication transition for LED0, LED1, LED2, and LED3

LED indication L3L2L1L0	State and cause when stopped after power-on	Action when stopped after power-on
□□□□	Power-off	
■■■■	After power-on, the DeviceNet application software does not start. Or, the DeviceNet slave function (software option) is disabled.	Store the DeviceNet application software in the Flash ROM of the CNC. Or, confirm that the DeviceNet slave function (software option) has been purchased.
□□□□	Initializing the firmware on the board.	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.
□□□■	The board firmware has been initialized.	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.
□□■□	A line baud rate check is in progress.	These faults are recoverable. When communication is normally established, the status changes to "I/O communication is normal". Each status corresponds to DeviceNet MPU status transition [NOTE].
□□■■	A MAC ID duplication check is in progress.	
□■□□	Waiting for I/O communication to be established.	
□■□■	I/O communication is normal.	
□■■□	I/O communication has timed out.	
□■■■	I/O communication is idle.	

LED indication L3L2L1L0	State and cause when stopped after power-on	Action when stopped after power-on
■□□□ ↑　↓ □□■□ (Repetition)	These faults are not recoverable on the board side. MAC ID duplication has been detected.	Check the following and then turn the slave power off and back on again. → MAC IDs are not duplicate by check the MAC IDs of all nodes.
■□□□ ↑　↓ □□■■ (Repetition)	These faults are not recoverable on the board side. Busoff was detected due to frequent occurrence of a communication error.	Check the following and then turn the slave power off and back on again. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.
■□□□ ↑　↓ □ ? ? ? (Repetition)	Any of other unrecoverable failures occurred on the board. The pattern indicated by LED0 to LED2 is other than the above two patterns.	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.
□□□□ ↑　↓ ■■■■ (Repetition)	An unrecoverable failure occurred on the CNC side.	Contact FANUC.

> **NOTE**
> When a transition to the "I/O communication normal" status is not made, confirm that the power for communication is correctly supplied because a network power failure may have occurred.

LED indication of LEDWD

LED indication	Status	Meaning
■	Board failure	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.

LED indication of MS and NS (during normal operation)

In the "during normal operation" status, when communication is normally established, a transition to the "I/O communication normal" status is made.

LED indication	Status	Meaning
MS □ Green MS □ Red NS □ Green NS □ Red	Immediately after power-on	The onboard firmware is being initialized when the onboard MPU is in the reset status or reset release status.
MS ■ Green MS □ Red NS □ Green NS □ Red	Communication under preparation	The onboard firmware performs processing in the order below. <1>Waits for the DeviceNet application software to be initialized. <2>Checks the baud rate. <3>Checks MAC ID duplication.
MS ■ Green MS □ Red NS ☆ Green NS □ Red	Waiting for establishment of I/O communication to be established	Each status corresponds to DeviceNet MPU status transition [NOTE].
MS ■ Green MS □ Red NS ■ Green NS □ Red	I/O communication normal	
MS ◇ Green MS ◇ Red NS ■ Green NS ☆ Red	I/O communication timeout	

> **NOTE**
> When a transition to the "I/O communication normal" status is not made, confirm that the power for communication is correctly supplied because a network power failure may have occurred.

LED indication of MS and NS (during occurrence of an unrecoverable failure)

In the "during occurrence of an unrecoverable failure" status, once an error occurred, recovery is not performed unless this slave station is powered off and back on again.

LED indication	Status	Error and action
MS ◇ Green MS ◇ Red NS □ Green NS ■ Red	Duplicate MAC IDs	Check the following and then turn the slave power off and back on again. → MAC IDs are not duplicate by check the MAC IDs of all nodes.
	Busoff detection	Check the following and then turn the slave power off and back on again. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.
MS □ Green MS ■ Red NS ◇ Green NS ◇ Red	Other unrecoverable onboard failures	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.

4.1.4 FL-net Board

- Specification

Item	Ordering code
FL-net board	A20B-8101-0031

- Connector mounting location

CD38N
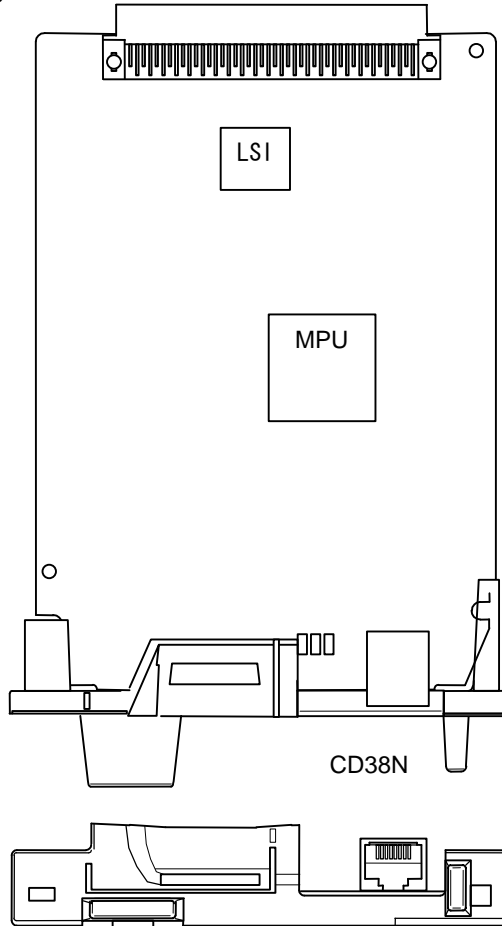
· LED indicators and their meanings

The board incorporates the following LEDs: Four green STATUS LEDs and one red ALARM LED for indicating the status. Two green LEDs, one yellow LED, and one red LED for indicating the communication status. The figure below shows the locations of these LEDs. The table below explains the LED lighting states.

In the following explanations, the LED lighting states are expressed as follows:

□: Off   ■: On   ☆: Blinking   ◊: Don't care

CD38N

ALM (red)
COM (yellow)
4(PQK) (STASUS) (green)
3(LNK) (STATUS) (green)
2(RES) (STATUS) (green)
1(ROS) (STATUS) (green)
LIL (green)
COL (red)
BTX (green)
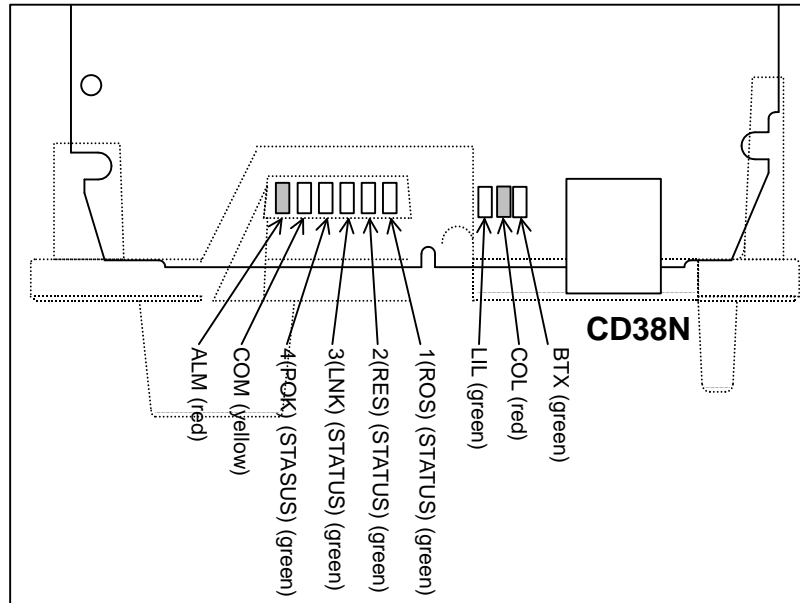
> **NOTE**
> The face plate is indicated by the broken line.

LED display transition for LED1, LED2, LED3, and LED4 (during power-on)

LED indication 4 3 2 1	Status	Meaning
□□□□	Power-off	
■■■■	Immediately after power-on	Initial state entered immediately after power-on. If the board is stopped in this condition, the cause is one of the following: ✓ The firmware is not stored in the Flash ROM of the CNC. ✓ The board is defective.
■■■□	Start of board	The board has started. If the board is stopped in this condition, the board may be defective.
■■□□	Completion of firmware downloading	The firmware has been downloaded to the board. If the board is stopped in this condition, the board may be defective.
■□□□	Firmware OS started.	The firmware OS has started. If the board is stopped in this condition, the cause is one of the following: ✓ The firmware stored in the Flash ROM of the CNC is destroyed. ✓ The board is defective.
□■■■	Completion of firmware OS initialization	Initialization of the firmware OS is completed. If the board is stopped in this condition, the cause is one of the following: ✓ The firmware stored in the Flash ROM of the CNC is destroyed. ✓ The board is defective.
◇◇□☆	Start completion	The board has started normally.

LED display for LED1, LED2, LED3, and LED4 (during normal operation)

LED indication	Status	Meaning
ROS ☆	Normal software operation	Blinks at 1-second intervals when the communication software on the FL-net board operates normally.

LED indication	Status	Meaning
RES □	Normally OFF	Normally, off
LNK ■	Participating in network	Turned on when the node participates in the FL-net network
POK ■	Normal parameters	Turned on when all FL-net parameters are valid.

LED display for BTX, LIL, COM, and ALM (during normal operation)

LED indication	Status	Meaning
BTX □	10BASE-T connection in progress	The communication rate is 10BASE-T.
BTX ■	100BASE-TX connection in progress	The communication rate is 100BASE-TX.
LIL ■	Connected to hub	The board is connected to the hub.
COM ■	Transmission/reception in progress	Data is being transmitted or received.
ALM □ (HER)	No alarm	No alarm is issued

LED display for LED1, LED2, LED3, and LED4 (when abnormality occurs)

The STATUS LEDs are turned on and off repeatedly with long on-time and short on-time.

LED indication [Long on-time] 4 3 2 1	LED indication [Short on-time] 4 3 2 1	Status	Description
■■□□	□□□■	Error on another board	A defect on another board or a problem on another board was detected.
■■□□	□□■□	Bus error	Software has a problem, or the board is defective.
■■□□	□□■■	Parity alarm	The board is defective.
■□■□	□□□□	Illegal general instruction	Software has a problem, or the board is defective.
■□■□	□□□■	Illegal slot instruction	Software has a problem, or the board is defective.
■□■□	□■□□	CPU address error	Software has a problem, or the board is defective.

> **NOTE**
> If an error occurs with the LEDs turned on and off with long on-time and short on-time in a manner not indicated above, contact FANUC.

LED display for COL, LIL, and ALM (when abnormality occurs)

LED indication	Status	Description
COL ■ COL ☆	Collision occurs. (Data collision occurs.)	When a data collision occurs on the network, the LED is lit or blinks. (Note)
LIL □	Not connected to hub	The board is not connected to the hub properly. The LIL LED stays off also when the power to the hub is off. Check whether the board is connected to the hub properly.
ALM ■ (HER)	Parity error occurs.	A parity error occurred in memory on the board. The board is defective.

> **NOTE**
> The FL-net manages the token-based transmission right so that no collision occurs.   If this LED is turned on frequently, a communication error has occurred due to noise, or an Ethernet compliant product other than the FL-net is connected.
> In such a case, check the devices connected to the network and the network installation status.

4.2 INSERTING AND EXTRACTING OPTION PCB

> ⚠ **WARNING**
> Only those personnel who have received approved safety and maintenance training may perform this replacement work.
> When opening the cabinet and replacing the card PCB, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover). Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

> ⚠ **CAUTION**
> Before replacing a printed circuit board, be sure to read Section 4.11, "CAUTIONS IN REPLACING PCB'S," to confirm the procedure.
> Before starting replacement work, back up the SRAM data of the CNC. Otherwise, the SRAM data may be lost during replacement work. See Section 3.9, "MAINTENANCE OF STAND-ALONE TYPE UNIT", Chapter 5, "INPUT AND OUTPUT OF DATA" or Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)" for explanations about how to save the contents of the SRAM memory.

4.2.1 Method of Extraction

<1> Detach the cable connected to the option board and the cable that interferes when the option board is extracted.
<2> Pinch handles A and B for extraction.
<3> Pinch handle A, and extract the printed circuit board while disengaging the latch.

4.2.2 Method of Insertion

<1> Pinch handles A and B for extraction, then insert the option board until the option board plugs into the connector of the back panel.
<2> Plug the detached cables again correctly.
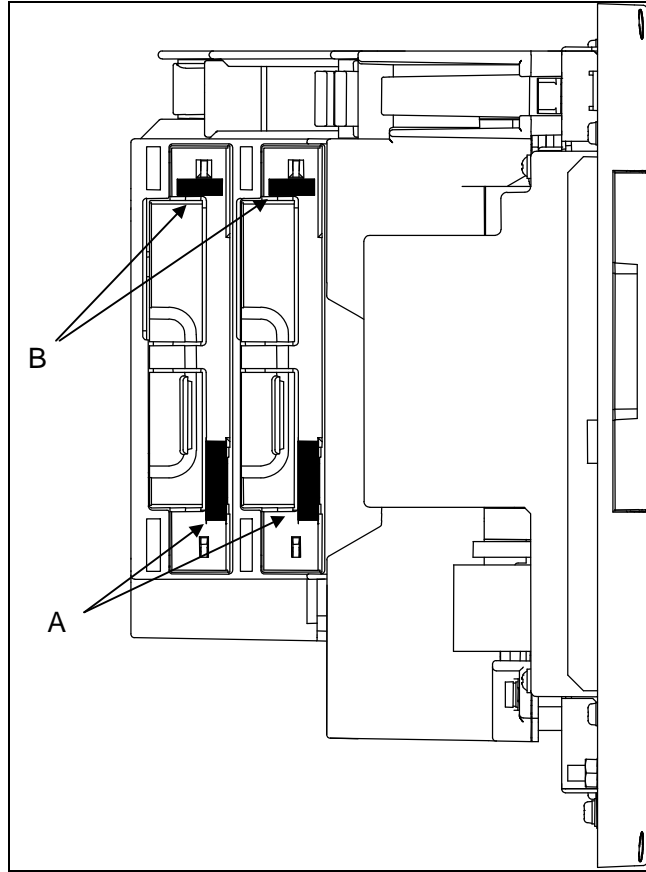
For LCD-mounted type control unit
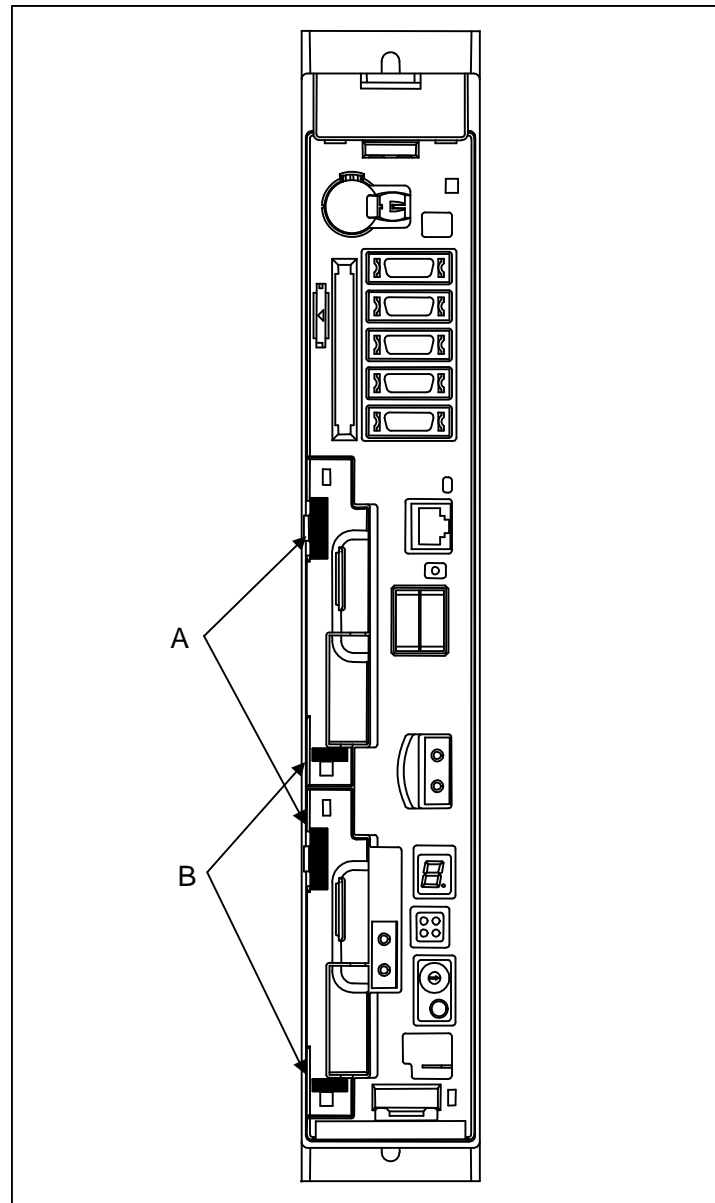
For stand-alone type control unit

4.3   MOUNTING AND DEMOUNTING AXIS CARD

> ⚠ **WARNING**
>   Only those personnel who have received approved safety and maintenance
>   training may perform this replacement work.
>   When opening the cabinet and replacing a card PCB, be careful not to touch the
>   high-voltage circuits (marked ⚠ and fitted with an insulating cover).
>   Touching the uncovered high-voltage circuits presents an extremely dangerous
>   electric shock hazard.

> ⚠ **CAUTION**
> Before replacing a printed circuit board, be sure to read Section 4.11,
> "CAUTIONS IN REPLACING PCB'S," to confirm the procedure.
> Before starting replacement work, back up the SRAM data of the CNC.
> Otherwise, the SRAM data may be lost during replacement work. See Section
> 3.9, "MAINTENANCE OF STAND-ALONE TYPE UNIT", Chapter 5, "INPUT AND
> OUTPUT OF DATA" or Appendix F, "MAINTENANCE OF OPEN CNC
> (BOOT-UP AND IPL" for explanations about how to save the contents of the
> SRAM memory.

4.3.1 Method of Extraction

<1> Pull outward and unlatch the two claws of the spacer fixing the axis card. (Fig. a)
<2> Pull up (in a direction perpendicular to the main board) and out the axis card. (Fig. b)

Fig. a

Fig. b
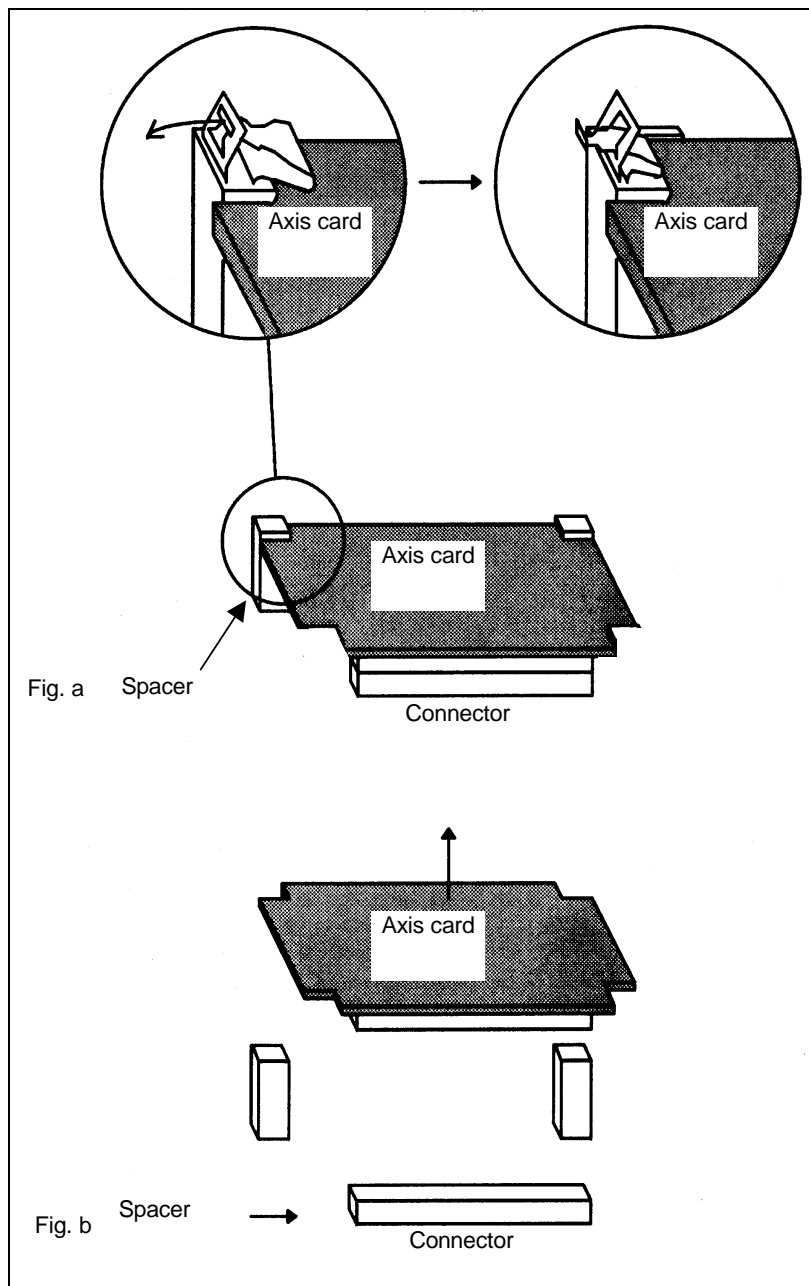
4.3.2   Method of Insertion

<1> Check that the metal fittings of the spacers are raised. (Fig. d)

<2> To align the card board insertion position, touch the spacer fixing end faces of the card board with the spacers as shown in the Fig. c. (At this time, the board can be touched with the spacers for easier position alignment by slightly holding up the connector side and lowering the spacer side only.)

<3> While aligning the card board with the spacers, lower the connector side slowly then cause the connectors to touch each other. (Fig. d)

<4> Push the connector side of the card board slowly. At this time, push the card board against the board on the rear side of the connector. The force required for connector insertion is about 10 kgf. If the connector cannot be mated by a force of about 10 kgf or more, the card board may be aligned incorrectly, and the connector can break. In this case, realign the card board. (NOTE: Do not press the radiation fin installed on a IC chip. Otherwise, the radiation fin can break.)

<5> Push in the spacer metal fittings. (Fig. e)
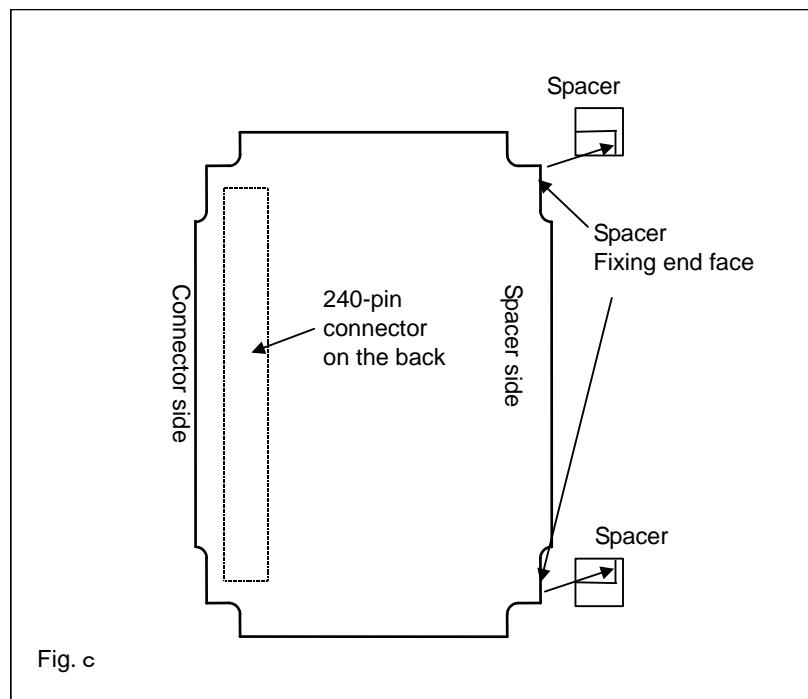
Fig. c

Fig. d

Axis card

Spacer

Connector

Fig. e

Axis card

Axis card

Axis card

Spacer

Connector
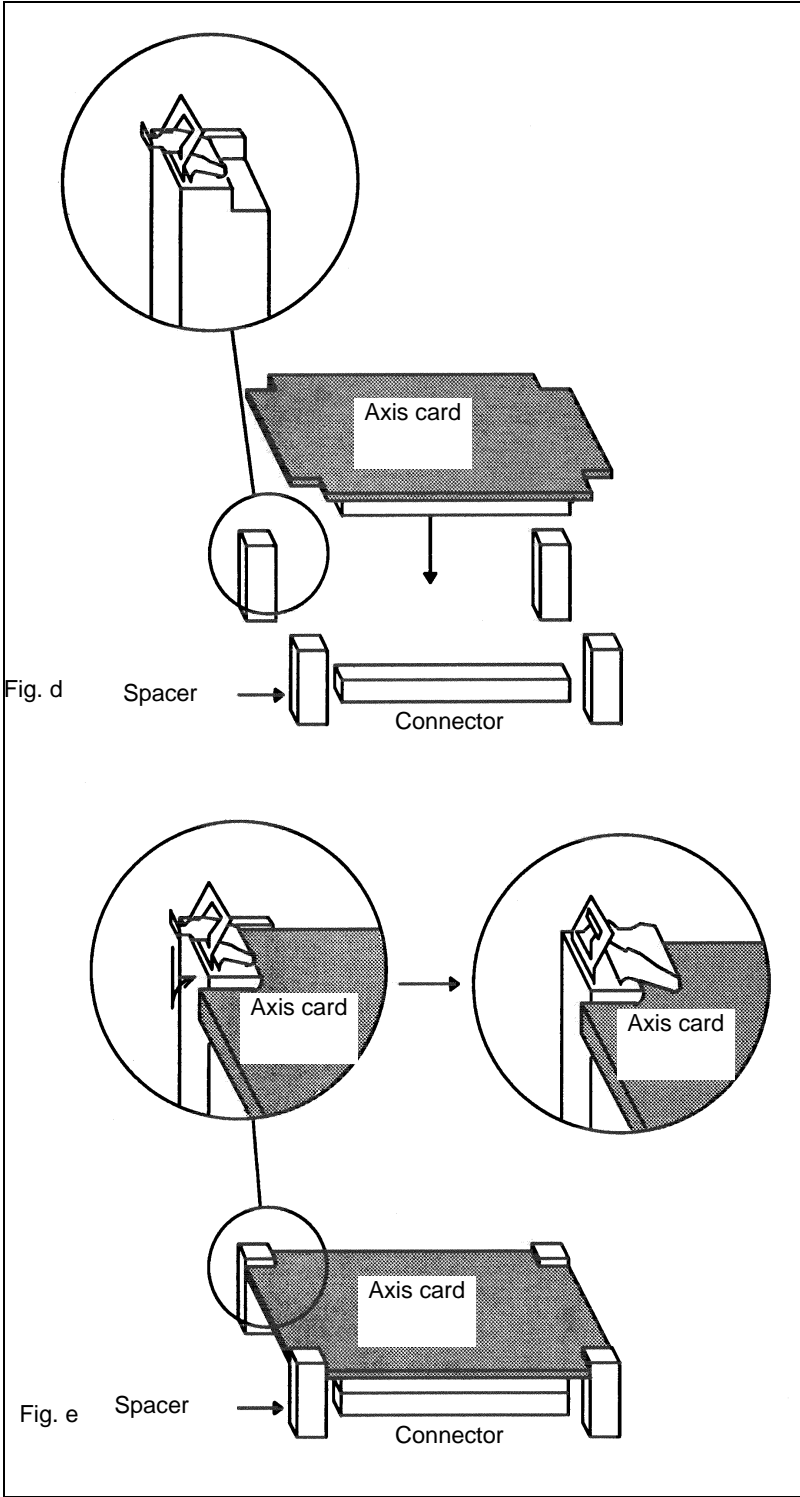
4.4   MOUNTING AND DEMOUNTING FROM/SRAM MODULE

⚠ **WARNING**
   Only those personnel who have received approved safety and maintenance
   training may perform this replacement work.
   When opening the cabinet and replacing a card PCB, be careful not to touch the
   high-voltage circuits (marked ⚠ and fitted with an insulating cover).
   Touching the uncovered high-voltage circuits presents an extremely dangerous
   electric shock hazard.

⚠ **CAUTION**
   Before replacing a printed circuit board, be sure to read Section 4.11,
   "CAUTIONS IN REPLACING PCB'S," to confirm the procedure.
   Before starting replacement work, back up the SRAM data of the CNC.
   Otherwise, the SRAM data may be lost during replacement work. See Section
   3.9, "MAINTENANCE OF STAND-ALONE TYPE UNIT", Chapter 5, "INPUT AND
   OUTPUT OF DATA" or Appendix F, "MAINTENANCE OF OPEN CNC
   (BOOT-UP AND IPL)" for explanations about how to save the contents of the
   SRAM memory.

4.4.1   Demounting a FROM/SRAM module

<1> Open the claw of the socket outward. (See Fig. a.)
<2> Extract the module slantly upward. (See Fig. b.)

4.4.2   Mounting a FROM/SRAM module

<1> Insert the module slantly into the module socket, with side B facing upward. (See Fig. b.)
<2> Push the module downward until it is locked. (See Fig. c.)
    At this time, push it down with pushing two points of (*) in the figure.

Fig. a

Fig. b

B-SIDE

Fig. c

(*)

(*)
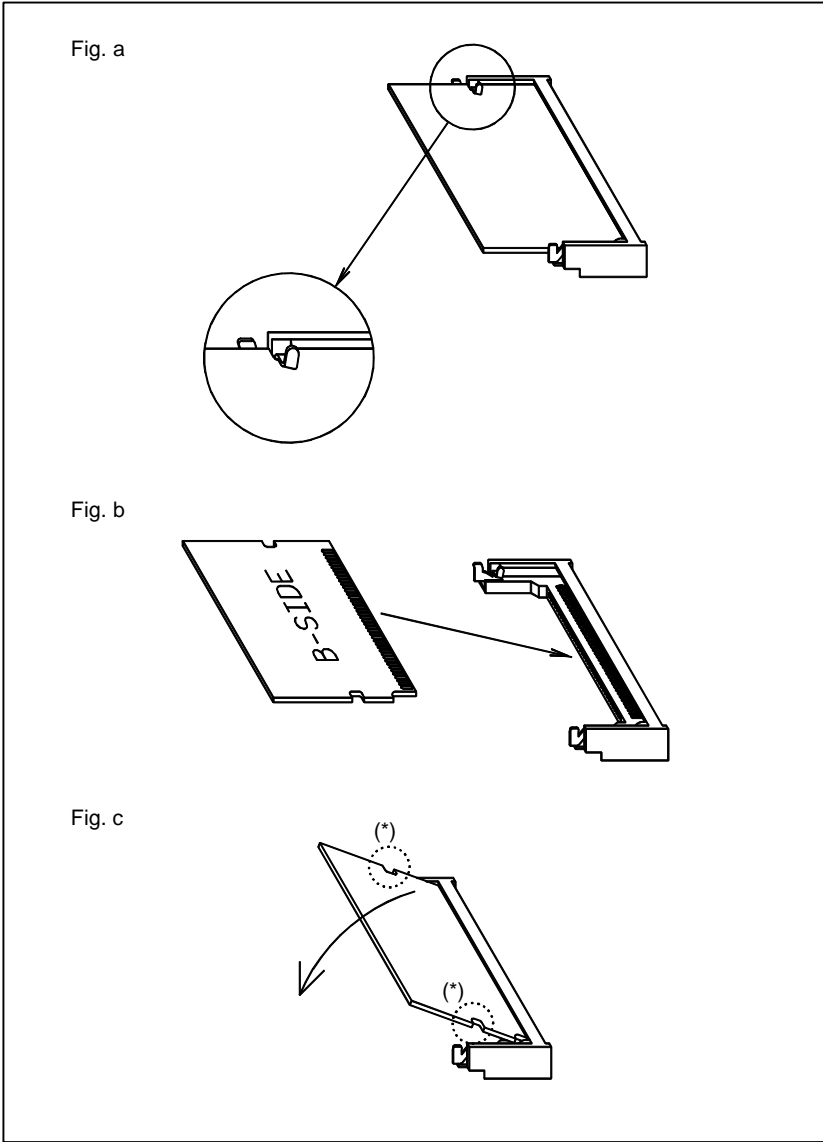
4.5　OTHER UNITS

4.5.1　Separate Detector Interface Unit

- **Specification**

Name	Specification
Basic unit	A02B-0303-C205
Additional unit	A02B-0236-C204

- **Connector mounting location**
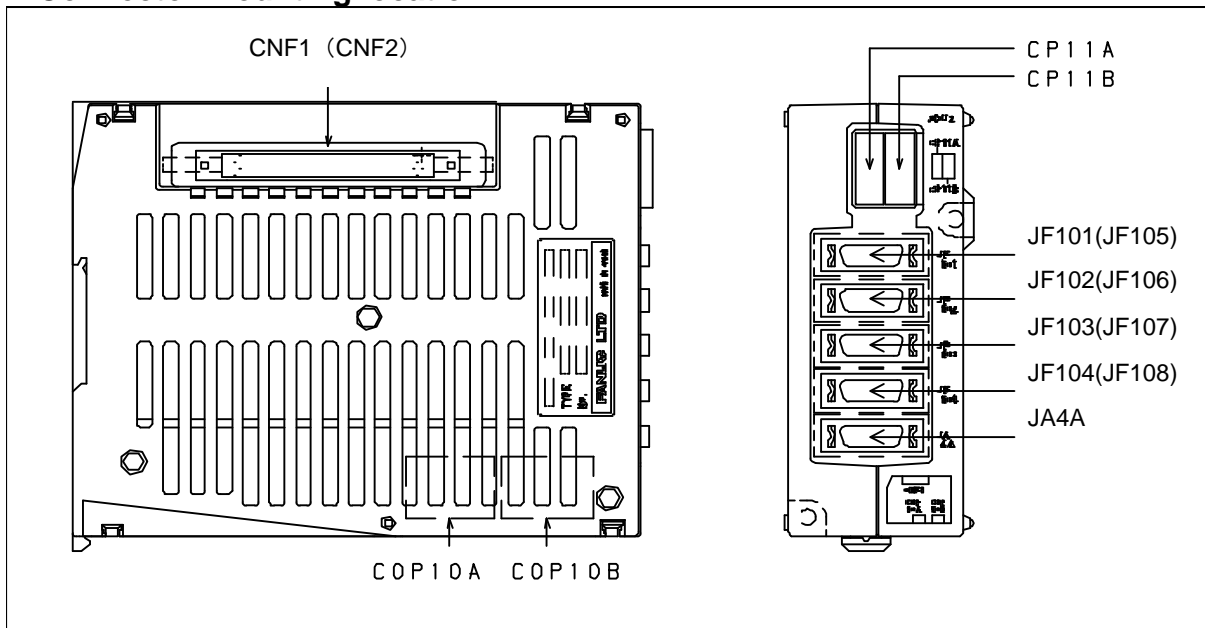
The parenthesized connector names are for the additional unit.

Connector number	Application
CP11A	24 VDC power input
CP11B	24 VDC power output
COP10A	Back stage of the FSSB interface
COP10B	Front stage of the FSSB interface
JF101 to JF104 (JF105 to JF108)	Separate detector interface
JA4A	Connection of a battery for the absolute detector
CNF1 (CNF2)	Connection of the additional unit

The parenthesized connector names are for the additional unit.

- LED display

Status indication LEDs are installed on the board in the basic unit case. Two green LEDs (POWER and OPEN) and two red LEDs (ERR1 and ERR2) are provided. The locations and meanings of the LEDs are indicated below.
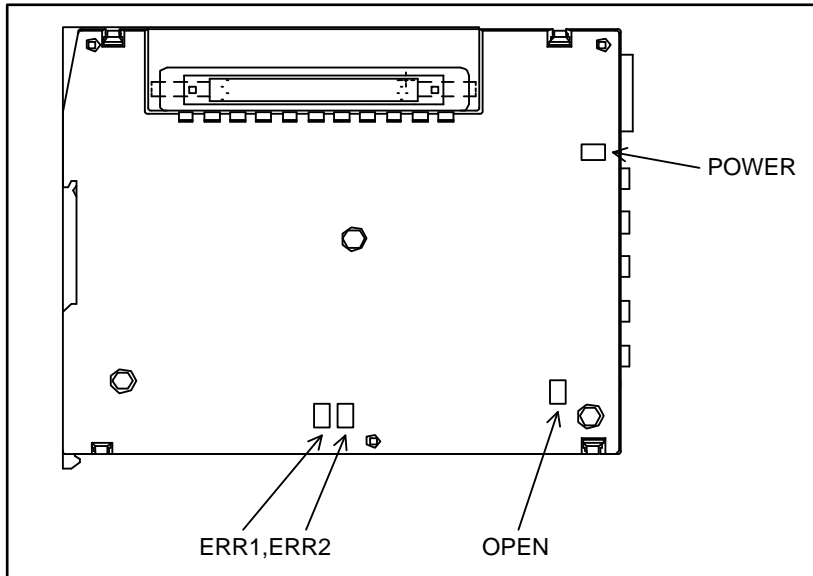
LED indication

No.	LED	Meaning
1	POWER	Turned on when the power is on
2	OPEN	Turned on when FSSB communication is performed
3	ERR1	Turned on when COP10A (back stage) is disconnected
4	ERR2	Turned on when COP10B (front stage) is disconnected

4.5.2 Analog Input Separate Detector Interface Unit

- Specification

Name	Specification
Basic unit	A06B-6061-C201

The additional unit A02B-0236-C204 mentioned in the previous subsection can be used with this interface unit.

- **Connector mounting location**
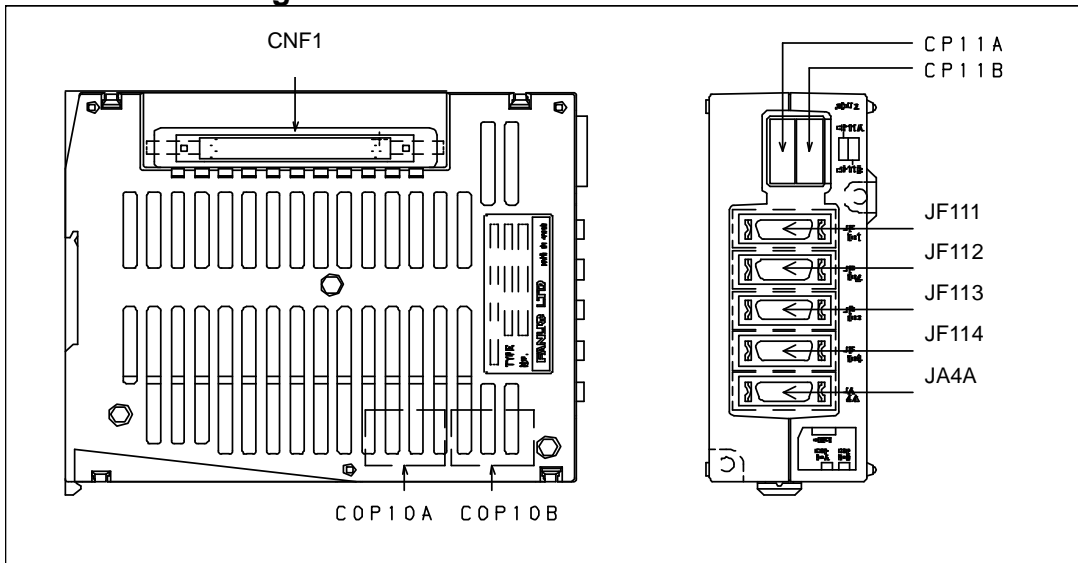
The parenthesized connector names are for the additional unit.

Connector number	Application
CP11A	24 VDC power input
CP11B	24 VDC power output
COP10A	Back stage of the FSSB interface
COP10B	Front stage of the FSSB interface
JF111～JF114	Separate detector interface
JA4A	Connection of a battery for the absolute detector
CNF1	Connection of the additional unit

- **LED display**

Status indication LEDs are installed on the board in the basic unit case. Two green LEDs (POWER and OPEN) and two red LEDs (ERR1 and ERR2) are provided. The locations and meanings of the LEDs are
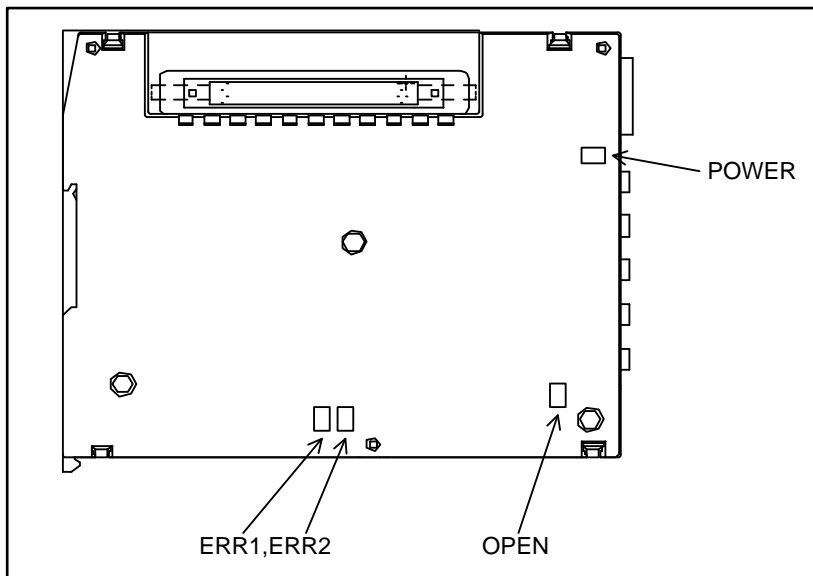
LED indication

No.	LED	Meaning
1	POWER	Turned on when the power is on

No.	LED	Meaning
2	OPEN	Turned on when FSSB communication is performed
3	ERR1	Turned on when COP10A (back stage) is disconnected
4	ERR2	Turned on when COP10B (front stage) is disconnected

4.5.3 I/O Link-AS-i Converter

- Specification

Name	Specification
For AS-i Ver 2.0	A03B-0817-C001
For AS-i Ver 2.1	A03B-0817-C002

- Connector mounting location
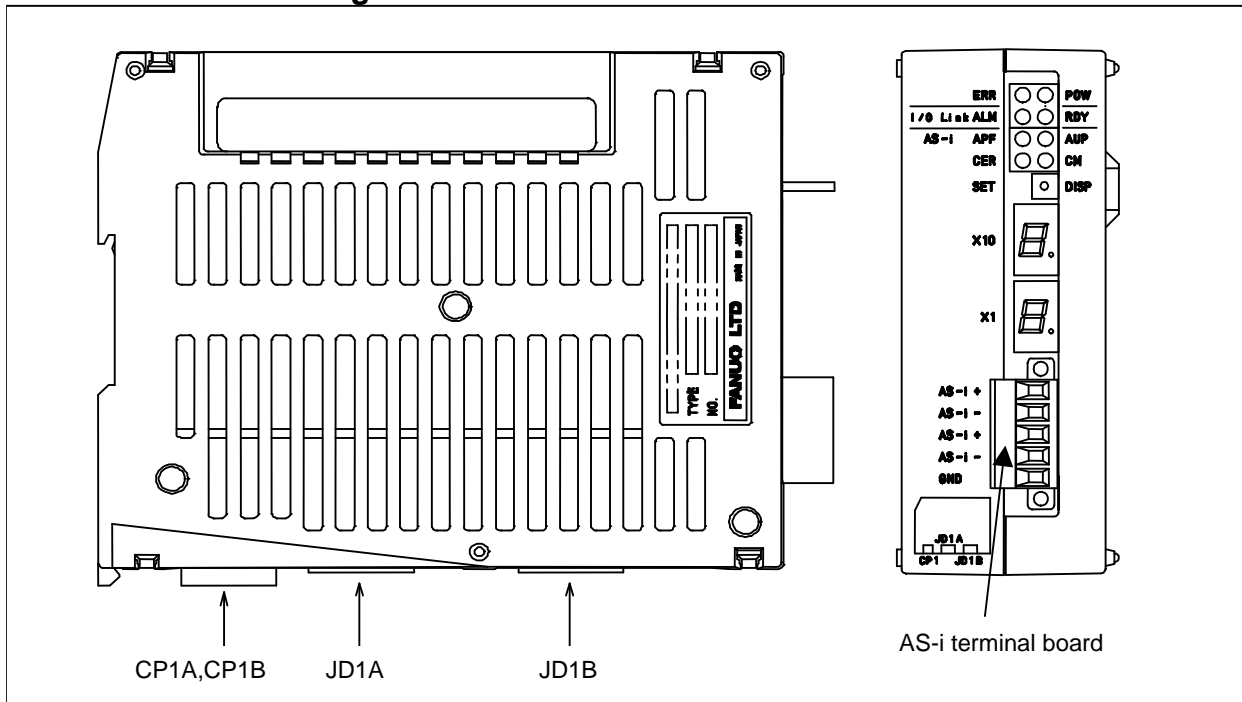
Connector number	Use
CP1A	24-VDC power supply input
CP1B	24-VDC power supply output
JD1A	Second I/O link stage
JD1B	First I/O link stage
AS-i terminal board	AS-i communication cable connection

- LED displays and setting switch

The I/O Link-AS-i converter is equipped with status display LEDs and a setting switch. The equipped LEDs include four green, four red, and two 7-segment LEDs.   Shown below are the location and use of each LED as well as what the setting switch is used for.

(1)LED

(2) 7-segment LEDs

(3) Setting switch

ERR POW
I/O Link ALM RDY
AS-i APF AUP
CER CM
SET DISP
X10
X1 ●B-
SLAVE

AS-i +
AS-i -
AS-i +
AS-i -
GND

JD1A
CP1 JD1B

Note: This label is only on Ver
2.1 of AS-i converter.
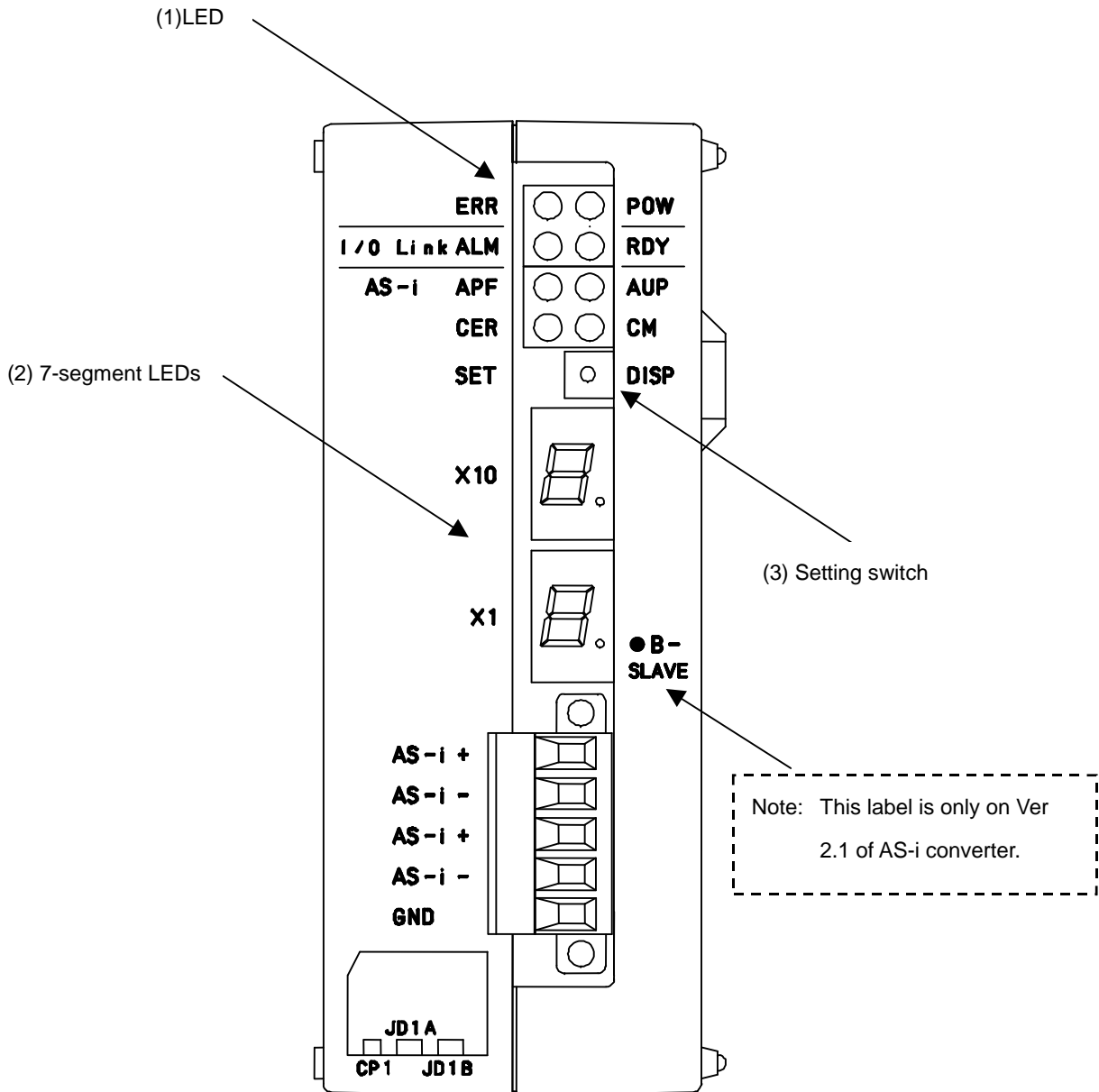
(1) LED displays

Function	Label	Color	Description
	POW	Green	Lights to indicate that the power for the I/O Link - AS-i converter is on.
	ERR	Red	Lights to indicate a failure (whose details can be checked using the other LED displays (including the 7-segment LED displays) and status information on the I/O Link).
I/O Link	RDY	Green	Lights to indicate that the I/O Link is ready to communicate.
	ALM	Red	Lights to indicate that an alarm condition (whose details can be checked using the 7-segment LED displays) has occurred on the I/O Link.

Function	Label	Color	Description
AS-i	AUP	Green	Lights to indicate that the current operation mode is the protected mode and automatic address is available.
	CM	Green	Lights to indicate that the current operation is the configuration mode and goes off to indicate that the current operation is the protected mode.
	APF	Red	Lights to indicate an AS-i power fail.
	CER	Red	Lights to indicate that a registered slave configuration (LPS, ID code, or I/O configuration) does not match the currently connected slaves.

(2) 7-segment LED displays

LED indication	Description
No display (If the setting switch is in the DISP position, the LED displays light according to the operation mode as listed below.)	Normal operation
E0	AS-i master error
E1	AS-i master EEPROM error
E2	ROM error
E3	RAM error
E5	Command execution error, SET switch execution error
E6	I/O Link slave watchdog alarm
E7	I/O Link RAM error
E8	Watchdog alarm 1
E9 or "·" (dot) at the tens digit	Watchdog alarm 2
00～31	Slave address display
"·" (dot) at the ones digit	Lights when the B slave address is displayed.
88	Initialize operation, mode shifting, AS-i power fail

Operation mode	Normal operation	When setting switch is in DISP position
Configuration mode	No display	The LES of each connected salve unit is displayed at 1-second intervals.
Protected mode	The lowest slave address among those which encountered a configuration mismatch is displayed.	Each slave unit that has encountered a configuration mismatch is displayed at 1-second intervals (in an LPS-LES mismatch list). Note: Nothing is displayed if there is no mismatched slave unit.

(a) Order in which Ver 2.1 displays slave numbers

The slave number of the standard slave or the A slave is displayed first (with "·" at the ones digit off).
The slave number of the B slave is displayed next (with "·" at the ones digit on).

Example: Address #10   Standard slave
        Address #20A   A/B slave
        Address #20B   A/B slave
        Address #30   Standard slave

If the above slave units are connected, their slave numbers are displayed in the order shown below.

Address #10   Address #20   Address #30   Address #20B
Standard slave   A/B slave   Standard slave   A/B slave

"·" (dot) at the ones digit lights.
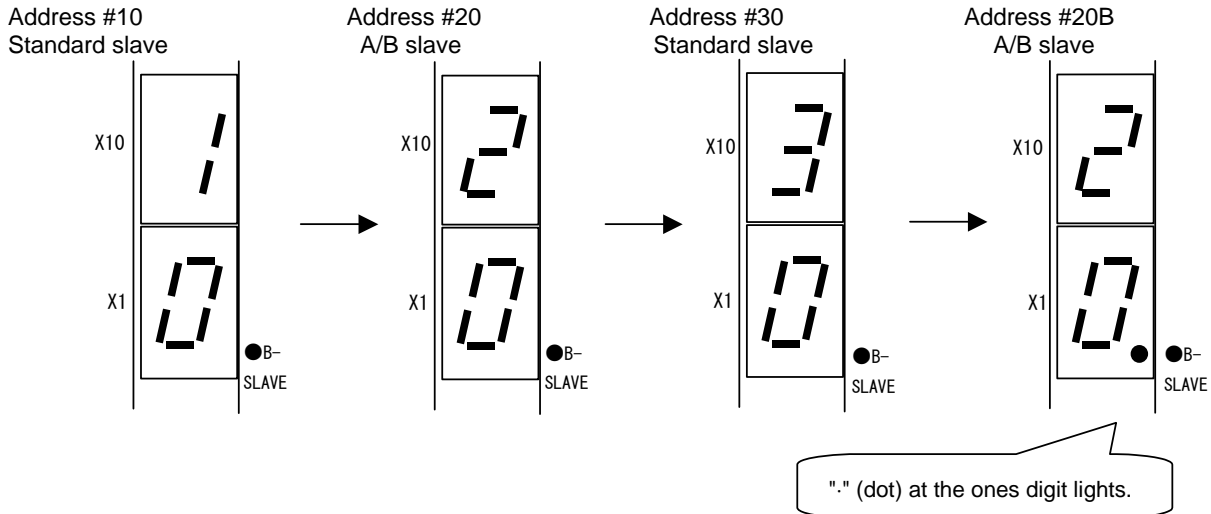
(3) What the setting switch specifies

Setting switch	Operation mode	
	Configuration	**Configuration**
DISP	Slave addresses are displayed. No other input is acceptable until all salve addresses are displayed.	
	The LES of each of all connected slaves are displayed at about 1-second intervals.	Each slave unit which has encountered a configuration mismatch is displayed at about 1-second intervals (in an LPS-LES mismatch list). Note) Nothing is displayed if there is no mismatched slave unit.
SET	The operation modes are switched. Note) Keeping pressing the switch will not change the modes. Keep your hand off the switch for at least 1 second to make it off.	
	Keeping pressing the switch for at least 5 seconds causes the current slave configuration (LPS, ID code, I/O configuration, and parameters) to be registered, enables automatic addressing, and selects the protected mode.(Note 1) Keeping pressing the switch for not longer than 5 seconds selects the protected mode but does not cause the configuration to be registered or enables automatic addressing.(Note 1)	Keeping pressing the switch for at least 5 seconds selects the configuration mode. Keeping pressing the switch for not longer than 5 seconds causes nothing.

NOTE
   If a slave unit with address "0" is connected, no configuration registration is
   made and the protected mode is not selected.   Alarm "E5" is displayed.

- Dealing with errors
Check error status according to the LED display or status signals on the I/O Link.

| Alarm or warning | LED indication | | Status signal on the I/O Link (X represents a PMC address) | | | Possible cause and action |
	LED	7-segment LED	ERR X+18 bit1	AS-i data ready X+18 bit0	Other	
Normal operation	-	Off	0	1	-	-
Configuration mismatch	CER on	Note)	0	1	X+16 bit7=0	The current slave configuration does not match the registered configuration. In the protected mode, selecting DISP causes the slave address encountering a configuration mismatch to be displayed. The possible causes include a slave unit failure, broken AS-i cable, and noise-induced AS-i communication error.
Initialization or mode change in progress	-	88	0	0	X+16 bit0=1 Or X+17 bit0=1	
AS-i power fail	APF on	88	1	0	X+16 bit1=1	Check to see if the AS-i power supply is normal and cables from the AS-i power supply are normal. Normal operation is resumed when the AS-i power returns to normal.
AS-i master EEPROM fail	ERR on	E1	1	0	X+17 bit2=0	Turn the power off and on again. Because the configuration may be corrupted, register the configuration again (see NOTE on the next page). If the alarm occurs again, replace the converter unit.
AS-i master fail	ERR on	E0	1	0	X+18 bit2=1	Turn the power off and on again. If the alarm occurs again, replace the converter unit.
ROM fail	ERR on	E2	1	0	X+18 bit3=1	Replace the converter unit.
RAM fail	ERR on	E3	1	0	X+18 bit4=1	Replace the converter unit.
Watchdog 1	ERR on	E8	1	0	X+18 bit5=1	Replace the converter unit.
Watchdog 2	ERR on	E9 or ×10 "."	1	0	-	An I/O Link system alarm occurred on the host CNC. Replace the converter unit.
I/O Link Slave Watchdog	ERR on	E6	-	-	-	An I/O Link system alarm occurred on the host CNC. The possible causes include a power failure in another unit on the I/O Link and a broken I/O Link cable as well as a noise-induced I/O Link communication error.
I/O Link RAM fail	ERR on	E7	-	-	-	An I/O Link system alarm occurred on host CNC. Replace the converter unit.

NOTE
- In the protected mode, the lowest address number among those encountering a configuration mismatch is displayed.   In the configuration mode, nothing is displayed.
- Use ladder programs to detect and display converter unit errors.
- If a converter unit error occurs, both the DO and DI are turned off.
- If it is impossible to continue AS-i communication, a watchdog alarm condition occurs in the slave unit.   How the DO behaves at the watchdog alarm is determined according to the slave unit type and parameter setting used.   See the relevant slave unit specification.
- How to handle AS-i master EEPROM errors
  If the 7-segment LEDs display "E1", it is likely that the registered configuration may be corrupted.   So, register it again according to the following chart.

| Turn off power |

↓

| Place switch in SET position, and turn on power again. |

↓

| 7-segment LED displays "E1" (keep switch in SET position). |

↓

| Keep switch in SET position until LED "CM" changes from off to on or from on to off.
(This operation may take 5 seconds or more.) |

↓

| Take your hand off switch, and turn power off and on again to restart system. |

↓

| If 7-segment LEDs do not display "E1", registered configuration has been repaired.
(If LED "CM" lights, protect registered configuration for subsequent operation.   Keep switch in SET position until "E1" disappears.   This operation takes 5 seconds or more.) |

↓

| If 7-segment LEDs still display "E1", replace converter unit. |

Note that if "E1" is displayed, the CNC may fail to start up.

The converter having this function is one shipped in or after June 2005.
Those shipped before do not support this function.   If EEPROM fails to operate normally, replace the converter unit.

- How to re-install

Once the I/O Link - AS-i converter is replaced, the new I/O Link - AS-i must be loaded with AS-i slave information according to the following procedure.
The procedure can be executed even when no I/O Link is connected (when power is supplied to the I/O Link - AS-i converter but not to the CNC or when no I/O Link cable is attached).

```
                          ┌─────────────┐
                          │    Start    │
                          └──────┬──────┘
                                 │
   ┌─────────────────────────────┴─────────────────────────────┐
   │ Mount I/O Link-AS-i converter, AS-i slave, and AS-i power supply. │
   └─────────────────────────────┬─────────────────────────────┘
                                 │
          ┌──────────────────────┴──────────────────────┐
          │              Connect AS-i cable.             │
          └──────────────────────┬──────────────────────┘
                                 │
   ┌─────────────────────────────┴─────────────────────────────┐
   │     Turn on power for I/O Link-AS-i converter and AS-i.     │
   └─────────────────────────────┬─────────────────────────────┘
                                 │
                                 ◇ Configuration mode?  ──YES──►
                                 │
                                NO
```

Mode	LED "CM"
Configuration	On
Protected	Off

```
   ┌─────────────────────────────────────────────────────────────────┐
   │ Keep pressing SET switch for at least 5 seconds to select configuration mode. │
   └─────────────────────────────────────────────────────────────────┘

   ┌─────────────────────────────────────────────────────────────────┐
   │ Press DISP switch and check slave number of currently connected slave. │
   └─────────────────────────────────────────────────────────────────┘

   ┌─────────────────────────────────────────────────────────────────┐
   │ Keep pressing SET switch for at least 5 seconds to select protected mode. │
   └─────────────────────────────────────────────────────────────────┘

                          ┌─────────────────┐
                          │  End of loading │
                          └─────────────────┘
```
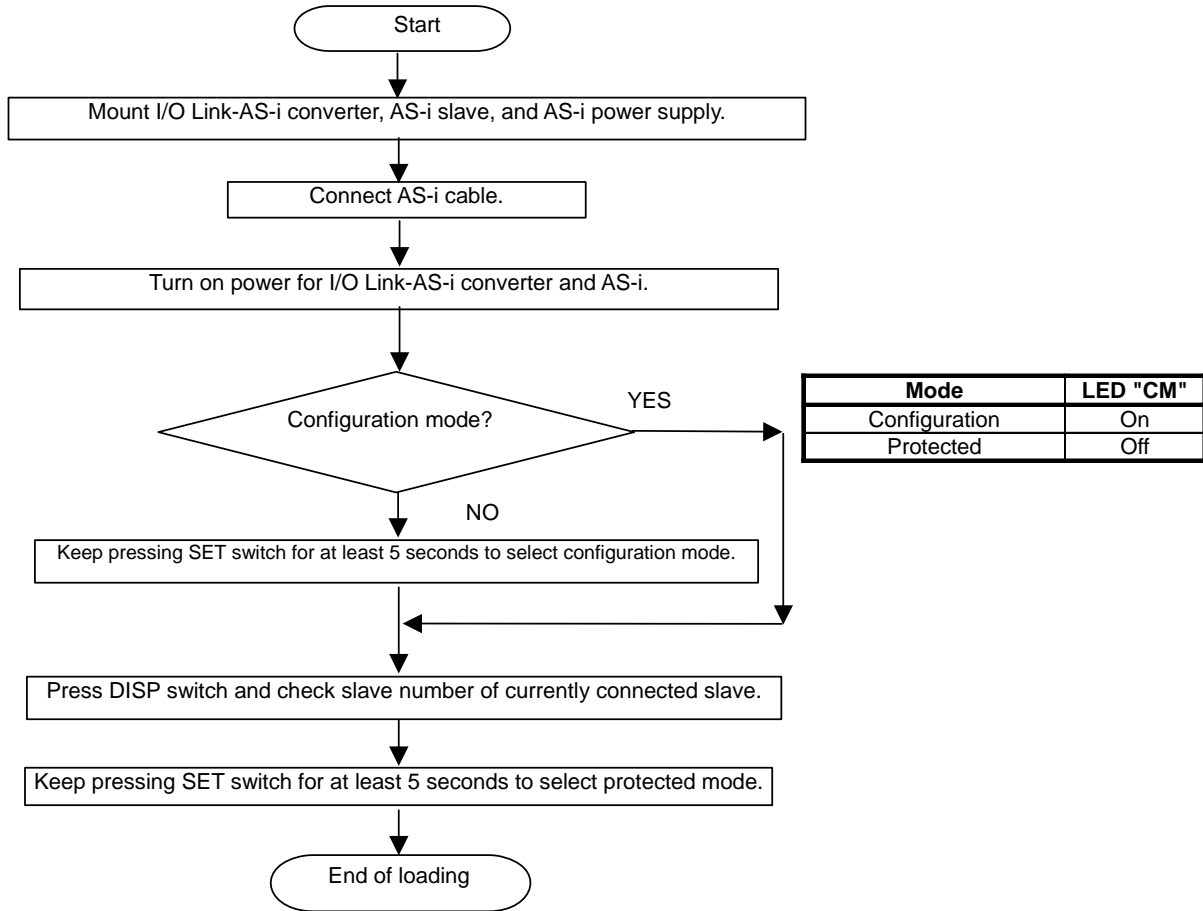
NOTE
1 When the protected mode is selected, the slave configuration is registered, and automatic addressing is enabled.
2 Turning the I/O Link-AS-i converter power on/off causes no operation mode change.   To change the operation modes, use the SET switch.

4.5.4   Terminal Board Type I/O Module

-   Specification

Name	Specification
Basic module	A03B-0823-C001
Expansion module A	A03B-0823-C002
Expansion module B	A03B-0823-C003
Expansion module C	A03B-0823-C004
Expansion module D	A03B-0823-C005

- Connector and LED mounting location
Basic module   A03B-0823-C001
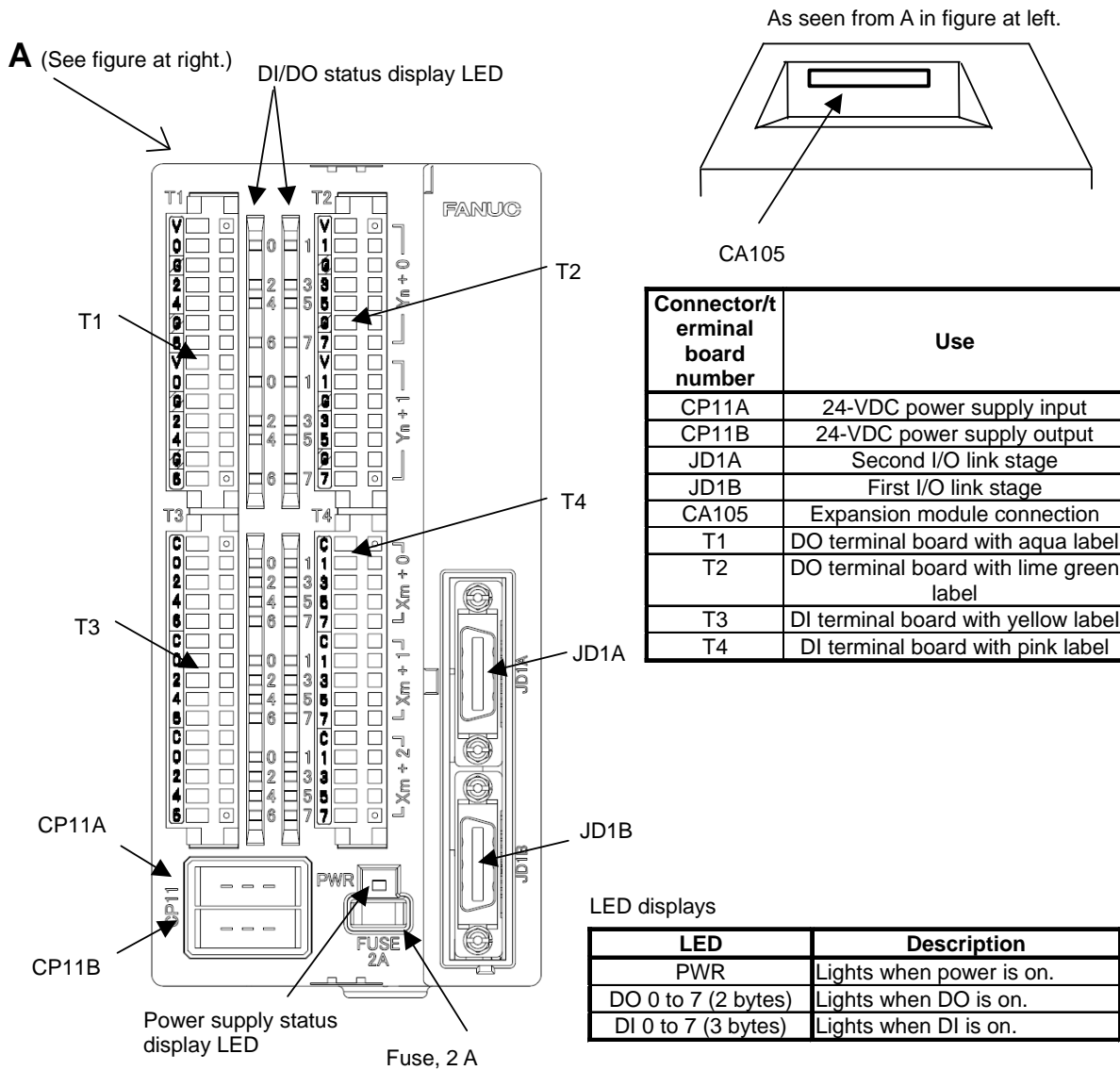
As seen from A in figure at left.

A (See figure at right.)

DI/DO status display LED

CA105

Connector/terminal board number	Use
CP11A	24-VDC power supply input
CP11B	24-VDC power supply output
JD1A	Second I/O link stage
JD1B	First I/O link stage
CA105	Expansion module connection
T1	DO terminal board with aqua label
T2	DO terminal board with lime green label
T3	DI terminal board with yellow label
T4	DI terminal board with pink label

T1

T2

T3

T4

JD1A

JD1B

CP11A

CP11B

Power supply status
display LED

Fuse, 2 A

LED displays

LED	Description
PWR	Lights when power is on.
DO 0 to 7 (2 bytes)	Lights when DO is on.
DI 0 to 7 (3 bytes)	Lights when DI is on.
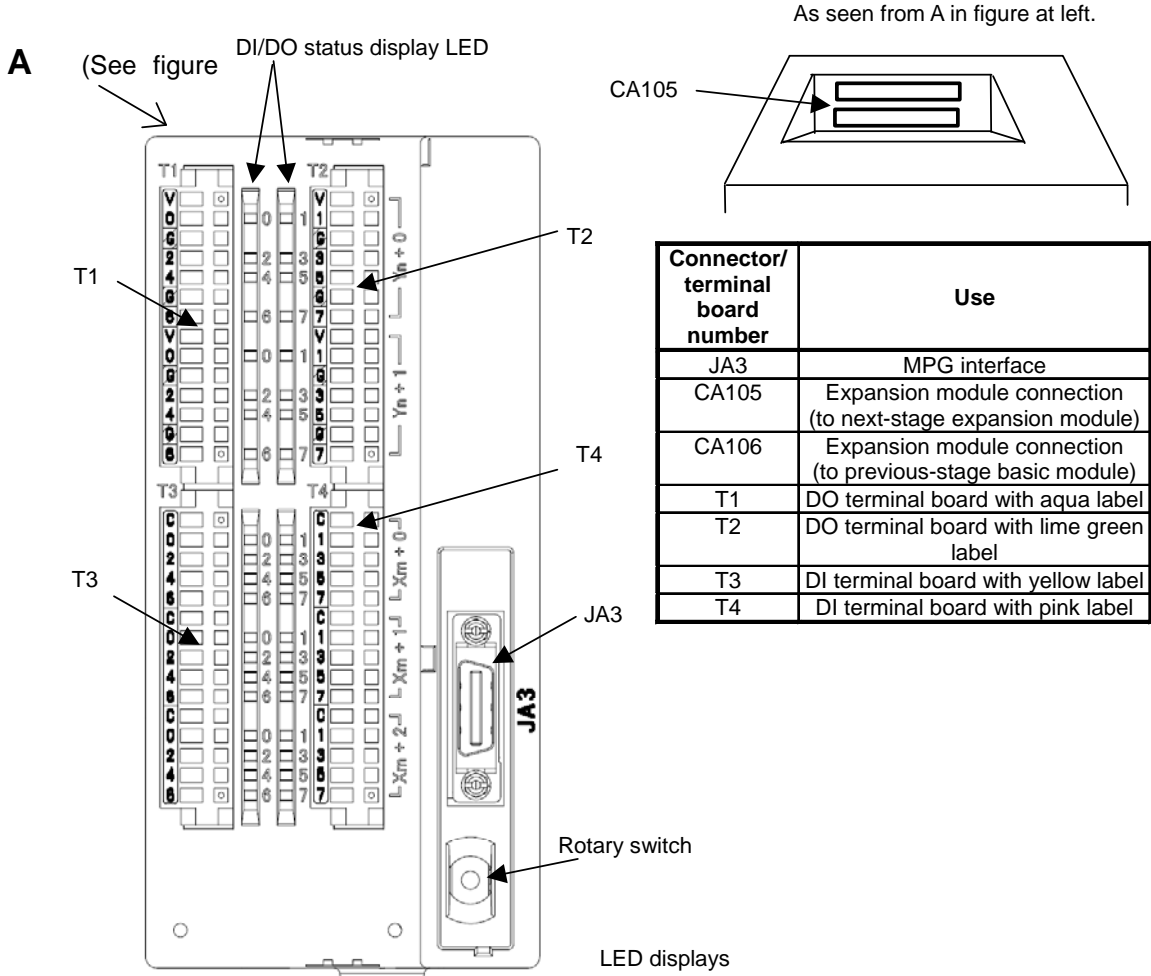
Expansion module A   A03B-0823-C002
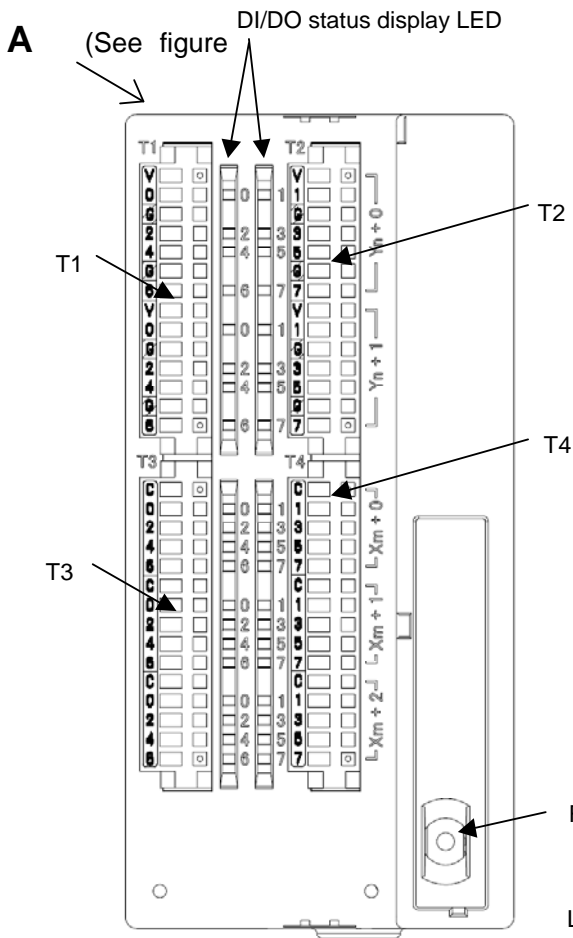
As seen from A in figure at left.

Connector/ terminal board number	Use
JA3	MPG interface
CA105	Expansion module connection (to next-stage expansion module)
CA106	Expansion module connection (to previous-stage basic module)
T1	DO terminal board with aqua label
T2	DO terminal board with lime green label
T3	DI terminal board with yellow label
T4	DI terminal board with pink label

LED displays

LED	Description
DO 0 to 7 (2 bytes)	Lights when DO is on.
DI 0 to 7 (3 bytes)	Lights when DI is on.

Expansion module B   A03B-0823-C003

DI/DO status display LED

A   (See figure

As seen from A in figure at left.

CA105

Connector/ terminal board number	Use
CA105	Expansion module connection (to next-stage expansion module)
CA106	Expansion module connection (to previous-stage basic or expansion module)
T1	DO terminal board with aqua label
T2	DO terminal board with lime green label
T3	DI terminal board with yellow label
T4	DI terminal board with pink label

Rotary switch

LED displays

LED	Description
DO 0 to 7 (2 bytes)	Lights when DO is on.
DI 0 to7 (2 bytes)	Lights when DI is on.

Expansion module C   A03B-0823-C004

DO status display LED (green)

A (See figure at right.)

DO alarm display LED (red)

As seen from A in figure at left.

CA105

Connector/ terminal board number	Use
CA105	Expansion module connection (to next-stage expansion module)
CA106	Expansion module connection (to previous-stage basic or expansion module)
T1	DO terminal board with aqua label
T2	DO terminal board with lime green label

T1

T2

Rotary switch

LED displays

LED	Description
DO 0 to 7 (2 bytes)	DLights when DO is on.
ALARM 0 to 7 (2 bytes)	Lights to indicate an alarm.

Expansion module D   A03B-0823-C005

A (See figure at right.)

As seen from A in figure at left.
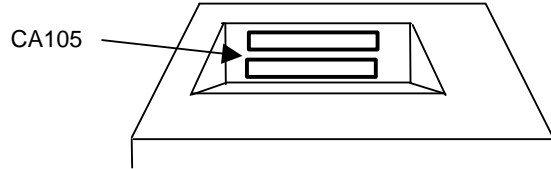
CA105

Connector/ terminal board number	Use
CA105	Expansion module connection (to next-stage expansion module)
CA106	Expansion module connection (to previous-stage basic or expansion module)
T1	Analog input CH1 and CH2 terminal board with yellow label
T2	Analog input CH3 and CH4 terminal board with pink label

T1

T2

CH1

CH2

CH3

CH4

Rotary switch

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Alarm detection function of expansion module C

The DO driver for expansion module C has overvoltage protection and broken-wire detection functions as well as the same overheat protection (overcurrent and temperature protection) function as for the basic module and expansion modules A and B. The protection circuit is provided for each DO1 bit.
If any of these functions operates, the corresponding bit of the LED "ALARM" of the module lights.
The following table lists the output status of each LED or DO when the protection functions operate.

- Status when the protection functions operate

Status	PMC output	Module DO output	DO status display LED (green)	DO alarm LED (red)	DO alarm information allotted to DI area
Normal operation	0	OFF	Does not light.	Does not light.	0
	1	ON	Lights.	Does not light.	0
Overheat protection function operated	0	OFF	Does not light.	Does not light.	0
	1	OFF	Does not light.	Lights.	1
Overvoltage protection function operated	0	OFF	Does not light.	Lights.	1
	1	OFF	Does not light.	Does not light.	0
Broken-wire detected	0	OFF	Does not light.	Does not light.	0
	1	ON	Lights.	Lights.	1

> **NOTE**
> 1 If the overheat or overvoltage protection function mentioned above operates, the corresponding DO bit is kept off until the cause is removed. Once the cause is removed, the DO bit becomes on even if the system is not restarted.
> 2 Broken-wire detection is performed by monitoring the current flowing through a load connected when the DO is on with an output device in the module. If the detected current becomes about 100 mA or lower, it is assumed that a broken wire has been detected. For this reason, if a light load (such as an LED) is connected, a broken wire is detected, resulting in a DO alarm condition. However, unlike the other protection functions, the broken-wire detection function does not cause the DO to become off. In addition, if a connected condition is resumed after a broken-wire condition is detected, the broken-wire condition can be removed even if the system is not restarted.

4.6 SETTING I/O MODULES

4.6.1 Distributed I/O Setting

By changing the setting (rotary switch) on an expansion module, a connection can be made to skip an expansion module or expansion modules as shown below.

When expansion module 1 is skipped | When expansion module 2 is skipped | When expansion modules 1 and 2 are skipped
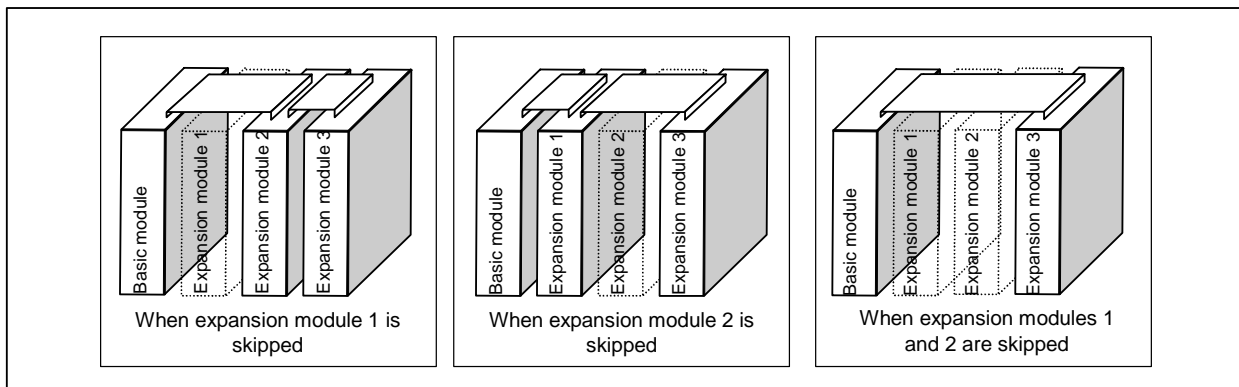
Method of setting (control and setting method)

A control (rotary switch) is provided on the location shown below of each expansion module. When changing the setting, turn the rotary switch with a flat-blade screwdriver with a tip diameter of about 2.5 mm.

Each setting position of the rotary switch has the meaning as indicated below.

Setting position	Indication	Meaning of setting
0	0	Standard setting. The rotary switch is set to this position at the time of shipment from FANUC. This setting is not skipped an expansion module.
1	-	Set the rotary switch of an expansion module to this position when the one preceding expansion module is skipped.
2	2	Set the rotary switch of an expansion module to this position when the two preceding expansion modules are skipped.
3	-	Setting prohibited
4 to F	4, -, 6, -, 8, -, A, -, C, -, E, -,	4, 8, or C has the effect of 0. 5, 9, or D has the effect of 1. 6, A, or E has the effect of 2. 7, B, or F has the effect of 3. (← setting prohibited)

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Examples of setting

This function was not available initially, but was recently added. This function became available, depending on the type of module, as indicated below.

Expansion module B (DI/DO = 24/16, without a manual pulse generator interface)	A03B-0815-C003	Available starting with shipment in June 1998 and later
Expansion module C (DO = 16, 24A output)	A03B-0815-C004	Available starting with shipment in August 1998 and later
Expansion module D (analog input)	A03B-0815-C005	Available starting with shipment in August 1998 and later

---

NOTE
   To expansion module A (DI/DO = 24/16, with a manual pulse generator interface) (A03B-0815-C002), a rotary switch is added as the other modules are modified. However, expansion module A is always installed at the location of expansion module 1, so that the setting of expansion module A need not be changed.

4.6.2 Terminal Type I/O Module Setting

By changing the setting (rotary switch) on an expansion module, a connection can be made to skip an expansion module or expansion modules as shown below.

Method of setting (control and setting method)
A control (rotary switch) is provided on the location shown below of each expansion module. When changing the setting, turn the rotary switch with a flat-blade screwdriver with a tip diameter of about 2.5 mm.

Standard setting

Each setting position of the rotary switch has the meaning as indicated below.

Setting position	Indication	Meaning of setting
0	0	Standard setting. The rotary switch is set to this position at the time of shipment from FANUC. This setting is not skipped an expansion module.
1	-	If an expansion module is skipped, make this setting for the one that would follow the skipped expansion module.
2	2	If two expansion module are skipped, make this setting for the one that would follow the second of the skipped expansion modules.
3	-	Setting prohibited
4 to F	4, -, 6, -, 8, -, A, -, C, -, E, -,	4, 8, or C has the effect of 0. 5, 9, or D has the effect of 1. 6, A, or E has the effect of 2. 7, B, or F has the effect of 3. (← setting prohibited)

Rotary switch setting example

(When expansion module 1 is skipped)
Set the rotary switch of expansion module 2 to setting position = 1. Do not change the setting (setting position = 0) of expansion module 3.

(When expansion module 2 is skipped)
Set the rotary switch of expansion module 3 to setting position = 1. Do not change the setting (setting position = 0) of expansion module 1.

(When expansion module 1 and expansion module 2 are skipped)
Set the rotary switch of expansion module 3 to setting position = 2.

> **NOTE**
> The expansion module A (A03B-0823-C002 with manual Pulsecoder I/F) is always installed in a location for expansion module 1, the setting need not be changed.

4.7 REPLACING FUSES ON VARIOUS UNITS

> ⚠ **WARNING**
> Before replacement of a blown fuse, the cause of the blown fuse must be corrected. So, fuse replacement work must be done only by a person who is trained in the related maintenance and safety requirements. When opening the cabinet and replacing a fuse inside, be careful not to touch the high-voltage circuits (marked with ⚠ and fitted with an insulating cover). Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

For the specification of the fuse of each unit, see the list of consumables in Appendix B, "LIST OF MAINTENANCE PARTS."
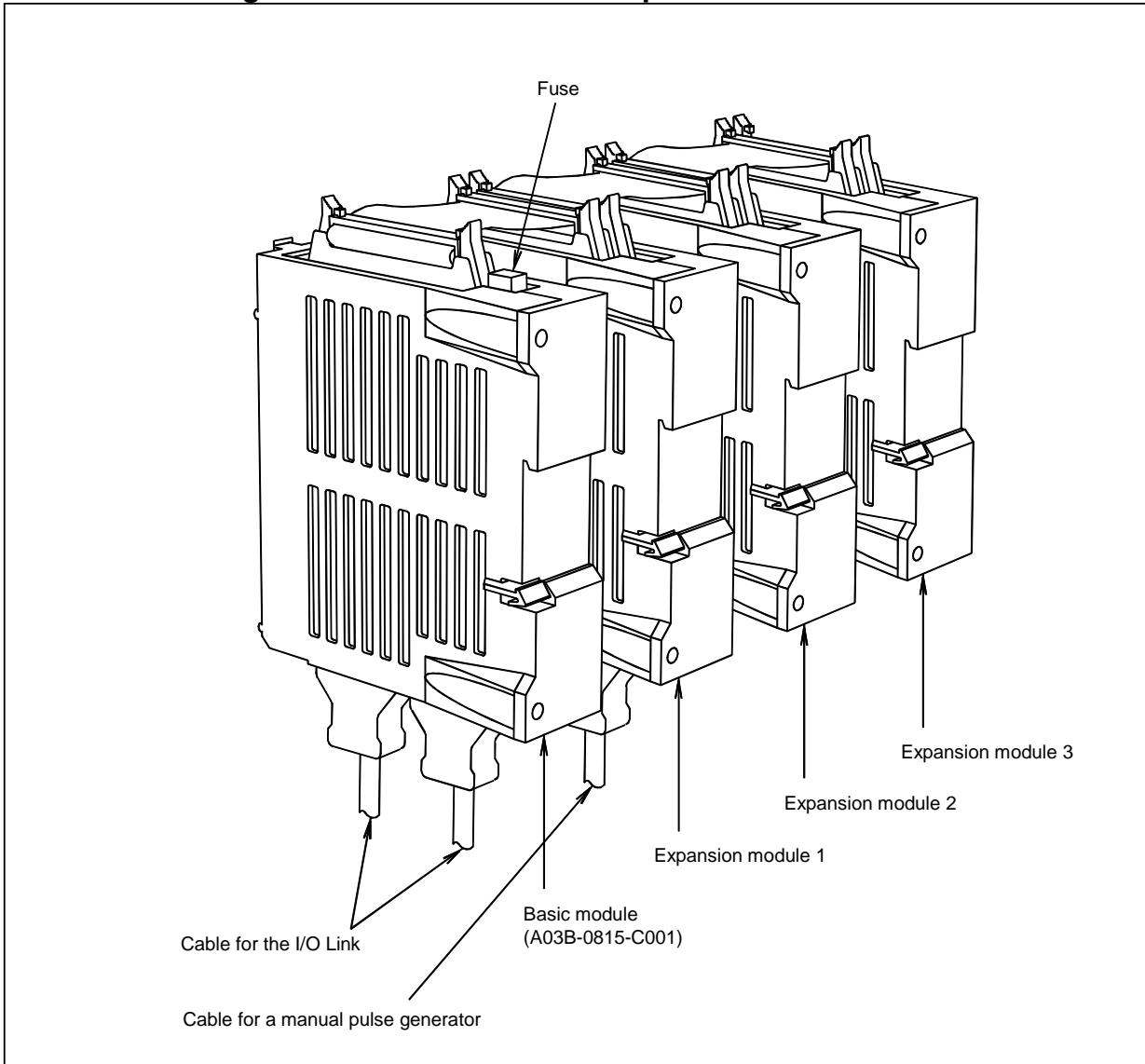
- **Fuse mounting location on the connector panel I/O modules**

NOTE
   No fuse is provided on the expansion modules. A fuse is provided on the basic
   module only.

- Fuse mounting location on the connector panel I/O modules (type-II)
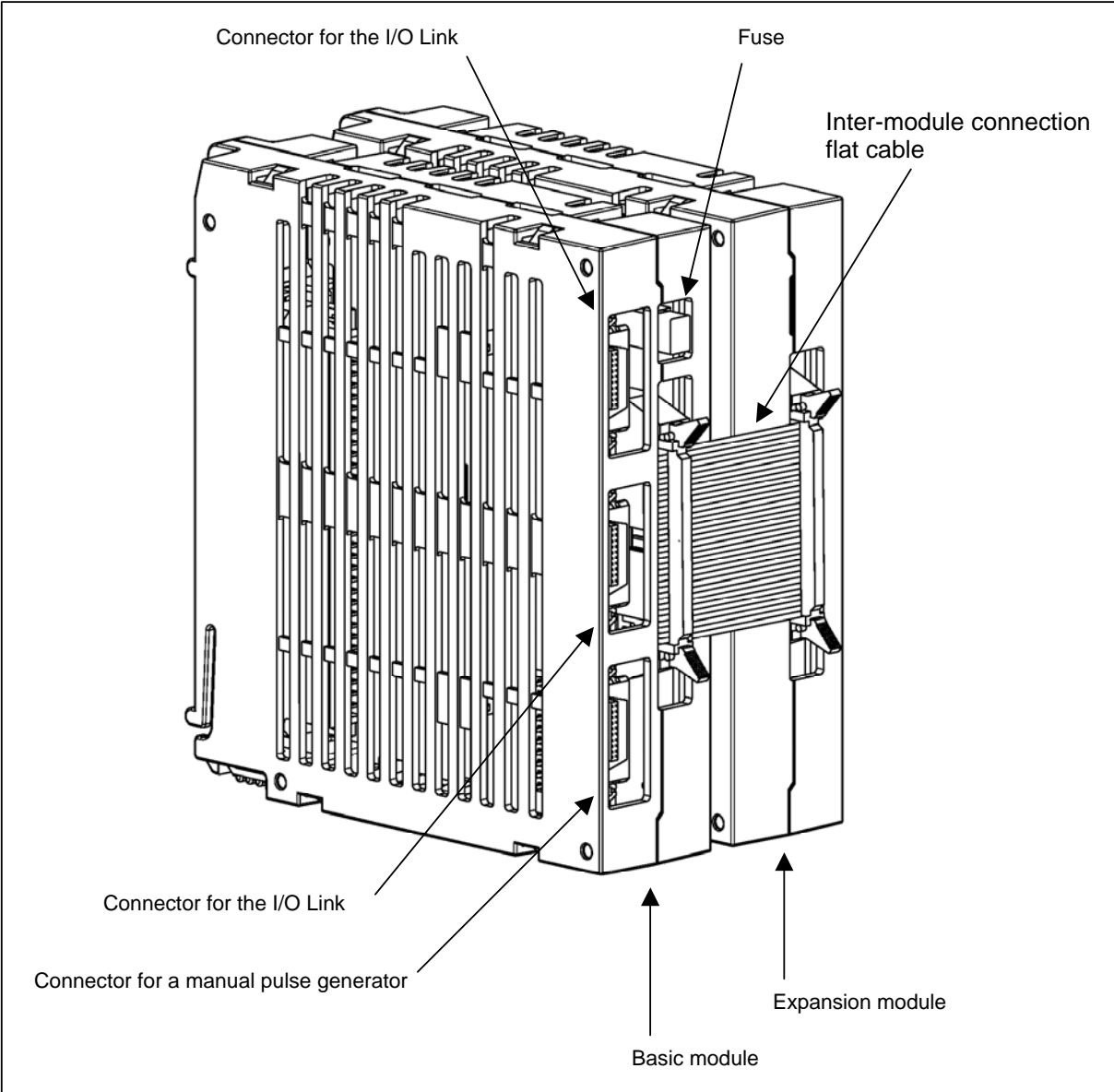
Connector for the I/O Link

Fuse

Inter-module connection flat cable

Connector for the I/O Link

Connector for a manual pulse generator

Expansion module

Basic module

NOTE
No fuse is provided on the expansion modules. A fuse is provided on the basic module only.

- **Fuse mounting location on the operator's panel I/O modules**

I/O connector

JD1A

JD1B

JA3

Power supply connector

Fuse

This drawing is for A20B-2002-0470, A20B-2002-0520, and A20B-2002-0521.
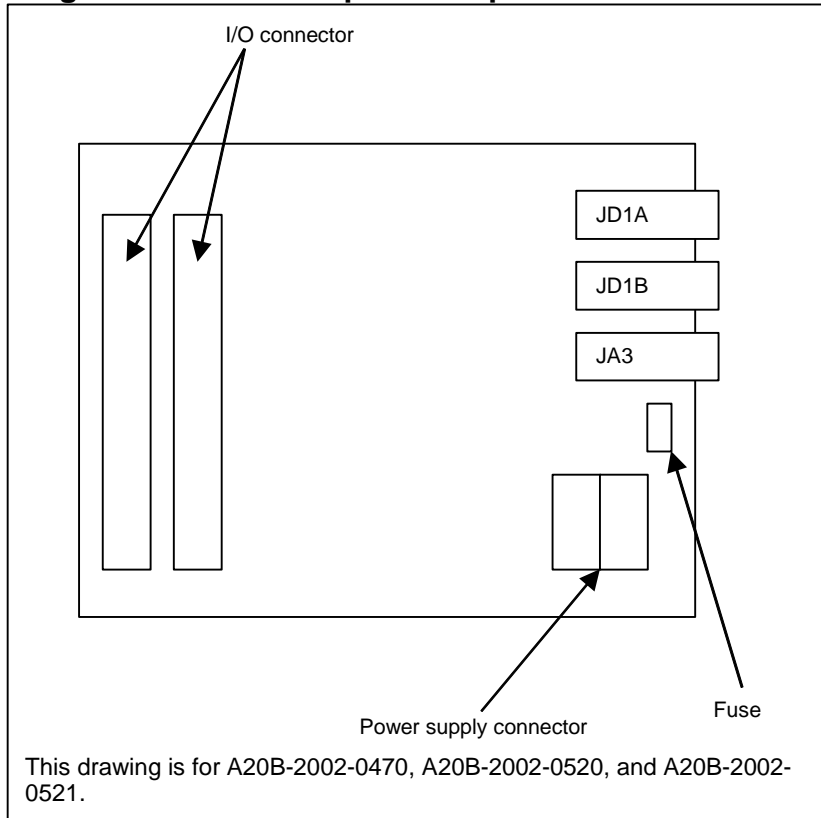
- **Fuse mounting location on the separate detector interface unit**
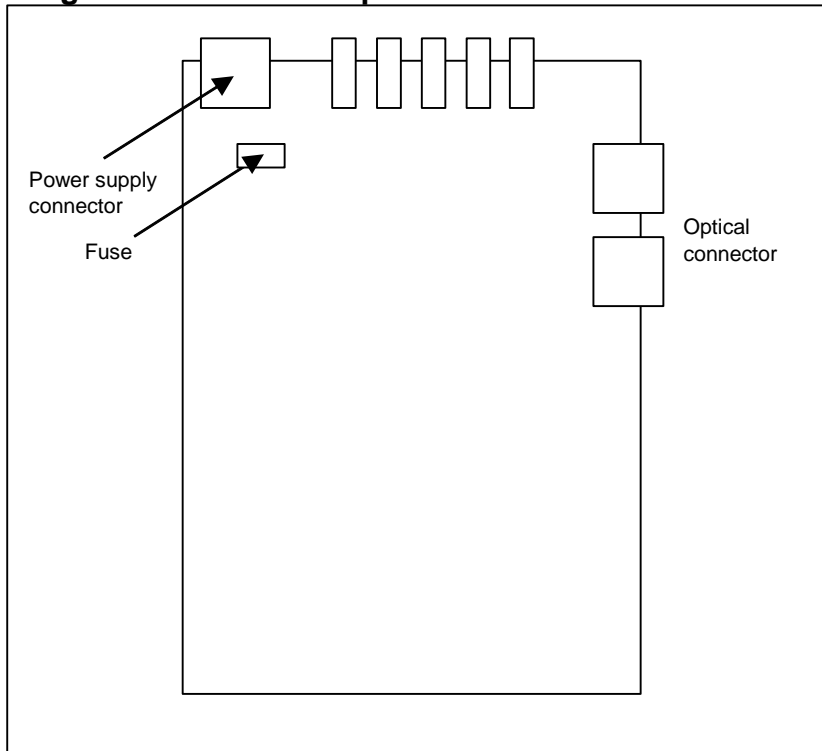
Power supply connector

Fuse

Optical connector

- **Fuse mounting location on the I/O Link-AS-i converter**
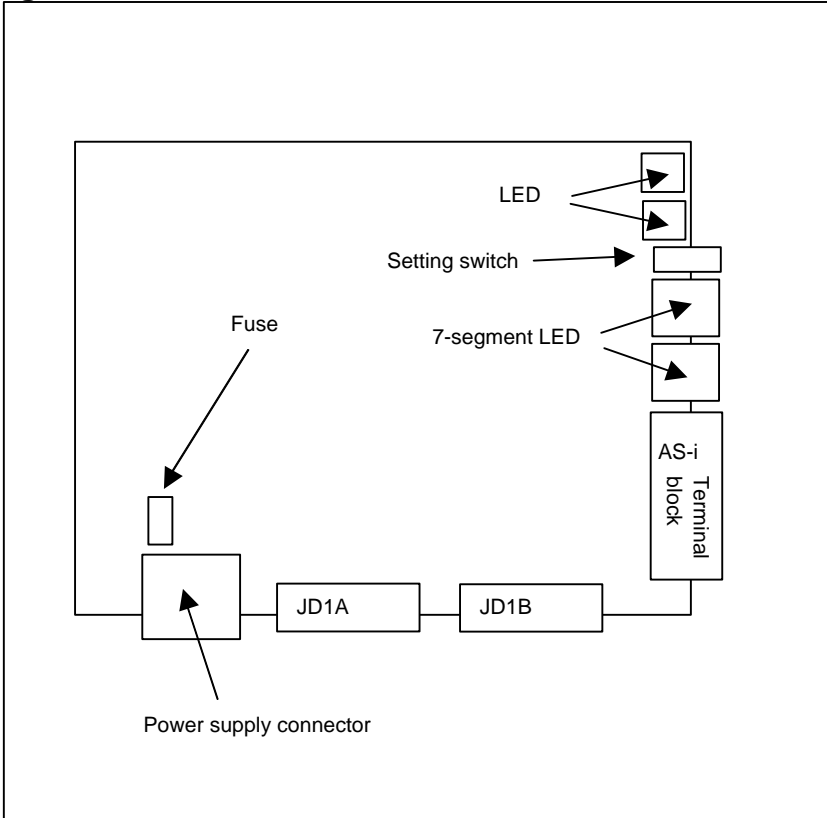
```
                                                        ┌──┐
                                                        └──┘
                                        LED ─────────── ┌──┐
                                                        └──┘
                Setting switch ─────────────────────── ┌────┐
                                                        └────┘
                                                        ┌────┐
                                                        └────┘
                            Fuse              7-segment LED ── ┌────┐
                                                        └────┘
                                                        ┌──────┐
                                                        │ AS-i │
                                                        │Terminal│
                             ┌─┐                        │block │
                             └─┘                        └──────┘
                          ┌─────┐   ┌──────┐  ┌──────┐
                          │     │   │ JD1A │  │ JD1B │
                          └─────┘   └──────┘  └──────┘

                    Power supply connector
```

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- **Fuse mounting location on the terminal type I/O modules**

Basic module
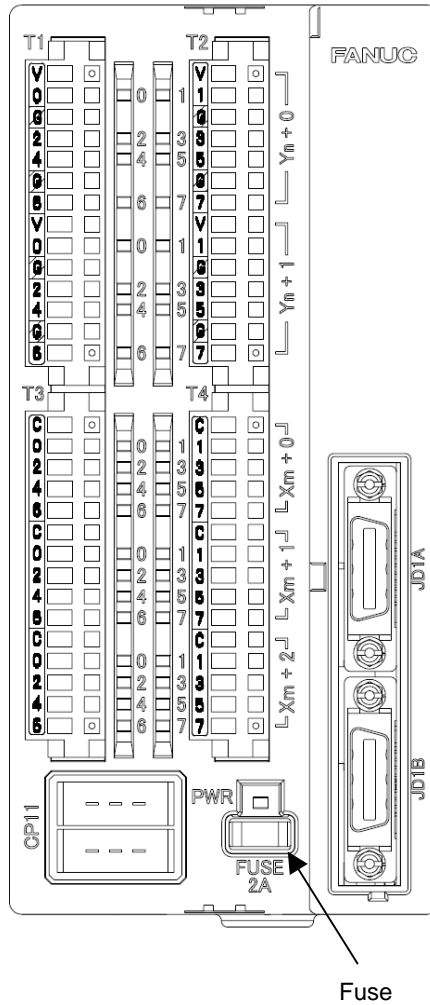
Fuse

> **NOTE**
> No fuse is provided on the expansion modules. A fuse is provided on the basic module only.

-   Fuse mounting location on the machine operator's panel
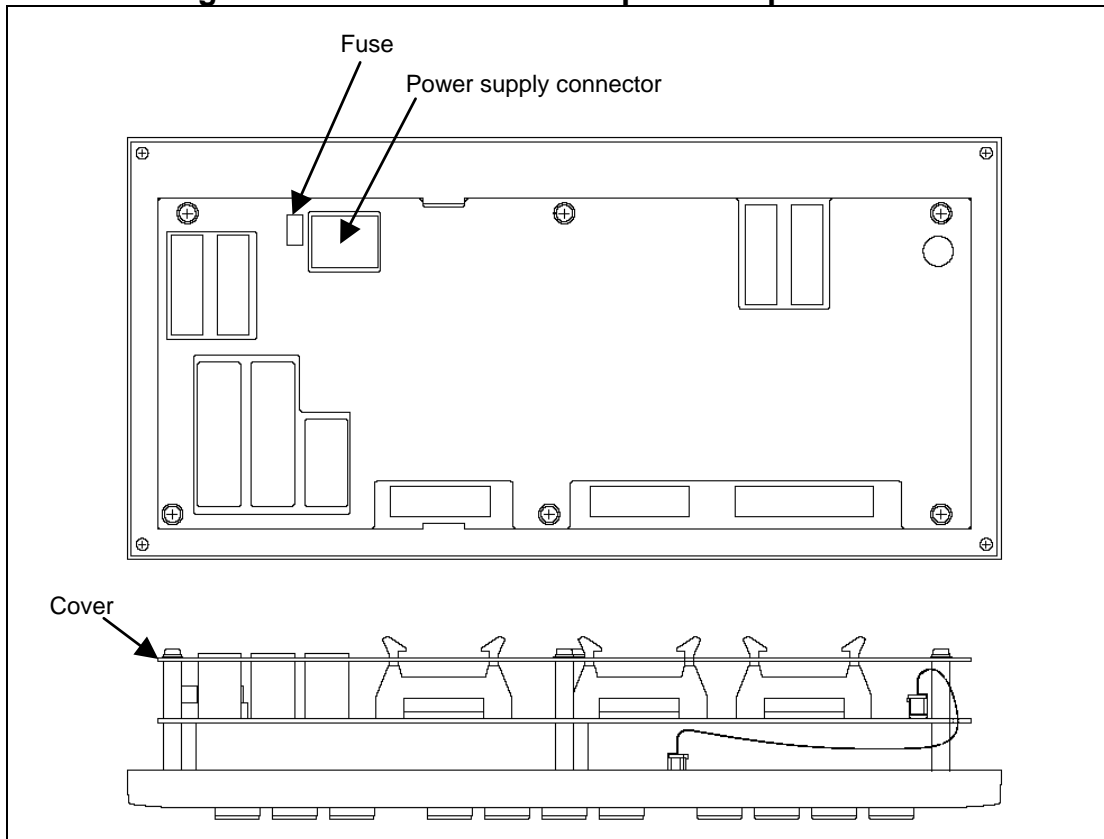
NOTE
    After removing the cover, replace the fuse.

4.8   ENVIRONMENTAL CONDITIONS OUTSIDE 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 LCD/MDI unit or operator's panel.
- Equivalent to the above.

The environmental conditions when installing these cabinets shall conform to the following table.

	Condition	LCD-mounted type control unit	Stand-alone type control unit
Ambient temperature of cabinets	Operating	0°C to 58°C	0°C to 55°C
	Storage, Transport	−20°C to 60°C	
	Temperature change	0.3°C/minute or less	
Humidity	Normal	75%RH or less, no condensation	
	Short period (less than 1 month)	95%RH or less, no condensation	

Vibration	Operating	0.5G or less
		A FANUC evaluation test is performed under the following conditions.
		    10 to 58Hz: 0.075 mm (amplitude)
		    58 to 500Hz: 1 G
		    Vibration directions: X, Y, and Z directions
		    Scanning frequency: 10 cycles
		    IEC60068-2-6 compliant	

	Non-operating	1.0G or less	

	Condition	LCD-mounted type control unit	Stand-alone type control unit
Meters above sea level	Operating	Up to 1000 m (Note)	
	Non-operating	Up to 12000 m	
Atmosphere		Prevent coolant, lubricant, and chippings from being applied directly to on the control unit. Make sure that corrosive gas is not present.	

> **NOTE**
> If the CNC is installed 1000 m or higher above sea level, the allowable upper ambient temperature of the CNC in the cabinet is changed as follows.
> Assume that the allowable upper ambient temperature of the CNC in the cabinet installed 1000 m or higher above sea level decreases by 1.0°C for every 100 m rise in altitude.
> Example)
>   The upper allowable ambient temperature of the CNC in the cabinet installed 1750 m above sea level is:
> $55°C - 1750/100 \times 1.0°C = 47.5°C$
> Therefore, the allowable ambient temperature range is from 0°C to 47.5°C.
> When a hard disk is used, the following installation height conditions are applied:
> Meters above sea level in the operating state   -60 to 3000m
> Meters above sea level in the non-operating state   -60 to 12000m

4.9 COUNTERMEASURES AGAINST NOISE

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.

4.9.1 Grounding

Grounding the power magnetics cabinet and devices is very important to prevent an electric shock and suppress a noise influence. The following describes the grounding methods for suppressing the noise influence.

4.9.1.1 About grounding types

The CNC system uses the following three types of grounding:

(1) Signal grounding
    This type of grounding is used to supply a reference potential (0 V) for the electrical signal system.
(2) Frame grounding
    This type of grounding is used for safety reasons as well as to suppress external and internal noise. For example, grounding is provided for the device frames, panels, and shielding on the interface cables connecting the devices.

(3) System grounding (PE)
This type of grounding is used to connect frame grounds, which are provided for the individual devices or between the units, to the ground as a system at a single point.

4.9.1.2   Grounding methods

Typically, noise that becomes a problem is high–frequency noise. To suppress high–frequency noise, it is important that the devices are grounded at low impedance[NOTE].
The grounding schemes for this purpose are described below.

(1) Multipoint grounding scheme
In this grounding scheme, when grounded at sufficiently low impedance, the cabinet metal plates are used as ground plates, to which grounding is provided in the vicinity of each device.
This scheme has a great effect of suppressing high–frequency noise because it enables grounding to the low–impedance metal plates of the cabinet in the shortest distance. However, the noise suppression effect depends on the cabinet structure because the cabinet metal plates are used as ground plates.
See Subsection 4.9.1.4 for the cabinet. Fig. 4.9.1.2 (a) is a schematic wiring diagram.
When the multipoint grounding scheme is adopted, the units can be grounded at low impedance, and ground wires can be shortened, so that wiring may be simplified.

(2) Single–point grounding scheme
In this grounding scheme, grounding separation is achieved between the signal system and power system, and grounding is provided at a single point to suppress the noise influence of the power system on the signal system.
This scheme tends to need longer connection wires for grounding the devices. To produce a sufficient effect of suppressing high–frequency noise, it is therefore necessary to use larger–diameter wires or use two or more wires for each connection. Fig. 4.9.1.2 (b) is a schematic wiring diagram.

NOTE
Impedance includes a resistance component that converts electric current to heat as well as a component called "reactance", and indicates a characteristic of resistance to the flow of alternating current at a certain frequency.
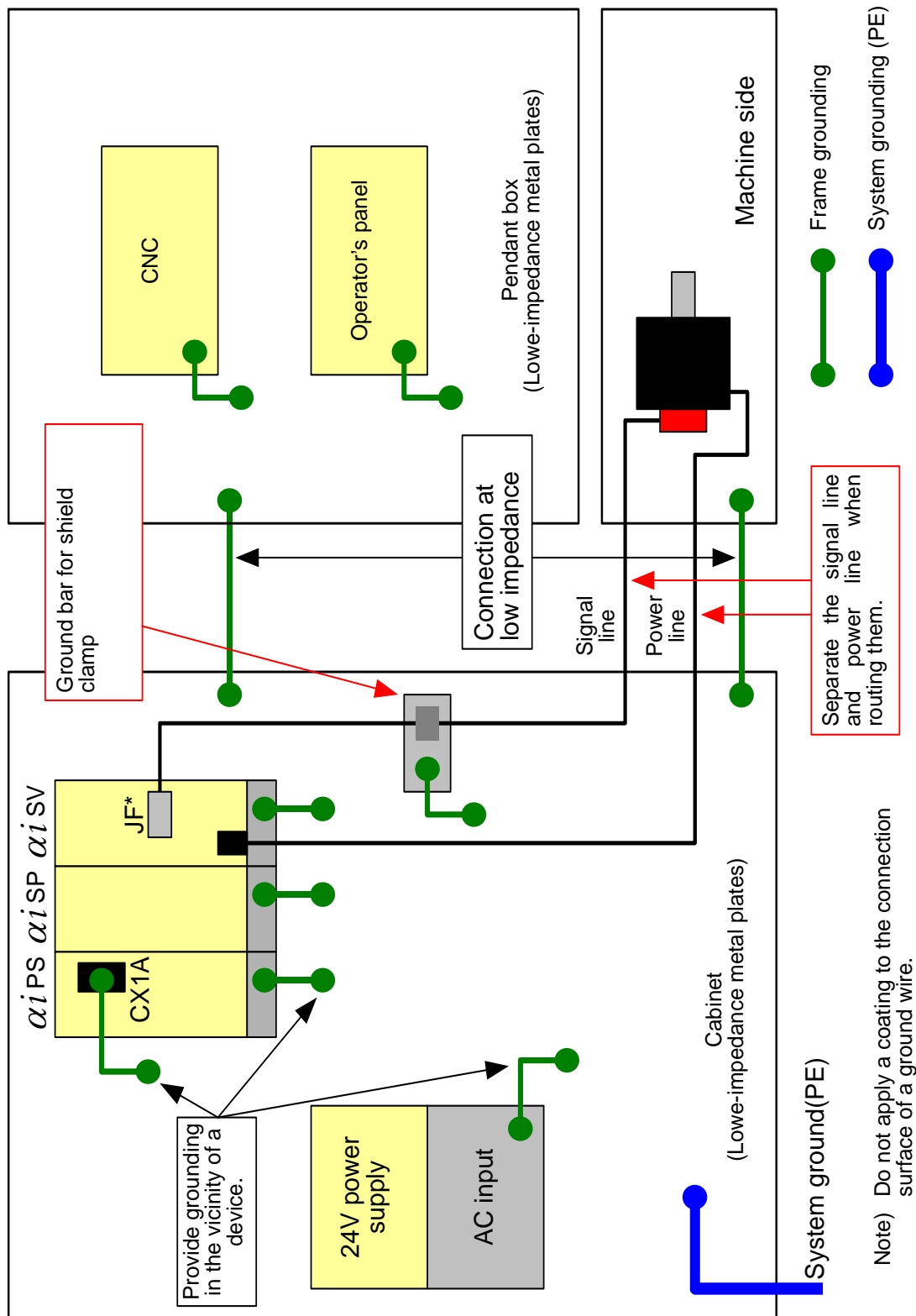
Fig. 4.9.1.2 (a) Schematic diagram for multipoint grounding scheme
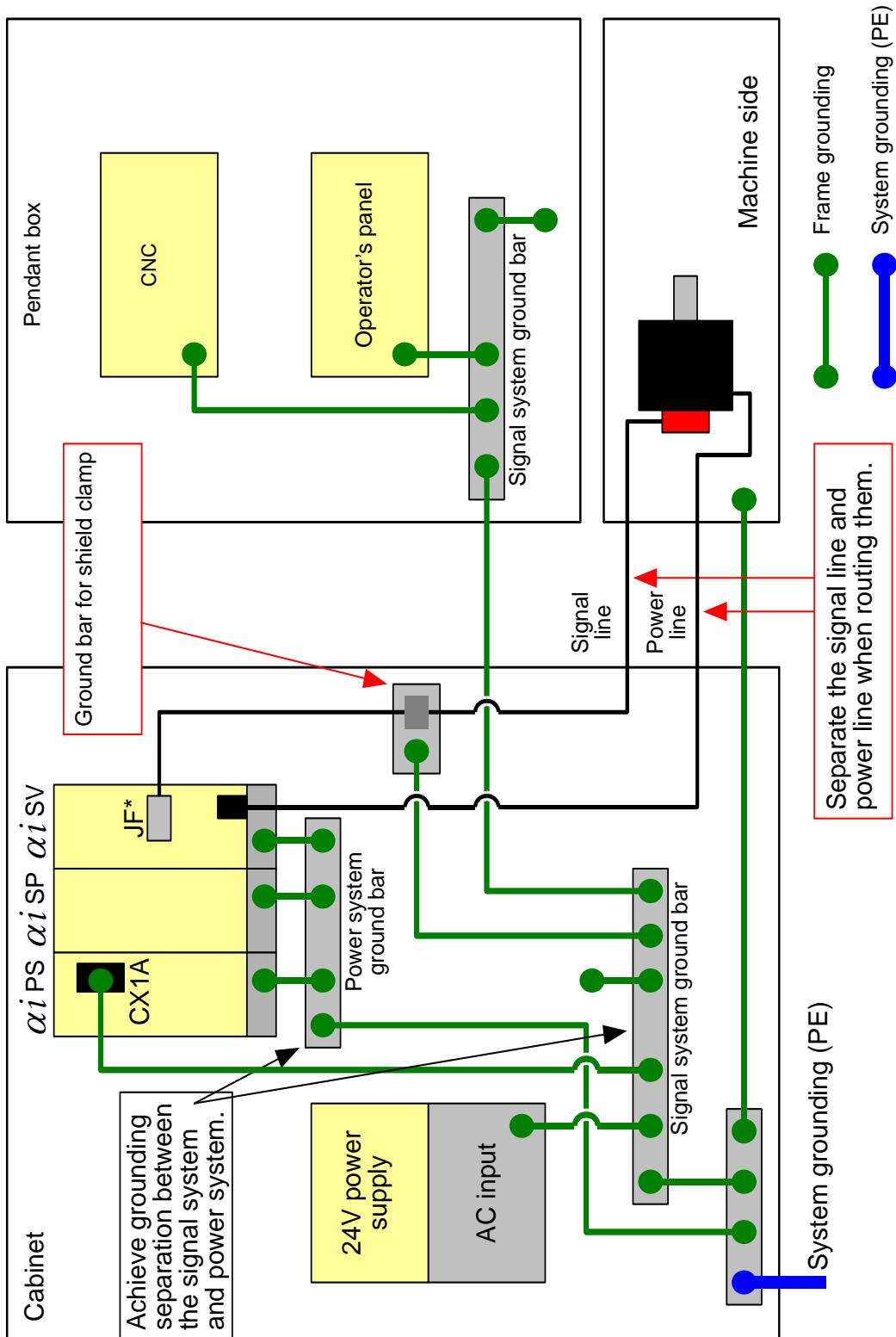
Fig. 4.9.1.2 (b) Schematic diagram for single–point grounding scheme

4.9.1.3   Cable clamp and shield processing

Signal lines basically require shield clamps. The influence of external noise can be suppressed by properly providing the signal lines with the shield clamps.

Partially peel the sheath off a cable and expose the shield, and press the exposed portion against the ground bar with the clamp. Care should be taken so that the ground bar and shield have a surface contact in a larger area. (See the figure below.)

When the multipoint grounding scheme is used, care should be taken so that the ground bar for the shield clamp and cabinet are connected at low impedance by, for example, preventing the cabinet side contact surface from being coated.
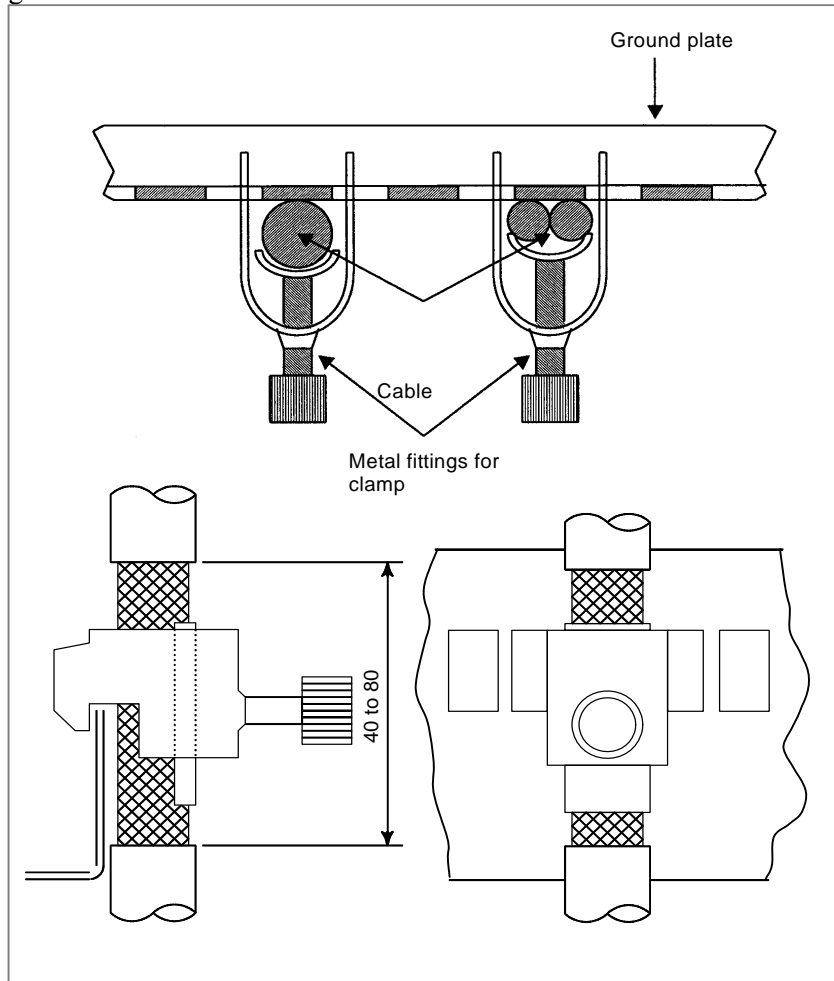
NOTE
   Select a cable with a proper length.
   If the cable is too long, the noise immunity may be reduced or noise may be caused on other cables.   In addition, when the excess length is coiled, the inductance is increased and a high voltage is induced during turning on or off of signals.   This may cause a malfunction due to a failure or noise.
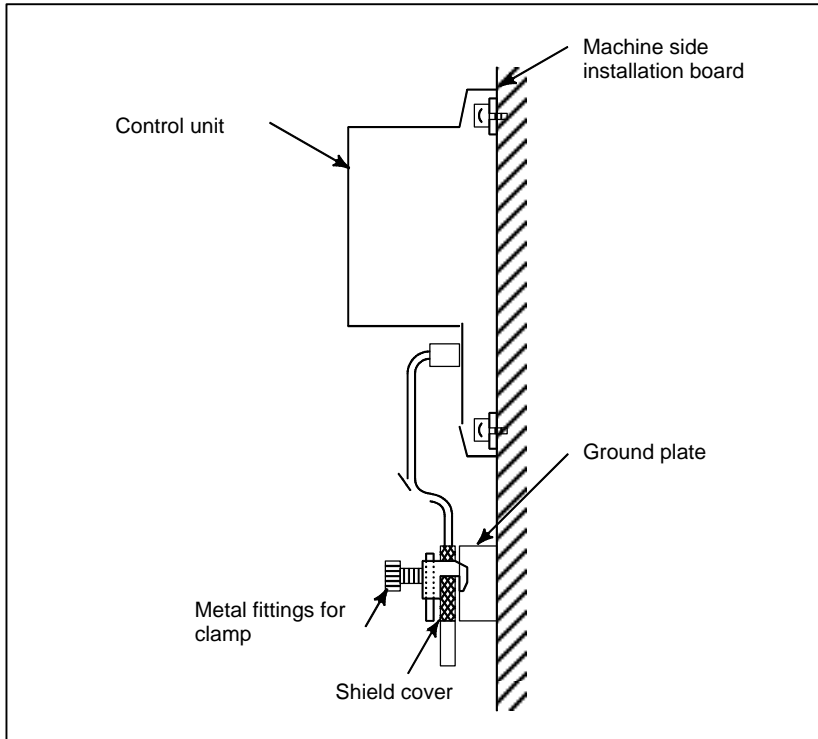
NOTE
Bundle the cables connected to a CNC or amplifier near each unit and shield them.

Prepare ground plate like the following figure.
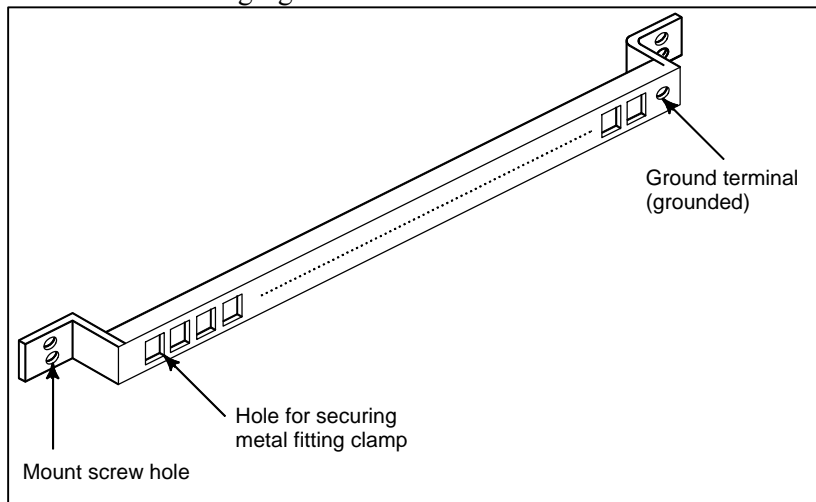
For the ground plate, use a metal plate of 2 mm or thicker, which surface is plated with nickel.
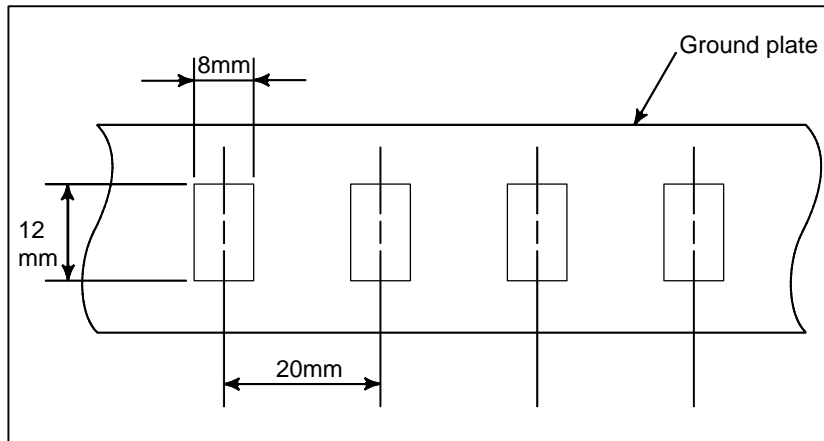
(Reference) Outer drawings of metal fittings for clamp.
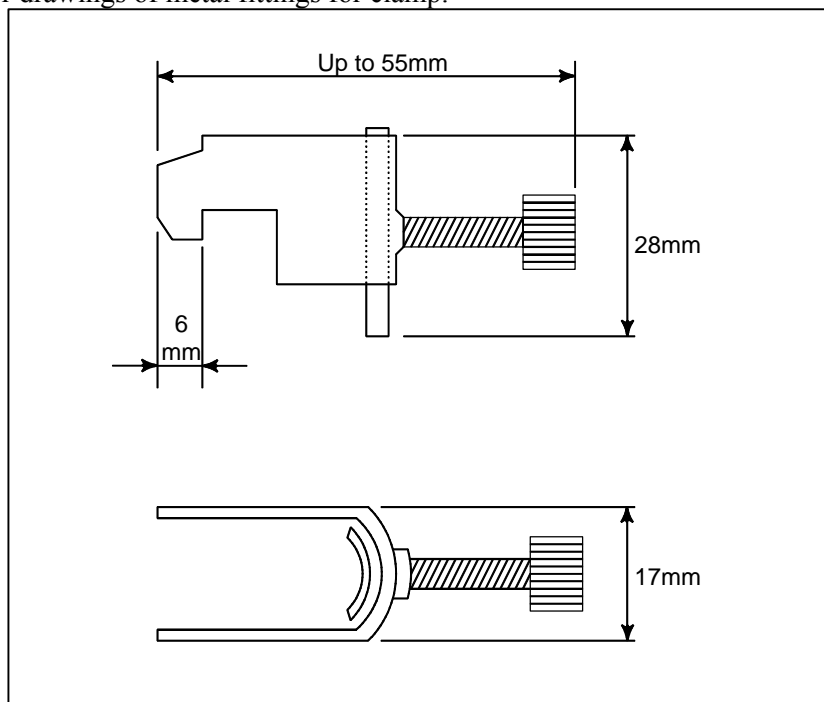
Ordering specification for metal fittings for clamp
  A02B-0124-K001 (8 pieces)

4.9.1.4   Cabinet

A cabinet is an important element in improving noise immunity and suppressing radiated noise. One of the causes of problems related to noise immunity and radiated noise is faulty electrical continuity between the metal plates that make up the cabinet. Typically, noise that becomes a problem is high–frequency noise, against which measures must be taken in the cabinet design.

(1) Basic cabinet structure
      A cabinet should basically be made of metal.
      To improve noise immunity, there must be low–impedance electrical continuity between the metal plates that make up the cabinet, which are the side plates, top plate, and bottom plate, and a welding–type cabinet structure is recommended.
      As for a cabinet welding method, bead welding is more suitable than spot welding for providing low–impedance electrical continuity between the metal plates.
      For an assembly–type cabinet structure, provide electrical continuity by bringing the metal plates into direct contact with each other, without applying a coating to their joint surface areas.
      In a structure that has the metal plates connected only with wires because of structural constraints, low–impedance connections are more difficult to make than in a structure in which welding is made or the metal plates are brought into direct contact with each other. It is necessary to maintain sufficient levels of items such as the cross–sectional area of a wire to use, continuity of connections, and contact areas.

Bead welding

Bring the metal plates into direct contact with each other, without applying a coating to their joint areas.
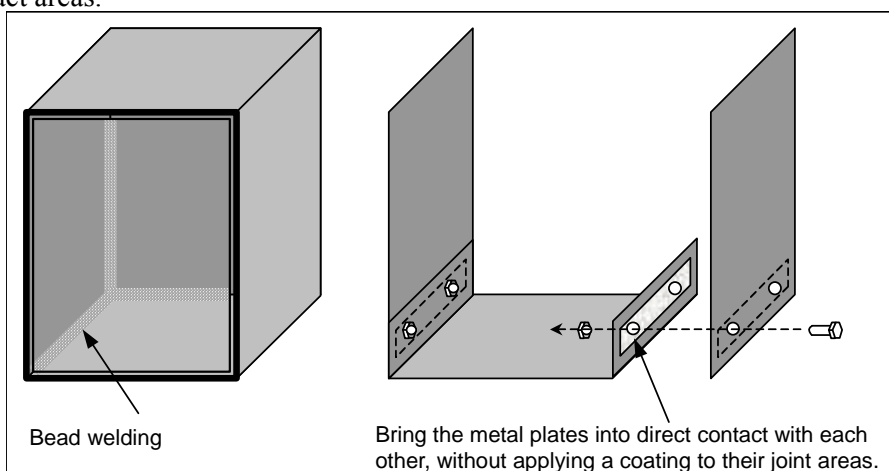
NOTE
For improved noise immunity, how to provide low-impedance electrical continuity in the cabinet is described here. To construct a protective circuit, a protective grounding connection must be made between the metal plates by using electric wires with a cross-sectional area appropriate for the AC input power capacity of the unit mounted on each metal plate.

(2) Mounting units on the cabinet
      The shortest possible lengths of unit ground wires should be used to make connections. A ground wire with a small conductor diameter causes impedance to high-frequency noise to become particularly higher, leading to an insufficient grounding effect. For the location of the ground terminal of each unit, refer to the manual relevant to the unit. The following shows the recommended method by which the metal plate with the unit mounted is installed on the cabinet. Care should be taken so that the cabinet and metal plate are connected to each other on their broad areas with no coating. It is not recommended that electrical continuity be provided only by screws, because impedance to high frequency cannot be sufficiently low.

<Good example>

Cabinet

Metal plate

Unit

Shortest connection with thick ground wire

Continuity on areas with no coating

<Bad example>

Cabinet

Metal plate

Unit

Continuity only by screw in a coated area

Thin ground wire, long ground wire
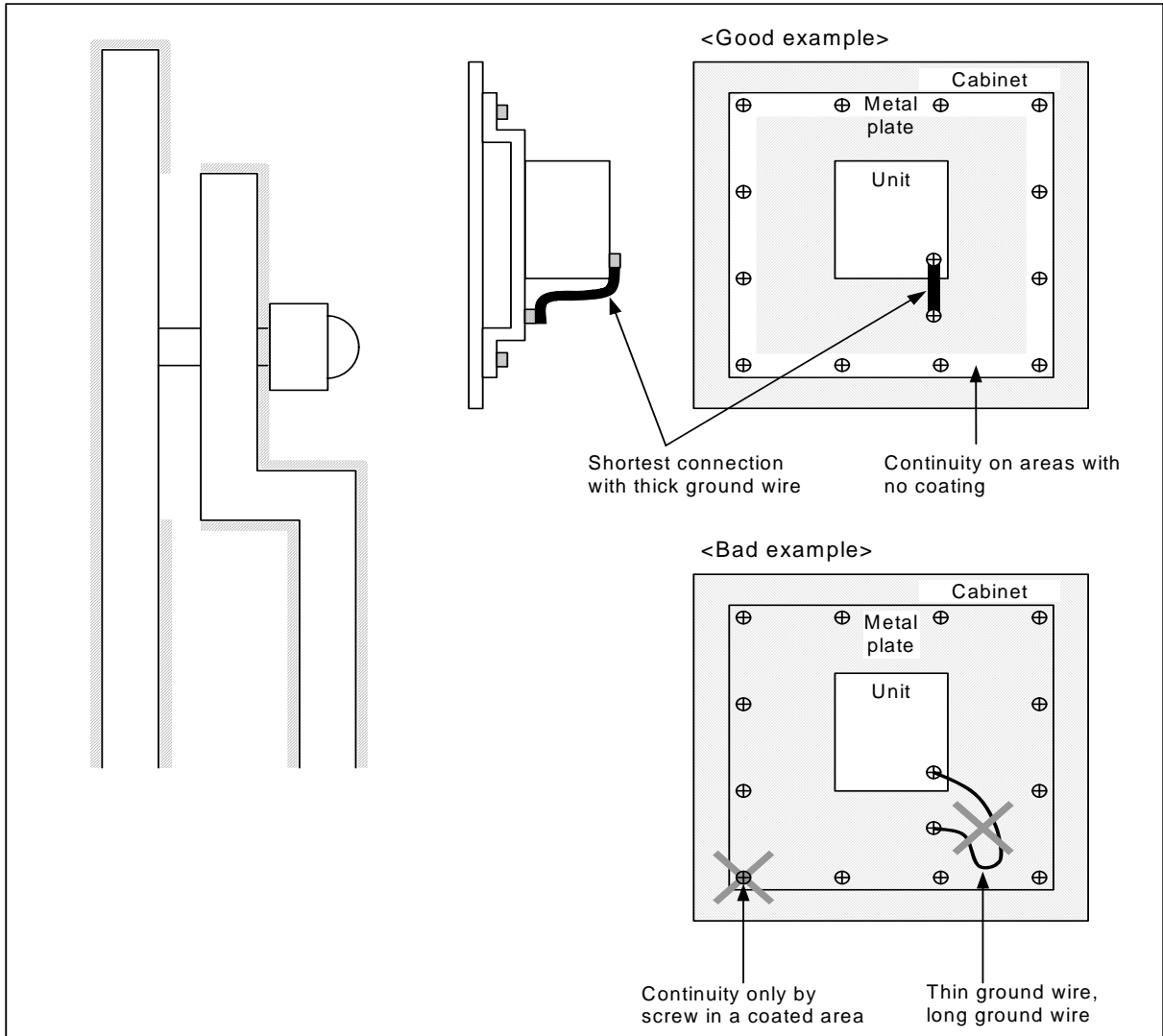
4.9.2 Connecting the Ground Terminal of the Control Unit

Connecting the 0 V output in the CNC to a protective circuit (ground)

The IEC 204-1 and JIS B 6015 standards specify the following:
- Protection against malfunctions due to ground faults

"To make the control circuit prevent malfunctions of a machine tool due to a ground fault and not to prevent the machine tool from stopping, either of the ground and electronic circuits shall be connected to a protective circuit."

Note that for each FANUC CNC, the 0V output in the CNC is connected to a protective circuit (ground).

For LCD-mounted type control unit

For the 8.4" LCD/MDI (horizontal) type

Unit back face

M4 screw

Grounding cable

For the 8.4" LCD/MDI (vertical) type

Unit back face

M4 screw

For the 10.4" LCD type

Unit back face

M4 stud
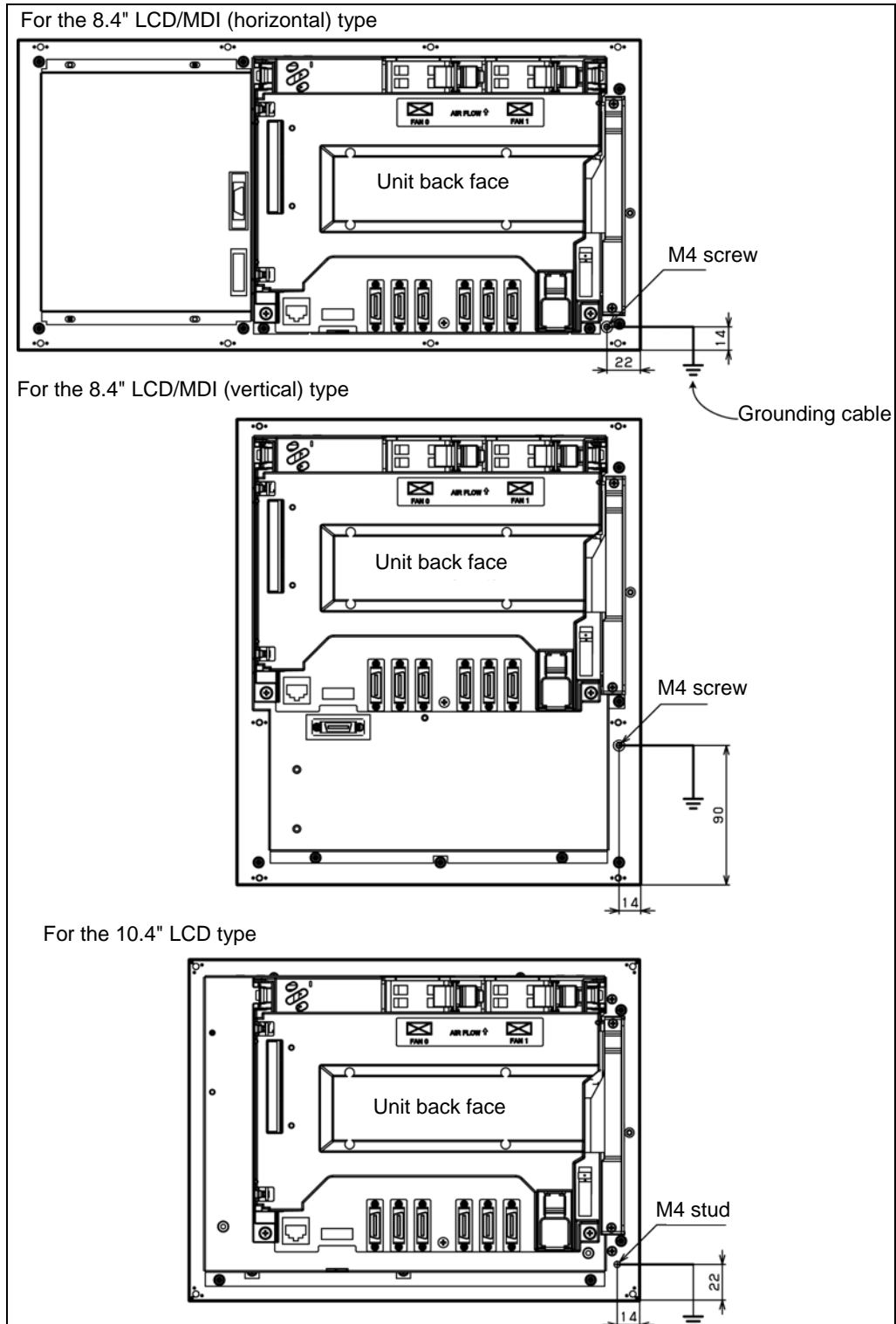
Connect the 0-V line in the control unit to the ground plate of or a metal plate near the cabinet via the protection ground terminal (above figure).

For stand-alone type control unit

For 2-slot rack

Protection ground terminal
(Faston terminal)

Ground cable

2mm^2 or more

Grounding plate of
the cabinet

PE
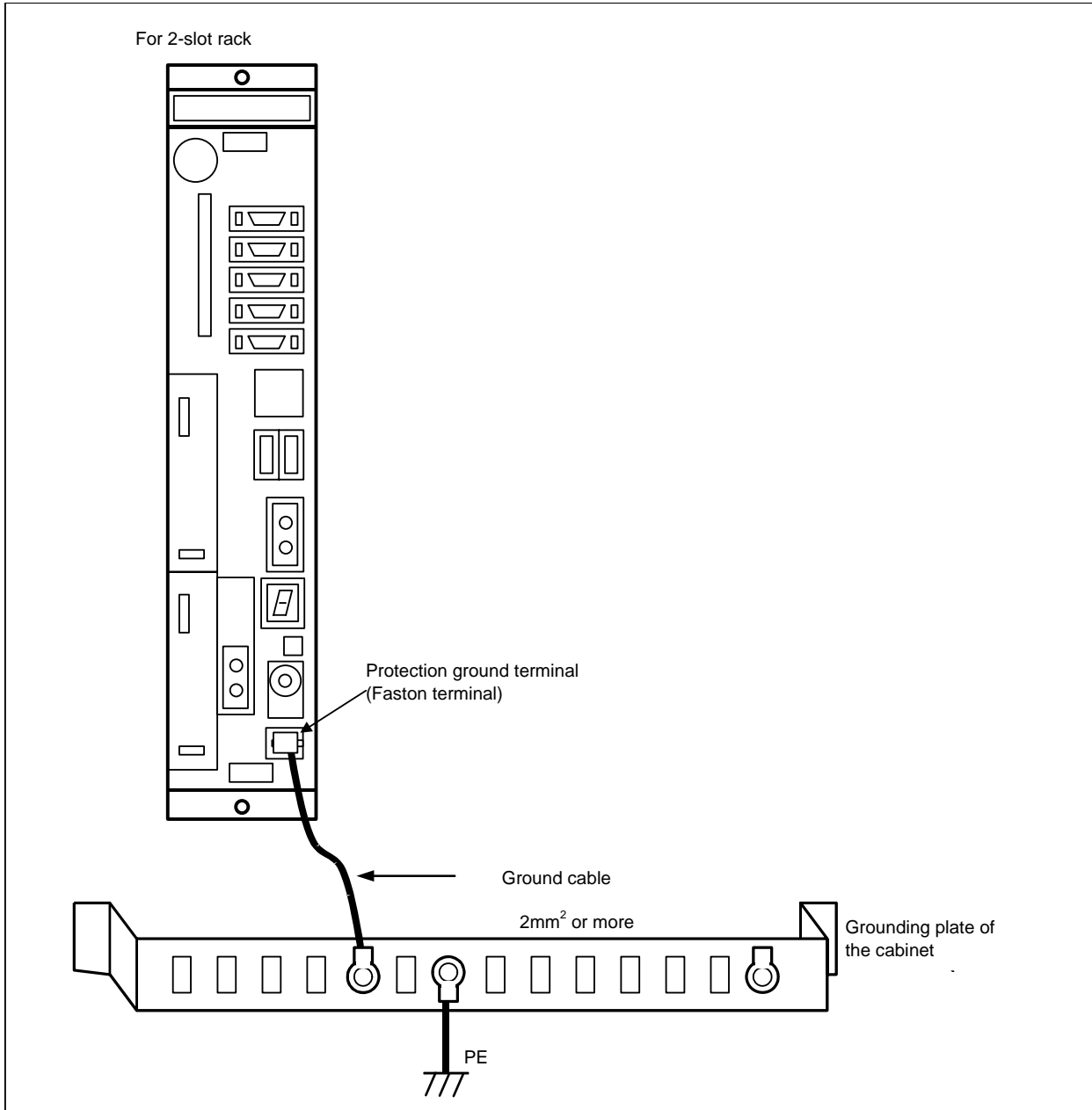
Connect the 0-V lines of the electronic circuits in the control unit to the ground plate of the cabinet via the protection ground terminal (above figure).
Use the Faston terminal (FANUC specification: A02B-0166-K330).

4.9.3   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 separately (Note 1) from groups B and C, or cover group A with an electromagnetic shield (Note 2). See Subsection 4.9.4 and connect spark killers or diodes with the solenoid and relay.
	Secondary AC power line	
	AC/DC power lines (containing the power lines for the servo and spindle motors)	
	AC/DC solenoid	
	AC/DC relay	
B	DC solenoid (24 VDC)	Connect diodes with the DC solenoid and relay. Bind the cables in group B separately from group A, or cover group B with an electromagnetic shield. Separate group B as far from group C as possible. It is desirable to perform shield processing.
	DC relay (24 VDC)	
	DI/DO cable between the I/O unit and power magnetics cabinet	
	DI/DO cable between the I/O unit and machine	
	24 VDC input power cables connected to the control unit and its peripherals	
C	Cable between the CNC and I/O unit	Bind the cables in group C separately from group A, or cover group C with an electromagnetic shield. Separate group C as far from group B as possible. Be sure to perform shield processing as described in Subsection 4.9.1.3.
	Cable for position and velocity feedback	
	Cable between the CNC and spindle amplifier	
	Cable for the position coder	
	Cable for the manual pulse generator	
	Cable between the CNC and the MDI (Note 3)	
	RS–232C and RS–422 interface cable	
	Cable for the battery	
	Other cables for which shield processing is specified	

NOTE
1 Binding the cables in one group separately from another means that the groups
   are placed 10 cm or more apart from one another.
2 Covering a group with an electromagnetic shield means that shielding is
   provided between groups with grounded steel plates.
3 The shield is not required when the cable between the CNC and MDI is no more
   than 30 cm in length.
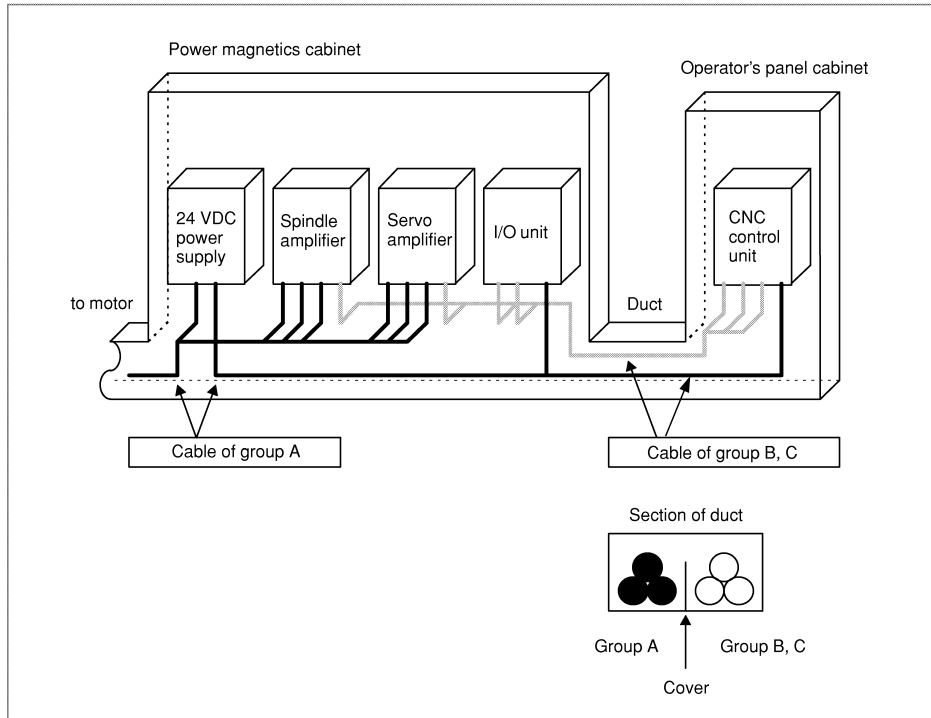
4.9.4   Noise Suppressor

The AC/DC solenoid, AC/DC relay, and other devices are used in the power magnetics cabinet.
A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage is induced through a cable or any other component, causing the electronic circuits to be disturbed.
Take the following measures against the pulse voltage:
1)   See Subsection 4.9.3 for groups A and B, and use spark killers for AC circuits or diodes for DC circuits.
2)   See "Notes on selecting the spark killer" below for information about selection of spark killers or diodes.

Notes on selecting the spark killer
- Use a CR–type spark killer. (Use it for AC circuits.)
  (A varistor is useful in clamping the peak pulse voltage, but cannot suppress the sudden rise of the pulse voltage. FANUC therefore recommends the use of a CR–type spark killer.)
- The reference CR values of the spark killer shall conform to the following based on the current ((I (A)) and DC resistance of the coil in the stationary state:
  1)   Resistance (R) :   Equivalent of the DC resistance of the coil

  2)   Capacitance (C)   : $\dfrac{I^2}{10} \sim \dfrac{I^2}{20}$ (μF)

     I   :Current of the coil in the stationary state [A]

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Equivalent circuit of the spark killer

Spark killer

AC relay

Spark killer

Motor

Mount the noise eliminator near a motor or a relay coil.
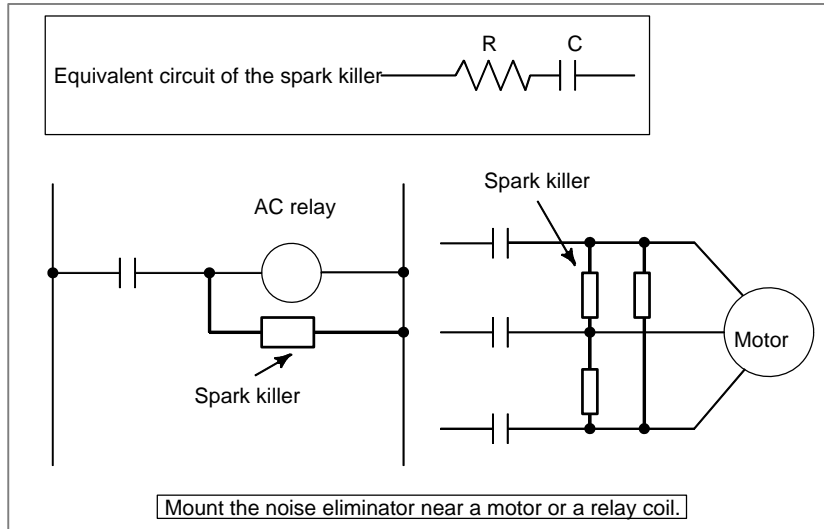
NOTE
  Use a CR-type noise eliminator. Varistor-type noise eliminators clamp the peak pulse voltage but cannot suppress a sharp rising edge.

Diode (used for direct-current circuits)

Diode

DC relay

Use a diode which can withstand a voltage up to two times the applied voltage and a current up to two times the applied current.
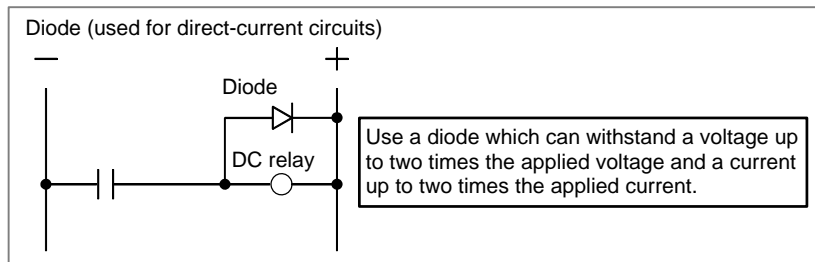
4.9.5   Measures Against Surges due to Lightning

To protect equipment from surge voltages caused by lightning, install a lightning surge protector between lines and between a line and ground. For how to install protectors, see Appendix A "FITTING A LIGHTNING SURGE PROTECTION DEVICE" in FANUC SERVO AMPLIFIER α*i* series DESCRIPTIONS (B-65282EN).

Lightning surge protector specifications

Ordering number	Specification	Remarks
A06B-6077-K142	For line-to-line installation: RAV-781BYZ-2 For line-to-ground installation: RAV-781BXZ-4	Manufactured by Okaya Electric Industries Co., Ltd. For 200VAC line TÜV approved products
A06B-6077-K143	For line-to-line installation: RAV-152BYZ-2A For line-to-ground installation: RAV-801BXZ-4	Manufactured by Okaya Electric Industries Co., Ltd. For 400VAC line TÜV approved products
A06B-6077-K144	Integration type for line-to-line installation/line-to-ground installation: RCM-601BUZ-4	Manufactured by Okaya Electric Industries Co., Ltd. For 200VAC line TÜV approved products

*   The line-to-line or line-to-ground installation type (A06B-6077-K144) and the integration type (A06B-6077-K142) are equivalent in performance and specifications.

4.10 REPLACING BATTERY FOR ABSOLUTE PULSECODERS

4.10.1 Overview

- When the voltage of the batteries for absolute Pulsecoders becomes low, alarm 307 or 306 occurs, with the following indication in the CNC state display at the bottom of the CNC screen.
  Alarm 307 (alarm indicating the voltage of the battery becomes low) :
    The indication "APC" blinks in reversed display.
  Alarm 306 (battery zero alarm) :
    The indication "ALM" blinks in reversed display.
- When alarm 307 (alarm indicating the voltage of the battery becomes low) occurs, replace the battery as soon as possible. In general, the battery should be replaced within one or two weeks, however, this depends on the number of Pulsecoders used.
- When alarm 306 (battery zero alarm) occurs, Pulsecoders are reset to the initial state, in which absolute positions are not held. Alarm 300 (reference position return request alarm) also occurs, indicating that reference position return is required.
- In general, replace the batteries periodically within the service life listed below.
  - A06B-6050-K061 or D-size alkaline dry cells (LR20) : Two years (for each six-axis configuration)
  - A06B-6073-K001 : Two years (for each three-axis configuration)
  - A06B-6114-K504 : One year (for each three-axis configuration)

> **NOTE**
> The above values indicate the estimated service life of batteries used with FANUC absolute Pulsecoders. The actual battery service life depends on the machine configuration based on, for example, detector types. For details, contact the machine tool builder.

4.10.2 Replacing Batteries

To prevent absolute position information in absolute Pulsecoders from being lost, turn on the machine power before replacing the battery. The replacement procedure is described below.
<1> Ensure that the power to the servo amplifier is turned on.
<2> Ensure that the machine is in the emergency stop state (the motor is inactive).
<3> Ensure that the DC link charge LED of the servo amplifier is off.
<4> Detach the old batteries and attach new ones.
The replacement of the batteries in a separate battery case and the replacement of the battery built into the servo amplifier are described below in detail.

> **⚠ WARNING**
> ・ The absolute Pulsecoder of each of the $\alpha i/\alpha i$ S series servo motors and the βi S series servo motors (βi S0.4 to βi S22) has a built-in backup capacitor. Therefore, even when the power to the servo amplifier is off and the batteries are replaced, reference position return is not required if the replacement completes within less than 10 minutes. Turn the power on and replace the batteries if the replacement will take 10 minutes or more.
> ・ To prevent electric shock, be careful not to touch metal parts in the power magnetics cabinet when replacing the batteries.
> ・ Because the servo amplifier uses a large-capacitance electrolytic capacitor internally, the servo amplifier remains charged for a while even after the power is turned off. Before touching the servo amplifier for maintenance or other purposes, ensure your safety by measuring the residual voltage in the DC link with a tester and confirming that the charge indication LED (red) is off.
> ・ Be sure to replace the batteries with specified ones. Pay attention to the battery polarity. If a wrong type of battery is used or a battery is installed with incorrect polarity, the battery may overheat, blow out, or catch fire, or the absolute position information in the absolute Pulsecoders may be lost.
> ・ Ensure that the battery connector is inserted in the correct position.

4.10.3 Replacing the Batteries in a Separate Battery Case

Use the following procedure to replace the batteries in the battery case.
<1> Loosen the screws on the battery case and detach the cover.
<2> Replace the batteries in the case (pay attention to the polarity).
<3> Attach the cover to the battery case.

Battery case (with a cover)
A06B-6050-K060

Batteries
Four A06B-6050-K061 batteries or
D-size alkaline dry cells
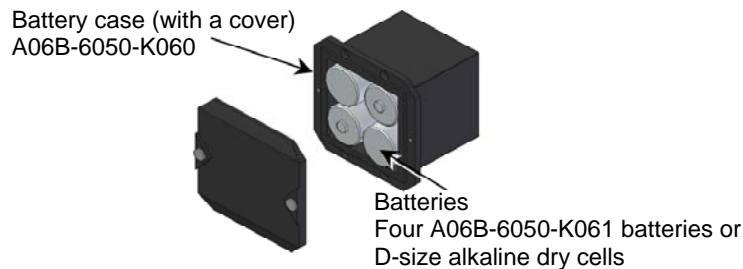
> **⚠ CAUTION**
> ・ Four D-size alkaline dry cells (LR20) that are commercially available can be used as batteries. A set of four A06B-6050-K061 batteries is optionally available from FANUC.
> ・ Replace all the four batteries with new ones. If old and new batteries are mixed, the absolute position information in the absolute Pulsecoders may be lost.

4.10.4 Replacing the Battery Built into the Servo Amplifier

Use the following procedure to replace the special lithium battery.
<1> Detach the battery cover.
<2> Replace the special lithium battery.
<3> Attach the battery cover.

> ⚠ **CAUTION**
> ・ Purchase the battery from FANUC because it is not commercially available. It is therefore recommended that you have a backup battery.
> ・ When the built-in battery is used, do not connect BATL (B3) of connector CXA2A/CXA2B. Also, do not connect two or more batteries to the same BATL (B3) line. These connections are dangerous because battery output voltages may be short-circuited, causing the batteries to overheat.
> ・ Install the battery in the servo amplifier in a direction that allows slack in the cable. If the battery cable is under tension, a bad connection may occur.
> ・ If the +6 V pin and 0 V pin are short-circuited, the battery may overheat, blow out, or catch fire, or the absolute position information in the absolute Pulsecoders may be lost.
> ・ When inserting the connector, align it to the connector pins.

[Connecting the battery]

The battery for the βiSV4 and βiSV20 series amplifiers is mounted in the battery case on the underside of each of the amplifiers.

The battery for the other βi series amplifiers and the αi series amplifiers is mounted at the front of each of the amplifiers.
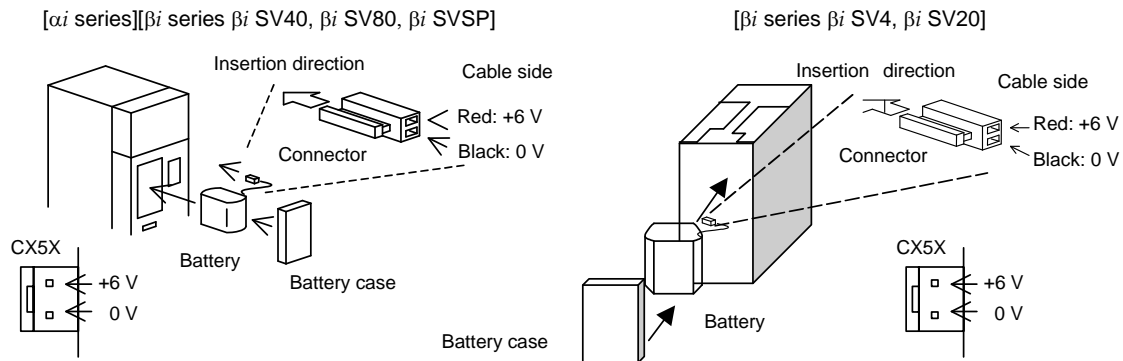
[Battery sets and outlines]

Battery ordering drawing number	Manufacturer model number	Applicable servo amplifier	Battery case ordering drawing number	Outline
A06B-6114-K504 (Note)	BR-2/3AGCT4A (Panasonic)	αi series 60/90 mm width	A06B-6114-K505	
		αi series 150/300 mm width	A06B-6114-K506	
		βi series βi SV (two-axis model)	A06B-6114-K505	
		βi series βi SVSP	A06B-6114-K506	
A06B-6093-K001	BR-AGCF2W (Panasonic)	βi series βiSV4, βiSV20	A06B-6093-K002	
		βi series βiSV40, βiSV80	A06B-6093-K002	

> **NOTE**
> When an old type BR-CCF2TH battery is used, order a battery case that accommodates battery A06B-6114-K504.

Used batteries

Old batteries should be disposed as "INDUSTRIAL WASTES" according to the regulations of the country or autonomy where your machine has been installed.

4.11   CAUTIONS IN REPLACING PCB'S

This CNC supports the "FANUC Remote Option System."
There are several cautions that should be observed in replacing printed circuit boards. Follow the replacement procedure below.

PCB replacement procedure
1) Optional parameters are stored in an option information file (with file name "OPRM INF") in the FROM module.
   Before replacing a printed-circuit board, back up the optional information file as well as SRAM data and user files as usual. If the optional information is corrupted during replacement, the backed-up data will become necessary in recovery work.
2) As usual, after replacing a printed-circuit board, restore the SRAM data and user files as required.
3) If the FROM/SRAM module is replaced, it is necessary to restore the optional information file that was held in the FROM module. Use the data backed up at step 1). Once restoration is finished, alarm PS5523 "Option authentication wait state" will occur when the power is turned on. It is necessary to access FANUC's web site and perform optional parameter authentication work with the "FANUC Remote Option System" within the period of validity (within 30 days since the occurrence of the alarm). (Within the period of validity, alarm PS5523 can be canceled by a reset.)
4) Replacing a printed-circuit board may result in a change to the CNC ID number. Check it on the CNC screen. If it is different from one described on the data sheet, correct the data sheet.

5 INPUT AND OUTPUT OF DATA

Parameters, offset values, and other data can be backed up in external I/O devices. SRAM data can also be backed up at a time. This backup data can be restored to set data again easily. It is recommended that various types of data and SRAM data be backed up periodically in case data stored in the CNC is destroyed due to an operation error or backup battery exhaustion.

This chapter explains how to input or output data, such as parameters, part programs, and tool offset values, with external I/O devices such as floppy disk units.
This chapter also explains automatic data backup (optional function) that automatically backs up SRAM data periodically.

SRAM data can be saved and restored at a time using the boot system. For details of the boot system, see Appendix C, "BOOT SYSTEM," and Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)."
For details of Inputting and Outputting Parameters of the I/O Link Option for the FANUC servo unit β*i* series (I/O Link β*i*), see section 1.8.2. For details of PMC data Input/Output, see section 6.4.7.

5.1 SETTING PARAMETERS FOR INPUT/OUTPUT

Setting procedure of parameters
Parameter writing is enabled with following steps 1 to 3.

1   Set to MDI mode or emergency stop state.
2   Press function key [⊡] several times or press soft key [SETTING] to display SETTING (HANDY) screen.
3   Set the cursor to PARAMETER WRITE and, press [·1] and [INPUT] keys in this order. Here alarm 100 will be displayed.
4   Press function key [SYSTEM] several times to display the following screen.

```
PARAMETER   (SETTING)      O1234 N12345

0000          SEQ          INI ISO TVC
       0   0   0   0   0   0   0   0
0001                       FCV
       0   0   0   0   0   0   0   0
0012 RMV                           MIR
  X    0   0   0   0   0   0   0   0
  Y    0   0   0   0   0   0   0   0
  Z    0   0   0   0   0   0   0   0
  B    0   0   0   0   0   0   0   0
0020   I/O CHANNEL

                           S   0 T0000
REF   ****  ***  ***       10: 15: 30
[ PARAM][ DGNOS][       ][SYSTEM][(OPRT)]
```
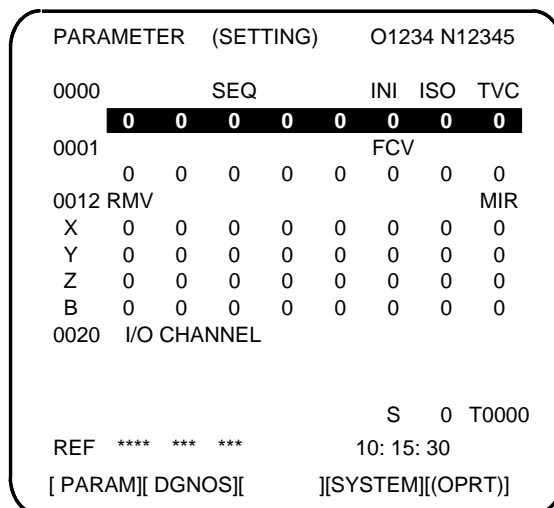
To make the cursor display in bit unit, press the cursor key [→] or [←].

5   Press soft key [(OPRT)] and the following operation menu is displayed.
      \<1> Soft key [NO. SRH] :
      Searched by number.
      Examination) Parameter number → [NO. SRH].
      \<2> Soft key [ON : 1] :
      Item with cursor position is set to 1 (bit parameter)
      \<3> Soft key [OFF : 0] :
      Item with cursor position is set to 0 (bit parameter)
      \<4> Soft key [+INPUT] :
      Input value is added to the value at cursor
      \<5> Soft key [INPUT] :
      Input value is replaced with the value at cursor
      \<6> Soft key [F INPUT] :
      Parameters are input from reader/puncher interface.
      \<7> Soft key [F OUTPUT] :
      Parameters are output to reader/puncher interface.

6   After the parameters have been input, set PARAMETER WRITE on the SETTING screen to 0. Press
    [RESET] key to release alarm 100.

7   Convenient method
    \<1> To change parameters in bit unit, press cursor key [←] or [→], then the cursor becomes
    bit length and you can set parameters bit by bit (Bit parameter only).

    \<2> To set data consecutively, use [EOB] key.

(Ex.1) [.1][#2][=3][←4][EOB][←4][5][→6][7][EOB][9][9][9][9][INPUT]

    This key sequence sets data as follows:
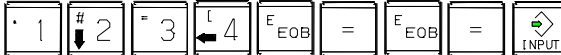
        0   1234
        0 ⇒   4567
        0   9999
        0   0

(Ex.2) [.1][#2][=3][←4][EOB][EOB][9][9][9][9][INPUT]

    This key sequence sets data as follows:

        0   1234
        0 ⇒   0
        0   9999
        0   0

    \<3> To set the same data sequentially, press [=] .

(Ex.1) [.1][#2][=3][←4][EOB][=][EOB][=][INPUT]

    This key sequence sets data as follows:

        0   1234
        0 ⇒   1234
        0   1234
        0   0

<4> Bit parameters can be set as follows:

(Ex.1) [· 1] [· 1] [ᴱ EOB] [=] [ᴱ EOB] [=] [⇩ INPUT]

This key sequence sets data as follows:

```
0 0 0 0 0 0 0 0              0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0      ⇒       0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0              0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0              0 0 0 0 0 0 0 0
```
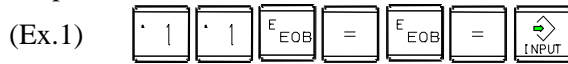
8   After the required parameters are set, set PARAMETER WRITE to 0.

5.2   INPUTTING/ OUTPUTTING DATA

The CNC memorized the following data.
Outputting the data I/O device while the CNC is running normally.
(1)   CNC parameter (See Section 5.2.2)
(2)   PMC parameter (See Section 6.4.7)
(3)   Pitch error compensation amount (See Section 5.2.3)
(4)   Custom macro variable values (See Section 5.2.4)
(5)   Tool compensation amount   (See Section 5.2.5)
(6)   Part program (machining program, custom macro program) (See Section 5.2.6)

5.2.1   Confirming the Parameters Required for Data Input/Output

Be sure that data output cannot be done in an alarm status.

The following parameters are required for F INPUT and F OUTPUT.
In addition, (*) indicates the standard setting for input/output devices made by FANUC. Change these settings according to the unit you actually use.
(Parameter can be changed in MDI mode or emergency stop status.)

	#7	#6	#5	#4	#3	#2	#1	#0
0000							ISO	

ISO   0:   Output with EIA code
       1:    Output with ISO code (for RS-232-C serial port 1 or 2)

0020	Selection of I/O channel

(*)   0 :   Channel 1 (RS-232-C serial port 1: JD36A of main board)
      1 :   Channel 1 (RS-232-C serial port 1: JD36A of main board)
      2 :   Channel 2 (RS-232-C serial port 2: JD36B of main board)
      4 :   Memory card interface
      5 :   Data Server interface
      9:    Embedded Ethernet interface

> **NOTE**
> In the operation examples in this chapter, data input/output is done with an I/O device connected to JD36A.   (I/O channel = 0)

	#7	#6	#5	#4	#3	#2	#1	#0
0101	NFD				ASI			SB2

NFD   0 :   Feed is output when data is output.
       1 :   Feed is not output when data is output.

ASI (*) 0 : EIA or ISO code is used for input/output data.
            (input: automatic detection, output: setting of bit 1 (ISO) of parameter No.
            0000)
        1 : ASCII code is used.
            (To use the ASCII code, set bit 1 (ISO) of parameter No. 0000 to 1.)
SB2   0 : No. of stop bits is 1.
   (*) 1 : No. of stop bits is 2.

0102	Number specified for the input/output device

Set value	Input/output device
0	RS-232-C (Used control codes DC1 to DC4)
1	FANUC CASSETTE ADAPTOR 1 (FANUC CASSETTE B1/B2)
2	FANUC CASSETTE ADAPTOR 3 (FANUC CASSETTE F1)
3	FANUC PROGRAM FILE Mate, FANUC FA Card Adaptor FANUC FLOPPY CASSETTE ADAPTOR, FANUC Handy File FANUC SYSTEM P-MODEL H
4	RS-232-C (Not used control codes DC1 to DC4)
5	Portable tape reader
6	FANUC PPR FANUC SYSTEM P-MODEL G, FANUC SYSTEM P-MODEL H

0103	Baud Rate

```
1:   50   7:     600  11:    9600
3:  110   8:    1200  12:  19200   [BPS]
4:  150   9:    2400
6:  300  (*)10: 4800
```

	#7	#6	#5	#4	#3	#2	#1	#0
0139								ISO

ISO   0: ASCII code input/output
        1: ISO code input/output (with memory card)

	#7	#6	#5	#4	#3	#2	#1	#0
0908								ISO

ISO   0 : ASCII code input/output
        1 : ISO code input/output (with Data Server)

5.2.2   Outputting CNC Parameters

1   Enter EDIT mode or the emergency stop condition.

2   Press function key [SYSTEM] and soft key [PARAMETER] to select a parameter screen.

3   Press soft key [(OPRT)] and continuous menu key [▷].

4   Press soft keys [F OUTPUT] and [EXEC], and the parameters are started to be output.

5.2.3   Outputting Pitch Error Compensation Amount

If pitch error compensation is enabled, a pitch error compensation amount is output.

1   Select EDIT mode.

2   Press the function key [SYSTEM].

3   Press continuous menu key [▷] several times, then press soft key [PITCH] to select the pitch error
     compensation setting screen.

4   Press soft key [(OPRT)] and continuous menu key ▷.

5   Press soft keys [F OUTPUT] and [EXEC], then pitch error compensation amount is started to be output.

5.2.4   Outputting Custom Macro Variable Values

When custom macro function is valid, values of variable No. 500 and later are output.

1   Select EDIT mode.

2   Press the function key ⊞.

3   Press continuous menu key ▷ several times, then press soft key [MACRO] to select custom macro variable screen.

4   Press soft key [(OPRT)] and then continuous menu key ▷.

5   Press soft keys [F OUTPUT] and [EXEC], then custom macro variable values are output.

5.2.5   Outputting Tool Compensation Amount

1   Select EDIT mode.

2   Press function key ⊞ and soft key [OFFSET] to display the tool compensation amount screen.

3   Press soft key [(OPRT)] and continuous menu key ▷.

4   Press soft keys [F OUTPUT] and [EXEC], and the tool compensation amount is started to be output.

5.2.6   Outputting Part Program

1   Confirm the following parameters.   If their setting does not match those indicated with the asterisk, select the MDI mode and re-set them and keep them re-set only while this work is being done.

However, if you changed the parameter setting, restore the original value after finishing this work.

	#7	#6	#5	#4	#3	#2	#1	#0
3202				NE9				NE8

    NE9 (*) 0:   Programs of 9000s are edited.
            1:    Programs of 9000s can be protected.
                            (Protected programs are not output.)
    NE8 (*) 0:   Programs of 8000s are edited.
            1:    Programs of 8000s can be protected.
                    (Protected programs are not output.)

2   Select EDIT mode.

3   Press the function key ▣ and then the soft key [PROGRM] to select the program content display screen.

4   Press soft key [(OPRT)] and press continuous menu key ▷.

5   Input a program number to be output. To output all programs input as:

    O – 9 9 9 9

6   Press soft keys [F OUTPUT] and [EXEC], then program output is started.

5.2.7   Inputting CNC Parameters

1   Set to the emergency stop state.

2   Press the function key ⊞ and then the soft key [SETTING] to select the setting screen.

    Confirm "PARAMETER WRITE=1" on the setting screen.

3   Press function key [SYSTEM] and soft key [PARAMETER] to select the parameter screen.

4   Press soft key [(OPRT)] and continuous menu key [▷].

5   Press soft keys [F INPUT] and [EXEC]. Then input of parameters are started.

6   Upon completion of parameter input, turn off the power then turn on the power again.

5.2.8   Inputting Pitch Error Compensation Amount

If pitch error compensation is enabled, a pitch error compensation amount is input.

1   Select EDIT mode.

2   Confirm that PARAMETER WRITE=1 on the setting screen.

3   Press the function key [SYSTEM].

4   Press continuous menu key [▷] several times, then press soft key [PITCH] to select the pitch error
     compensation setting screen.

5   Press soft key [(OPRT)] and continuous menu key [▷].

6   Press soft keys [F INPUT] and [EXEC], then pitch error compensation amount is started to be input.

7   After a pitch error compensation amount is input, display the setting screen and reset
     "PARAMETER WRITE" to "0" on the setting screen.

5.2.9   Inputting Custom Macro Variable Values

When custom macro function is valid, input the variable values.

1   Select EDIT mode.

2   Turn off the program protect (KEY2=1).

3   Press the function key [SET].

4   Press continuous menu key [▷] several times, then press soft key [MACRO] to select the custom
     macro variable screen.

5   Press soft key [(OPRT)] and continuous menu key [▷].

6   Press soft keys [F INPUT] and [EXEC], then custom macro variable values is started to be input.

5.2.10   Inputting Tool Compensation Amount

1   Select EDIT mode.

2   Turn off the program protect (KEY=1).

3   Press the function key [SET].

4   Press soft key [OFFSET] to display the tool compensation amount display screen.

5   Press soft key [(OPRT)] and continuous menu key [▷].

6   Press soft keys [F INPUT] and [EXEC], then tool compensation amount is started to be input.

5.2.11   Inputting Part Programs

1   Confirm the following parameters.   If their setting does not match those indicated with the asterisk,
     select the MDI mode and re-set them and keep them re-set only while this work is being done.

However, if you changed the parameter setting, restore the original value after finishing this work.

	#7	#6	#5	#4	#3	#2	#1	#0
3201		NPE					RAL	

NPE   When programs are registered in part program storage area, M02,M30 and M99 are:

0:    Regarded as the end of program.

(*) 1:   Not regarded as the end of program.
RAL   When programs are registered:
 (*) 0:   All programs are registered.
 1:   Only one program is registered.

	#7	#6	#5	#4	#3	#2	#1	#0
3202				NE9				NE8

NE9 (*) 0:   Programs of 9000s can be edited.
 1:   Programs of 9000s are protected.
NE8 (*) 0:   Programs of 8000s can be edited.
 1:   Programs of 8000s are protected.

2   Select EDIT mode.
3   Turn off the program protect (KEY3=1).
4   Press the function key [PROG] and then the soft key [PROGRM] to select the program content display screen.
5   Press soft key [(OPRT)] and press continuous menu key [▷].
6   Press soft keys [F INPUT] and [EXEC], then program input is started.

5.3   AUTOMATIC DATA BACKUP

It is possible to back up data held in the CNC's FROM/SRAM by storing it automatically in the FROM, which requires no battery and to restore the baked-up data as required.   If data is lost from the CNC due to unforeseen circumstances, this function can be used to restore the data easily.

Also, it is possible to hold three occurrences of backup data.   With this function, the CNC data can be quickly switched to a post-machine adjustment state or an arbitrary backup state.
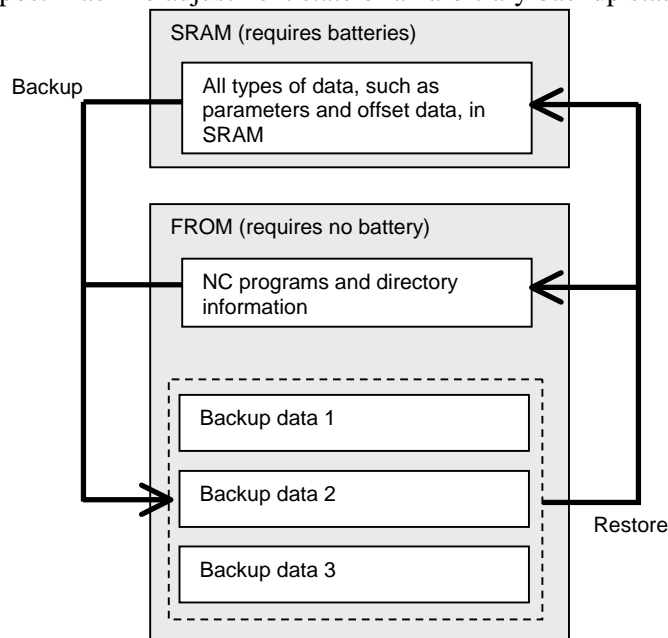
NOTE
   Automatic data backup function is optional function.

Explanation
- Data to be backed up
Data in the CNC is backed up by storing it in the FROM, which requires no battery.
• NC programs held in the FROM (which requires no battery)

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- Various types of data, such as parameters and offset values, held in the SRAM (which requires batteries)

Setting bit 2 (AAP) of parameter No.10340 to 1 enables NC programs in the FROM to be backed up. Set this parameter only when necessary, because the required backup time and data storage size vary depending on the size of the programs.

Also, it is possible to hold three occurrences of backup data.

- Backup modes
The following three backup modes are available.
1. Automatic backup occurring every time the power is turned on
2. Automatic backup occurring at intervals of a specified number of days when the power is turned on
3. Backup started manually at an emergency stop

- Automatic backup occurring every time the power is turned on
Data in the CNC can be backed up automatically when the power is turned on.
This mode can be used by:
- Setting bit 0 (ABP) of parameter No. 10340 to 1
- Setting bit 2 (AAP) of parameter No. 10340 to 1 if also NC programs in the FROM must be backed up

- Automatic backup occurring at intervals of a specified number of days when the power is turned on
Data in the CNC can be backed up automatically when the power is turned on for the first time in a specified number of days since the previous backup.
This mode can be used by:
- Selecting the first backup mode (automatic backup occurring every time the power is turned on)
- Setting parameter No. 10341 with a number of days at intervals of which automatic backup is to be made cyclically

- Backup started manually at an emergency stop
Data in the CNC can be backed up by starting an appropriate procedure manually in an emergency stop state. This mode makes it possible to back up data without turning off the power for the CNC at an arbitrary timing, such as when machining has been set up or before a holiday.
If you want to back up NC programs in the FROM, set bit 2 (AAP) of parameter No. 10340 to 1 before backup operation.

[Backup procedure]
1. Put the machine in an emergency stop state.
2. Set bit 7 (EEB) of parameter No. 10340 to 1 to start backup. This parameter becomes 0 just after the backup sequence has started.
3. The execution status of backup can be checked with No. 1016 on the diagnosis screen described later.

> **NOTE**
> It takes time since the beginning of backup till the end of backup. So, if data being backed up is updated, it is likely that a mismatch may occur between the original data and backup data. When updating data in the CNC at an emergency stop, watch the automatic data backup in-progress signal ATBK and perform appropriate processing.

- Backup execution status
In the backup modes used at power-on time, 10 dots "." are used to indicate the execution status of backup. For example, the completion of backup is indicated with: "AUTO BACKUP : ……….END

The diagnosis screen can also be used to check the execution status of backup as follows:
- No.1016#0 (AEX):   Backup in progress
- No.1016#6 (ACM):   Backup completed
- No.1016#7 (ANG):   Error during backup
- No.1016#1 (DT1), #2 (DT2), #3 (DT3):   Numbers of updated backup data items

- Write-protected backup data
Factory-set or post-adjustment machine status data can be held as write-protected backup data.   The first piece (data 1) of backup data is handled as write-protected backup data.
This function is enabled by:
- Setting bit 1 (ABI) of parameter No. 10340 to 1
- Setting bit 2 (AAP) of parameter No. 10340 to 1 if also NC programs in the FROM must be backed up

[Procedure for creating write-protected data]
1.   Set bit 6 (EIB) of parameter No. 10340 to 1.
2.   Turn the power for the CNC off and on again.   When the power is turned on, the first piece of backup data is updated automatically, and bit 6 (EIB) of parameter No. 10340 becomes 0.

Then, the first backup data is handled as write-protected data until the same operation is performed again. The second and third pieces of backup data are updated each time another type of backup (automatic backup occurring every time the power is turned on, automatic backup occurring at intervals of a specified number of days when the power is turned on, or backup started manually at an emergency stop) is made.

- Parity check
A parity check is made at backup.   If a parity error is detected, the backup is not completed.

- Restoring backed-up data
With the BOOT SYSTEM, executing the following procedure can restore backed-up data from FROM.
1.   From the BOOT's TOP menu, select "7. SRAM DATA UTILITY".   The following menu appears. Select "3".

```
SRAM DATA UTILITY

 1. SRAM BACKUP  ( CNC -> MEMORY CARD )
 2. SRAM RESTORE ( MEMORY CARD -> CNC )
 3. AUTO BKUP RESTORE ( FROM -> CNC )
 4. END
```

2.   From the menu below, select data and run restore.

```
AUTO BACKUP DATA RESTORE

 1. BACKUP DATA1 yyyy/mm/dd **:**:**
 2. BACKUP DATA2 yyyy/mm/dd **:**:**
 3. BACKUP DATA3 yyyy/mm/dd **:**:**
 4  END
```

3.   Exit BOOT.

Signal

Automatic data backup in-progress signal ATBK<F0520.0>
[Classification] Output signal
    [Function] This signal is "1" during automatic data backup.   When updating data in the CNC at an emergency stop, perform appropriate processing according to the state of this signal.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F0520								ATBK

Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
10340	EEB	EIB				AAP	ABI	ABP

[Input type] Parameter input
[Data type] System-common type

 # 0   ABP Automatic data backup at power-on is:
  0: Disabled.
  1: Enabled.

 # 1   ABI Overwrite-protected backup data is:
  0: Regarded as invalid.
  1: Regarded as valid.

 # 2   AAP Backup of NC programs in FROM is:
  0: Disabled.
  1: Enabled.

 # 6   EIB When the CNC is turned on next, overwrite-protected backup data is:
  0: Not updated.
  1: Updated.

> **NOTE**
> This parameter is valid when bit 1 (ABI) of parameter No. 10340 is set to 1.

 # 7   EEB When an emergency stop occurs, a backup operation is:
  0: Not performed.
  1: Performed.

10341	**Interval at which automatic data backup is performed periodically**

[Input type] Parameter input
[Data type] Word
[Unit of data] No unit
[Valid data range] 0 to 365
  When automatic data backup is performed periodically, this parameter sets the interval as the number of days. When the power is turned on after a set number of days has passed from the date of the previous backup, a backup operation is performed. If 0 is set in this parameter, this function is disabled.

Diagnosis display

This function enables the status of backup execution to be checked.

		#7	#6	#5	#4	#3	#2	#1	#0
1016		ANG	ACM			DT3	DT2	DT1	AEX

#0   AEX Indicates whether automatic data backup is being executed, as follows:
    0:    Not being executed
    1:    Being executed

#1   DT1 Indicates whether data 1 has been updated in the previous backup, as follows:
    0:    Not updated
    1:    Updated

#2   DT2 Indicates whether data 2 has been updated in the previous backup, as follows:
    0:    Not updated
    1:    Updated

#3   DT3 Indicates whether data 3 has been updated in the previous backup, as follows:
    0:    Not updated
    1:    Updated

#6   ACM Indicates whether automatic data backup has been executed, as follows:
    0:    Not executed
    1:    Executed

#7   ANG Indicates whether an error has occurred in automatic data backup, as follows:
    0:    Not occurred
    1:    Occurred

Caution

> ⚠ **CAUTION**
> 1 Do not turn off the power for the NC during backup or restoration.
> 2 If backed-up data is restored, parameters submitted to automatic backup are returned to the state in which they were when backed up.   Change them as required.

6   INTERFACE BETWEEN CNC AND PMC

This section briefly describes the PMC function.   It also explains the CNC-PMC interface.

6.1   WHAT IS PMC?

The programmable machine controller (PMC) is a programmable controller (PC) built into a CNC to perform sequence control for a machine tool (spindle rotation, tool change, machine operator's panel control, and so on).
Sequence control is to perform control steps successively in a predetermined sequence or according to the logic operation.
Programs for performing sequence control for machine tools are called sequence programs.   Generally, sequence programs coded in the Ladder language are used.

6.1.1   Basic Configuration of PMC

The following is the basic configuration of the PMC:
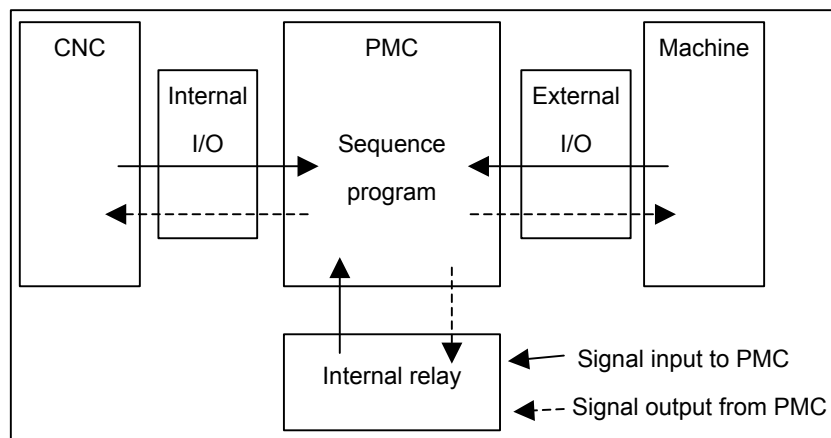
Fig. 6.1.1   Basic configuration of PMC

The sequence program reads input signals, performs operations, and outputs results in a predetermined sequence.

6.1.2   I/O Signals of PMC

Input signals of the PMC include signals input from the CNC (such as M and T function signals) and signals input from the machine (such as the cycle start button and feed hold signal button).   Output signals of the PMC include signals output to the CNC (such as the cycle start command and feed hold signal command) and signals output to the machine (such as turret rotation and spindle stop).   The PMC controls these I/O signals by executing a sequence program to control the machine tool.

6.1.3   PMC Signal Addresses

PMC signal addresses indicate the locations of I/O signals exchanged with the machine, I/O signals exchanged with the CNC, and signals for internal relays and data (PMC parameters) in nonvolatile memory. PMC addresses are roughly classified as shown in Fig. 6.1.3 (a).
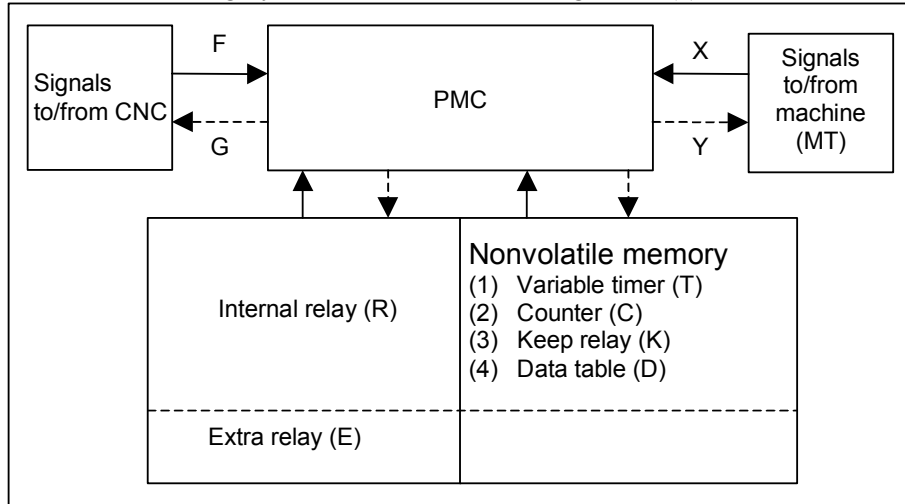
Fig. 6.1.3 (a)   PMC-related addresses

The PMC signal address format consists of an address number and bit number (0 to 7) as follows:
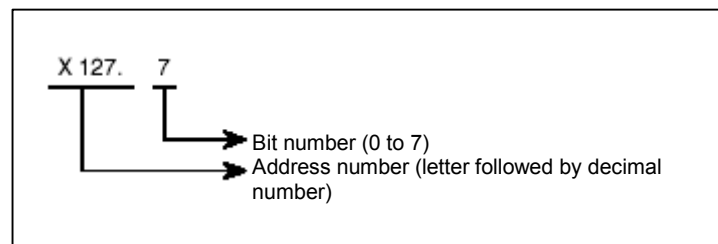
Fig. 6.1.3 (b)   PMC address format

The first letter of an address number represents the type of the signal.
In sequence programs, an address of a byte may be specified.   In the above example, specify X127 to specify a byte address.   In this case, the period "." and bit number are unnecessary.

Table 6.1.3 lists the address symbols and corresponding signals.

Table 6.1.3   Address Symbols and signal types

Symbol	Signal type
F	Input signal from CNC to PMC (CNC $\rightarrow$ PMC)
G	Output signal from PMC to CNC (PMC $\rightarrow$ CNC)
X	Input signal from machine to PMC (MT $\rightarrow$ PMC)
Y	Output signal from PMC to machine (PMC $\rightarrow$ MT)
R	Internal relay
E	Extra relay
A	Message display
T	Variable timer
C	Counter
K	Keep relay
D	Data table
L	Label number
P	Subprogram number

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(1) Addresses of signals between the PMC and CNC (F and G)
These addresses are assigned to interface signals between the CNC and PMC. The relationships between the signals and addresses are defined by the CNC.
F indicates an input signal from the CNC to PMC.
G indicates an output signal from the PMC to CNC.

(2) Addresses of signals between the PMC and machine (X and Y)
I/O signals exchanged with an externally connected machine can be assigned to any addresses within an available range to control the machine.
X indicates an input signal from the machine to PMC.
Y indicates an output signal from the PMC to machine.

(3) Addresses of internal relays and extra relays (R and E)
These addresses are used to temporarily store operation results during sequence program execution processing.
The address locations of internal relays also include a reserved area used by the PMC system software. The signals in the reserved area cannot be written by sequence programs.

(4) Signal addresses for message display (A)
Instruction "DISPB" used in sequence programs include instructions to display a message on the CNC screen. These addresses are used by such instructions.

(5) Nonvolatile memory addresses
The contents of these address locations are not erased even when the power is turned off.
These addresses are used for management of the data items listed below. These data items are called PMC parameters.
   (a) Variable timer (T)
   (b) Counter (C)
   (c) Keep relay (K)
       A reserved area used by the PMC system software is partly included.
   (d) Data table (D)

(6) Other addresses
   (a) Label number (L)
       Sequence program instructions include an instruction to cause a jump to a specified position in the middle of processing. This address indicates the jump destination used by this instruction. The contents of L address can not be read/written in sequence program.
   (b) Subprogram number (P)
       In sequence programs, a main program can call subprograms. P addresses indicate the numbers of these subprograms. The contents of P address can not be read/written in sequence program.

6.1.4   System Relay Addresses (R9000)

The System Relay is used to control a sequence program by PMC System software. And, some addresses such as 'Operation results of functional instructions' are used to condition of a sequence program.

Table 6.1.4 (a)   Address of System Relay

System Relay	R9000 to R9499

Operation results of functional instructions

This area holds information necessary for individual ladder levels, such as the operation results of functional instructions.   This information is saved/restored when the task is switched.

(1)   R9000 (operation output register for the ADDB, SUBB, MULB, DIVB, and COMPB functional instructions)

```
                7 6 5 4 3 2 1 0
       R9000   ┌─┬─┬─┬─┬─┬─┬─┬─┐
               └─┴─┴─┴─┴─┴─┴─┴─┘
                          └  The result is 0.
                          ─── The result is negative.
                          ─── The result has overflowed.
```
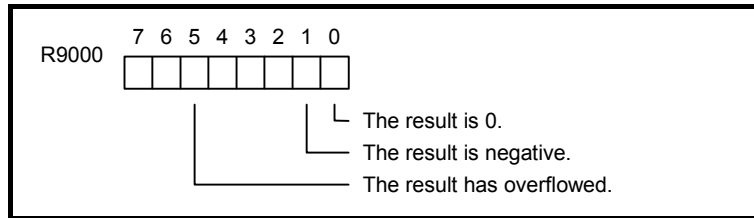
(2)   R9000 (error output for the EXIN, WINDR, and WINDW functional instructions)

```
                7 6 5 4 3 2 1 0
       R9000   ┌─┬─┬─┬─┬─┬─┬─┬─┐
               └─┴─┴─┴─┴─┴─┴─┴─┘
                          └  The result is erroneous.
```
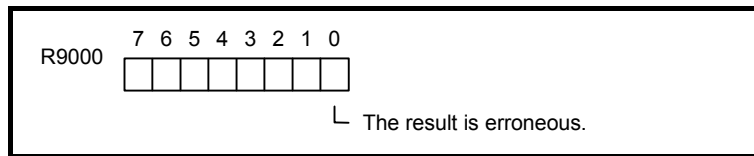
(3)   R9002 to R9005 (operation output registers for the DIVB functional instruction)
The remainder of a division performed with the DIVB functional instruction is output to these addresses.

System timers
Four signals can be used as system timers.
Their specifications are as follows.

```
                7 6 5 4 3 2 1 0
       R9000   ┌─┬─┬─┬─┬─┬─┬─┬─┐
               └─┴─┴─┴─┴─┴─┴─┴─┘
                          └  Constantly OFF signal
                          ─── Constantly ON signal
                          ─── 200 msec cyclic signal
                              (104 msec ON and 96 msec OFF)
                          ─── 1 sec cyclic signal
                              (504 msec ON and 496 msec OFF)
```
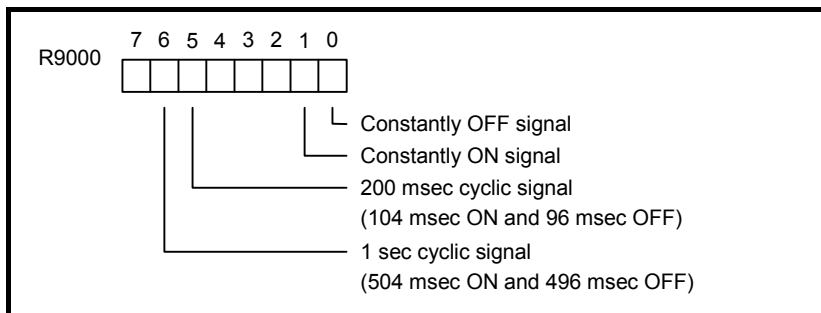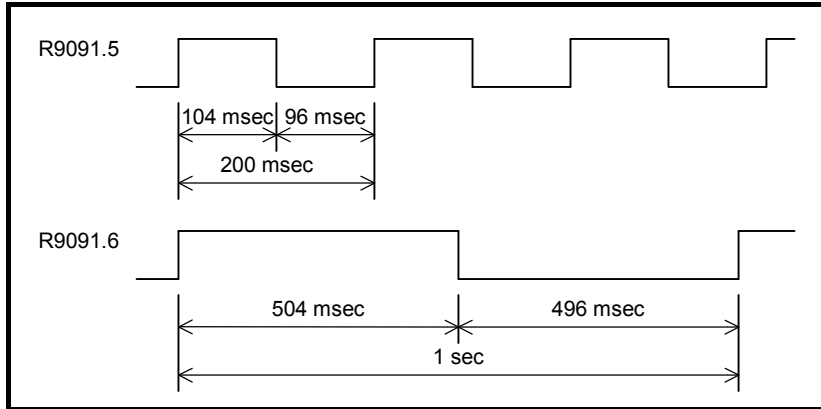
> ⚠ **CAUTION**
> 1 Each signal is initially OFF.
> 2 The signals R9091.0, R9091.1 are set at the beginning of the first ladder level on every cycle.
> 3 Each pulse signal (ON-OFF signal) has an error of ±8 msec (ladder execution period).

Ladder execution start signal
Ladder stop signal
Ladder execution status signal

Using the ladder execution start and stop signals in a ladder program can detect when the ladder program starts and stops.

Referencing the ladder execution status signal from an external system or program, such as the network board, C Language executor program, FOCAS2 Ethernet, or HSSB library, can detect the execution status of the ladder program.
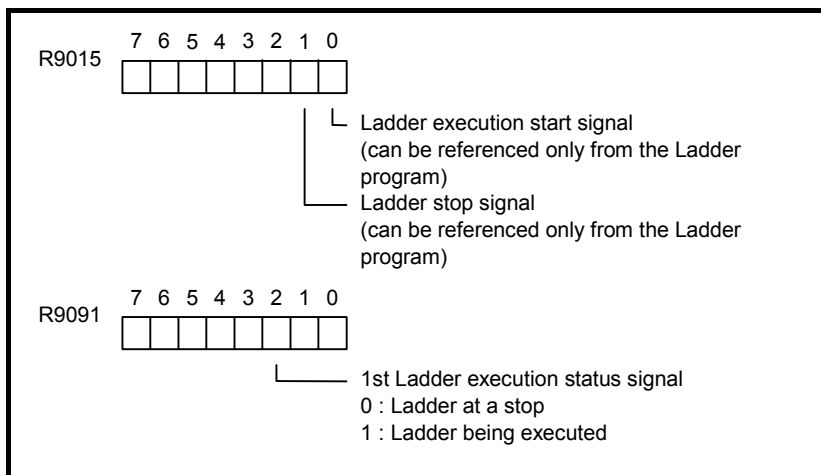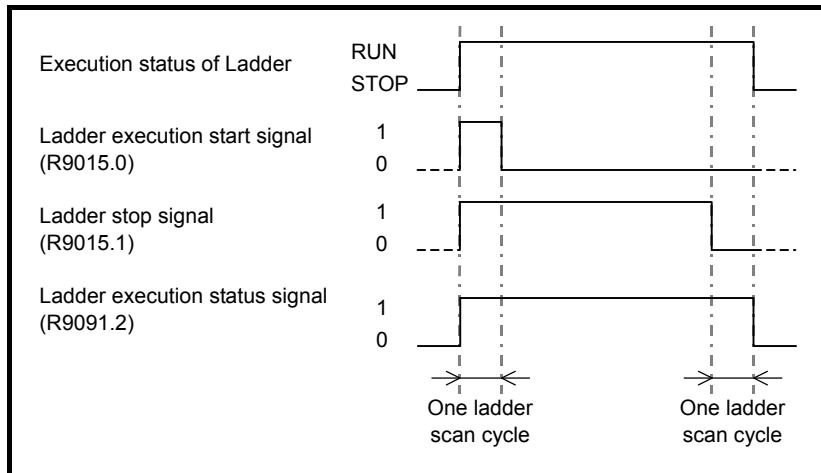
(1) Ladder execution start signal (R9015.0)
When directed to start ladder program execution, the system software starts executing the ladder program, turns on this signal, and keeps it on for the first one scan cycle.   Like R9000, this signal indicates the status of ladder execution corresponding to each ladder execution level.   For this reason, this signal is securely turned on for the first one scan cycle after the start of execution no matter on what execution level the signal is referenced.   This signal is turned on when:

(a) Ladder execution begins at power turn-on.

(b) The [RUN] soft key on the PMC screen is pressed.

(c) FANUC LADDER-III or a ladder editing package directs the ladder to start.

Referencing this signal in a ladder program can detect when ladder execution has begun, making it possible to program preprocessing related to ladder execution.

> ⚠ **CAUTION**
> Reference this signal only within a ladder program.   Do not reference it from an external system or program as it indicates the status of ladder execution separately for each ladder execution level.

(2) Ladder stop signal (R9015.1)
When directed to stop ladder program execution, the system software turns off this signal and keeps it off for the last one scan before stopping ladder program execution.   Like R9000, this signal indicates the status of ladder execution corresponding to each ladder execution level.   For this reason, this signal is securely turned off for the last one scan before the stop of execution no matter on what execution level the signal is referenced.   This signal is turned off when:

(a) The [STOP] soft key on the PMC screen is pressed.

(b) FANUC LADDER-III or a ladder editing package directs the ladder to stop.

(c) On the PMC DATA I/O screen, the ladder program is loaded to the PMC.

(d) FANUC LADDER-III or a ladder editing package stores the ladder program to the PMC.

Referencing this signal in a ladder program can detect when ladder execution stops, making it possible to program post processing related to ladder execution (that is, preprocessing for ladder execution stop).   Before the ladder is stopped, for example, it is possible to put signals in a proper state for safety purposes.

⚠ CAUTION
1 Reference this signal only within the ladder program.   Do not reference it from an external system or program as it indicates the status of ladder execution separately for each ladder execution level.
2 If the power is turned off or a CNC system alarm occurs, ladder execution and I/O signal transfer are immediately stopped for safety purposes.   In this case, therefore, this signal cannot be used.

---

(3) Ladder execution status signal (R9091.2)
Referencing this signal from an external system or program, such as the network board, C language executor program, FOCAS2 Ethernet, or HSSB library, can detect the execution status of the ladder program.

(4) Example of using the signals
(a) Example of calling a subprogram just before the ladder stops

```
        R9015.1
          ┌──────┬───────┐
  ──┤/├───┤SUB65 │ Pxxxx │────────
          │CALL  │       │
          └──────┴───────┘
```
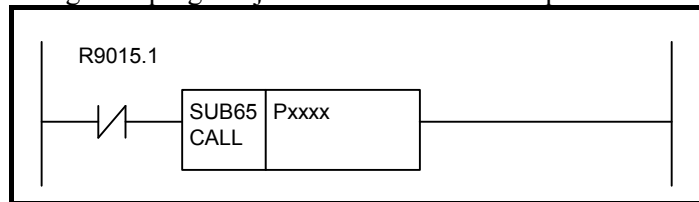
(b) Example of forcibly turning off an output signal programmed on the first ladder level just before the ladder stops

```
                  R9015.1
     Input                                      Output
  ───┤ ├──┬──┤ ├──────────────────────────────────( )──
          │
       ───┤ ├─┘
```
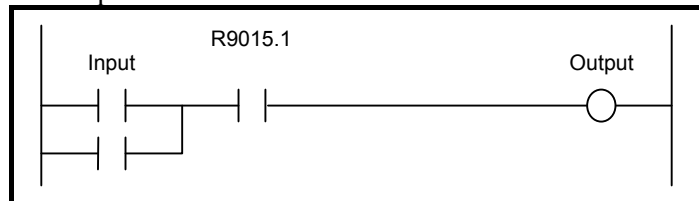
(c) Example of sending an execution-in-progress signal to the outside
Outputting the status of this signal as the DO signal (output address from the PMC) assigned to the I/O Link causes the CNC unit to be interlocked with an external system.

```
 ┌─────────────────────────────────┐
 │ CNC Unit                        │
 │  ┌──────────────────┐    Y0.0   │      ┌───────────────┐
 │  │ R9015.1          │  ────────▶│      │               │
 │  │ ──┤ ├─────( )     │   ╭╮      │      │ I/O Link slave│
 │  │          Y0.0    │   │ │     │      │               │
 │  └──────────────────┘   I/O Link│      └───────────────┘
 └─────────────────────────────────┘
```
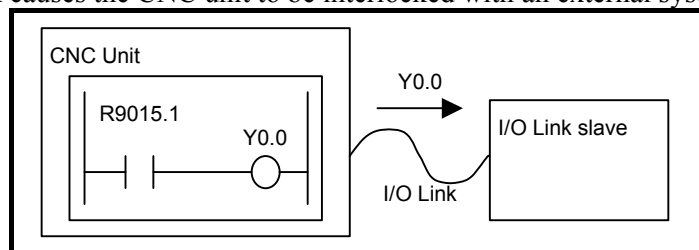
6.2 PMC SPECIFICATIONS

6.2.1 Basic Specifications

Table 6.2.1 (a)   Basic specifications of each PMC path

Function	0*i*-D PMC	0*i*-D / 0*i* Mate-D PMC/L	0*i*-D DCSPMC (Note 9)
Programming language	Ladder Function block (Note4)	Ladder Function block (Note4)	Ladder Function block (Note4)
Number of ladder levels	3	2 (Note1)	2 (Note1)
Level 1 execution period	8 msec	8 msec	8 msec
Processing power • Basic instruction processing speed	25 nsec/step	1 μsec/step	1 μsec/step
Program capacity (Note2) • Ladder • Symbol & Comment • Message	Up to about 32,000 steps At least 1KB At least 8KB	Up to about 8,000 steps At least 1KB At least 8KB	Up to about 3,000 steps At least 1KB At least 8KB
Instructions • Basic instructions • Functional instructions (Note3)	14 93 (105)	14 92 (105)	14 85 (105)
Instructions(option) • Basic instructions • Functional instructions (Note3)	24 218 (230)	24 217 (230)	24 210 (230)
CNC interface • Inputs (F) • Outputs (G)	768 bytes × 2 768 bytes × 2	768 bytes 768 bytes	768 bytes 768 bytes
DI/DO • I/O Link • Inputs (X) • Outputs (Y)	Up to 2,048 points Up to 2,048 points	Up to 1,024 points(Note8) Up to 1,024 points(Note8)	Up to 64 points Up to 64 points
Symbol & Comment(Note5) • Number of symbol characters • Number of comment characters (Note6)	40 255	40 255	40 255
Program storage area (Flash ROM) (Note7)	Up to 384KB	128KB	128KB

NOTE
1 A program can be created on level 3 for the compatibility with programs for other models, but it is not executed.
2 The maximum overall program size (including the maximum number of ladder steps, symbols/ comments, and messages) varies depending on option settings. See PMC PROGRAMMING MANUAL (B-64393EN) .
3 For the number of functional instructions, each parenthesized number indicates the number of all functional instructions, and each non-parenthesized number, the number of valid functional instructions.
4 To use the Function Block function, its option is necessary for each CNC. When specifying this option, the Extended PMC Ladder Instruction Function can also be used. Because the Extended PMC Ladder Instruction Function is included in the Function Block function, it is not necessary to order the option of the Extended PMC Ladder Instruction Function separately.
5 These are the number for extended symbol and comment character. The number of basic symbol character is 16 and the number of comment character is 30. Refer to PMC PROGRAMMING MANUAL (B-64393EN) for details
6 This number is the number of single-byte characters. When you use double-byte characters as a comment, the number becomes half.
7 The capacity of the program storage area varies depending on option settings. See PMC PROGRAMMING MANUAL (B-64393EN).
8 Maximum input/output number of I/O link for 0i Mate-D is 256points/256points.
9 This PMC is used for Dual Check Safety function (option) and handles the safety related signals. See "FANUC Series 0i-D Dual Check Safety Connection Manual (B-64303EN-4)" for details.

Table 6.2.1 (b)   Basic specifications of each PMC Memory Type

Function	0i-D PMC	0i-D / 0i Mate-D PMC/L	0i-D DCSPMC (Note 2)
PMC Memory			
• Internal relay (R)	8,000 bytes	1,500 bytes	1,500 bytes
• System Relay (R9000)	500 bytes	500 bytes	500 bytes
• Extra relay (E)	10,000 bytes	10,000 bytes	(Note 3)
• Message display (A) · Display requests · Status displays	 2,000 points 2,000 points	 2,000 points 2,000 points	 (Note 4) (Note 4)
Nonvolatile memory			
• Timer (T) · Variable timer · Variable timer precision (Note 1)	 500 bytes (250 pieces) 500 bytes (250 pieces)	 80 bytes (40 pieces) 80 bytes (40 pieces)	 80 bytes (40 pieces) 80 bytes (40 pieces)
• Counter (C) · Variable counter · Fixed counter	 400 bytes (100 pieces) 200 bytes (100 pieces)	 80 bytes (20 pieces) 40 bytes (20 pieces)	 80 bytes (20 pieces) 40 bytes (20 pieces)
• Keep relay (K) · User area · System area	 100 bytes 100 bytes	 20 bytes 100 bytes	 20 bytes 100 bytes
• Data table (D)	10,000 bytes	3,000 bytes	3,000 bytes
Functional instructions			
• Variable timers (TMR)	250 pieces	40 pieces	40 pieces
• Fixed timers (TMRB/TMRBF)	500 pieces	100 pieces	100 pieces
• Variable counters (CTR)	100 pieces	20 pieces	20 pieces
• Fixed counters (CTRB)	100 pieces	20 pieces	20 pieces
• Rising/Falling edge detection (DIFU/DIFD)	1,000 pieces	256 pieces	256 pieces
• Labels (LBL)	9,999 pieces	9,999 pieces	9,999 pieces
• Subprograms (SP)	5,000 pieces	512 pieces	512 pieces

NOTE
1 This area is used to specify the precision of the variable timer.   Do not use this area in user programs.
2 This PMC is used for Dual Check Safety function (option). See "FANUC Series 0i-D Dual Check Safety Connection Manual (B-64303EN-4)" for details.
3 There are no extra relays in Dual Check Safety PMC.
4 The message display relay can not be used in Dual Check Safety PMC because of invalid function.

Table 6.2.1 (c)   PMC Address list

Signals	Symbol	0*i*-D PMC	0*i*-D / 0*i* Mate-D PMC/L	0*i*-D DCSPMC (Note 4)
Input signal to the PMC from the machine	X	X0~X127 X200~X327 X400~X527 (Note1) X600~X727 (Note1) X1000~X1127(Note1)	X0~X127	X0~X127
Output signal from the PMC to the machine	Y	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527(Note1) Y600 ~ Y727(Note1) Y1000 ~ Y1127 (Note1)	Y0 ~ Y127	Y0 ~ Y127
Input signal to the PMC from the CNC	F	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767(Note2) F3000 ~ F3767(Note2) F4000 ~ F4767(Note2) F5000 ~ F5767(Note2) F6000 ~ F6767(Note2) F7000 ~ F7767(Note2) F8000 ~ F8767(Note2) F9000 ~ F9767(Note2)	F0 ~ F767 F1000 ~ F1767 (Note2)	F0 ~ F767
Output signal from the PMC to the CNC	G	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767(Note2) G3000 ~ G3767(Note2) G4000 ~ G4767(Note2) G5000 ~ G5767(Note2) G6000 ~ G6767(Note2) G7000 ~ G7767(Note2) G8000 ~ G8767(Note2) G9000 ~ G9767(Note2)	G0 ~ G767 G1000 ~ G1767 (Note2)	G0 ~ G767
Internal relay	R	R0 ~ R7999	R0 ~ R1499	R0 ~ R1499
System relay	R	R9000 ~ R9499	R9000 ~ R9499	R9000 ~ R9499
Extra relay	E	E0 ~ E9999	E0 ~ E9999	(Note 5)
Message display -Display request -Display status	A	 A0 ~ A249 A9000 ~ A9249	 A0 ~ A249 A9000 ~ A9249	 (Note 6) (Note 6)
Timer -Variable timer -Variable timer precision (Note3)	T	 T0 ~ T499 T9000 ~ T9499	 T0 ~ T79 T9000 ~ T9079	 T0 ~ T79 T9000 ~ T9079
Counter -Variable counter -Fixed counter	C	 C0 ~ C399 C5000 ~ C5199	 C0 ~ C79 C5000 ~ C5039	 C0 ~ C79 C5000 ~ C5039
Keep relay -User area -System area	K	 K0 ~ K99 K900 ~ K999	 K0 ~ K19 K900 ~ K999	 K0 ~ K19 K900 ~ K999
Data table	D	D0 ~ D9999	D0 ~ D2999	D0 ~ D2999
Label	L	L1 ~ L9999	L1 ~ L9999	L1 ~ L9999
Subprogram	P	P1 ~ P5000	P1 ~ P512	P1 ~ P512

NOTE
1   This area is reserved for PMC management software.   No I/O can be allocated in this area.   Do not use it in user programs.
2   This area is reserved for PMC management software.   Do not use it in user programs.
3   This area is used to specify the precision of a variable timer.
    -   Don't modify the value of timer and precision except for writing same value when working the timer.
    -   Don't set the value other than the following range.
    -   If above rules are violated, the working of the timer is not guaranteed.
    -   Other than the range from T9000 to T9999 are reserved.

    The value of precision
      0: Default (8msec or 48msec)
      1: 1msec
      2: 10msec
      3: 100msec
      4: 1sec
      5: 1min

4   This PMC is used for Dual Check Safety function (option). See "FANUC Series 0i-D Dual Check Safety Connection Manual (B-64303EN-4)" for details.
5   No extra relay is available for the Dual Check Safety PMC.
6   No message display relay can not be used in Dual Check Safety PMC because of invalid function.

6.3   OPERATING THE PMC SCREEN

The basic configuration of the PMC screen is described below.
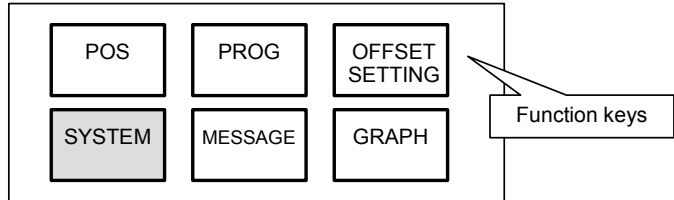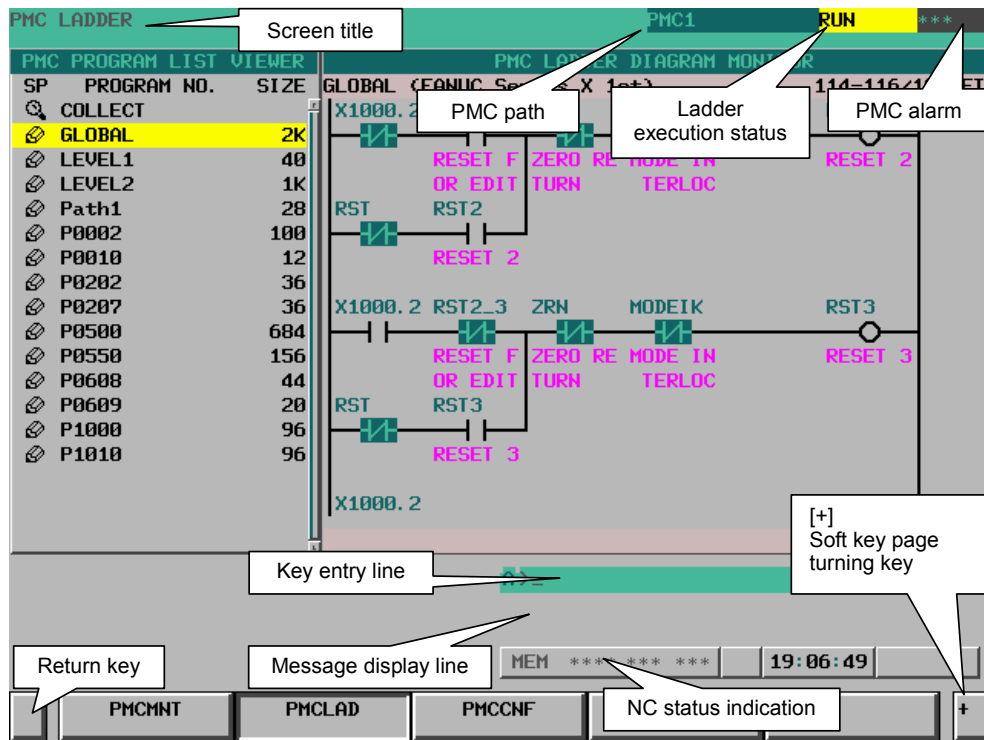
- Screen title   : Displays the name of a specific submenu of the PMC.
- Ladder execution status : Displays the execution status of the ladder program.
- PMC alarm   : Indicates whether any PMC alarm is occurring.
- PMC path   : Displays the currently selected PMC.
- Key entry line   : Line for entering a numerical value or character key string.
- Message display line   : Displays an error or warning message.
- NC status indication   : Displays the NC mode, the execution status of the NC program, the currently selected NC path number.
- Return key   : Used to switch from the PMC operation menu to a specific PMC submenu or from a specific PMC submenu to the main menu of the PMC.
- Soft key page turning key : Used to turn soft key pages.

About the PMC screen

When you press the [SYSTEM] function key and then turn the soft key page by pressing the [+] soft key, the main menu of the PMC is displayed.

The PMC main menu offers the following three types of submenus, which are respectively used for specific purposes.

- PMC Maintenance ([PMCMNT] screen)
- PMC Ladder ([PMCLAD] screen)
- PMC Configuration ([PMCCNF] screen)

Each of these PMC submenus is explained below.

(1) PMC Maintenance menu
   This menu displays the screens related to the maintenance of the PMC, such as those for PMC signal status monitoring and traces and for PMC data display and editing.

(2) PMC Ladder menu
   This menu displays the screens related to the display and editing of the ladder program.

(3) PMC Configuration menu
   This menu displays the screens related to the display and editing of the data other than the ladder constituting the sequence program, as well as the screen for setting the PMC functions.

This manual briefly describes the screen of each of the PMC maintenance and PMC ladder menus.   For detailed descriptions and the PMC configuration menu, refer to "PMC Programming Manual (B-64393EN)."

6.3.1 Transition of the PMC Screens
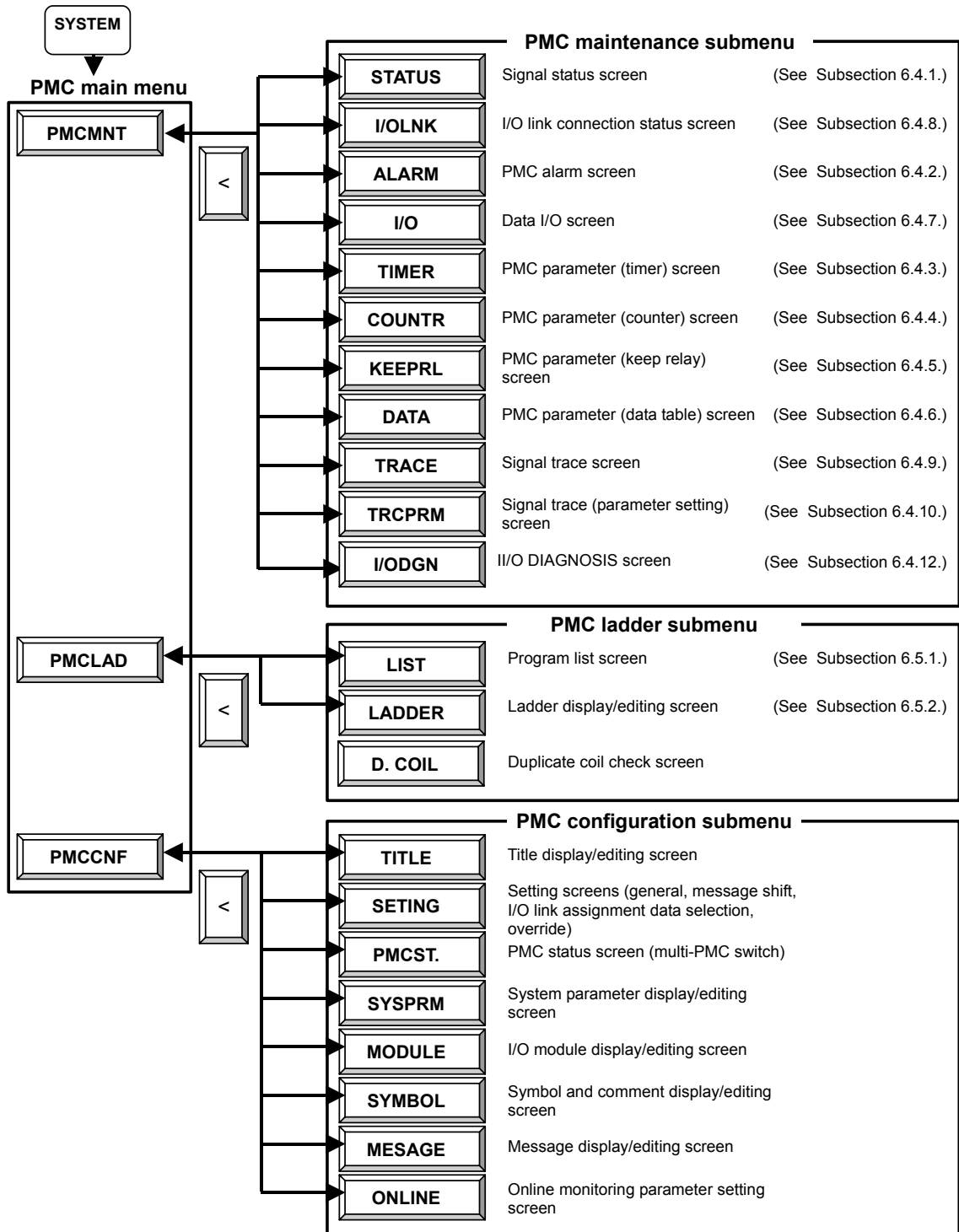
6.4 PMC DIAGNOSIS AND MAINTENANCE SCREENS ([PMCMNT])

6.4.1 Monitoring PMC Signal Status ([STATUS] Screen)

The SIGNAL STATUS screen displays the data at all addresses specified in the program.   The data of each address consists of a bit pattern ("0"s and/or "1"s) and a hexadecimal or decimal number at the rightmost position on a byte-by-byte basis.
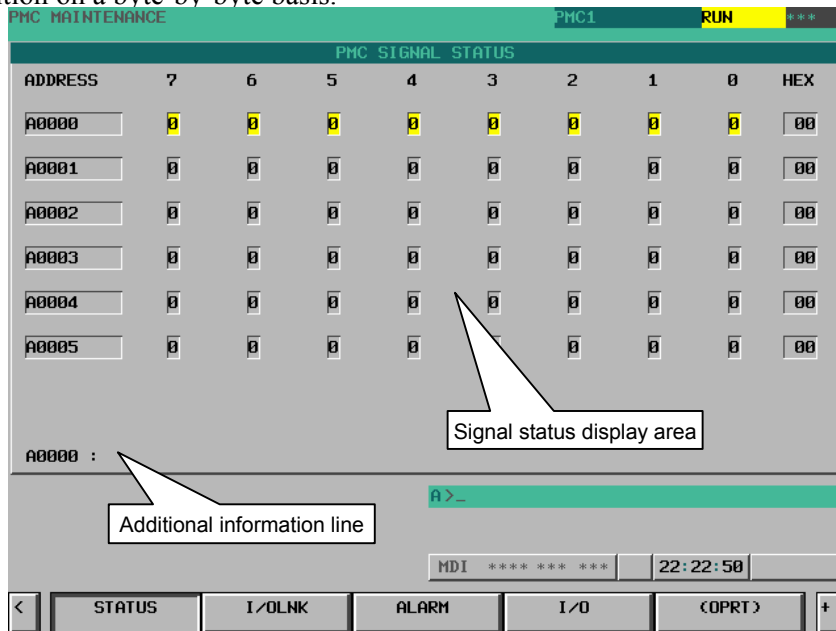
The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed.   When the cursor is placed on a byte, the byte symbol and comment are displayed.
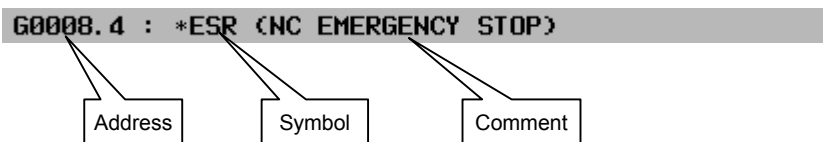
Table contents
- ADDRESS: Address referenced by a sequence program
- 0 to 7:   Data at each bit position
- HEX: Display of each byte in hexadecimal
- DEC: Display of each byte in decimal

Operation procedure
(1) Press the [STATUS] soft key.   The screen shown above appears.
(2) Key in an address whose data to be displayed, then press the [SEARCH] soft key.
(3) The data starting at the input address is displayed as a bit pattern.
(4) To display the data at another address, press the cursor keys, page keys, or [SEARCH] soft key.
(5) To modify the status of a signal, switch to the forced I/O screen by pressing the [FORCE] soft key.

```
NOTE
   The [FORCE] soft key is displayed and usable when the forced I/O function is
   enabled.    For details, see PMC PROGRAMMING MANUAL (B-64393EN).
```

(6) On the forced I/O screen, an overridden X signal or Y signal is prefixed by a greater-than sign (>) to indicate the setting of override.

ADDRESS	7	6	5	4	3	2	1	0	HEX
X0000	0	>1	0	1	>0	0	>0	0	50

Soft keys on the Signal Status screen

Address search   Switching to display in decimal   Switching to the forced I/O screen

| < | SEARCH | DEC | | | FORCE | + |
| < | | | | SW PMC | | + |

Switching to display in hexadecimal

| < | SEARCH | HEX | | | FORCE | + |
| < | | | | SW PMC | | + |
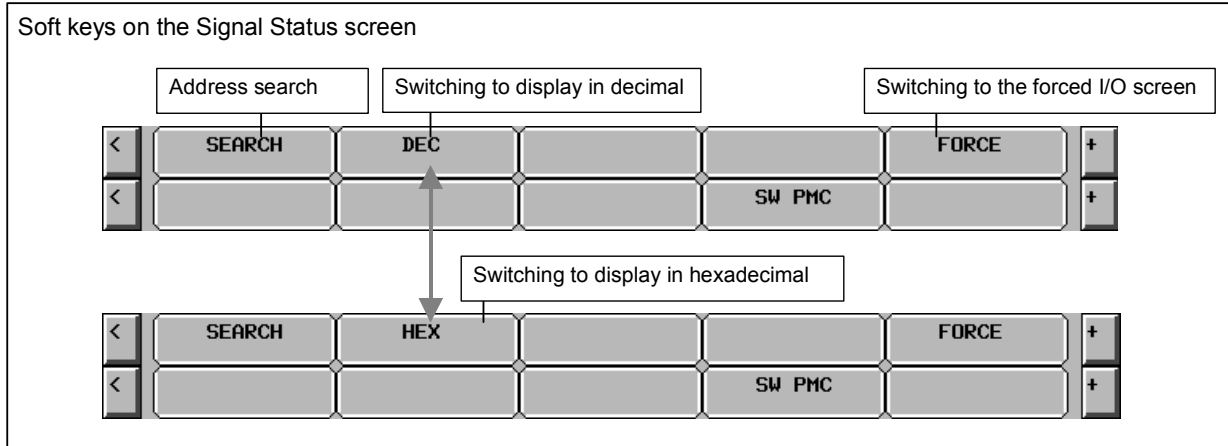
Fig. 6.4.1 (a)   Soft keys on the SIGNAL STATUS screen

6.4.2   Checking PMC Alarms ([ALARM] Screen)

On this screen, an alarm message output from the PMC is displayed.   To move to the PMC alarm screen, press the [ALARM] soft key.
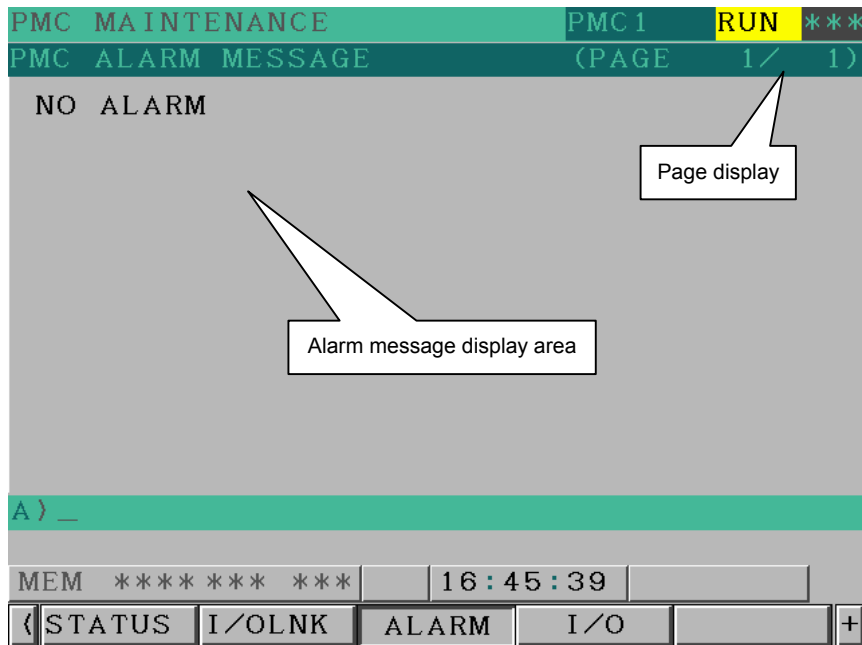
In the alarm message display area, an alarm message output from the PMC is displayed.   When many alarm messages are output to two or more pages, the page keys can be used to switch from one page to another.

In the page display area to the right of the title, the number of the page currently displaying messages is indicated.

For information about messages displayed, see Appendix A "Alarm List."

6.4.3   Setting and Displaying Variable Timers ([TIMER] Screen)

This screen is used to set and display timer values for functional instruction variable timers (TMR:SUB 3).
This screen can be used in one of two modes: the simple display mode and the comment display mode.
To move to the TIMER screen, press the [TIMER] soft key.
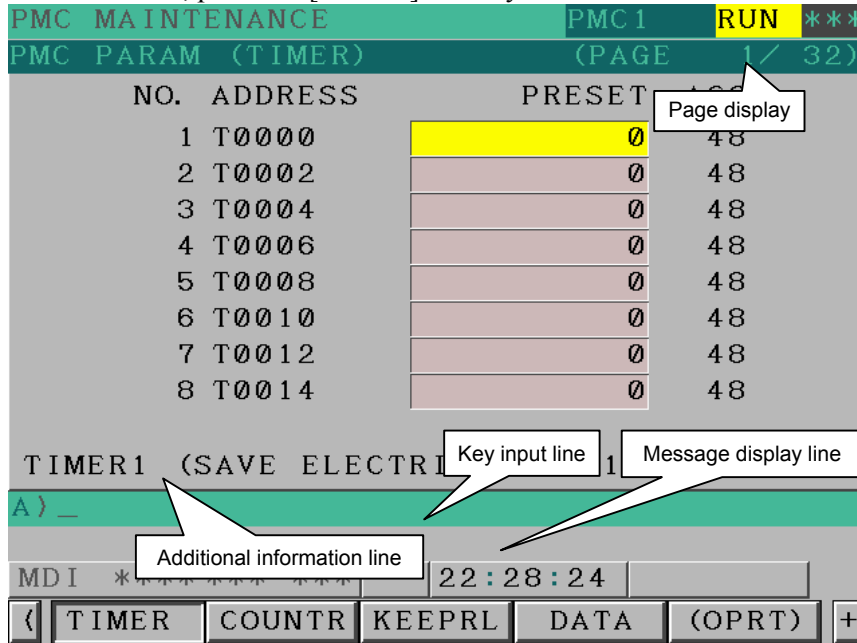
Simple display mode
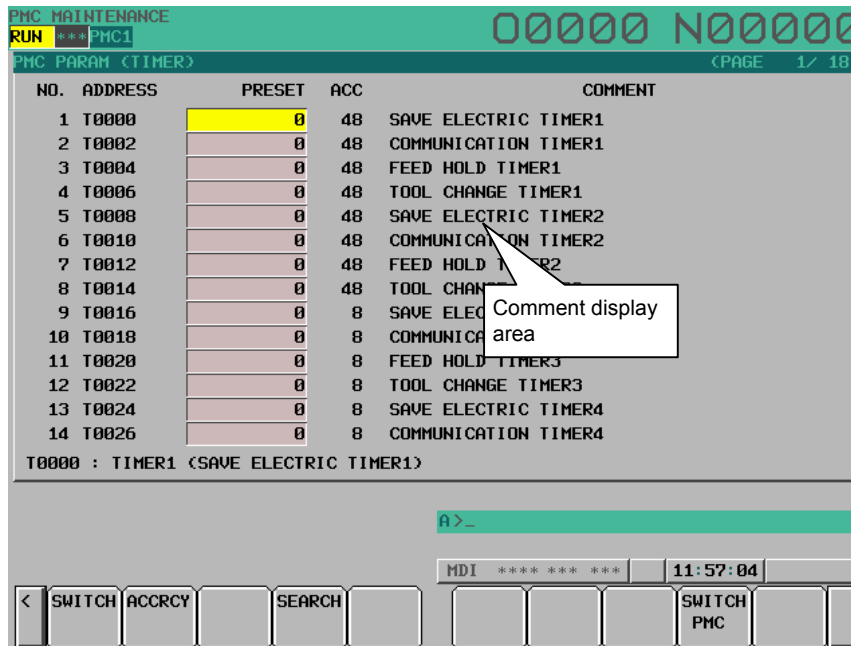
Comment display mode (12-soft key display unit)

Table contents

- NO. : Timer number specified for a functional instruction timer.
- ADDRESS : Address referenced by a sequence program
- PRESET : Timer setting value
- ACC : Timer accuracy
- COMMENT : T address comment

In the PRESET column, timer setting values are displayed. When the timer accuracy is 8, 48, 1, 10, or 100 msec, only a numeric value is displayed. When the timer accuracy is the second or minute, a time value is displayed using H, M, and S with the separator "_" used to delimit one unit from another as follows:

aaH_bbM_ccS

In the ACC column, timer accuracy values are displayed. The table below indicates the time setting values and notation of each accuracy value.

Timer No.	Accuracy notation	Minimum time setting	Maximum time setting
1 to 8	48 (initial value)	48 msec	1572.8 seconds
9 to 250	8 (initial value)	8 msec	262.1 seconds
1 to 250	1	1 msec	32.7 seconds
1 to 250	10	10 msec	327.7 seconds
1 to 250	100	100 msec	54.6 minutes
1 to 250	S	1 second	546 minutes
1 to 250	M	1 minute	546 hours

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed.

- 214 -
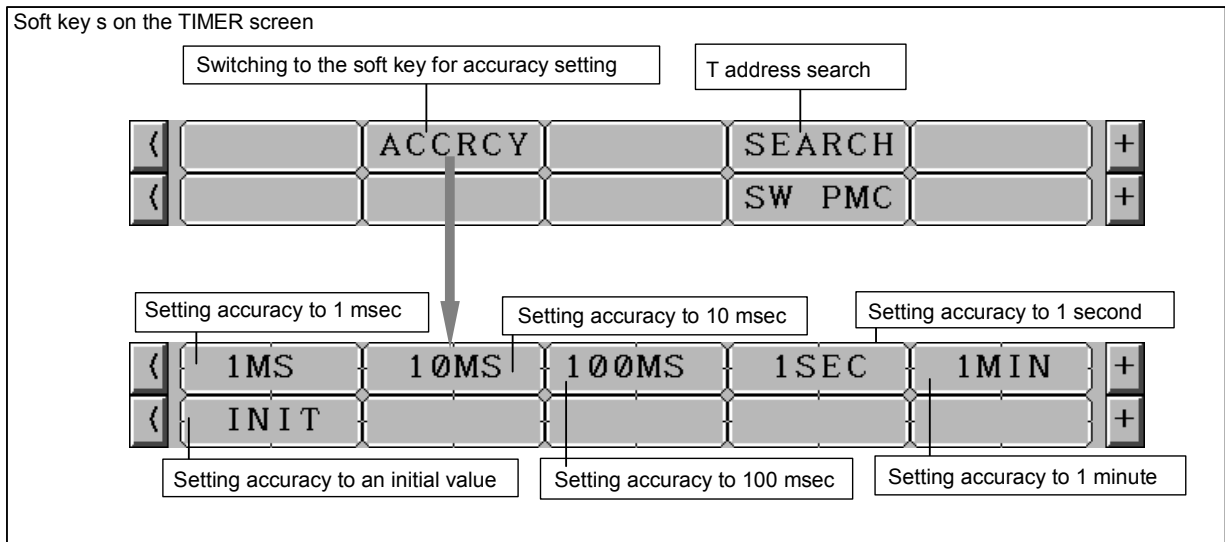
6.4.4   Setting and Displaying Counter Values ([COUNTR] Screen)

This screen is used to set and display the maximum and minimum counter values for functional instruction counters (CTR: SUB 5). This screen can be used in one of two modes: the simple display mode and the comment display mode. To move to the COUNTER screen, press the [COUNTR] soft key.
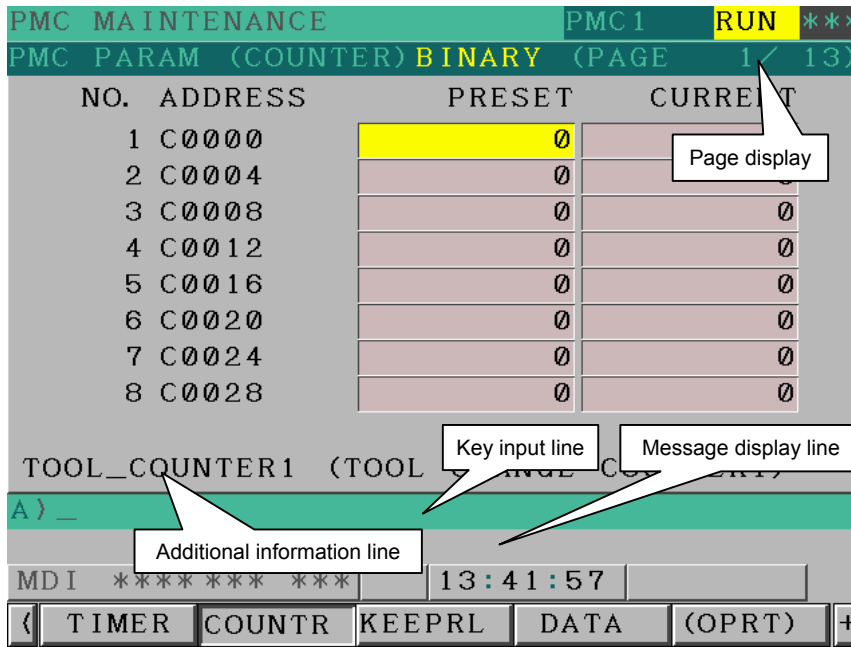
Simple display mode
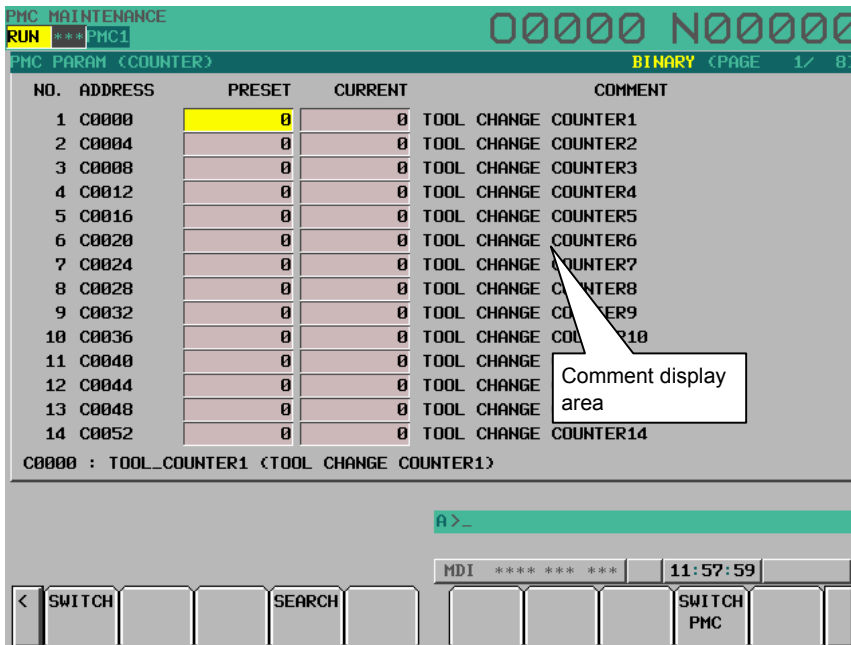
Comment display mode (12-soft key display unit)

Table contents

- NO.   : Counter number specified for a functional instruction counter
- ADDRESS   : Address referenced by a sequence program
- PRESET   : Maximum counter value (a minimum counter value is specified by a counter instruction)
- CURRENT   : Current counter value
- COMMENT   : Comment on the C address of a setting value

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. If the cursor is placed on a PRESET value, the symbol and comment of the address of the PRESET value are displayed. If the cursor is placed on a CURRENT value, the symbol and comment of the address of the CURRENT value are displayed.

Counter types and maximum values

Counter type	PRESET maximum value	CURRENT maximum value
BINARY	32767	32767
BCD	9999	9999

Soft keys on the COUNTER screen

C address search

| (| | | | SEARCH | | + |
| (| | | | SW PMC | | + |

6.4.5 Setting and Displaying Keep Relays ([KEEPRL] Screen)

This screen is used for setting and displaying the Keep Relays. To move to the KEEP RELAY screen, press the [KEEPRL] soft key.
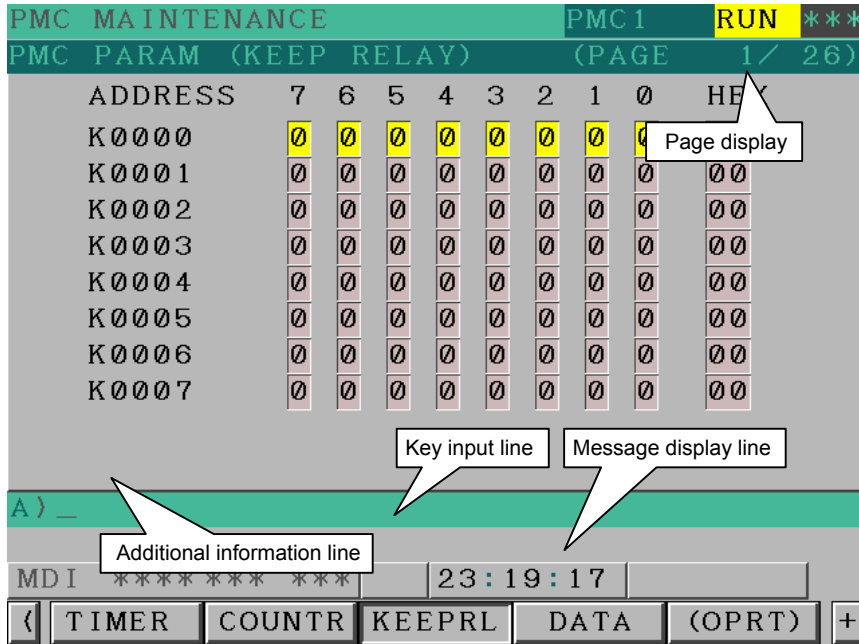
Contents of the table

- ADDRESS : Address referred by sequence Program
- 0 to 7 : Contents of each bit
- HEX : Value of the byte data in hexadecimal notation

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. When the cursor is placed on a byte, the byte symbol and comment are displayed.

Since Keep Relay is nonvolatile memory, the contents are not lost even if you turn off the power.

The Keep Relay area consists of parts as follows.

	0*i*-D PMC	0*i*-D /0*i* Mate-D PMC/L	0*i*-D DCSPMC
User area	K0 to K99	K0 to K19	K0 to K19
Area for management software	K900 to K999	K900 to K999	K900 to K999

> ⚠ **CAUTION**
> If the area for the PMC management software is protected by the programmer protection function, the area is not displayed on the KEEP RELAY screen. For details, see PMC PROGRAMMING MANUAL (B-64393EN).

6.4.6   Setting and Displaying Data Tables ([DATA] Screen)

There are two data table types (DATA TABLE CONTROL and DATA TABLE). To move to the data screen, press the [DATA] soft key.

DATA TABLE CONTROL screen ([List] screen)

Pressing the [DATA] soft key displays the DATA TABLE CONTROL screen for data table management. This screen can be used in one of two modes: the simple display mode and the comment display mode.
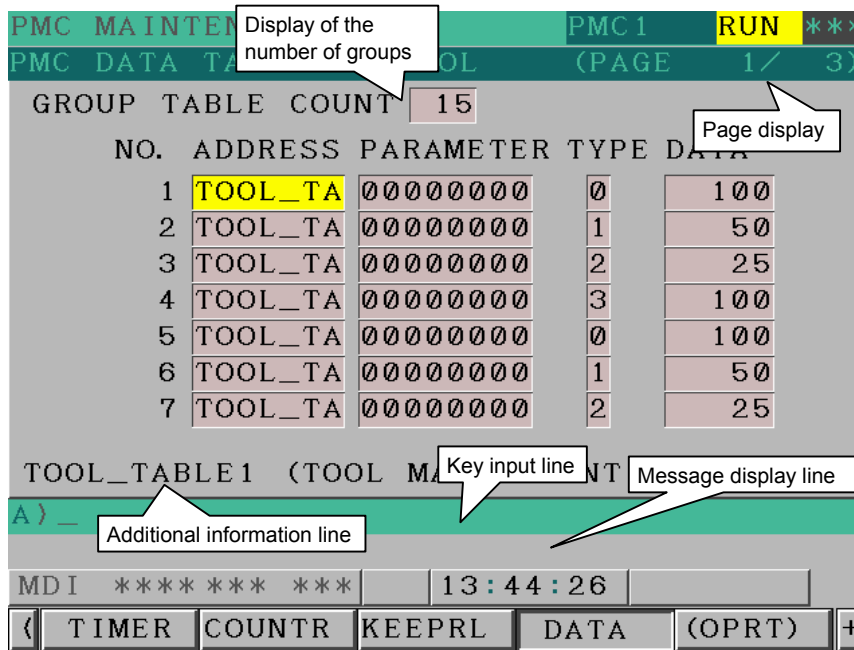
Simple display mode
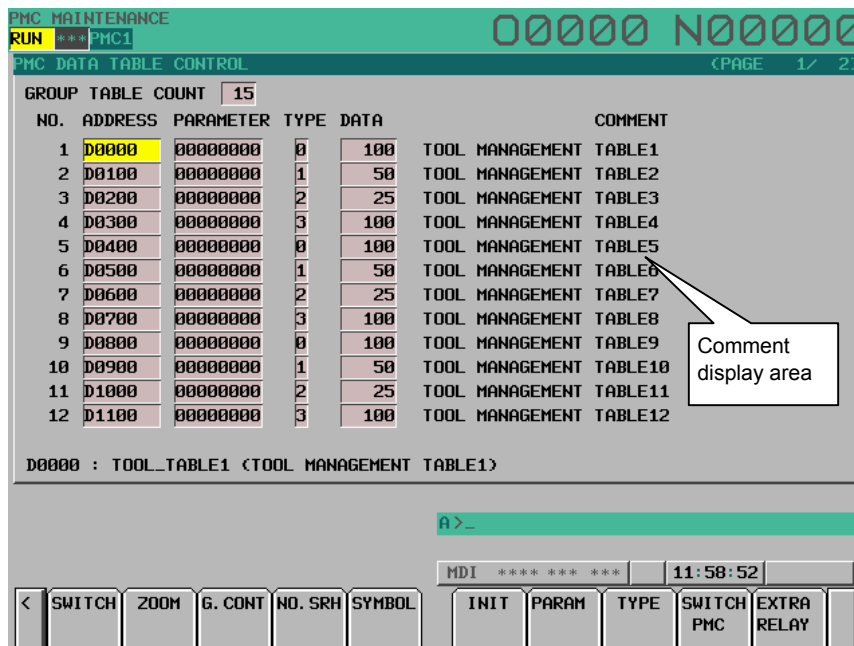
Comment display mode (12-soft key display unit)

- Table contents

- GROUP TABLE COUNT   : Number of data items in the data table
- NO.   : Group number
- ADDRESS   : Data table start address
- PARAMETER   : Data table control parameter
- TYPE   : Data length (0 = 1 byte, 1 = 2 bytes, 2 = 4 bytes, 3 = bit)
- DATA   : Number of data items in each data table
- COMMENT   : Comment on the start D address of each group

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. When the cursor is placed on the PARAMETER, TYPE, or DATA column, the current setting is displayed.

The ADDRESS column displays the start address of a data table. Multiple groups may share an address. When the [SYMBOL] soft key is pressed, the symbol of the start address is displayed.

NOTE
The data table control parameters have the following meanings:

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

- 0: Binary format
- 1: BCD format (Bits 2 and 3 are invalid.)
- 0: Without input protection
- 1: With input protection
- 0: Binary or BCD format (Bit 0 is valid.)
- 1: Hexadecimal format (Bits 0 and 3 are invalid.)
- 0: Signed (valid only when bits 0 and 2 are set to 0)
- 1: Unsigned (valid only when bits 0 and 2 are set to 0)
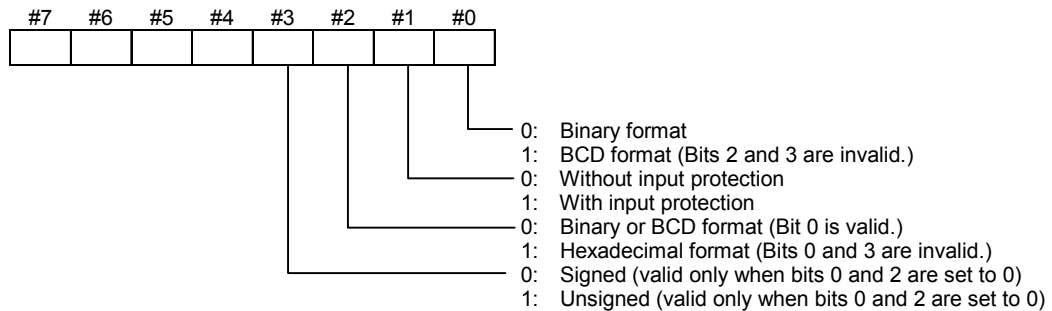
NOTE
1 When data table control data is protected by the programmer protection function, the data table control data screen is not displayed. For details, see PMC PROGRAMMING MANUAL (B-64393EN).
2 When PMC parameters are output using the I/O screen (see Subsection 6.4.7, "Data Input/Output ([I/O] Screen)"), only the data of an address D area set in the data table control data is output from the data table screen. The data of an address D area not set in the data table control data is not output.

Soft keys on the DATA TABLE CONTROL screen

Switching to the zoom screen

Group number search

Symbol display switching

⟨ | | ZOOM | G. CONT | NO. SRH | SYMBOL | + |

Input of the number of groups

Address display switching

ADRS

Data table control data initialization

Switching to the soft keys for data size setting

Switching to Extra relay screen

⟨ | INIT | PARAM | TYPE | SW PMC | RELAY | + |

Switching to the soft keys for parameter setting

TABLE

Switching to Data table screen

Soft keys for parameter setting

Setting for signed decimal

Setting for BCD

Protection state modification

⟨ | SIGN | UNSIGN | BCD | HEX | PROT. | |

Setting for unsigned decimal

Setting for hexadecimal

Soft keys for data size setting

Setting for byte

Setting for bit

⟨ | BYTE | WORD | DWORD | BIT | | |

Setting for word

Setting for double word

DATA TABLE screen ([ZOOM] screen)

If the data table control data is specified, pressing the [ZOOM] soft key on the data table control data screen displays the data table setting screen. This screen can be used in one of three modes: the simple display mode, the comment display mode, and the bit display mode.

Simple display mode

Comment display mode (12-soft key display unit)

```
PMC MAINTENANCE                        PMC1   RUN ***
PMC PARAM (DATA TABLE)         (PAGE  1/  15)
  NO. 4    SIGN DEC:BIT  NO PROT.

    ADDRESS 7  6  5  4  3  2  1  0    HEX
    D0300   0  0  0  0  0  0  0  0    00
    D0301   0  0  0  0  0  0  0  0    00
    D0302   0  0  0  0  0  0  0  0    00
    D0303   0  0  0  0  0  0  0  0    00
    D0304   0  0  0  0  0  0  0  0    00
    D0305   0  0  0  0  0  0  0  0    00
    D0306   0  0  0  0  0  0  0  0    00

  TOOL_TABLE4  (TOOL MANAGEMENT TABLE4)
  A)_

  MDI  **** *** ***     09:42:29
  (        LIST   G-SRCH SEARCH  RELAY +
```
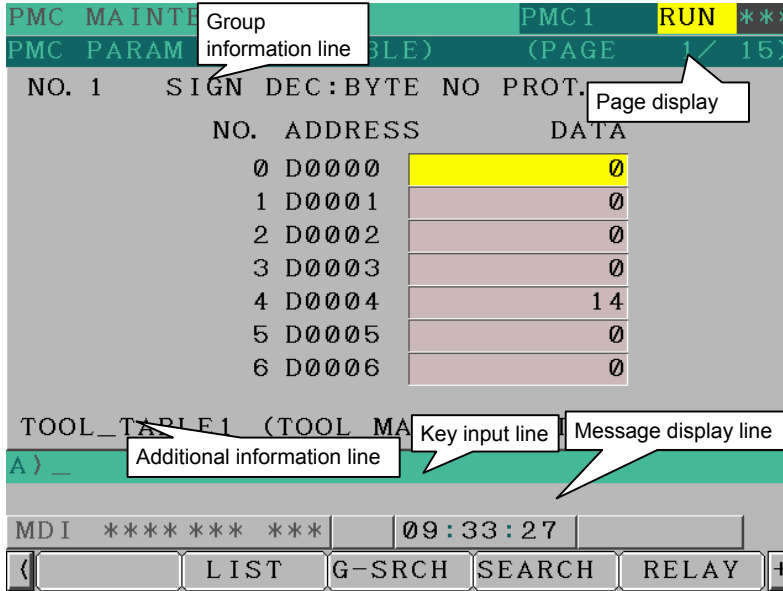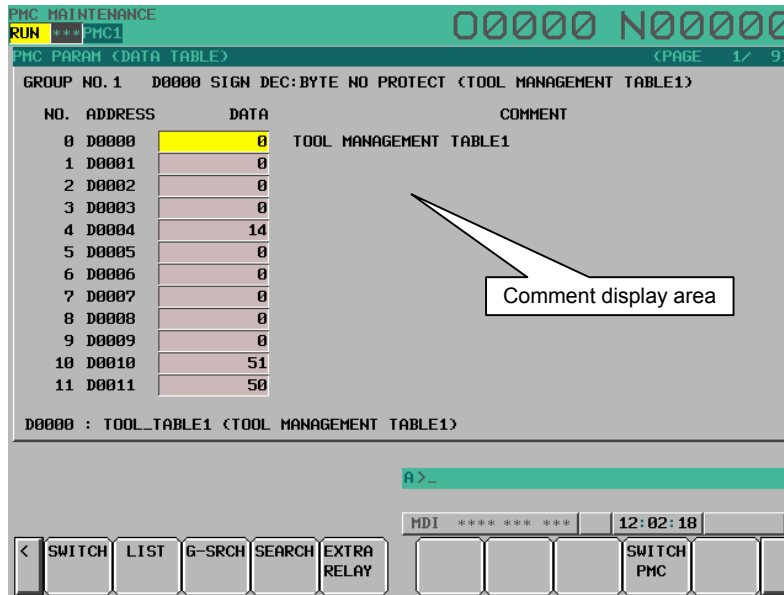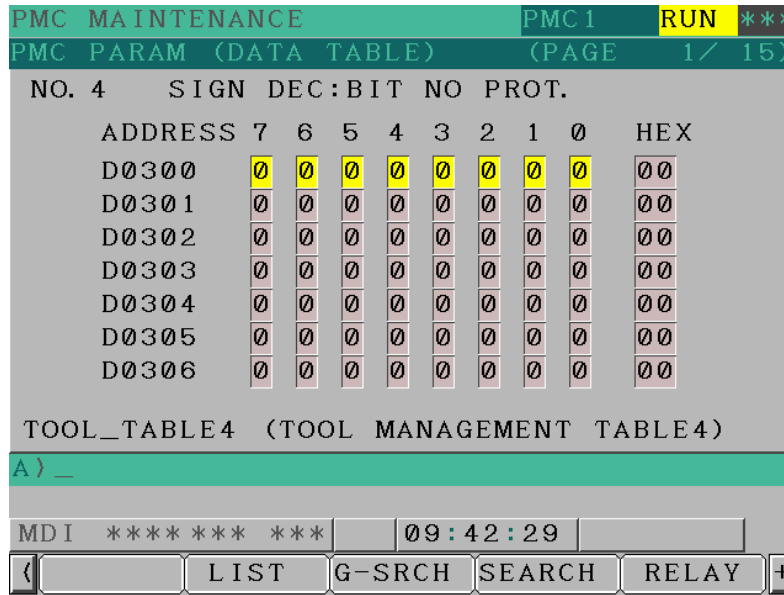
Bit display mode

- Table contents

- NO.
- ADDRESS   : Address used by the sequence program
- DATA   : Data value of data table
- COMMENT : Comment on the D address
- 0 to 7   : Data of each bit
- HEX   : Display of each byte in hexadecimal

The group information line at the top of the screen displays a group number, group start address, settings, and comment on the start address.

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. In the bit display mode, a bit symbol and comment, or a byte symbol and comment are displayed, depending on the cursor position.

```
Soft keys on the DATA TABLE screen

            Switching to the list screen        Address search    Switching to the Extra relay screen

(         LIST   G-SRCH  SEARCH   RELAY  +

                 Group number search                     TABLE

                      Switching to the Data table screen

(                                SW PMC              +
```
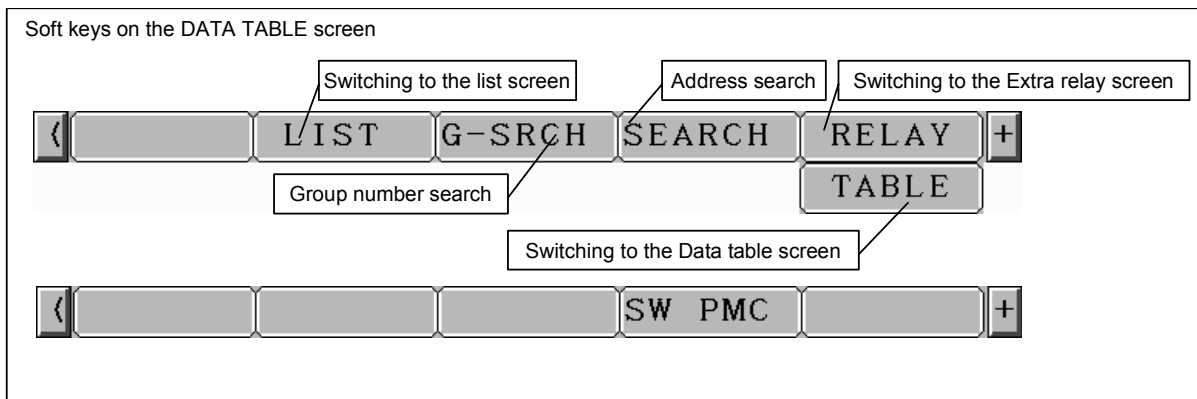
6.4.7   Data Input/Output ([I/O] Screen)

To move to the I/O screen, press the [I/O] soft key.
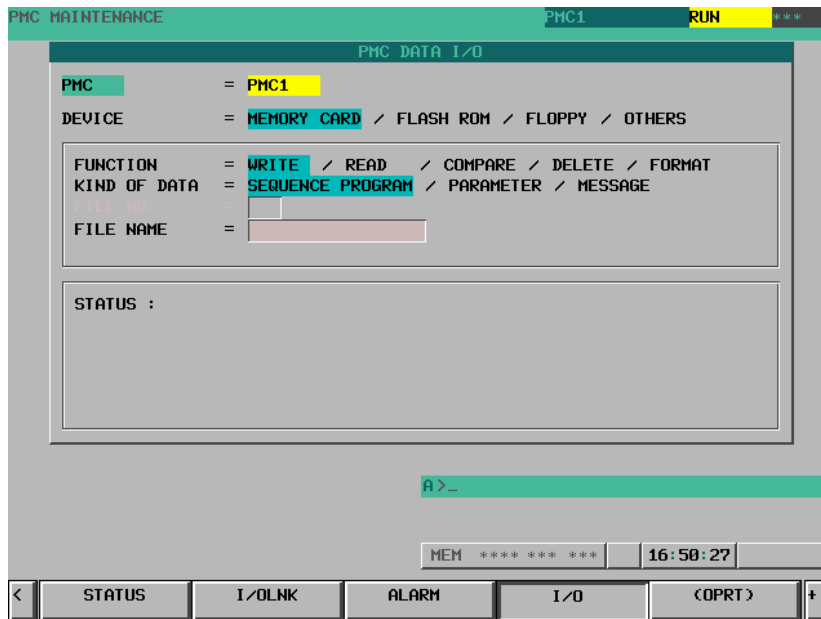
On this screen, sequence programs, PMC parameters and PMC message data for multi-language display can be written to the specified device, read from the device, and compared. The query selection cursor, which moves vertically from one question to another, is displayed, as is the option selection cursor, which moves horizontally from one option to another.

The following types of devices can be used for input/output. The desired device type can be selected by positioning the query selection cursor to "DEVICE" and moving the option selection cursor to that type.

- MEMORY CARD : Data can be output to and input from a memory card.
- FLASH ROM : Data can be output to and input from flash ROM.
- FLOPPY : Data can be output to and input from handy files or floppy cassettes.
- OTHERS : Data can be output to and input from other general-purpose RS-232C input/output devices.

In STATUS in the lower part of the screen, a detailed explanation of execution and the execution status are displayed. During write, read, and comparison, the size of the data already transferred is indicated as the execution (intermediate) result.

The following gives a display example shown when PMC parameters are written to a memory card:
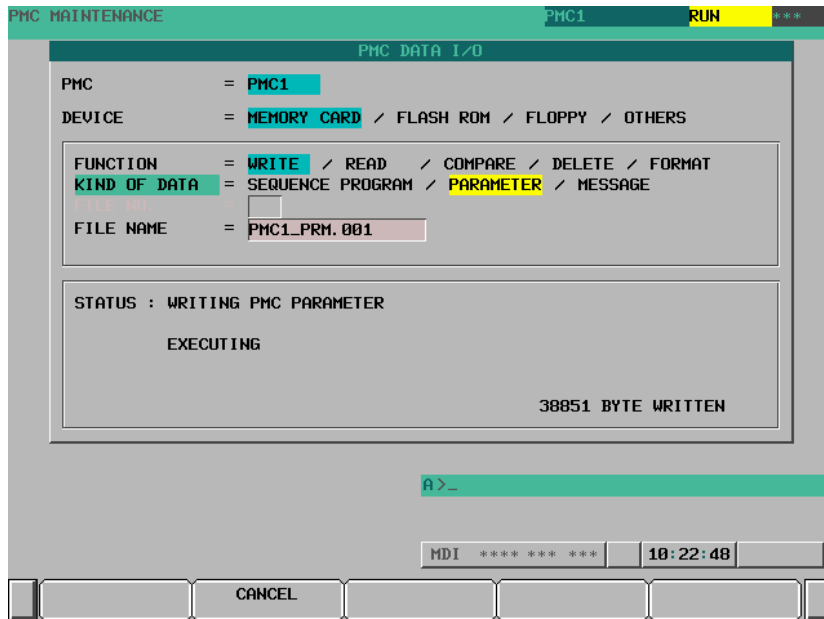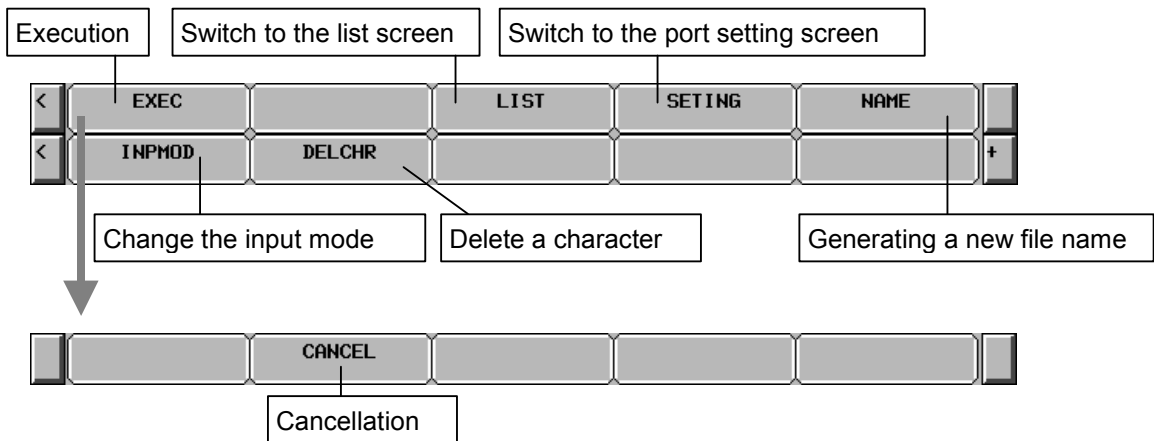
6.4.8   Displaying I/O Link Connection Status ([I/OLNK] Screen)

I/O LINK MONITOR screen shows the types and the ID codes of I/O Units that are connected to I/O Link in order of Group number.
To switch the screen display to the I/O LINK MONITOR screen, press the [I/OLNK] soft key.
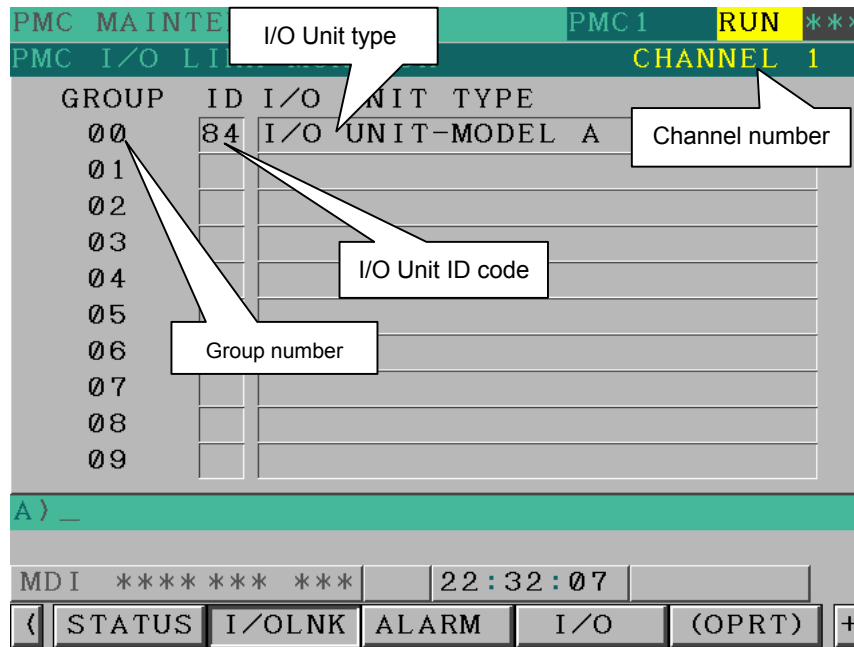
Table 6.4.8 Displayed type and true type of I/O Units

Displayed I/O Unit	ID	True I/O Unit
CONNECTION UNIT	80	Connection Unit
OPERATOR PANEL	82	Connection Unit for Operators Panel
I/O-B3	83	I/O B3
IO UNIT-MODEL A	84 86 87	I/O Unit-MODEL A
PLC SERIES 90-30	45	PLC SERIES 90-30
POWER MATE / I/O LINK BETA	4A	Power Mate or I/O Link β
SERIES 0	50	Series 0
OPERATOR I/F BOARD (MPG1)	53	Machine Operators Panel Interface
LINK CONNECTION UNIT	96	I/O Link Connecting Unit
I/O UNIT-MODEL B	9E	I/O Unit-MODEL B
R-J MATE	61	R-J Mate
CONNECTOR PANEL MODULE	A9	I/O module for connector panel
OPERATOR PANEL A1	AA	I/O module for operator's panel
OPERATOR I/F BOARD (MPG3)	6B	Operator Interface(with MPG)
FRC DIF	B0	DIF Board for ROBOCUT
FRC MIF	B1	MIF Board for ROBOCUT
I/O CARD	B2	I/O board
ROBOSHOT I/O CARD A	B3	I/O for ROBOSHOT
PROCESS I/O FA	B5	Process I/O for robot controller
PROCESS IO	89	Process I/O for robot controller
I/O LINK ADAPTER	8B	I/O Link adapter
ROBOT CONTROLLER	52	Controller for robot
GE Fanuc PLC	54	GE Fanuc PLC
OPERATOR PANEL	95	I/O for Series 0

Table 6.4.8 Displayed type and true type of I/O Units

Displayed I/O Unit	ID	True I/O Unit
LASER OSCILLATOR	97	Laser Oscillator
FIXED I/O TYPE A	98	I/O for Robot Type A
FIXED I/O TYPE B	99	I/O for Robot Type B
AS-I CONVERTER	77	AS-i Converter
OPERATOR PANEL B	A8	I/O Module(for Operator Panel 48/32)
MACHINE OPERATOR PANEL A	A8	I/O Module(for Machine Operator Panel of 0 Type)
CONNECTION UNIT C1 (MPG)	A8	Connection Unit C1(with MPG)
MACHINE OPERATOR PANEL B	A8	I/O Module (for Machine Operator Panel)
I/O MODULE WITH LCD	A8	LCD display embedded I/O
UNKNOWN UNIT	-	Unknown I/O Unit

> ⚠ **CAUTION**
> 1 IDs other than those for the I/O units listed in Table 6.4.8 represent undefined units.
> 2 I/O Units not for this CNC are written in Table 6.4.8.

Soft keys

Displays connection status of the previous channel

Displays connection status of the next channel
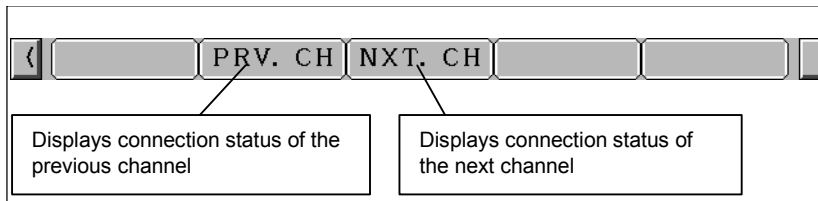
6.4.9   Signal Trace Function ([TRACE] Screen)
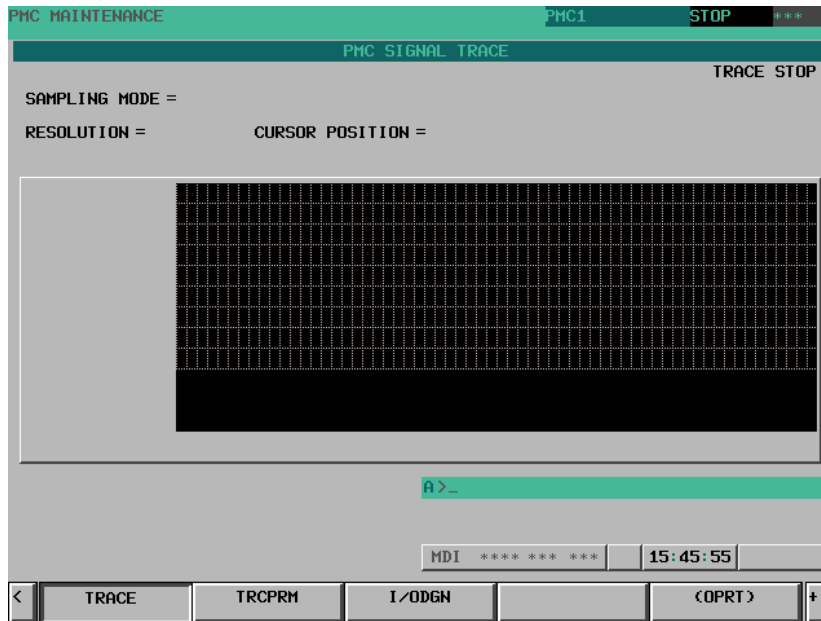
SIGNAL TRACE screen (initial screen)

Before trace operation can be executed, the trace parameters must be set. Press the [TRCPRM] soft key to switch the screen display to the trace parameter setting screen.
By setting the PMC setting screen, the trace function can be automatically started after the power is turned on. In this case as well, the trace parameters must be set beforehand.

NOTE
    For the setting to automatically start the trace function after the power is turned on, see Subsection 6.4.11.2.

6.4.10   Setting of Trace Parameter ([TRCPRM] Screen)

On the trace parameter setting screen, a sampling condition can be set. The screen consists of two pages. Use the page keys to switch between the pages.

Trace parameter setting screen (first page)

(a) SAMPLING/ MODE

     Determines the sampling mode.

- TIME CYCLE   : Samples at every specified cycle time.
- SIGNAL TRANSITION : Monitors the signal at a set cycle and samples when the signal makes a transition.

(b) SAMPLING/ RESOLUTION

     The resolution of sampling is inputted. The default value is the minimum sampling resolution (msec), which varies depending on the CNC.

     Setting range: Minimum sampling resolution to 1000 (msec)

     An input value is rounded off to a multiple of the minimum sampling resolution (msec) which is closest to but not greater than the input value.

(c) SAMPLING/ TIME

     This parameter is displayed when "TIME CYCLE" is set on "SAMPLING/ MODE". The execution time of trace is inputted. The value of "SAMPLING/ RESOLUTION" or the number of specified signal address changes the range of the value that is able to input. The range is displayed on the right side.

(d) SAMPLING/ FRAME

     This parameter is displayed when "SIGNAL TRANSITION" is set on SAMPLING/ MODE". The number of sampling is inputted. The value of "SAMPLING/ RESOLUTION" or the number of specified signal addresses changes the range of the value that is able to input. The range is displayed on the right side.

(e) STOP CONDITION

     Determines the condition to stop the trace.

- NONE   : Does not stop the tracing automatically.
- BUFFER FULL   : Stops the tracing when the buffer becomes full.
- TRIGGER   : Stops the tracing by trigger.

(f) STOP CONDITION/ TRIGGER/ ADDRESS

     When "TRIGGER" is set on "STOP CONDITION", this parameter is enabled. Input signal address or symbol name as stop trigger.

(g) STOP CONDITION/ TRIGGER/ MODE
When "TRIGGER" is set on "STOP CONDITION", this parameter is enabled. Determine the trigger mode when the trace is stopped.
- RISING EDGE   : Stops the tracing automatically by rising up of the trigger signal.
- FALLING EDGE : Stops the tracing automatically by falling down of the trigger signal.
- BOTH EDGE   : Stops the tracing automatically by rising up or falling down of the trigger signal.

(h) STOP CONDITION/ TRIGGER/ POSITION
When "TRIGGER" is set on "STOP CONDITION", this parameter is enabled. Input the ratio of the sampling time or number which specifies the position where specified trigger condition is on. If you would like to examine the transitions of the signal before the trigger condition, you should set a big value in this parameter. If you would like to examine the transitions of the signal after the trigger condition, you should set a small value in this parameter.
Example: The case that sampling time is 10 seconds and trigger position is set as "10%".
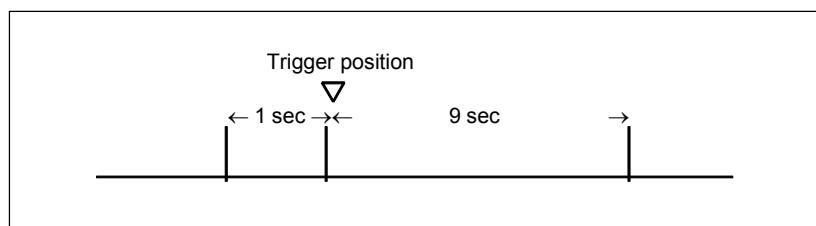
(i) SAMPLING CONDITION
When "SIGNAL TRANSITION" is set on "TRACE MODE", this parameter is enabled.
Determine the sampling condition.
- TRIGGER   : Samples the status of specified signals when the specified sampling condition is on.
- ANY CHANGE   : Samples the status of specified signals when the signals change.

(j) SAMPLING CONDITION/ TRIGGER/ ADDRESS
When "SIGNAL TRANSITION" is set on "TRACE MODE", and "TRIGGER" is set on "SAMPLING CONDITION", this parameter is enabled. Input signal address or symbol name as sampling trigger.

(k) SAMPLING CONDITION/ TRIGGER/ MODE
When "SIGNAL TRANSITION" is set on "TRACE MODE", and "TRIGGER" is set on "SAMPLING CONDITION", this parameter is enabled. Input trigger mode that determines the condition of specified trigger.
- RISING EDGE   : Samples the status of specified signals by rising up of the trigger signal.
- FALLING EDGE : Samples the status of specified signals by falling down of the trigger signal.
- BOTH EDGE   : Samples the status of specified signals by rising up or falling down of the trigger signal.
- ON   : Samples the status of specified signals during the trigger signal is on.
- OFF   : Samples the status of specified signals during the trigger signal is off.

TRACE PARAMETER SETTING screen (page 2)

In page 2 of the PARAMETER SETTING screen, you can set the addresses or symbols that should be sampled.

Trace parameter setting screen (second page)

(a) Setting addresses

In case of inputting discrete bit addresses, any bit address can be inputted.

Moreover, when you input byte address, all bits of the address (bits 0 to 7) are set automatically. Maximum 32 points of signal address can be inputted.

NOTE

Increasing the number of the signal address changes the capacity of "SAMPLING/ TIME" or "SAMPLING/ FRAME" in page 1. If the capacity is changed, the following warning message is displayed. (The "n" on the message means the maximum value that is able to input.)
a) In case of "TIME CYCLE" mode
     "SAMPLING TIME IS REDUCED TO n SEC."
b) In case of "SIGNAL TRANSITION" mode
     "SAMPLING FRAME IS REDUCED TO n."

(b) Soft keys

Soft keys on the setting screen of sampling address are as follows
- [DELETE]   : Clears the value of the edit box on the cursor.
- [SYMBOL]/[ADRS] : Changes the address display to the symbol display. However, display of the address that is not defined the symbol does not change. This soft key also changes to "ADDRESS". The following soft keys are displayed.
- [MV.UP]   : Exchanges the signal indicated the cursor for the signal above one line.
- [MV.DWN]   : Exchanges the signal indicated the cursor for the signal below one line.
- [DELALL]   : Clears all of the value of the edit box.

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(c) Trigger setting
When "SIGNAL TRANSITION" is set on "TRACE MODE" and "ANY CHANGE" is set on "SAMPLING CONDITION", it can be set whether to use the setting address as the signals that should trigger the sampling in the setting signals. As for the signal address where the trigger was set, "✓" is displayed right. Soft keys on the Trigger setting screen are as follows:

- TRGON   : Sets the Trigger on.
- TRGOFF : Sets the Trigger off.

The default setting is trigger on for all signals.

6.4.11   Execution of Trace

After the trace parameters are set, a trace operation can be started by pressing the [(OPRT)] soft key and the [START] soft key on the SIGNAL TRACE screen. The following is the screen examples of the trace execution by "TIME CYCLE" mode and "SIGNAL TRANSITION" mode.
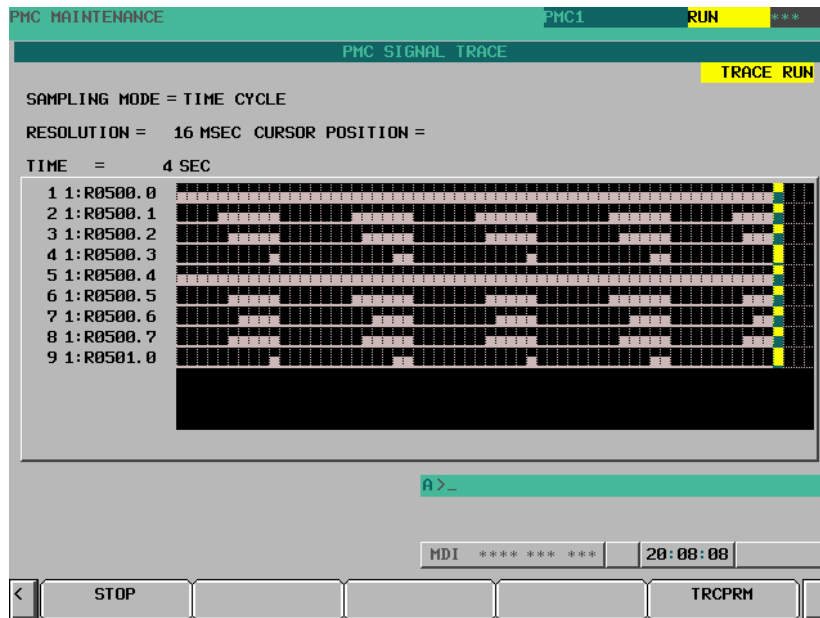
Execution of trace screen (TIME CYCLE mode)
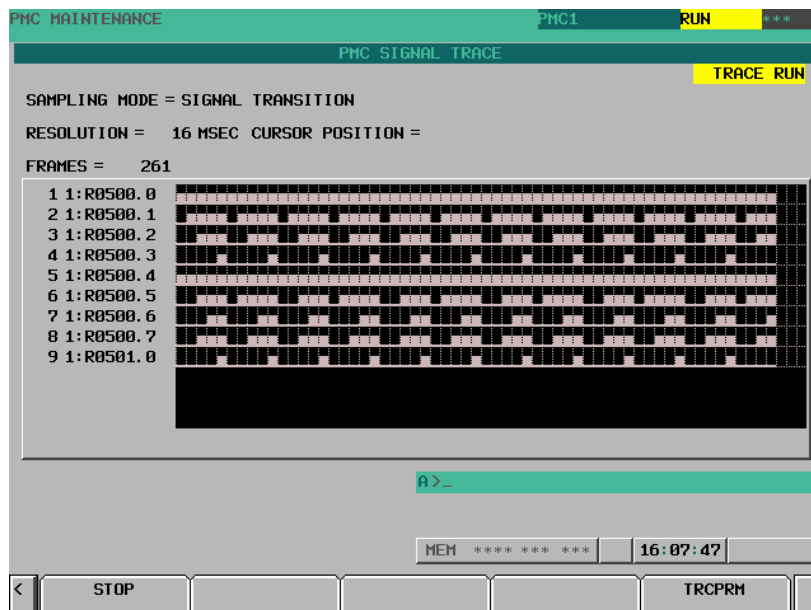
Execution of trace screen (SIGNAL TRANSITION mode)

The result of trace is immediately displayed during execution of the trace.
When the stop conditions that is set in parameter setting screen is satisfied the execution is finished. Pressing [STOP] soft key aborts the execution. In "SIGNAL TRANSITION" mode, graphic display is not refreshed until any signal for sampling trigger changes.

6.4.11.1   Operation after execution of trace

When the execution is finished, the result of trace is displayed. The followings are the screen examples of trace by "TIME CYCLE" and "SIGNAL TRANSITION" mode.
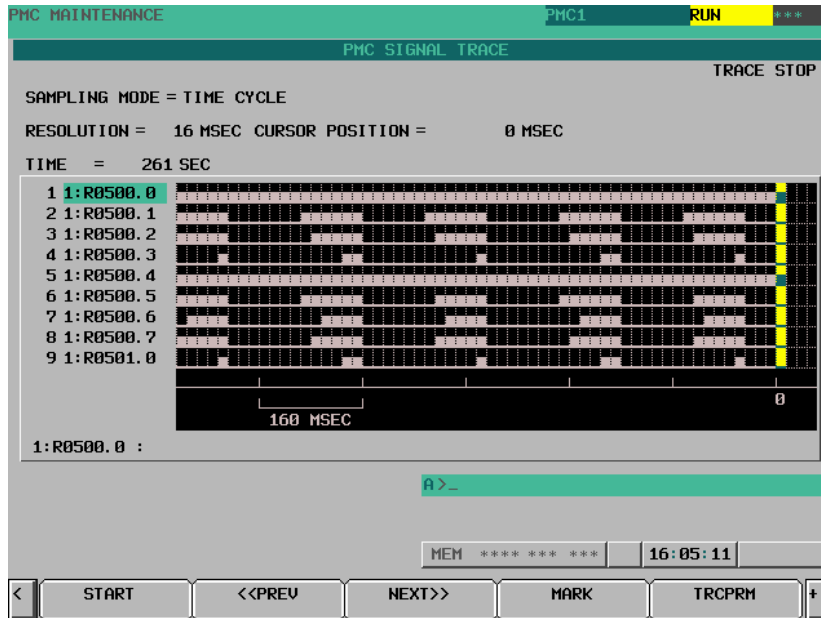
Result of trace screen (TIME CYCLE mode)
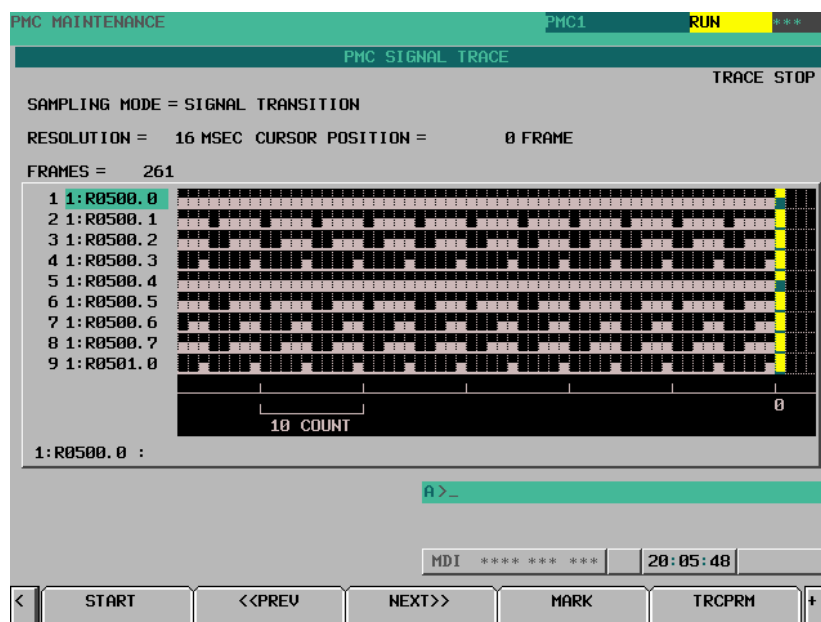
Result of trace screen (SIGNAL TRANSITION mode)

The cursor indicating current position is initially displayed on the original point (0 point). The position of the cursor is displayed in "CURSOR POSITION" in the upper of the screen. The cursor can move horizontally with the $<\leftarrow>$ or $<\rightarrow>$ key. After the execution, following operation is enabled.
(a)   Scroll of screen
- Cursor up/down key and Page up/down key
  Enables the vertical scroll for the specified signal
- Cursor right/left key, [NEXT>>] soft key and [<< PREV] soft key
  Enables the horizontal scroll of the graph.

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(b) Automatic calculation of the selected range
Pressing [MARK] soft key marks the current position and displays the mark cursor.
If the mark cursor duplicates with the current position cursor, the current position cursor has priority of display. The "MARK POSITION" that shows the position of the mark cursor and "RANGE" that shows the range between the mark cursor and the current position cursor are displayed in the upper of screen.
Moving the current position cursor changes these values. Pressing [MARK] again releases the select range mode.
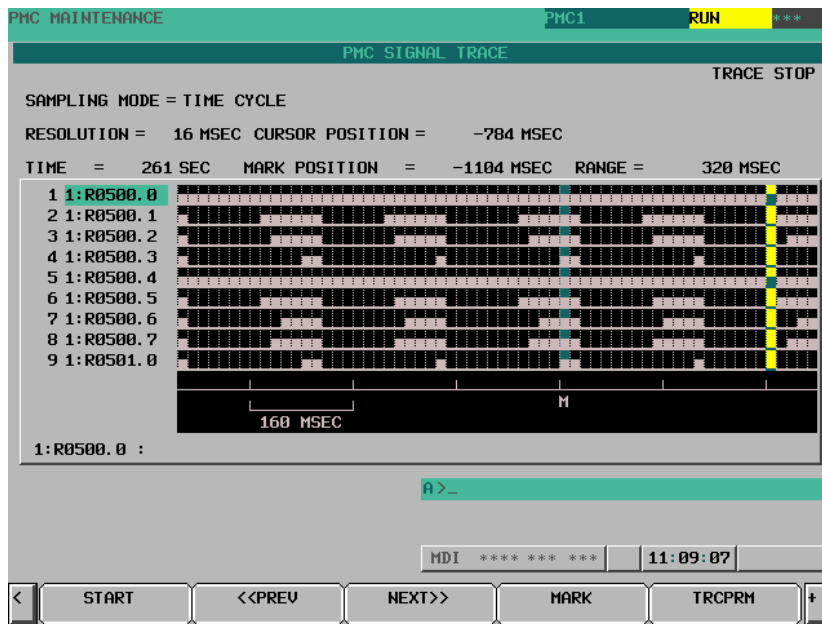
Result of trace screen (Mark cursor display)

(c) Zoom in/Zoom out of waveform
Pressing [Z.IN] soft key magnifies the display of chart. Pressing [Z.OUT] soft key reduces the display of chart. Pressing these soft keys also change the scale value of the graduation on the graph. When trace is just finished, the default zooming level was the most magnified level. In "ZOOM OUT" mode, "▨" is displayed as following screen example when the transitions of signal cannot be expressed accurately enough. The limitation of "ZOOM OUT" displays all of result of the trace in one page.
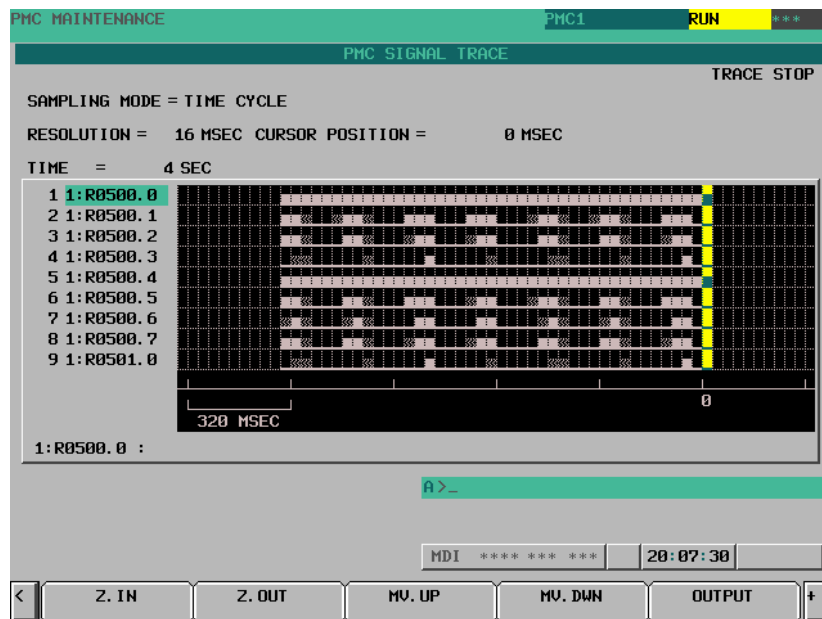
Result of trace screen (Zoom out display)

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(d) Exchange of sampling signal
    Pressing [MV.UP] soft key exchanges the signal indicated by the signal cursor for the signal one line
    above. Pressing [MV.DWN] soft key exchanges the signal indicated by the signal cursor for the
    signal one line below. The result of the operation is cancelled by the execution of trace or putting the
    power off. When you would like to preserve the order of displayed signals against the executing or
    powering off, please change the order on "SAMPLING ADDRESS" screen.

6.4.11.2 Automatic start of trace setting

Trace execution is automatically started after power-on by setting a PMC setting data.

- TRACE START = MANUAL/AUTO

NOTE
    For details of the method of setting PMC setting data, see PMC
    PROGRAMMING MANUAL (B-64393EN).

6.4.12   MONITORING I/O DIAGNOSIS ([I/ODGN] SCREEN)

In I/O Diagnosis screen, you can check the status of each I/O variable. You can also check the configuration of I/O devices and the communication status with them.
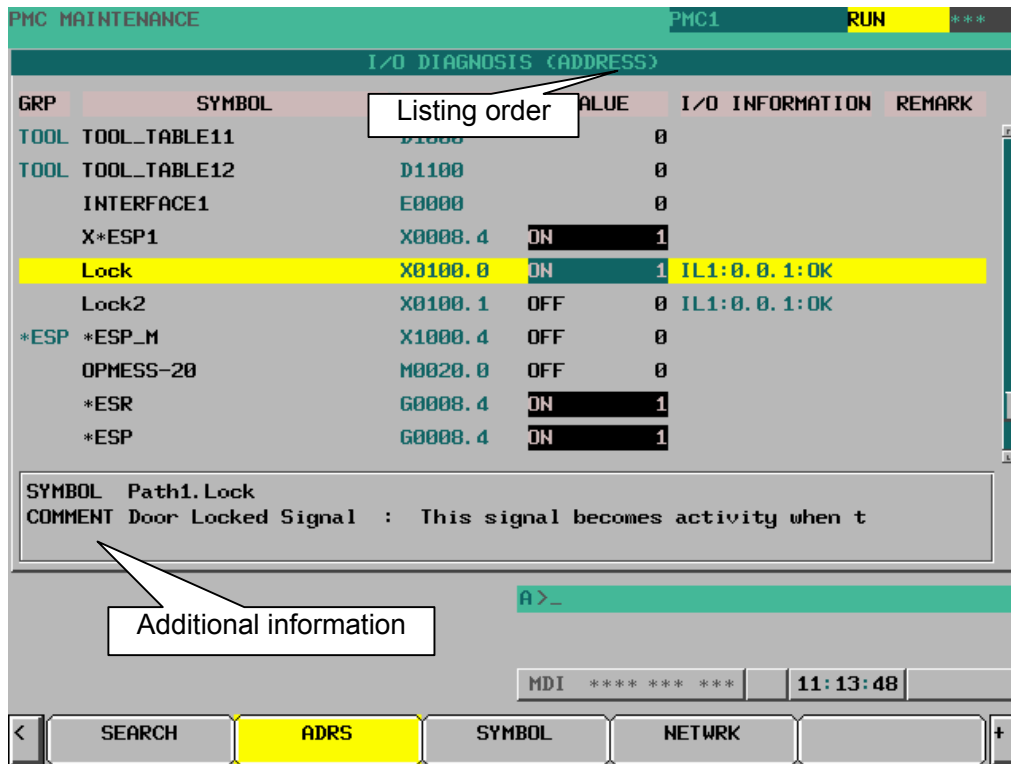
(1) GRP (GROUP)

To include a specific string which means a kind of signals in a part of symbol string, these signals on I/O diagnosis screen are classified and you can easy to understand the status of signals.

The group names of the I/O variables are displayed, which are extracted (Max. 4 chars) out of their symbol names as configured in "GROUP FORMAT" in the setting screen.

The groups to be displayed can be specified by soft key.

[ALLGRP]   All groups are displayed.

[GROUP]   The group entered by key or the group under the cursor is selected to be displayed.

(2) PROG.SYMBOL (SYMBOL)

The symbol names of the I/O variables are displayed.

(3) ADDRESS

The actual locations of I/O variables are displayed.

(4) VALUE

The current values of I/O variables are displayed as signed decimal, according to the data type of them (i.e. BOOL, BYTE, WORD, and DWORD).

(5) I/O INFORMATION

The information related to I/O network is displayed in the display format below:

<I/O type><Network type> : <Network address> : <status>

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I/O type: The address I/O type is displayed.

Module type	Shown as
Input module	I
Output module	O
Other	*

Network type: The network type is displayed.

Network type	Shown as
PROFIBUS	P
I/O LINK	Ln (n: channel number)

Network address: The network address is displayed. The format differs depending on the network type.

Network type	Network address notation
PROFIBUS	*<Slave #>.<Slot #>*
I/O LINK	*<Group #>.<Base #>.<Slot #>*

NOTE

This screen shows the I/O information according to the network setting that became effective at the time of the last power-on.
The notes for each network device are as follows:

PROFIBUS
1. If you have changed some of the Profibus parameters, you have to cycle the power once to make the changes take effect.

I/O LINK
1. Only the I/O Link assignments, which are made effective by the setting of "Machine Signal Interface" in Configuration Parameter menu and the setting of "Selectable I/O Link Assignment Function", are displayed.
2. If you have changed the following parameters, you have to cycle the power once to make them take effect:
   - "I/O module assignment data"
   - "Machine signal interface" in PMC configuration parameter
   - "Selectable I/O Link assignment function"
3. If you have stored new sequence program to PMC, its I/O Link assignment data will not take effect until you write it into Flash-ROM and cycle the power once.

Status: the status of communication
"OK" or "NG" is displayed.

(6) REMARK

The remarks up to 8 characters extracted from comment data are displayed.　To specify the remark at this field, set "100" to the attribute value of the comment, which you want to show in this field, on FANUC LADDER-III,

(7) Additional information window

In this window, symbol and comment of the I/O variable under the cursor are displayed. When language dependent comment attributes are specified, corresponding comment is displayed according to the current language setting of the CNC.

In FANUC LADDER-III, the attribute value of comment should be set to 0 to 17 to display language dependent comment

Attribute value: 0 to 17

0:	English	9:	Danish
1:	Japanese	10:	Portuguese
2:	German	11:	Polish
3:	French	12:	Hungarian
4:	Chinese (Traditional)	13:	Swedish
5:	Italian	14:	Czech
6:	Korean	15:	Chinese (Simplified)
7:	Spanish	16:	Russian
8:	Dutch	17:	Turkish

> **NOTE**
> In case of the extended symbol and comment, the comments on the screen will be switched dynamically another language when the language setting of CNC changes.

Soft keys

Softkeys on the I/O Diagnosis screen
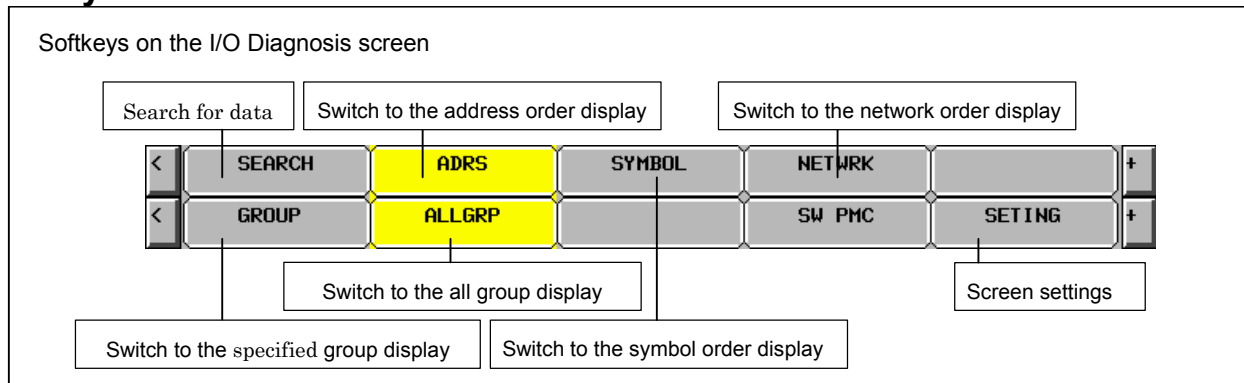
6.5   LADDER DIAGRAM MONITOR AND EDITOR SCREENS ([PMCLAD])

The PMC LADDER menu contains the screens related to PMC Ladder diagrams, such as the PROGRAM LIST screen and the LADDER DIAGRAM MONITOR/EDITOR screens.

You can switch to the PMC LADDER menu by operating on the "SYSTEM" key and then the [PMCLAD] soft key.
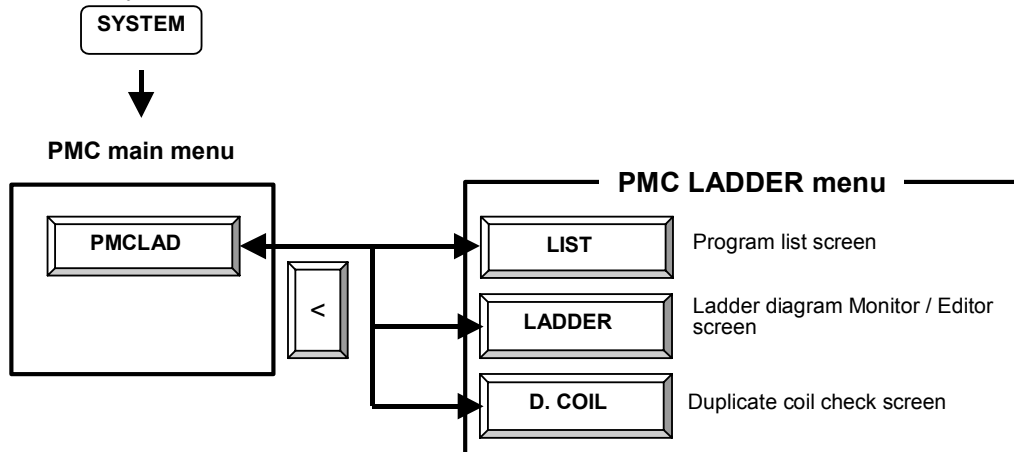
Pressing the [LADDER] soft key causes the sequence program to be dynamically displayed, allowing you to monitor operation. The editor screen allows you to make changes to relay and functional instructions in the sequence program to change the operation of the sequence program.

The ladder diagram display/editor functions consist of the following screens:

(1) Ladder diagram display screen (LADDER DIAGRAM MONITOR screen)
     Displays ladder diagrams to monitor the current states of relays, coils, and so on.
(2) COLLECTIVE MONITOR screen
     Displays only a selected ladder net to monitor the current states of relays, coils, and so on.
(3) LADDER DIAGRAM EDITOR screen
     Allows you to edit a ladder diagram in units of nets.
(4) NET EDITOR screen
     Allows you to edit a single net in a ladder diagram.
(5) PROGRAM LIST VIEWER screen
     Allows you to select the subprogram to be displayed on the LADDER DIAGRAM MONITOR screen.
(6) PROGRAM LIST EDITOR screen
     Allows you to edit a ladder program in units of subprograms. Also allows you to select the subprogram to be edited on the LADDER DIAGRAM EDITOR screen.
(7) SUBPROGRAM LIST VIEWER screen
     Displays a list of called subprograms and subprogram display history.

The following screens can be called from the LADDER DIAGRAM EDITOR screen:

(8) FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen
     Allows you to view the contents of the data table for a data table attached functional instruction.
(9) FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen
     Allows you to edit the contents of the data table for a data table attached functional instruction.

NOTE
  You can protect these screens by using the programmer protection function. For details, see PMC PROGRAMMING MANUAL (B-64393EN).

You can change between screens as shown in the figure below.
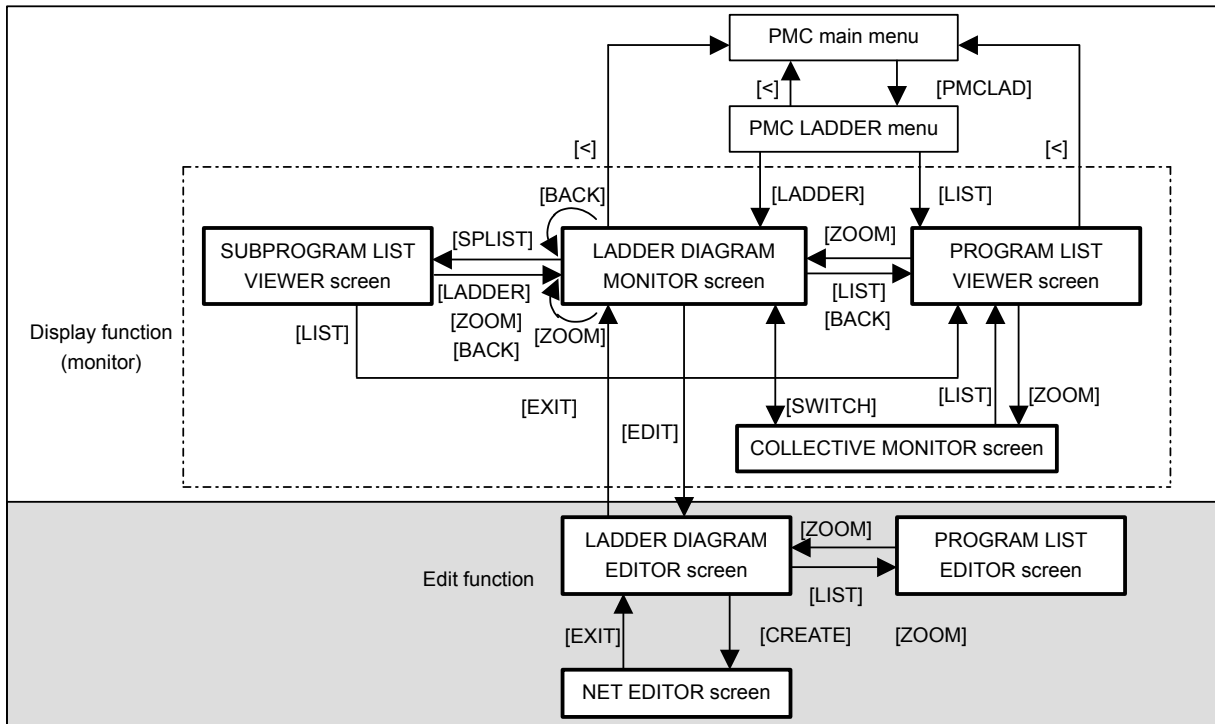
Fig. 4.5 Changes between screens

> **NOTE**
> The [EDIT] soft key on the LADDER DIAGRAM MONITOR screen is displayed so that it is available if the programmer protection function is enabled. While the online monitor function is enabled, you cannot move to the LADDER DIAGRAM EDITOR screen. (To stop the online monitor function, change the settings of "RS-232C" and "HIGH SPEED" to "NOT USE").

6.5.1 Displaying a Program List ([LIST] Screen)

The PROGRAM LIST VIEWER screen shows program information such as the program size.
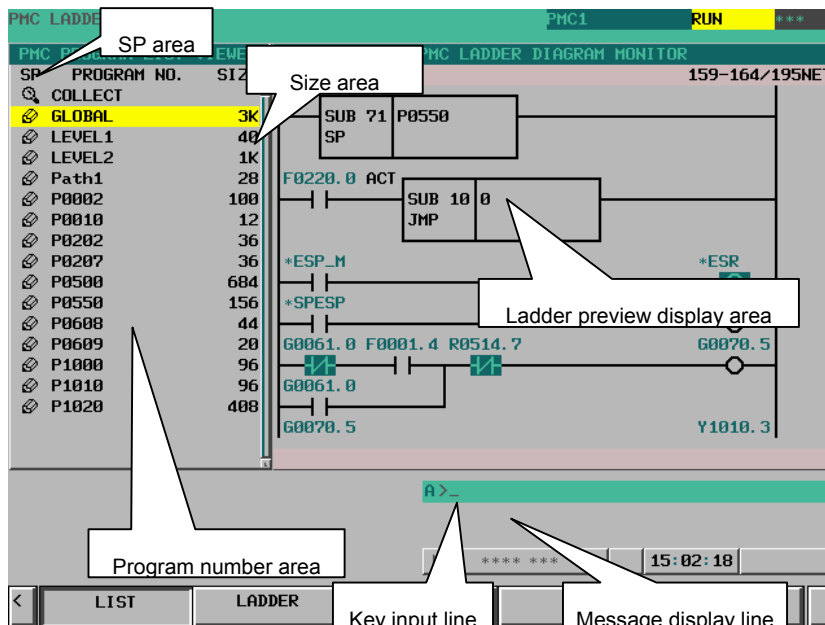
(1) Screen structures
   (a) A program list is displayed on the left side of the screen; on the right side, the ladder diagram of the program currently indicated by the cursor on the program list is displayed.
   (b) In the message line, error messages or inquiry messages will be displayed depending on the situation.
   (c) The program list displays up to 18 programs at a time in the list display area.
(2) Area of program list
   (a) In the "SP area", the protect information for subprograms is displayed, so are their program types.

   🔒 (Key)   : Ladder program, cannot be viewed, cannot be edited
   🔍 (Magnifying glass) : Ladder program, can be viewed, cannot be edited
   ✏ (Pencil)   : Ladder program, can be viewed, can be edited

   (b) Program name is displayed in the "PROG NO." field for each program.
        There are four kinds of program names.
        COLLECT   : It means the collective program.
        GLOBAL   : It means the whole program.
        LEVELn (n = 1, 2, 3) : It means the Ladder level 1, 2 and 3.
        Pm (m = subprogram number):
                               It means subprogram.
        By changing the "ADDRESS NOTATION" item on the LADDER DIAGRAM MONITOR Setting screen to "SYMBOL", you can display symbols.
   (c) The program size is displayed in the "SIZE" field for each program.
        If the program size is not over 1024 byte, the unit is shown in byte.
        If it is over 1024 byte, the unit is shown in kilo (1024) byte with "K".
        Ex.) The case that program size is not over 1024 byte.
              1023 bytes: "1023" is shown.
        Ex.) The case that program size is over 1024 byte.
              20000 bytes: "19K" is shown.
              (Sizes are rounded off to whole numbers before being displayed.)

Soft key of PROGRAM LIST VIEWER screen

Search for program

| < | ZOOM | SEARCH | | | | + |
| < | | | | SW PMC | | + |

Display the contents
of program
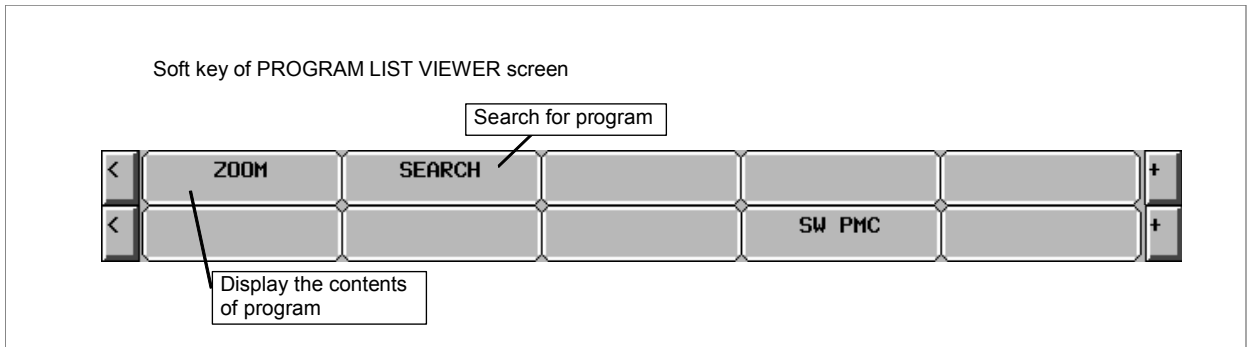
6.5.2 Monitoring Ladder Diagrams ([LADDER] Screen)

LADDER DIAGRAM MONITOR screen shows the on/off status of contacts and coils, and the contents of address specified for parameter of functional instructions.

From the PMC LADDER menu, you can switch to the LADDER DIAGRAM MONITOR screen by using the [LADDER] soft key. You can use following operation at this screen, including "Forced I/O function (Forcing mode)", by which you can force the relay or the address parameters of functional instructions to a new status or value.

- Switch subprogram to show   [LIST]
- Search for address or others   [SEARCH]
- Show data table of functional instructions [TABLE]
- Go to COLLECTIVE MONITOR Screen   [SWITCH]
- Forced I/O function (Forcing mode)   "number" + INPUT key
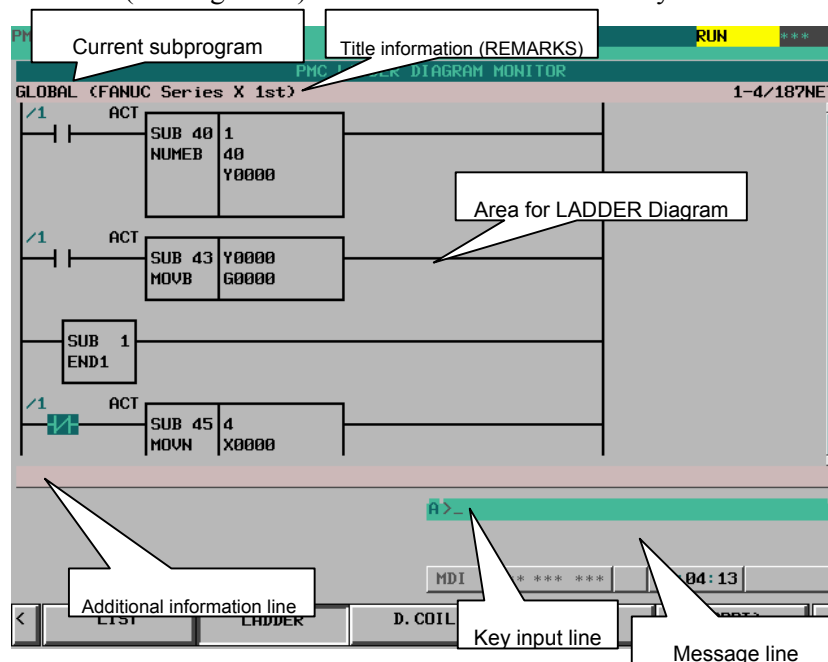
(1) Screen structures
   (a) Title information (REMARKS) of the LADDER Program, the current subprogram, and the current position information of the Diagram displayed in this screen, are displayed above the LADDER Diagram.

When you select a subprogram to be displayed, range for search function is indicated at right of the top line as "LOCAL" or "GLOBAL". In case of "LOCAL", the range for search function is restricted within the current subprogram. In case of "GLOBAL", on the other hand, search function searches whole of LADDER program, and switch current subprogram automatically according to the result of searching.
   (b) In the additional information line near the bottom of the screen, the following information of the address under the cursor is displayed when the cursor is shown.
      - Net number of the net with the cursor
      - Address and its symbol and comment information
      - Current value
   (c) In the message line, error messages or inquiry messages will be displayed depending on the situation.
   (d) In the area for LADDER diagrams, 8×8, 8×6, 8×4, 7×8, 7×6, and 7×4 relays can be displayed (horizontally and vertically).   For details, see PMC PROGRAMMING MANUAL (B-64393EN).
   (e) The gage indicating the current display position in relation to the whole Ladder program is displayed at the right end of the screen.

(2) LADDER diagram
    (a) Nets wider than the screen width are displayed as "Continuous Net" using continuous marks (">A1>"). Same continuous marks mean they are connected with each other.
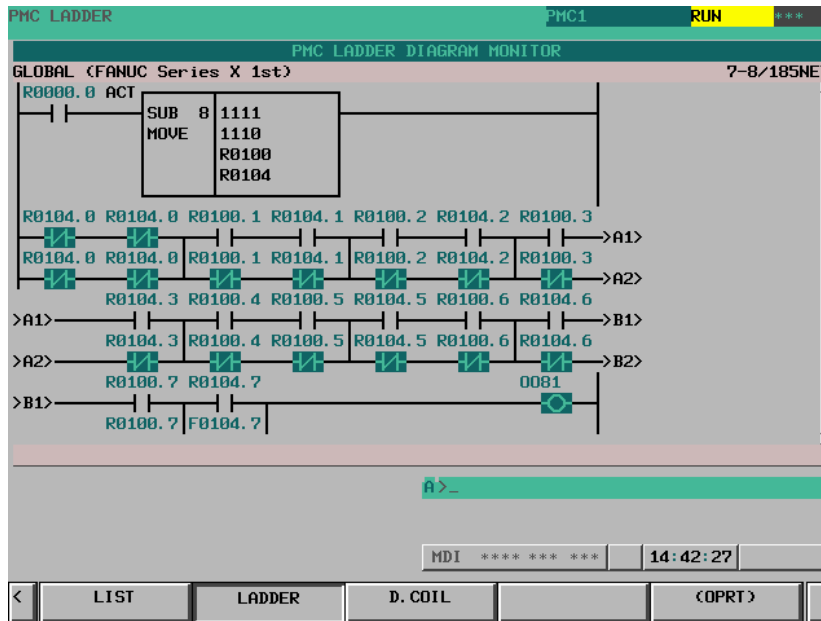
(3) Monitor
    (a) Contacts and coils change their colors and/or shapes according to the status of the signal. The status of power flow is not displayed.
    (b) Usually, the parameters of functional instructions are monitored and displayed. You can suppress the monitor and display by an appropriate setting. For details, see PMC PROGRAMMING MANUAL (B-64393EN).

(4) Displaying Symbols and Comments
    (a) Usually, addresses are displayed above contacts and coils. For an address with a symbol assigned, you can change the setting so that the symbol is displayed instead of the address. You can add colors to addresses. For details, see Subsection "Setting the Display Format of the LADDER DIAGRAM MONITOR Screen" in the PMC PROGRAMMING MANUAL (B-64393EN).
    (b) If the address of a contact has a comment attached, the comment is displayed below the contact. You can change its display mode by changing the setting. You can add colors to comments. For details, see Subsection "Setting the Display Format of the LADDER DIAGRAM MONITOR Screen" in the PMC PROGRAMMING MANUAL (B-64393EN).
    (c) If the address used with coil has a comment string assigned, the comment strings will be displayed at the right margin beside the coil. You can use this margin area to display an additional relay instead of the comment string by setting: at this setting, one more relay can be displayed in each diagram line. You can add colors to comments. For details, see Subsection "Setting the Display Format of the LADDER DIAGRAM MONITOR Screen" in the PMC PROGRAMMING MANUAL (B-64393EN).

Main soft keys of LADDER Diagram Monitor screen

Display Data Table

Program List

Display Subprogram

LADDER Diagram Editor

Switch to COLLECTIVE MONITOR screen

LIST	SEARCH	ZOOM	EDIT	SWITCH

TABLE

BACK		SPLIST	SW PMC	SETING

Back previous

Subprogram List

Screen Settings

Search soft keys

Jump to Top/Bottom

Search Address or Net

Search Write Coil

Search Functional Instruction

Pick up a Ladder Diagram net

TOPBTM	SEARCH	W-SRCH	F-SRCH	PICKUP
PREV	NEXT	LOCAL		EXIT

Search previous

Search next

Switch range

Exit
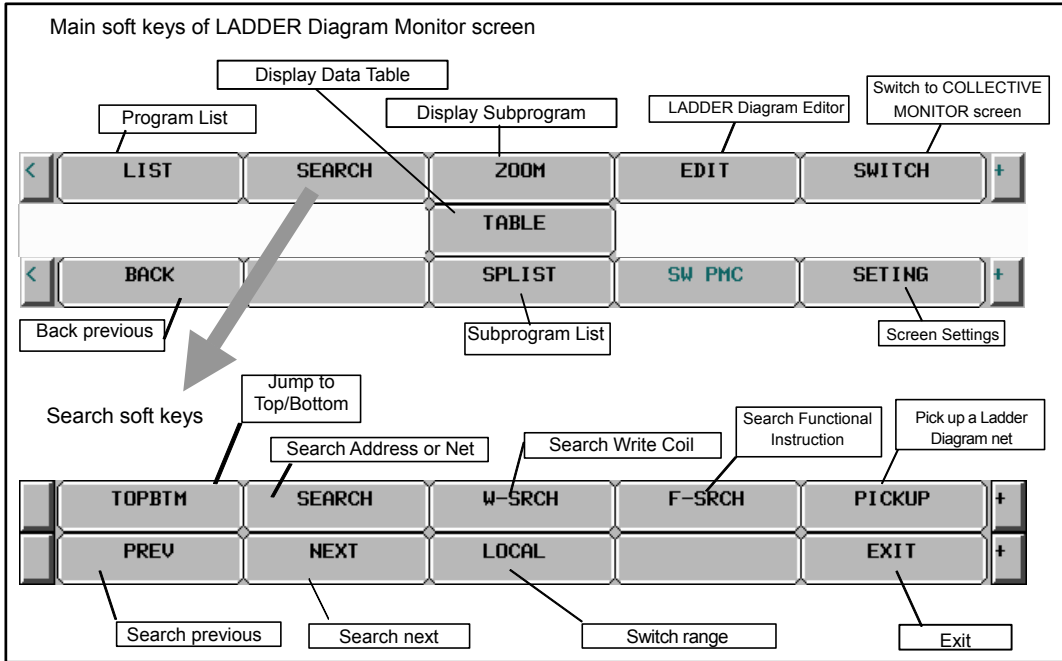
6.5.3   Editing Ladder Programs

At LADDER DIAGRAM EDITOR screen you can edit LADDER program to change its behavior.
To switch LADDER DIAGRAM EDITOR screen, press [EDIT] soft key at LADDER DIAGRAM
MONITOR screen.
Following operations are available at LADDER DIAGRAM EDITOR screen.

- Delete by net   [DELETE]
- Move by net   [CUT] & [PASTE]
- Copy by net   [COPY] & [PASTE]
- Change address of contacts and coils   "bit address" + INPUT key
- Change parameters of functional instructions   "number" or "byte address" + INPUT key
- Add new net   [CREATE]
- Change construction of net   [ZOOM]
- Make changes effective   [UPDATE]
- Abandon changes   [RESTRE]
- Cancel edit   [CANCEL]
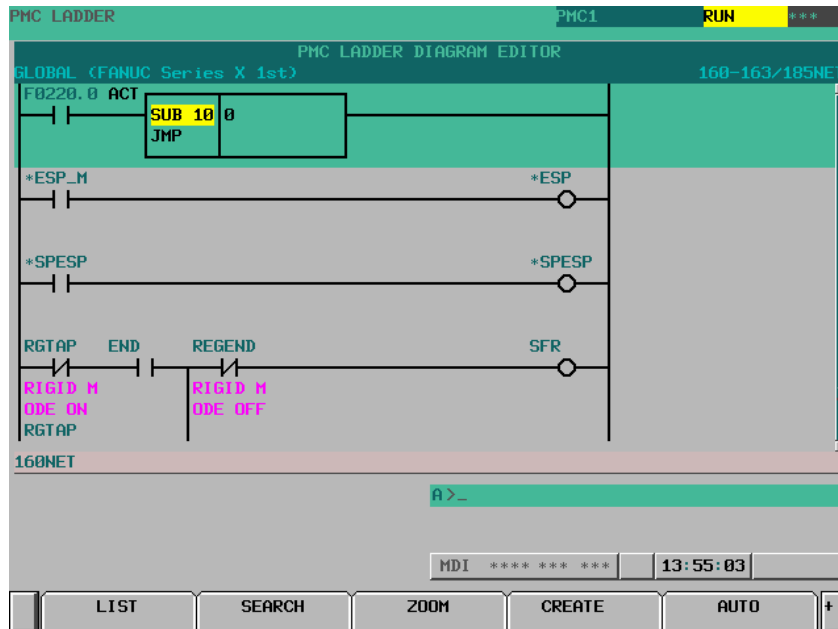
LADDER DIAGRAM EDITOR screen

> ⚠**CAUTION**
> 1 You can edit ladder programs regardless of whether they are active or not. To execute a ladder program with the results of editing being reflected, you must update the ladder program. To do this, press the [UPDATE] soft key, or update the program when exiting from the LADDER DIAGRAM EDITOR screen. For details of the method of protecting editing, see "PMC PROGRAMMING MANUAL (B-64393EN)."
> 2 After you have edited a sequence program, the results of editing will be lost if the power is turned off without first writing the edited sequence program to flash ROM.
> Write the sequence program to flash ROM on the I/O screen. If you set "WRITE TO F-ROM(EDIT)" to "YES" on the general functions' setting parameter screen, a confirmation message will be displayed, prompting you to ask whether to write a sequence program to flash ROM after the end of editing. For details of this setting, see "PMC PROGRAMMING MANUAL (B-64393EN)."

(1) Screen structures
   (a) It is basically same with LADDER DIAGRAM MONITOR screen, except that no monitor displays of relays and parameters of functional instructions are displayed.
   (b) At right side of LADDER Diagram area, a position bar is always displayed, which indicates screen position within current subprogram: in LADDER DIAGRAM MONITOR screen, this position bar is exclusively displayed with comments of write coil. Sometimes, this position bar hides a part of write coil comments.

(2) LADDER Diagram
   (a) Style of LADDER Diagram is basically same with LADDER DIAGRAM MONITOR screen, except that functional instructions are drawn always in "COMPACT" format that has no monitor displays.
   (b) Cursor is shown always. And the net, which will be an object of following editing operations, is emphasized in screen.

Soft keys of LADDER Diagram Editor screen
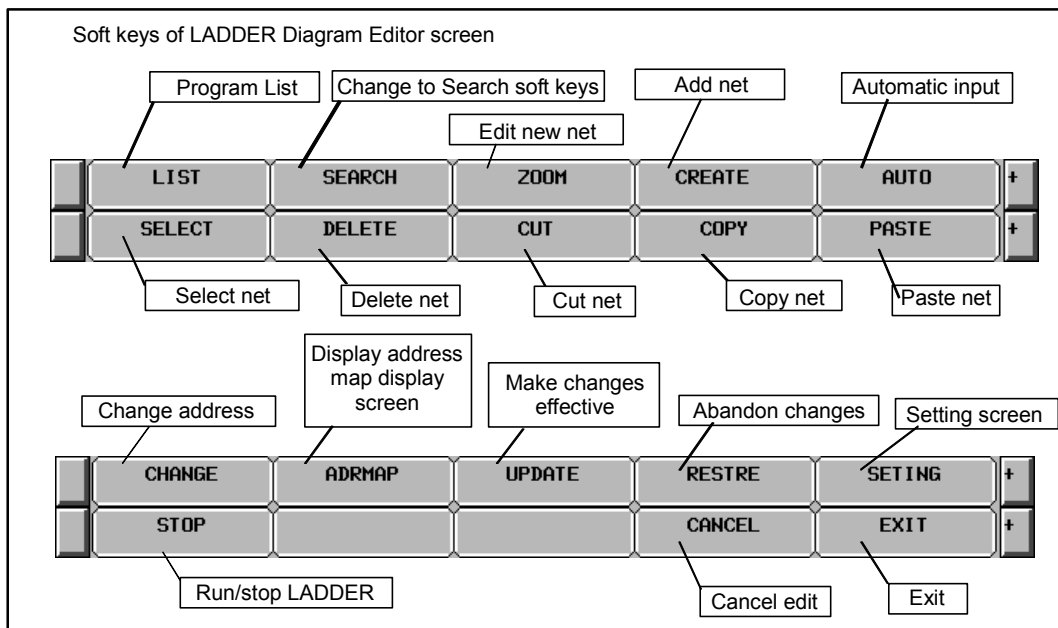
> ⚠ **WARNING**
> You have to pay special attention to modify running LADDER program. If you modify LADDER program in wrong way, or update LADDER program with the machine in improper status, it may cause unexpected reaction of the machine. You have to make it sure that modifications you make on LADDER program is appropriate, machine is in proper status, and nobody is near the machine, when you update LADDER program.

6.5.3.1   NET EDITOR Screen

At NET EDITOR screen, you can create new net, and modify existing net.

- Changing existing nets
  If you move a net with the [ZOOM] soft key, you will enter a mode (Modify mode) in which you can add changes to the net currently indicated by the cursor.
- Adding a new net
  When [CREATE] soft key is used, this screen is in "New mode" to create new net from nothing.

Following operations are available at this screen:
- Place new contacts and coils   "bit address" + [—┤ ├—], [—O—], etc.
- Change type of contacts and coils   [—┤ ├—], [—O—], etc.
- Place new functional instructions   [FUNC]
- Change type of functional instructions   [FUNC]
- Erase contacts, coils, and functional instructions   [· · · · · · ·]
- Draw/erase connecting lines   [———]/[· · · · · · ·], [↑———], [———↑]
- Edit data table of functional instructions   [TABLE]
- Insert line/column   [INSLIN], [INSCLM], [APPCLM]
- Change address of contacts and coils   "bit address" + INPUT key
- Change parameters of functional instructions "number" or "byte address" + INPUT key
- Abandon modifications   [CANCEL]
- Restore the net to the state it was before editing   [RESTRE]

Fig. 6.5.3.1 (a) Structure of the NET EDITOR screen

(1) Screen structures
(a) It is basically same with LADDER DIAGRAM EDITOR screen, except that only one net is in this screen, and that position bar at right edge of screen does not appear at this screen.
(b) Current edit mode is indicated at right of the top line as "NEW MODE" or "MODFY MODE". When [ZOOM] soft key at LADDER DIAGRAM EDITOR screen is used to reach NET EDITOR screen, the screen is in Modify mode, and when [CREATE] soft key is used, it is in New mode.
(c) Current net number is displayed at right of the top line. The net number is same with the net number in previous LADDER DIAGRAM EDITOR screen.
(d) NET EDITOR screen expands image of net horizontally for a wider net according to its width, while LADDER DIAGRAM MONITOR/EDITOR screen folds nets wider than screen width. When net width is expanded over screen width, attempt to move cursor out of screen will scroll net image to the direction.
The net of maximum size occupies area of 1024 elements, but actually available area may be little less for internal use according to the internal condition: "element" means the space that is occupied by single relay.

Soft keys of Net Editor screen

A contact	B contact	Normal coil	Inverted coil	Functional instructions
─┤├─	─┤/├─	─○─	─◇○─	FUNC
───	··········	↑──	──↑	AUTO
Horizontal connection	Delete	Left vertical connection	Right vertical connection	Automatic input

Set coil	Reset coil	Data table	Abandon changes	Edit next net
─Ⓢ─	─Ⓡ─	TABLE	RESTRE	NXTNET
INSLIN	INSCLM	APPCLM	CANCEL	EXIT
Insert line	Insert column	Add column	Cancel edit	Exit

6.5.4   PROGRAM LIST EDITOR Screen

At PROGRAM LIST EDITOR screen you can create new program and delete a program in addition to the function of PROGRAM LIST VIEWER screen. To reach this screen, press [LIST] soft key at LADDER DIAGRAM EDITOR screen. Following operations are available at PROGRAM LIST EDITOR screen. For more detail of these operations, see the descriptions of each key to operate.

- Create new program [NEW]
- Delete a program   [DELETE]
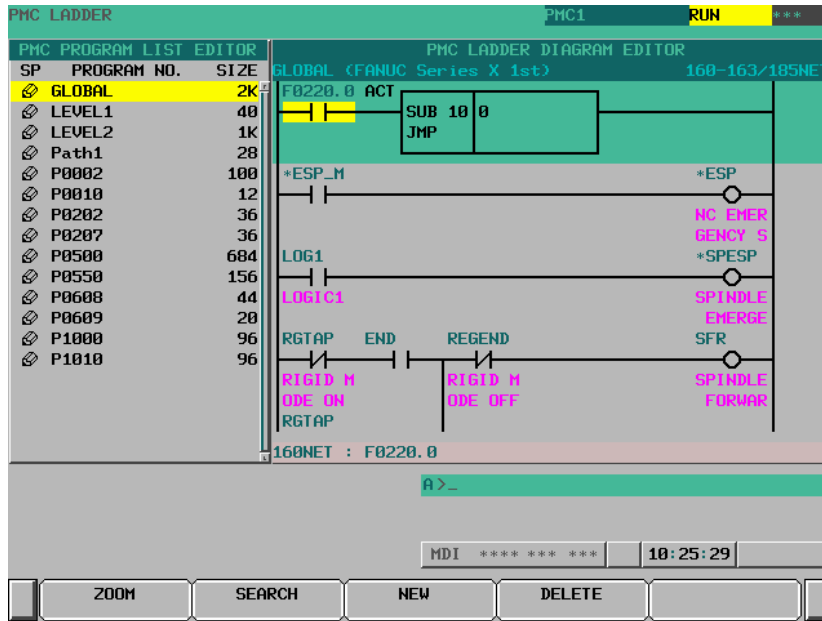
Fig. 6.5.4 PROGRAM LIST EDITOR screen

On the PROGRAM LIST EDITOR screen, a preview of the editor screen for the ladder program currently positioned by the cursor on the program list is displayed on the right of the screen.
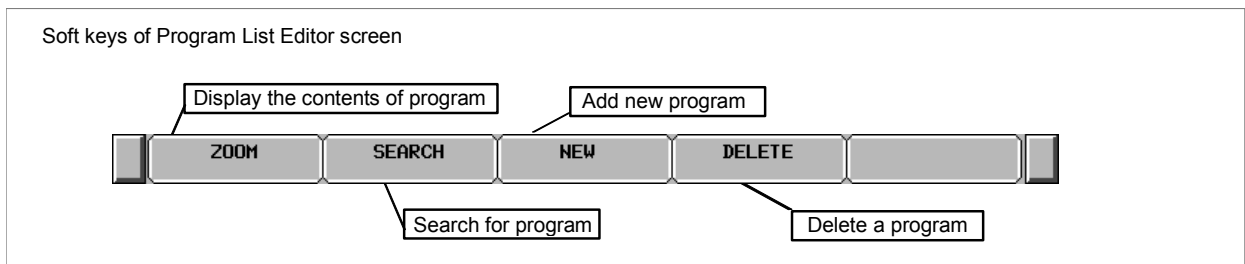
6.5.5   Collective Monitor Function

The COLLECTIVE MONITOR screen allows you to specify the ladder net containing the coils to be monitored, so that you can monitor only the necessary ladder net.
The COLLECTIVE MONITOR screen can be called in either of the following ways:

(1)   Calling from the PROGRAM LIST VIEWER screen
       On the program list screen, move the cursor to the "COLLECT" program position, then press the [ZOOM] soft key.
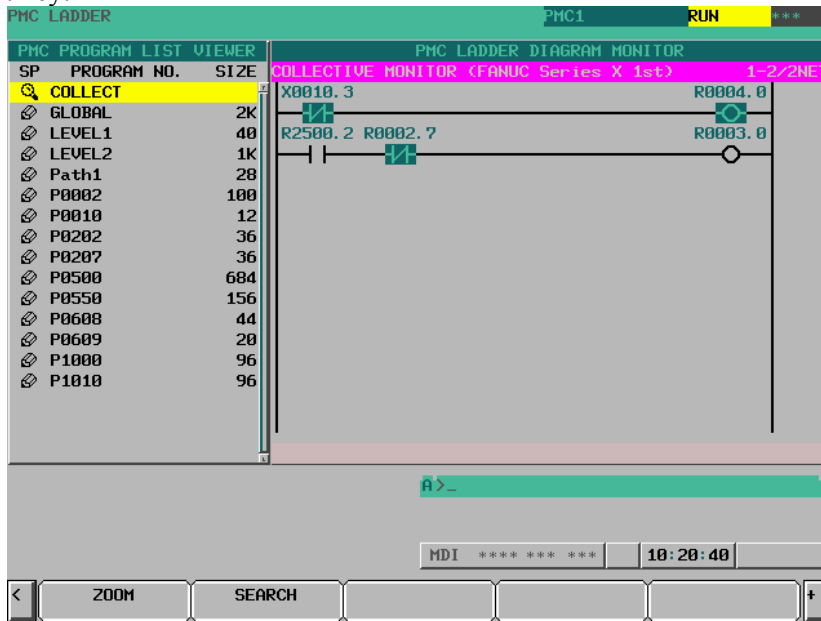
Fig. 6.5.5 (a) PROGRAM LIST VIEWER screen

(2)   Calling from the LADDER DIAGRAM MONITOR screen
       On the LADDER DIAGRAM MONITOR screen, press the [SWITCH] soft key.
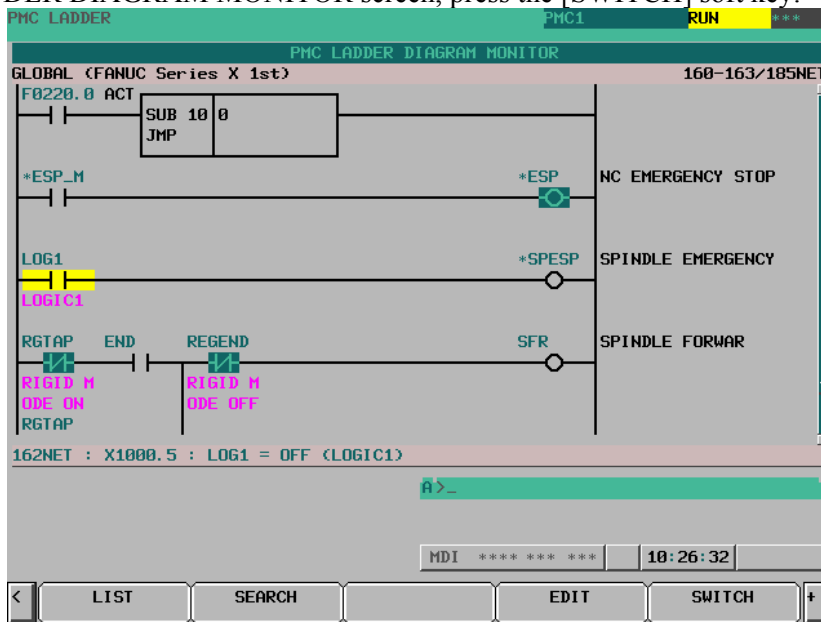
Fig. 6.5.5 (b) LADDER DIAGRAM MONITOR screen

6.5.5.1   COLLECTIVE MONITOR Screen

The COLLECTIVE MONITOR screen is such as that shown below. At first, it does not display any ladder diagram. Ladder nets will be added to this screen as they are selected with coil search and pickup operations. Up to 128 nets can be added to the COLLECTIVE MONITOR screen. If an attempt is made to add more, the most recently added 128 nets will be displayed.
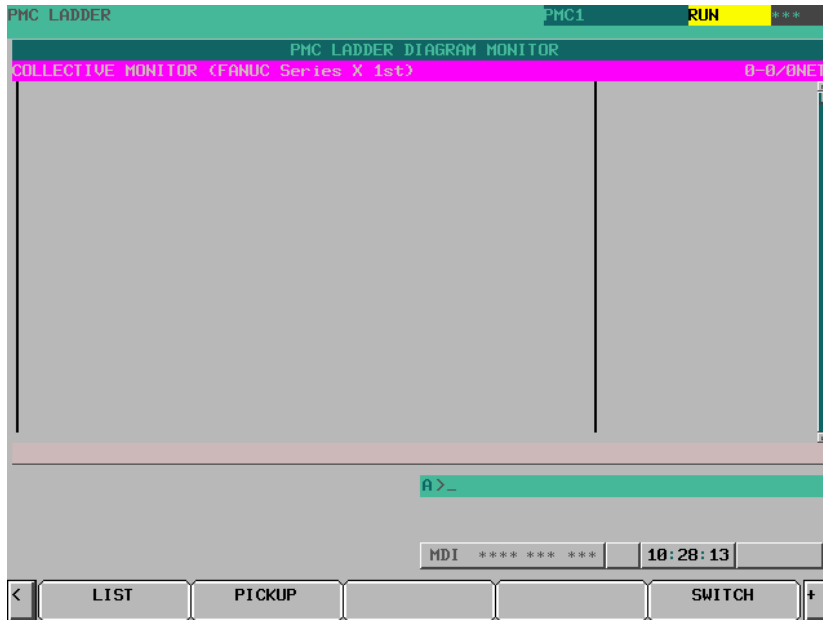
Fig. 6.5.5.1 (a) COLLECTIVE MONITOR screen (initial screen)

(1)   Operations using the soft keys
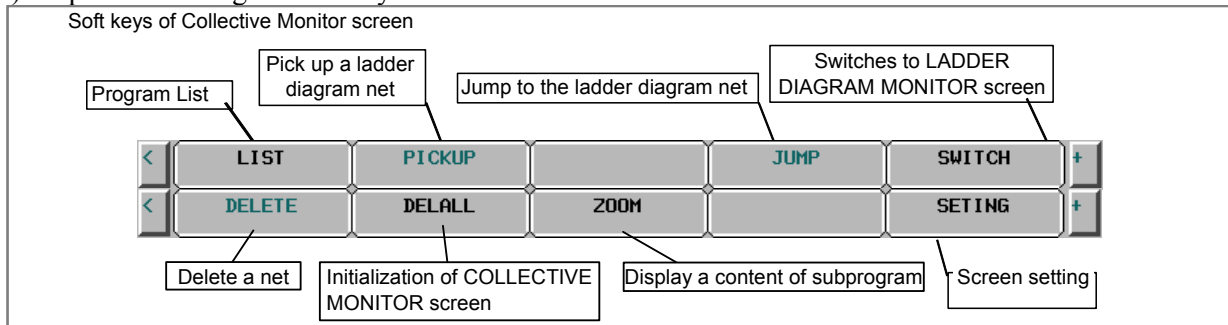
Fig. 6.5.5.1 (b) Soft keys of COLLECTIVE MONITOR screen

(2)   Specifying the ladder diagram to monitor
       The operation for picking up ladder nets which you want to monitor on COLLECTIVE MONITOR screen is as follows.
       (a)   Specification of ladder nets on COLLECTIVE MONITOR screen
              •   Specify the address by key input
                   Pick up a ladder net by keying in the address used by a coil.
              •   Indication from a ladder net on the COLLECTIVE MONITOR screen
                   Indicate a relay on an already picked up ladder net, with the cursor, to pick up the net that uses the relay address for the coil.
       (b)   Specifying a ladder net from the LADDER DIAGRAM MONITOR screen
              Specify a net from the LADDER DIAGRAM MONITOR screen to pick it and load it into the COLLECTIVE MONITOR screen.

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(3) Picking up a ladder net on the COLLECTIVE MONITOR screen
     You can pick up a ladder net from the COLLECTIVE MONITOR screen. The procedure for picking
     up a ladder net is as described below.
     (a) Address specification
          (i)   Enter the address to monitor (for example, R10.1).
          (ii) Press the [PICKUP] soft key.
          (iii) The net in which a coil uses the address specified in (i) will be picked up and loaded at the
                beginning of the screen.
     (b) Specification of an address from a ladder net on the screen
          (i)   Move the cursor to a relay on the ladder net that uses the address you want to monitor.
          (ii) Press the [PICKUP] soft key.
          (iii) The net in which a coil uses the address specified in (i) will be picked up and loaded at the
                beginning of the screen, and the cursor moves to the specified coil position.
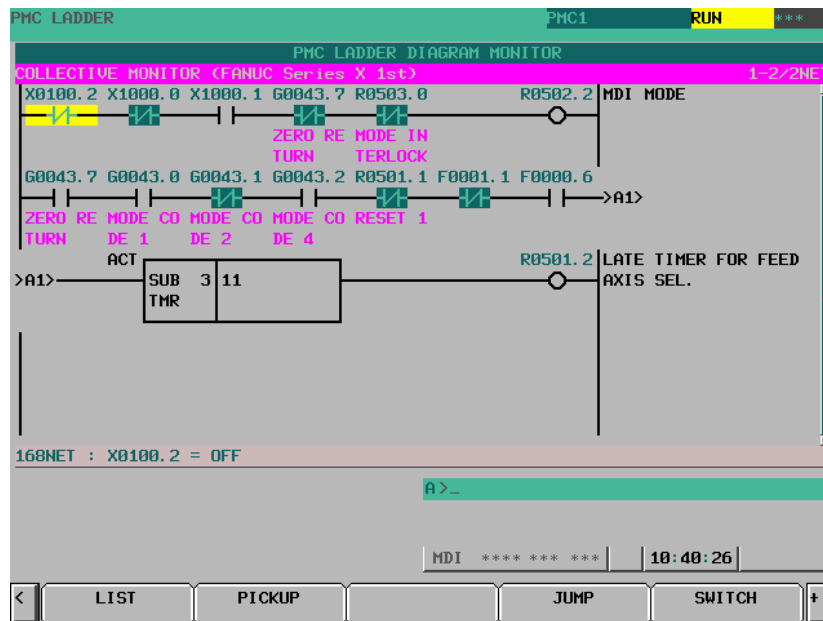
Fig. 6.5.5.1 (c) COLLECTIVE MONITOR screen

(4) Picking up a ladder net from the LADDER DIAGRAM MONITOR screen
     You can pick up a ladder net from the LADDER DIAGRAM MONITOR screen. The procedure for
     picking up a ladder net is as described below.
     (a) From the LADDER DIAGRAM MONITOR screen, press the [SEARCH] soft key to display
          the soft keys for search.
     (b) Move the cursor to the ladder net to pick up.
     (c) Press the [PICKUP] soft key to pick up and load the net specified in (b) at the beginning of the
          COLLECTIVE MONITOR screen.
     (d) For the ladder net picked up and loaded into the COLLECTIVE MONITOR screen, the "⚲"
          mark is displayed at the left end of the net.
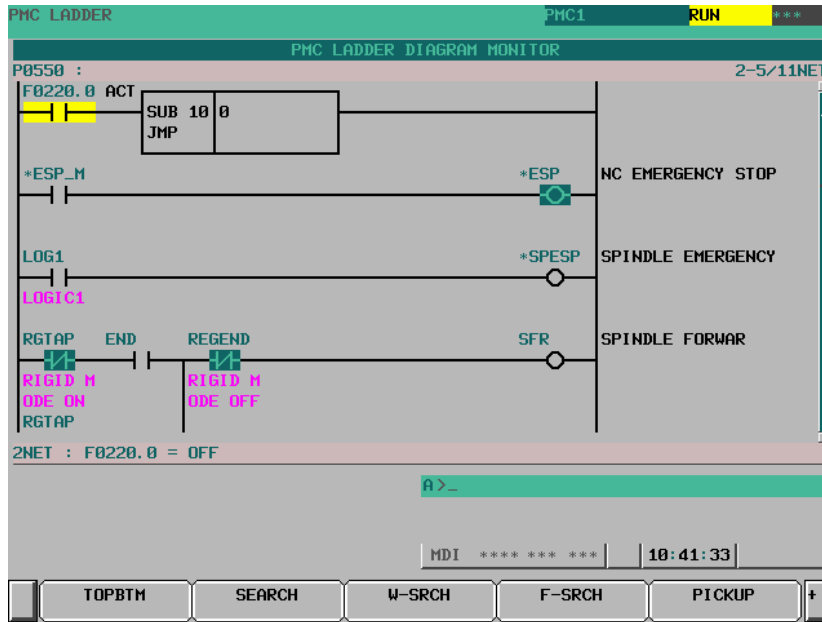
Fig. 6.5.5.1 (d) LADDER DIAGRAM MONITOR screen (search soft keys)

6.6   LIST OF ADDRESSES

Interface addresses among CNC and PMC are as follows:

[Example of controlling one path using one PMC]
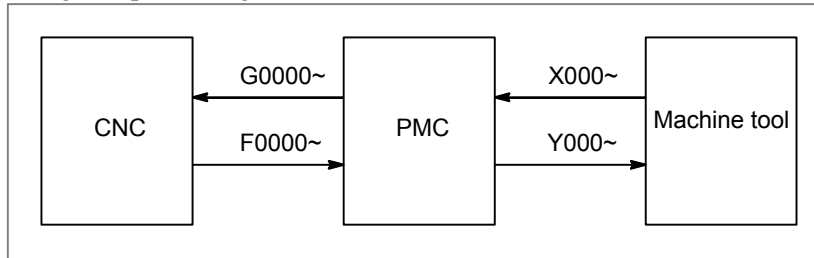
[Example of controlling two paths using one PMC]
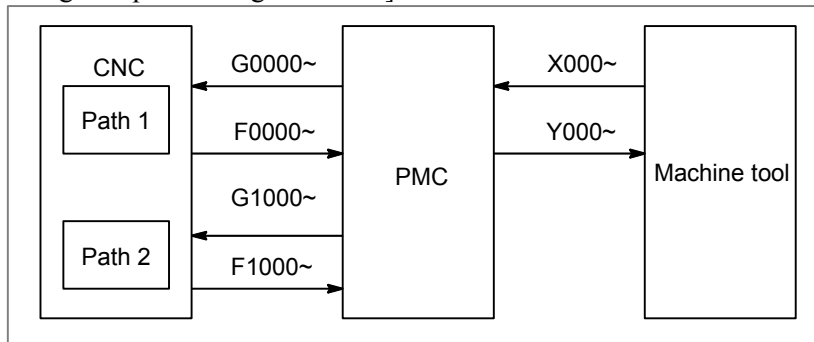
-   Expression of signals
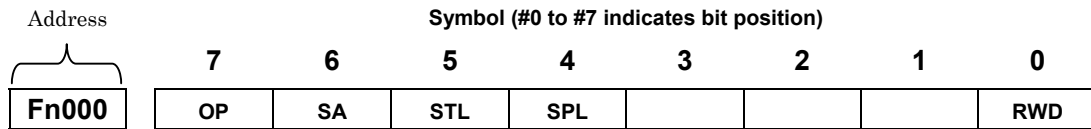
In an item where both T series and M series are described, some signals are covered with shade (　　　) in the signal address figure as shown below. This means either lathe system or machining center system does not have this signal. Upper part is for lathe system and lower part is for machining center system.
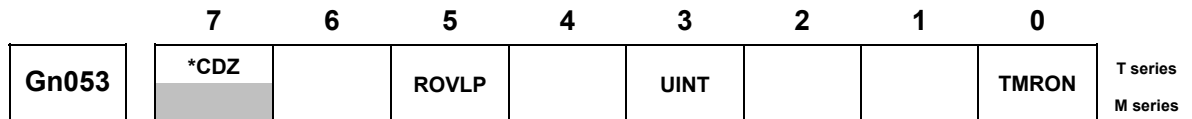
[Example 1]
    The figure above indicates *CDZ is provided only for the T series while the other signals for both the T series M series.
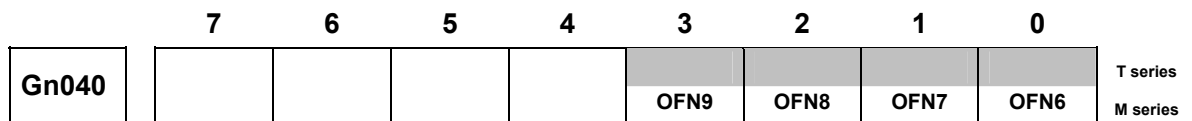
[Example 2]
    Signals OFN6 to OFN9 are for M series only.

When the signals at the same address are used differently between T series and M series, both T series and M series are described.

The same signal may be used for multiple purposes.   (The signal is used only for one of these purposes at a time.)

	7	6	5	4	3	2	1	0
X013 T series	SKIP [#2]	ESKIP[#2]	-MIT2[#2]	+MIT2[#2]	-MIT1[#2]	+MIT1[#2]		
		SKIP6 [#2]	SKIP5 [#2]	SKIP4 [#2]	SKIP3 [#2]	SKIP2 [#2]	SKIP8 [#2]	SKIP7 [#2]
X013 M series								

[Example 3]
    Bit 7 of X013 is used for SKIP[#2] for T series, but is not used for M series.
[Example 4]
    For T series, bit 2 of X013 is used as either +MIT1[#2] or SKIP2[#2].

NOTE
1   One of the following superscripts is attached to the top right of a symbol depending on the signal type.
    - For path 1 : #1
    - For path 2 : #2
    For the G and F addresses in the table, #P, #SV, and #SP represent signals prepared exclusively for, respectively, each path, controlled axis, and spindle.
    - Path type : #P
    - Controlled axis type : #SV
    - Spindle type : #SP
    #PX represents signals prepared for each PMC axis control group.
    - PMC axis control group type : #PX
2   For the signals, a single data number is assigned to 8 bits. Each bit has a different meaning.
3   The letter "n" in each address representation indicates the address position used in each path on the CNC side, as shown below.
        1st path : n=0 (No. 0 to 999)
        2nd path : n=1 (No. 1000 to 1999)

MT → CNC

Address | Bit number

Address	7	6	5	4	3	2	1	0
X000								
X001								
X002								
X003								
X004 T series	SKIP #1	ESKIP / SKIP6 #1	-MIT2#1 / SKIP5 #1	+MIT2#1 / SKIP4 #1	-MIT1#1 / SKIP3 #1	+MIT1#1 / SKIP2 #1	XAE2 / SKIP8 #1	XAE1 / SKIP7 #1
X004 M series	SKIP #1	ESKIP / SKIP6 #1	SKIP5 #1	SKIP4 #1	SKIP3 #1	XAE3 / SKIP2 #1	XAE2 / SKIP8 #1	XAE1 / SKIP7 #1
X005								
X006								
X007				*DEC5#2	*DEC4#2	*DEC3#2	*DEC2#2	*DEC1#2
X008				*ESP				
X009				*DEC5#1	*DEC4#1	*DEC3#1	*DEC2#1	*DEC1#1
X010								
X011								
X012								
X013 T series	SKIP #2	ESKIP#2 / SKIP6#2	-MIT2#2 / SKIP5#2	+MIT2#2 / SKIP4#2	-MIT1#2 / SKIP3#2	+MIT1#2 / SKIP2#2	SKIP8#2	SKIP7#2
X013 M series								

PMC → CNC

Address	Bit number							
	7	6	5	4	3	2	1	0
Gn000	ED7#P	ED6#P	ED5#P	ED4#P	ED3#P	ED2#P	ED1#P	ED0#P
Gn001	ED15#P	ED14#P	ED13#P	ED12#P	ED11#P	ED10#P	ED9#P	ED8#P
Gn002	ESTB#P	EA6#P	EA5#P	EA4#P	EA3#P	EA2#P	EA1#P	EA0#P
Gn003								
Gn004			MFIN3#P	MFIN2#P	FIN#P			
Gn005	BFIN#P	AFL#P			TFIN#P	SFIN#P		MFIN#P
Gn006		SKIPP#P		OVC#P		*ABSM#P		SRN#P
Gn007	RLSOT#P	EXLM#P	*FLWU#P	RLSOT3#P		ST#P	STLK#P	RVS#P
Gn008	ERS#P	RRW#P	*SP#P	*ESP#P	*BSL#P		*CSL#P	*IT#P
Gn009				PN16#P	PN8#P	PN4#P	PN2#P	PN1#P
Gn010	*JV7#P	*JV6#P	*JV5#P	*JV4#P	*JV3#P	*JV2#P	*JV1#P	*JV0#P
Gn011	*JV15#P	*JV14#P	*JV13#P	*JV12#P	*JV11#P	*JV10#P	*JV9#P	*JV8#P
Gn012	*FV7#P	*FV6#P	*FV5#P	*FV4#P	*FV3#P	*FV2#P	*FV1#P	*FV0#P
Gn013								
Gn014							ROV2#P	ROV1#P
Gn015								
Gn016	F1D#P							
Gn017								
Gn018	HS2D#P	HS2C#P	HS2B#P	HS2A#P	HS1D#P	HS1C#P	HS1B#P	HS1A#P
Gn019	RT#P		MP2#P	MP1#P	HS3D#P	HS3C#P	HS3B#P	HS3A#P
Gn020								
Gn021								
Gn022								
Gn023				HREV#P	HNDLF#P			
Gn024	EPN7#P	EPN6#P	EPN5#P	EPN4#P	EPN3#P	EPN2#P	EPN1#P	EPN0#P
Gn025	EPNS#P		EPN13#P	EPN12#P	EPN11#P	EPN10#P	EPN9#P	EPN8#P
Gn026							PC4SLC#P	PC3SLC#P

Address	Bit number							
	7	6	5	4	3	2	1	0
Gn027	CON#P		*SSTP3#SP	*SSTP2#SP	*SSTP1#SP		SWS2#P	SWS1#P
Gn028	PC2SLC#P	SPSTPA#SP	*SCPFA#SP	*SUCPFA#SP		GR2#SP	GR1#SP	
Gn029		*SSTP#P	SOR#P	SAR#P			GR22#SP	GR21#SP
Gn030	SOV7#P	SOV6#P	SOV5#P	SOV4#P	SOV3#P	SOV2#P	SOV1#P	SOV0#P
Gn031	PKESS2#P	PKESS1#P						
Gn032	R08I#SP	R07I#SP	R06I#SP	R05I#SP	R04I#SP	R03I#SP	R02I#SP	R01I#SP
Gn033	SIND#SP	SSIN#SP	SGN#SP		R12I#SP	R11I#SP	R10I#SP	R09I#SP
Gn034	R08I2#SP	R07I2#SP	R06I2#SP	R05I2#SP	R04I2#SP	R03I2#SP	R02I2#SP	R01I2#SP
Gn035	SIND2#SP	SSIN2#SP	SGN2#SP		R12I2#SP	R11I2#SP	R10I2#SP	R09I2#SP
Gn036								
Gn037								
Gn038	*BECLP#P	*BEUCP#P	SDPC#P		SPPHS#P	SPSYC#P	SBRT#P	*PLSST#P
Gn039	GOQSM#P	WOQSM#P	OFN5#P	OFN4#P	OFN3#P	OFN2#P	OFN1#P	OFN0#P
Gn040	WOSET#P	PRC#P	S2TLS#P		OFN9#P	OFN8#P	OFN7#P	OFN6#P
Gn041	HS2ID#P	HS2IC#P	HS2IB#P	HS2IA#P	HS1ID#P	HS1IC#P	HS1IB#P	HS1IA#P
Gn042	DMMC#P				HS3ID#P	HS3IC#P	HS3IB#P	HS3IA#P
Gn043	ZRN#P		DNCI#P			MD4#P	MD2#P	MD1#P
Gn044							MLK#P	BDT1#P
Gn045	BDT9#P	BDT8#P	BDT7#P	BDT6#P	BDT5#P	BDT4#P	BDT3#P	BDT2#P
Gn046	DRN#P	KEY4	KEY3	KEY2	KEY1		SBK#P	KEYP
Gn047	TL128#P	TL64#P	TL32#P	TL16#P	TL08#P	TL04#P	TL02#P	TL01#P
Gn048		TLRSTI#P				LFCIV#P		TL256#P
Gn049								
Gn050								
Gn051								
Gn052								
Gn053	*CDZ#P	SMZ#P	ROVLP#P		UINT#P			TMRON#P
Gn054	UI007#P	UI006#P	UI005#P	UI004#P	UI003#P	UI002#P	UI001#P	UI000#P

Address   Bit number

	7	6	5	4	3	2	1	0
Gn055	UI015#P	UI014#P	UI013#P	UI012#P	UI011#P	UI010#P	UI009#P	UI008#P
Gn056								
Gn057								
Gn058					EXWT#P	EXSTP#P	EXRD#P	
Gn059	NSYNCA#P							
Gn060	*TSB#P							
Gn061			RGTSP2#SP	RGTSP1#SP				RGTAP#P
Gn062		RTNT#P						
Gn063	NMWT#P	INFD#P	NOZAGC#P		SLSPB#P	SLSPA#P	NOWT	HEAD
Gn064		ESRSYC#P			SLPCB#P	SLSPA#P		
Gn065								
Gn066	EKSET			RTRCT#P			ENBKY	IGNVRY#P
Gn067	HCREQ	HCABT			MCHK#P	MMOD#P		MTLC#P
Gn068	MTL07#P	MTL06#P	MTL05#P	MTL04#P	MTL03#P	MTL02#P	MTL01#P	MTL00#P
Gn069	MTL15#P	MTL14#P	MTL13#P	MTL12#P	MTL11#P	MTL10#P	MTL09#P	MTL08#P
Gn070	MRDYA#SP	ORCMA#SP	SFRA#SP	SRVA#SP	CTH1A#SP	CTH2A#SP	TLMHA#SP	TLMLA#SP
Gn071	RCHA#SP	RSLA#SP	INTGA#SP	SOCNA#SP	MCFNA#SP	SPSLA#SP	*ESPA#SP	ARSTA#SP
Gn072	RCHHGA#SP	MFNHGA#SP	INCMDA#SP	OVRIDA#SP	DEFMDA#SP	NRROA#SP	ROTAA#SP	INDXA#SP
Gn073						MPOFA#SP	SLVA#SP	MORCMA#SP
Gn074	MRDYB#SP	ORCMB#SP	SFRB#SP	SRVB#SP	CTH1B#SP	CTH2B#SP	TLMHB#SP	TLMLB#SP
Gn075	RCHB#SP	RSLB#SP	INTGB#SP	SOCNB#SP	MCFNB#SP	SPSLB#SP	*ESPB#SP	ARSTB#SP
Gn076	RCHHGB#SP	MFNHGB#SP	INCMDB#SP	OVRIDB#SP	DEFMDB#SP	NRROB#SP	ROTAB#SP	INDXB#SP
Gn077						MPOFB#SP	SLVB#SP	MORCMB#SP
Gn078	SH07A#SP	SH06A#SP	SH05A#SP	SH04A#SP	SH03A#SP	SH02A#SP	SH01A#SP	SH00A#SP
Gn079					SH11A#SP	SH10A#SP	SH09A#SP	SH08A#SP
Gn080	SH07B#SP	SH06B#SP	SH05B#SP	SH04B#SP	SH03B#SP	SH02B#SP	SH01B#SP	SH00B#SP

Address | | | | | | | Bit number

Address	7	6	5	4	3	2	1	0
Gn081					SH11B#SP	SH10B#SP	SH09B#SP	SH08B#SP
Gn082	EUI07#P	EUI06#P	EUI05#P	EUI04#P	EUI03#P	EUI02#P	EUI01#P	EUI00#P
Gn083	EUI15#P	EUI14#P	EUI13#P	EUI12#P	EUI11#P	EUI10#P	EUI09#P	EUI08#P
Gn084								
Gn085								
Gn086								
Gn087				MP32#P	MP31#P		MP22#P	MP21#P
Gn088								
Gn089								
Gn090						G2RVY#P	G2RVZ#P	G2RVX#P
to								
Gn096	HROV#P	*HROV6#P	*HROV5#P	*HROV4#P	*HROV3#P	*HROV2#P	*HROV1#P	*HROV0#P
Gn097								
Gn098	EKC7	EKC6	EKC5	EKC4	EKC3	EKC2	EKC1	EKC0
Gn099								
Gn100				+J5#SV	+J4#SV	+J3#SV	+J2#SV	+J1#SV
Gn101				*+ED25#SV	*+ED24#SV	*+ED23#SV	*+ED22#SV	*+ED21#SV
Gn102				-J5#SV	-J4#SV	-J3#SV	-J2#SV	-J1#SV
Gn103				*-ED25#SV	*-ED24#SV	*-ED23#SV	*-ED22#SV	*-ED21#SV
Gn104				+EXL5#SV	+EXL4#SV	+EXL3#SV	+EXL2#SV	+EXL1#SV
Gn105				-EXL5#SV	-EXL4#SV	-EXL3#SV	-EXL2#SV	-EXL1#SV
Gn106				MI5#SV	MI4#SV	MI3#SV	MI2#SV	MI1#SV
Gn107				*+ED35#SV	*+ED34#SV	*+ED33#SV	*+ED32#SV	*+ED31#SV
Gn108				MLK5#SV	MLK4#SV	MLK3#SV	MLK2#SV	MLK1#SV
Gn109				*-ED35#SV	*-ED34#SV	*-ED33#SV	*-ED32#SV	*-ED31#SV
Gn110				+LM5#SV	+LM4#SV	+LM3#SV	+LM2#SV	+LM1#SV
Gn111								
Gn112				-LM5#SV	-LM4#SV	-LM3#SV	-LM2#SV	-LM1#SV
Gn113								
Gn114				*+L5#SV	*+L4#SV	*+L3#SV	*+L2#SV	*+L1#SV

Address　　　　　　　　　　　　　　　　Bit number

Address	7	6	5	4	3	2	1	0
Gn115								
Gn116				*-L5#SV	*-L4#SV	*-L3#SV	*-L2#SV	*-L1#SV
Gn117								
Gn118				*+ED5#SV	*+ED4#SV	*+ED3#SV	*+ED2#SV	*+ED1#SV
Gn119								
Gn120				*-ED5#SV	*-ED4#SV	*-ED3#SV	*-ED2#SV	*-ED1#SV
Gn121								
Gn122	PKESS2#P	PKESS1#P		PK5#SV	PK4#SV	PK3#SV	PK2#SV	PK1#SV
Gn123								
Gn124				DTCH5#SV	DTCH4#SV	DTCH3#SV	DTCH2#SV	DTCH1#SV
Gn125				IUDD5#SV	IUDD4#SV	IUDD3#SV	IUDD2#SV	IUDD1#SV
Gn126				SVF5#SV	SVF4#SV	SVF3#SV	SVF2#SV	SVF1#SV
Gn127								
Gn128				MIX5#SV	MIX4#SV	MIX3#SV	MIX2#SV	MIX1#SV
Gn129								
Gn130				*IT5#SV	*IT4#SV	*IT3#SV	*IT2#SV	*IT1#SV
Gn131								
Gn132				+MIT5#P	+MIT4#P	+MIT3#P	+MIT2#P	+MIT1#P
Gn133								
Gn134				-MIT5#P	-MIT4#P	-MIT3#P	-MIT2#P	-MIT1#P
Gn135								
Gn136				EAX5#SV	EAX4#SV	EAX3#SV	EAX2#SV	EAX1#SV
Gn137								
Gn138				SYNC5#SV	SYNC4#SV	SYNC3#SV	SYNC2#SV	SYNC1#SV
Gn139								
Gn140				SYNCJ5#SV	SYNCJ4#SV	SYNCJ3#SV	SYNCJ2#SV	SYNCJ1#SV
Gn141								
Gn142	EBUFA#PX	ECLRA#PX	ESTPA#PX	ESOFA#PX	ESBKA#PX	EMBUFA#PX	ELCKZA#PX	EFINA#PX

Address	Bit number							
	7	6	5	4	3	2	1	0
Gn143	EMSBKA#PX	EC6A#PX	EC5A#PX	EC4A#PX	EC3A#PX	EC2A#PX	EC1A#PX	EC0A#PX
Gn144	EIF7A#PX	EIF6A#PX	EIF5A#PX	EIF4A#PX	EIF3A#PX	EIF2A#PX	EIF1A#PX	EIF0A#PX
Gn145	EIF15A#PX	EIF14A#PX	EIF13A#PX	EIF12A#PX	EIF11A#PX	EIF10A#PX	EIF9A#PX	EIF8A#PX
Gn146	EID7A#PX	EID6A#PX	EID5A#PX	EID4A#PX	EID3A#PX	EID2A#PX	EID1A#PX	EID0A#PX
Gn147	EID15A#PX	EID14A#PX	EID13A#PX	EID12A#PX	EID11A#PX	EID10A#PX	EID9A#PX	EID8A#PX
Gn148	EID23A#PX	EID22A#PX	EID21A#PX	EID20A#PX	EID19A#PX	EID18A#PX	EID17A#PX	EID16A#PX
Gn149	EID31A#PX	EID30A#PX	EID29A#PX	EID28A#PX	EID27A#PX	EID26A#PX	EID25A#PX	EID24A#PX
Gn150	EDRN#P	ERT#P	EOVC#P				EROV2#P	EROV1#P
Gn151	*EFOV7#P	*EFOV6#P	*EFOV5#P	*EFOV4#P	*EFOV3#P	*EFOV2#P	*EFOV1#P	*EFOV0#P
Gn152								
Gn153								
Gn154	EBUFB#PX	ECLRB#PX	ESTPB#PX	ESOFB#PX	ESBKB#PX	EMBUFB#PX	ELCKZB#PX	EFINB#PX
Gn155	EMSBKB#PX	EC6B#PX	EC5B#PX	EC4B#PX	EC3B#PX	EC2B#PX	EC1B#PX	EC0B#PX
Gn156	EIF7B#PX	EIF6B#PX	EIF5B#PX	EIF4B#PX	EIF3B#PX	EIF2B#PX	EIF1B#PX	EIF0B#PX
Gn157	EIF15B#PX	EIF14B#PX	EIF13B#PX	EIF12B#PX	EIF11B#PX	EIF10B#PX	EIF9B#PX	EIF8B#PX
Gn158	EID7B#PX	EID6B#PX	EID5B#PX	EID4B#PX	EID3B#PX	EID2B#PX	EID1B#PX	EID0B#PX
Gn159	EID15B#PX	EID14B#PX	EID13B#PX	EID12B#PX	EID11B#PX	EID10B#PX	EID9B#PX	EID8B#PX
Gn160	EID23B#PX	EID22B#PX	EID21B#PX	EID20B#PX	EID19B#PX	EID18B#PX	EID17B#PX	EID16B#PX
Gn161	EID31B#PX	EID30B#PX	EID29B#PX	EID28B#PX	EID27B#PX	EID26B#PX	EID25B#PX	EID24B#PX
Gn162			EOVCB#PX					
Gn163	*EFOV7B#PX	*EFOV6B#PX	*EFOV5B#PX	*EFOV4B#PX	*EFOV3B#PX	*EFOV2B#PX	*EFOV1B#PX	*EFOV0B#PX
Gn164								
Gn165								
Gn166	EBUFC#PX	ECLRC#PX	ESTPC#PX	ESOFC#PX	ESBKC#PX	EMBUFC#PX	ELCKZC#PX	EFINC#PX
Gn167	EMSBKC#PX	EC6C#PX	EC5C#PX	EC4C#PX	EC3C#PX	EC2C#PX	EC1C#PX	EC0C#PX
Gn168	EIF7C#PX	EIF6C#PX	EIF5C#PX	EIF4C#PX	EIF3C#PX	EIF2C#PX	EIF1C#PX	EIF0C#PX
Gn169	EIF15C#PX	EIF14C#PX	EIF13C#PX	EIF12C#PX	EIF11C#PX	EIF10C#PX	EIF9C#PX	EIF8C#PX
Gn170	EID7C#PX	EID6C#PX	EID5C#PX	EID4C#PX	EID3C#PX	EID2C#PX	EID1C#PX	EID0C#PX
Gn171	EID15C#PX	EID14C#PX	EID13C#PX	EID12C#PX	EID11C#PX	EID10C#PX	EID9C#PX	EID8C#PX
Gn172	EID23C#PX	EID22C#PX	EID21C#PX	EID20C#PX	EID19C#PX	EID18C#PX	EID17C#PX	EID16C#PX

Address　　　　　　　　　　　　　　　　Bit number

Address	7	6	5	4	3	2	1	0
Gn173	EID31C#PX	EID30C#PX	EID29C#PX	EID28C#PX	EID27C#PX	EID26C#PX	EID25C#PX	EID24C#PX
Gn174			EOVCC#PX					
Gn175	*EFOV7C#PX	*EFOV6C#PX	*EFOV5C#PX	*EFOV4C#PX	*EFOV3C#PX	*EFOV2C#PX	*EFOV1C#PX	*EFOV0C#PX
Gn176								
Gn177								
Gn178	EBUFD#PX	ECLRD#PX	ESTPD#PX	ESOFD#PX	ESBKD#PX	EMBUFD#PX	ELCKZD#PX	EFIND#PX
Gn179	EMSBKD#PX	EC6D#PX	EC5D#PX	EC4D#PX	EC3D#PX	EC2D#PX	EC1D#PX	EC0D#PX
Gn180	EIF7D#PX	EIF6D#PX	EIF5D#PX	EIF4D#PX	EIF3D#PX	EIF2D#PX	EIF1D#PX	EIF0D#PX
Gn181	EIF15D#PX	EIF14D#PX	EIF13D#PX	EIF12D#PX	EIF11D#PX	EIF10D#PX	EIF9D#PX	EIF8D#PX
Gn182	EID7D#PX	EID6D#PX	EID5D#PX	EID4D#PX	EID3D#PX	EID2D#PX	EID1D#PX	EID0D#PX
Gn183	EID15D#PX	EID14D#PX	EID13D#PX	EID12D#PX	EID11D#PX	EID10D#PX	EID9D#PX	EID8D#PX
Gn184	EID23D#PX	EID22D#PX	EID21D#PX	EID20D#PX	EID19D#PX	EID18D#PX	EID17D#PX	EID16D#PX
Gn185	EID31D#PX	EID30D#PX	EID29D#PX	EID28D#PX	EID27D#PX	EID26D#PX	EID25D#PX	EID24D#PX
Gn186			EOVCD#PX					
Gn187	*EFOV7D#PX	*EFOV6D#PX	*EFOV5D#PX	*EFOV4D#PX	*EFOV3D#PX	*EFOV2D#PX	*EFOV1D#PX	*EFOV0D#PX
Gn188								
Gn189								
Gn190				OVLS5#SV	OVLS4#SV	OVLS3#SV	OVLS2#SV	OVLS1#SV
Gn191								
Gn192				IGVRY5#SV	IGVRY4#SV	IGVRY3#SV	IGVRY2#SV	IGVRY1#SV
Gn193					HDSR#P			
Gn194								
Gn195								
Gn196				*DEC5#SV	*DEC4#SV	*DEC3#SV	*DEC2#SV	*DEC1#SV
Gn197								
Gn198				NPOS5#SV	NPOS4#SV	NPOS3#SV	NPOS2#SV	NPOS1#SV
Gn199							IOLBH2	IOLBH1
Gn200	EASIP8#SV	EASIP7#SV	EASIP6#SV	EASIP5#SV	EASIP4#SV	EASIP3#SV	EASIP2#SV	EASIP1#SV
Gn201								

Address	7	6	5	4	3	2	1	0
Gn202	NDCAL8#SV	NDCAL7#SV	NDCAL6#SV	NDCAL5#SV	NDCAL4#SV	NDCAL3#SV	NDCAL2#SV	NDCAL1#SV
Gn203	PWFL							
to								
Gn210	ED23#P	ED22#P	ED21#P	ED20#P	ED19#P	ED18#P	ED17#P	ED16#P
Gn211	ED31#P	ED30#P	ED29#P	ED28#P	ED27#P	ED26#P	ED25#P	ED24#P
to								
Gn264							ESSYC2#SP	ESSYC1#SP
Gn265							PKESE2#SP	PKESE1#SP
to								
Gn274				CSFI1#SP				
to								
Gn288							SPSYC2#SP	SPSYC1#SP
Gn289							SPPHS2#SP	SPPHS1#SP
to								
Gn295	CNCKY	C2SEND						
to								
Gn347							HDN#P	
Gn348								
Gn349								
Gn350								
Gn351								
Gn352	*FHRO7#P	*FHRO6#P	*FHRO5#P	*FHRO4#P	*FHRO3#P	*FHRO2#P	*FHRO1#P	*FHRO0#P
Gn353	FHROV#P						*FHRO9#P	*FHRO8#P
Gn354								
Gn355								
Gn356								
Gn357								
Gn358				WPRST5#SV	WPRST4#SV	WPRST3#SV	WPRST2#SV	WPRST1#SV
to								

Address   Bit number

Address	7	6	5	4	3	2	1	0
Gn376	SOV27	SOV26	SOV25	SOV24	SOV23	SOV22	SOV21	SOV20
to								
Gn400							*SUCPFB#SP	
Gn401							*SCPFB#SP	
Gn402							SPSTPB#SP	
Gn403								
Gn404								
Gn405								
Gn406	ITF08#P	ITF07#P	ITF06#P	ITF05#P	ITF04#P	ITF03#P	ITF02#P	ITF01#P
Gn407							ITF10#P	ITF09#P
Gn408								STCHK#P
to								
Gn512	MCST8#P	MCST7#P	MCST6#P	MCST5#P	MCST4#P	MCST3#P	MCST2#P	MCST1#P
Gn513	MCST16#P	MCST15#P	MCST14#P	MCST13#P	MCST12#P	MCST11#P	MCST10#P	MCST9#P
Gn514								MCFIN#P
Gn515								
Gn516								
Gn517						GAE3#P	GAE2#P	GAE1#P
Gn518								
Gn519								
Gn520								
Gn521				SRVON5	SRVON4	SRVON3	SRVON2	SRVON1
Gn522								
Gn523				SVRVS5	SVRVS4	SVRVS3	SVRVS2	SVRVS1
Gn524								
Gn525	MT8N07#P	MT8N06#P	MT8N05#P	MT8N04#P	MT8N03#P	MT8N02#P	MT8N01#P	MT8N00#P
Gn526	MT8N15#P	MT8N14#P	MT8N13#P	MT8N12#P	MT8N11#P	MT8N10#P	MT8N09#P	MT8N08#P

Address   Bit number

	7	6	5	4	3	2	1	0
Gn527	MT8N23#P	MT8N22#P	MT8N21#P	MT8N20#P	MT8N19#P	MT8N18#P	MT8N17#P	MT8N16#P
Gn528	MT8N31#P	MT8N30#P	MT8N29#P	MT8N28#P	MT8N27#P	MT8N26#P	MT8N25#P	MT8N24#P
to								
Gn531							MRVM#P	FWSTP#P
Gn532								
Gn533								
Gn534								
Gn535								
Gn536	SPSP#P							
to								
Gn767								

CNC → PMC

Address   Bit number

Address	7	6	5	4	3	2	1	0
Fn000	OP$^{\#P}$	SA$^{\#P}$	STL$^{\#P}$	SPL$^{\#P}$				RWD$^{\#P}$
Fn001	MA$^{\#P}$		TAP$^{\#P}$	ENB$^{\#SP}$	DEN$^{\#P}$	BAL$^{\#P}$	RST$^{\#P}$	AL$^{\#P}$
Fn002	MDRN$^{\#P}$	CUT$^{\#P}$		SRNMV$^{\#P}$	THRD$^{\#P}$	CSS$^{\#P}$	RPDO$^{\#P}$	INCH$^{\#P}$
Fn003		MEDT$^{\#P}$	MMEM$^{\#P}$	MRMT$^{\#P}$	MMDI$^{\#P}$	MJ$^{\#P}$	MH$^{\#P}$	MINC$^{\#P}$
Fn004			MREF$^{\#P}$	MAFL$^{\#P}$	MSBK$^{\#P}$	MABSM$^{\#P}$	MMLK$^{\#P}$	MBDT1$^{\#P}$
Fn005	MBDT9$^{\#P}$	MBDT8$^{\#P}$	MBDT7$^{\#P}$	MBDT6$^{\#P}$	MBDT5$^{\#P}$	MBDT4$^{\#P}$	MBDT3$^{\#P}$	MBDT2$^{\#P}$
Fn006						ERTVA$^{\#P}$	MDIRST$^{\#P}$	TPPRS
Fn007	BF$^{\#P}$				TF$^{\#P}$	SF$^{\#P}$		MF$^{\#P}$
Fn008			MF3$^{\#P}$	MF2$^{\#P}$				
Fn009	DM00$^{\#P}$	DM01$^{\#P}$	DM02$^{\#P}$	DM30$^{\#P}$				
Fn010	M07$^{\#P}$	M06$^{\#P}$	M05$^{\#P}$	M04$^{\#P}$	M03$^{\#P}$	M02$^{\#P}$	M01$^{\#P}$	M00$^{\#P}$
Fn011	M15$^{\#P}$	M14$^{\#P}$	M13$^{\#P}$	M12$^{\#P}$	M11$^{\#P}$	M10$^{\#P}$	M09$^{\#P}$	M08$^{\#P}$
Fn012	M23$^{\#P}$	M22$^{\#P}$	M21$^{\#P}$	M20$^{\#P}$	M19$^{\#P}$	M18$^{\#P}$	M17$^{\#P}$	M16$^{\#P}$
Fn013	M31$^{\#P}$	M30$^{\#P}$	M29$^{\#P}$	M28$^{\#P}$	M27$^{\#P}$	M26$^{\#P}$	M25$^{\#P}$	M24$^{\#P}$
Fn014	M207$^{\#P}$	M206$^{\#P}$	M205$^{\#P}$	M204$^{\#P}$	M203$^{\#P}$	M202$^{\#P}$	M201$^{\#P}$	M200$^{\#P}$
Fn015	M215$^{\#P}$	M214$^{\#P}$	M213$^{\#P}$	M212$^{\#P}$	M211$^{\#P}$	M210$^{\#P}$	M209$^{\#P}$	M208$^{\#P}$
Fn016	M307$^{\#P}$	M306$^{\#P}$	M305$^{\#P}$	M304$^{\#P}$	M303$^{\#P}$	M302$^{\#P}$	M301$^{\#P}$	M300$^{\#P}$
Fn017	M315$^{\#P}$	M314$^{\#P}$	M313$^{\#P}$	M312$^{\#P}$	M311$^{\#P}$	M310$^{\#P}$	M309$^{\#P}$	M308$^{\#P}$
Fn018								
Fn019								
Fn020								
Fn021								
Fn022	S07$^{\#P}$	S06$^{\#P}$	S05$^{\#P}$	S04$^{\#P}$	S03$^{\#P}$	S02$^{\#P}$	S01$^{\#P}$	S00$^{\#P}$
Fn023	S15$^{\#P}$	S14$^{\#P}$	S13$^{\#P}$	S12$^{\#P}$	S11$^{\#P}$	S10$^{\#P}$	S09$^{\#P}$	S08$^{\#P}$
Fn024	S23$^{\#P}$	S22$^{\#P}$	S21$^{\#P}$	S20$^{\#P}$	S19$^{\#P}$	S18$^{\#P}$	S17$^{\#P}$	S16$^{\#P}$
Fn025	S31$^{\#P}$	S30$^{\#P}$	S29$^{\#P}$	S28$^{\#P}$	S27$^{\#P}$	S26$^{\#P}$	S25$^{\#P}$	S24$^{\#P}$
Fn026	T07$^{\#P}$	T06$^{\#P}$	T05$^{\#P}$	T04$^{\#P}$	T03$^{\#P}$	T02$^{\#P}$	T01$^{\#P}$	T00$^{\#P}$
Fn027	T15$^{\#P}$	T14$^{\#P}$	T13$^{\#P}$	T12$^{\#P}$	T11$^{\#P}$	T10$^{\#P}$	T09$^{\#P}$	T08$^{\#P}$

Address   Bit number

Address	7	6	5	4	3	2	1	0
Fn028	T23#P	T22#P	T21#P	T20#P	T19#P	T18#P	T17#P	T16#P
Fn029	T31#P	T30#P	T29#P	T28#P	T27#P	T26#P	T25#P	T24#P
Fn030	B07#P	B06#P	B05#P	B04#P	B03#P	B02#P	B01#P	B00#P
Fn031	B15#P	B14#P	B13#P	B12#P	B11#P	B10#P	B09#P	B08#P
Fn032	B23#P	B22#P	B21#P	B20#P	B19#P	B18#P	B17#P	B16#P
Fn033	B31#P	B30#P	B29#P	B28#P	B27#P	B26#P	B25#P	B24#P
Fn034	SRSRDY#P	SRSP1R#SP	SRSP2R#SP			GR3O#P	GR2O#P	GR1O#P
Fn035								SPAL#P
Fn036	R08O#SP	R07O#SP	R06O#SP	R05O#SP	R04O#SP	R03O#SP	R02O#SP	R01O#SP
Fn037					R12O#SP	R11O#SP	R10O#SP	R09O#SP
Fn038						ENB2#SP	SUCLPA#SP	SCLPA#SP
Fn039								MSPOSA#SP
Fn040	AR07#SP	AR06#SP	AR05#SP	AR04#SP	AR03#SP	AR02#SP	AR01#SP	AR00#SP
Fn041	AR15#SP	AR14#SP	AR13#SP	AR12#SP	AR11#SP	AR10#SP	AR09#SP	AR08#SP
Fn042								
Fn043							SYCAL2#SP	SYCAL1#SP
Fn044				SYCAL#P	FSPPH#P	FSPSY#P	FSCSL#P	
Fn045	ORARA#SP	TLMA#SP	LDT2A#SP	LDT1A#SP	SARA#SP	SDTA#SP	SSTA#SP	ALMA#SP
Fn046	MORA2A#SP	MORA1A#SP	PORA2A#SP	SLVSA#SP	RCFNA#SP	RCHPA#SP	CFINA#SP	CHIPA#SP
Fn047							INCSTA#SP	PC1DEA#SP
Fn048				CSPENA#SP				
Fn049	ORARB#SP	TLMB#SP	LDT2B#SP	LDT1B#SP	SARB#SP	SDTB#SP	SSTB#SP	ALMB#SP
Fn050	MORA2B#SP	MORA1B#SP	PORA2B#SP	SLVSB#SP	RCFNB#SP	RCHPB#SP	CFINB#SP	CHIPB#SP
Fn051							INCSTB#SP	PC1DEB#SP
Fn052								
Fn053	EKENB				RPALM#P	RPBSY#P	PRGDPL	INHKY
Fn054	UO007#P	UO006#P	UO005#P	UO004#P	UO003#P	UO002#P	UO001#P	UO000#P
Fn055	UO015#P	UO014#P	UO013#P	UO012#P	UO011#P	UO010#P	UO009#P	UO008#P

Address	\#7	6	5	4	3	2	1	0
Fn056	UO107$^{\#P}$	UO106$^{\#P}$	UO105$^{\#P}$	UO104$^{\#P}$	UO103$^{\#P}$	UO102$^{\#P}$	UO101$^{\#P}$	UO100$^{\#P}$
Fn057	UO115$^{\#P}$	UO114$^{\#P}$	UO113$^{\#P}$	UO112$^{\#P}$	UO111$^{\#P}$	UO110$^{\#P}$	UO109$^{\#P}$	UO108$^{\#P}$
Fn058	UO123$^{\#P}$	UO122$^{\#P}$	UO121$^{\#P}$	UO120$^{\#P}$	UO119$^{\#P}$	UO118$^{\#P}$	UO117$^{\#P}$	UO116$^{\#P}$
Fn059	UO131$^{\#P}$	UO130$^{\#P}$	UO129$^{\#P}$	UO128$^{\#P}$	UO127$^{\#P}$	UO126$^{\#P}$	UO125$^{\#P}$	UO124$^{\#P}$
Fn060						ESCAN$^{\#P}$	ESEND$^{\#P}$	EREND$^{\#P}$
Fn061			MTLA$^{\#P}$	MTLANG$^{\#P}$	HCEXE	HCAB2	BCLP$^{\#P}$	BUCLP$^{\#P}$
Fn062	PRTSF$^{\#P}$			S2MES$^{\#P}$	S1MES$^{\#P}$			AICC$^{\#P}$
Fn063	PSYN$^{\#P}$	WATO$^{\#P}$		COSP2$^{\#P}$	COSP1$^{\#P}$	PSAR$^{\#P}$	PSE2$^{\#P}$	PSE1$^{\#P}$
Fn064	TIALM$^{\#P}$	TICHK$^{\#P}$	COSP$^{\#P}$			TLCHI$^{\#P}$	TLNW$^{\#P}$	
Fn065		SYNMOD$^{\#P}$		RTRCTF$^{\#P}$		RSMAX$^{\#P}$	RGSPM$^{\#P}$	RGSPP$^{\#P}$
Fn066			PECK2$^{\#P}$			FEED0$^{\#P}$	RTPT$^{\#P}$	
Fn067								
Fn068								
Fn069								
Fn070	PSW08$^{\#P}$	PSW07$^{\#P}$	PSW06$^{\#P}$	PSW05$^{\#P}$	PSW04$^{\#P}$	PSW03$^{\#P}$	PSW02$^{\#P}$	PSW01$^{\#P}$
Fn071	PSW16$^{\#P}$	PSW15$^{\#P}$	PSW14$^{\#P}$	PSW13$^{\#P}$	PSW12$^{\#P}$	PSW11$^{\#P}$	PSW10$^{\#P}$	PSW09$^{\#P}$
Fn072	OUT7$^{\#P}$	OUT6$^{\#P}$	OUT5$^{\#P}$	OUT4$^{\#P}$	OUT3$^{\#P}$	OUT2$^{\#P}$	OUT1$^{\#P}$	OUT0$^{\#P}$
Fn073				ZRNO$^{\#P}$		MD4O$^{\#P}$	MD2O$^{\#P}$	MD1O$^{\#P}$
Fn074	OUT15$^{\#P}$	OUT14$^{\#P}$	OUT13$^{\#P}$	OUT12$^{\#P}$	OUT11$^{\#P}$	OUT10$^{\#P}$	OUT9$^{\#P}$	OUT8$^{\#P}$
Fn075	SPO$^{\#P}$	KEYO	DRNO$^{\#P}$	MLKO$^{\#P}$	SBKO$^{\#P}$	BDTO$^{\#P}$		
Fn076			ROV2O$^{\#P}$	ROV1O$^{\#P}$	RTAP$^{\#P}$		MP2O$^{\#P}$	MP1O$^{\#P}$
Fn077		RTO$^{\#P}$			HS1DO$^{\#P}$	HS1CO$^{\#P}$	HS1BO$^{\#P}$	HS1AO$^{\#P}$
Fn078	*FV7O$^{\#P}$	*FV6O$^{\#P}$	*FV5O$^{\#P}$	*FV4O$^{\#P}$	*FV3O$^{\#P}$	*FV2O$^{\#P}$	*FV1O$^{\#P}$	*FV0O$^{\#P}$
Fn079	*JV7O$^{\#P}$	*JV6O$^{\#P}$	*JV5O$^{\#P}$	*JV4O$^{\#P}$	*JV3O$^{\#P}$	*JV2O$^{\#P}$	*JV1O$^{\#P}$	*JV0O$^{\#P}$
Fn080	*JV15O$^{\#P}$	*JV14O$^{\#P}$	*JV13O$^{\#P}$	*JV12O$^{\#P}$	*JV11O$^{\#P}$	*JV10O$^{\#P}$	*JV9O$^{\#P}$	*JV8O$^{\#P}$
Fn081	-J4O$^{\#P}$	+J4O$^{\#P}$	-J3O$^{\#P}$	+J3O$^{\#P}$	-J2O$^{\#P}$	+J2O$^{\#P}$	-J1O$^{\#P}$	+J1O$^{\#P}$

Address	Bit number							
	7	6	5	4	3	2	1	0
Fn082						RVSL#P		
Fn083								
Fn084	EUO07#P	EUO06#P	EUO05#P	EUO04#P	EUO03#P	EUO02#P	EUO01#P	EUO00#P
Fn085	EUO15#P	EUO14#P	EUO13#P	EUO12#P	EUO11#P	EUO10#P	EUO09#P	EUO08#P
Fn086								
Fn087								
Fn088								
Fn089								
Fn090						ABTSP2#SP	ABTSP1#SP	ABTQSV#P
Fn091					MMMOD#P	MRVSP#P	MNCHG#P	MRVMD#P
Fn092								
Fn093	SVWRN4#P	SVWRN3#P	SVWRN2#P	SVWRN1#P		LFCIF#P		
Fn094				ZP5#SV	ZP4#SV	ZP3#SV	ZP2#SV	ZP1#SV
Fn095								
Fn096				ZP25#SV	ZP24#SV	ZP23#SV	ZP22#SV	ZP21#SV
Fn097								
Fn098				ZP35#SV	ZP34#SV	ZP33#SV	ZP32#SV	ZP31#SV
Fn099								
Fn100				ZP45#SV	ZP44#SV	ZP43#SV	ZP42#SV	ZP41#SV
Fn101								
Fn102				MV5#SV	MV4#SV	MV3#SV	MV2#SV	MV1#SV
Fn103								
Fn104				INP5#SV	INP4#SV	INP3#SV	INP2#SV	INP1#SV
Fn105								
Fn106				MVD5#SV	MVD4#SV	MVD3#SV	MVD2#SV	MVD1#SV
Fn107								
Fn108				MMI5#SV	MMI4#SV	MMI3#SV	MMI2#SV	MMI1#SV
Fn109								
Fn110				MDTCH5#SV	MDTCH4#SV	MDTCH3#SV	MDTCH2#SV	MDTCH1#SV

Address	7	6	5	4	3	2	1	0
Fn111								
Fn112	EADEN8#SV	EADEN7#SV	EADEN6#SV	EADEN5#SV	EADEN4#SV	EADEN3#SV	EADEN2#SV	EADEN1#SV
Fn113								
Fn114				TRQL5#SV	TRQL4#SV	TRQL3#SV	TRQL2#SV	TRQL1#SV
Fn115								
Fn116								
Fn117								
Fn118				SYN50#SV	SYN40#SV	SYN30#SV	SYN20#SV	SYN10#SV
Fn119								
Fn120				ZRF5#SV	ZRF4#SV	ZRF3#SV	ZRF2#SV	ZRF1#SV
Fn121								
Fn122					HDO3#P	HDO2#P	HDO1#P	HDO0#P
Fn123								
Fn124				+OT5#SV	+OT4#SV	+OT3#SV	+OT2#SV	+OT1#SV
Fn125								
Fn126				-OT5#SV	-OT4#SV	-OT3#SV	-OT2#SV	-OT1#SV
Fn127								
Fn128								
Fn129	*EAXSL#P		EOV0#P					
Fn130	EBSYA#PX	EOTNA#PX	EOTPA#PX	EGENA#PX	EDENA#PX	EIALA#PX	ECKZA#PX	EINPA#PX
Fn131					EMF3A#PX	EMF2A#PX	EABUFA#PX	EMFA#PX
Fn132	EM28A#PX	EM24A#PX	EM22A#PX	EM21A#PX	EM18A#PX	EM14A#PX	EM12A#PX	EM11A#PX
Fn133	EBSYB#PX	EOTNB#PX	EOTPB#PX	EGENB#PX	EDENB#PX	EIALB#PX	ECKZB#PX	EINPB#PX
Fn134					EMF3B#PX	EMF2B#PX	EABUFB#PX	EMFB#PX
Fn135	EM28B#PX	EM24B#PX	EM22B#PX	EM21B#PX	EM18B#PX	EM14B#PX	EM12B#PX	EM11B#PX
Fn136	EBSYC#PX	EOTNC#PX	EOTPC#PX	EGENC#PX	EDENC#PX	EIALC#PX	ECKZC#PX	EINPC#PX
Fn137					EMF3C#PX	EMF2C#PX	EABUFC#PX	EMFC#PX
Fn138	EM28C#PX	EM24C#PX	EM22C#PX	EM21C#PX	EM18C#PX	EM14C#PX	EM12C#PX	EM11C#PX
Fn139	EBSYD#PX	EOTND#PX	EOTPD#PX	EGEND#PX	EDEND#PX	EIALD#PX	ECKZD#PX	EINPD#PX

Address   Bit number

	7	6	5	4	3	2	1	0
Fn140					EMF3D#PX	EMF2D#PX	EABUFD#PX	EMFD#PX
Fn141	EM28D#PX	EM24D#PX	EM22D#PX	EM21D#PX	EM18D#PX	EM14D#PX	EM12D#PX	EM11D#PX
Fn142	EM48A#PX	EM44A#PX	EM42A#PX	EM41A#PX	EM38A#PX	EM34A#PX	EM32A#PX	EM31A#PX
Fn143								
Fn144								
Fn145	EM48B#PX	EM44B#PX	EM42B#PX	EM41B#PX	EM38B#PX	EM34B#PX	EM32B#PX	EM31B#PX
Fn146								
Fn147								
Fn148	EM48C#PX	EM44C#PX	EM42C#PX	EM41C#PX	EM38C#PX	EM34C#PX	EM32C#PX	EM31C#PX
Fn149								
Fn150								
Fn151	EM48D#PX	EM44D#PX	EM42D#PX	EM41D#PX	EM38D#PX	EM34D#PX	EM32D#PX	EM31D#PX
Fn152								
Fn153								
Fn154								TLAL
to								
Fn160	MSP07#P	MSP06#P	MSP05#P	MSP04#P	MSP03#P	MSP02#P	MSP01#P	MSP00#P
Fn161	MSP15#P	MSP14#P	MSP13#P	MSP12#P	MSP11#P	MSP10#P	MSP09#P	MSP08#P
to								
Fn172	PBATL#P	PBATZ#P						
to								
Fn180				CLRCH5#SV	CLRCH4#SV	CLRCH3#SV	CLRCH2#SV	CLRCH1#SV
Fn181								
Fn182				EACNT5#SV	EACNT4#SV	EACNT3#SV	EACNT2#SV	EACNT1#SV
Fn183								
Fn184				ABDT5#SV	ABDT4#SV	ABDT3#SV	ABDT2#SV	ABDT1#SV
Fn185								
Fn186								
Fn187								
Fn188				AMRST5#SV	AMRST4#SV	AMRST3#SV	AMRST2#SV	AMRST1#SV

Address　　　　　　　　　　　　　　　　　Bit number

Address	7	6	5	4	3	2	1	0
Fn189								
Fn190				TRQM5#SV	TRQM4#SV	TRQM3#SV	TRQM2#SV	TRQM1#SV
to								
Fn200	R08O2#SP	R07O2#SP	R06O2#SP	R05O2#SP	R04O2#SP	R03O2#SP	R02O2#SP	R01O2#SP
Fn201					R12O2#SP	R11O2#SP	R10O2#SP	R09O2#SP
Fn202	AR072#SP	AR062#SP	AR052#SP	AR042#SP	AR032#SP	AR022#SP	AR012#SP	AR002#SP
Fn203	AR152#SP	AR142#SP	AR132#SP	AR122#SP	AR112#SP	AR102#SP	AR092#SP	AR082#SP
Fn204	R08O3#SP	R07O3#SP	R06O3#SP	R05O3#SP	R04O3#SP	R03O3#SP	R02O3#SP	R01O3#SP
Fn205					R12O3#SP	R11O3#SP	R10O3#SP	R09O3#SP
Fn206								
Fn207								
Fn208								
Fn209								
Fn210				SYNMT5#P	SYNMT4#P	SYNMT3#P	SYNMT2#P	SYNMT1#P
Fn211				SYNOF5#P	SYNOF4#P	SYNOF3#P	SYNOF2#P	SYNOF1#P
to								
Fn264	SPWRN8#P	SPWRN7#P	SPWRN6#P	SPWRN5#P	SPWRN4#P	SPWRN3#P	SPWRN2#P	SPWRN1#P
Fn265								SPWRN9#P
Fn266								
Fn267								
Fn268								
Fn269								
Fn270	R08O4#SP	R07O4#SP	R06O4#SP	R05O4#SP	R04O4#SP	R03O4#SP	R02O4#SP	R01O4#SP
Fn271					R12O4#SP	R11O4#SP	R10O4#SP	R09O4#SP
Fn272								
Fn273								
Fn274				CSFO1#SP				
to								
Fn288							FSPSY2#SP	FSPSY1#SP

Address	Bit number							
	7	6	5	4	3	2	1	0
Fn289							FSPPH2#SP	FSPPH1#SP
to								
Fn295	CNCKYO	C2SENO						
to								
Fn341				SYCM5#SV	SYCM4#SV	SYCM3#SV	SYCM2#SV	SYCM1#SV
Fn342				SYCS5#SV	SYCS4#SV	SYCS3#SV	SYCS2#SV	SYCS1#SV
Fn343				MIXO5#SV	MIXO4#SV	MIXO3#SV	MIXO2#SV	MIXO1#SV
Fn344				OVMO5#SV	OVMO4#SV	OVMO3#SV	OVMO2#SV	OVMO1#SV
Fn345				OVSO5#SV	OVSO4#SV	OVSO3#SV	OVSO2#SV	OVSO1#SV
Fn346				SMPK5#SV	SMPK4#SV	SMPK3#SV	SMPK2#SV	SMPK1#SV
to								
Fn358				WPSF5#SV	WPSF4#SV	WPSF3#SV	WPSF2#SV	WPSF1#SV
to								
Fn400							SUCLPB#SP	
Fn401							SCLPB#SP	
Fn402							MSPOSB#SP	
Fn403								SYNER#P
to								
Fn512						MCSP#P	MCRQ#P	MCEXE#P
Fn513	ZRNR#P		DNCIR#P			MD4R#P	MD2R#P	MD1R#P
Fn514	MCEX8#P	MCEX7#P	MCEX6#P	MCEX5#P	MCEX4#P	MCEX3#P	MCEX2#P	MCEX1#P
Fn515	MCEX16#P	MCEX15#P	MCEX14#P	MCEX13#P	MCEX12#P	MCEX11#P	MCEX10#P	MCEX9#P
Fn516								
Fn517								
Fn518								
Fn519								
Fn520								ATBK

Address   Bit number

	7	6	5	4	3	2	1	0
Fn521				SVREV5	SVREV4	SVREV3	SVREV2	SVREV1
Fn522				SPP5	SPP4	SPP3	SPP2	SPP1
to								
Fn532				SYNO5#SV	SYNO4#SV	SYNO3#SV	SYNO2#SV	SYNO1#SV
to								
Fn767								

7   EMBEDDED ETHERNET FUNCTION

This chapter describes the specifications of the embedded Ethernet function.

Chapter 7, "EMBEDDED ETHERNET FUNCTION", consists of the following sections:

7.1   EMBEDDED ETHERNET PORT AND PCMCIA ETHERNET CARD

The embedded Ethernet function can be used by selecting one of two types of devices: the embedded Ethernet port and PCMCIA Ethernet card.
A selection can also be made to stop the embedded Ethernet function.
The PCMCIA Ethernet card is to be inserted into the memory card slot for temporary communication.

⚠ **CAUTION**
1 When using the embedded Ethernet function for the first time, set an IP address and other items carefully as instructed by the network administrator, then perform a sufficient communication test.
   Note that an incorrect IP address or other setting may cause a communication failure on the entire network.
2 A unit such as a PC situated in the same network can increase the communication processing load on the CNC even if the unit is not communicating with the CNC.
   Avoid connecting the CNC to a factory-wide network.   Use a router or the like to separate the network including the CNC from the other networks.

NOTE
1 Use the PCMCIA Ethernet card designated by FANUC.   General Ethernet cards available on the market cannot be used.
2 The PCMCIA Ethernet card is used for FANUC LADDER-III or SERVO GUIDE.
3 Use the PCMCIA Ethernet card just for temporary communication as described above.   Avoid using the card for continuous communication.
4 The PCMCIA Ethernet card is inserted into a memory card slot, with a part of the card left uninserted.   When using the PCMCIA Ethernet card, take great care not to damage the card by hitting the protruding part of the card.
   When the card becomes unnecessary, remove the card immediately, in order to prevent any damage to the card.

Related NC parameters

	#7	#6	#5	#4	#3	#2	#1	#0
14880								ETH

[Input type] Setting input
[Data type] Bit

#0   **ETH**   The embedded Ethernet function (embedded Ethernet port or PCMCIA Ethernet card) is:
0:   Used.
1:   Not used.

7.2   SETTING UP THE EMBEDDED ETHERNET FUNCTION

This section describes the setting of parameters for the embedded Ethernet function.

7.2.1   Setting of the FOCAS2/Ethernet Function

This subsection describes the settings required to operate the FOCAS2/Ethernet function.

Notes on using the FOCAS2/Ethernet function for the first time

> **NOTE**
> 1   When running user's original application software created by using the FOCAS2/Ethernet function, use the embedded Ethernet port.
> 2   The FOCAS2/Ethernet function allows up to five FOCAS2/Ethernet clients to be connected to one CNC.
> 3   Concurrent access by multiple applications or personal computers may overload the CNC, reducing the communication speed.

7.2.1.1   Operation on the FOCAS2/Ethernet setting screen

On the Ethernet parameter setting screen, set the parameters for operating the FOCAS2/Ethernet function.

Procedure

1   Press the function key [SYSTEM].
2   Soft keys [EMBED] and [PCMCIA] appear.
    (When there is no soft keys, press the continue key.)
3   To display the Ethernet Setting screen for the embedded Ethernet port or the PCMCIA Ethernet card, press soft key [EMBED] or [PCMCIA], respectively.
4   Press soft keys [COMMON] and [FOCAS2] and then enter parameters for the items that appear.

> **NOTE**
> 1   The parameters for the embedded Ethernet port and the parameters for the PCMCIA Ethernet card are independent of each other.
> 2   The settings of the FOCAS2/Ethernet function for the PCMCIA Ethernet card are made when a connection to SERVO GUIDE and FANUC LADDER-III is established.

COMMON screen (BASIC)

Press soft key [COMMON].　　The COMMON screen (BASIC) is displayed.

```
EMB_ETH  [EMB_PORT]              O0000 N00000
        COMMON: Setting[EMBEDDED]
 BASIC
  MAC ADDRESS              00E0E4000001
  IP ADDRESS              192. 168. 0. 100
  SUBNET MASK            255. 255. 255. 0
  ROUTER IP ADDRESS     192. 168. 0. 253




  AVAILABLE DEVICE      EMBEDDED        1/ 2
A〉_


 MDI  **** *** ***      12:00:00
 〈 COMMON  FOCAS2  FTPTRNS          (OPRT)  +
```

COMMON screen (BASIC)

Settings items

Item	Description
IP ADDRESS	Specify the IP address of the embedded Ethernet. (Example of specification format: "192.168.0.100")
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example of specification format: "192.168.0.253")

Display items

Item	Description
MAC ADDRESS	Embedded Ethernet MAC address
AVAILABLE DEVICE	Enabled device of the embedded Ethernet. Either the embedded Ethernet port or the PCMCIA Ethernet card is displayed.

FOCAS2 screen

Press soft key [FOCAS2].   The FOCAS2 screen is displayed.
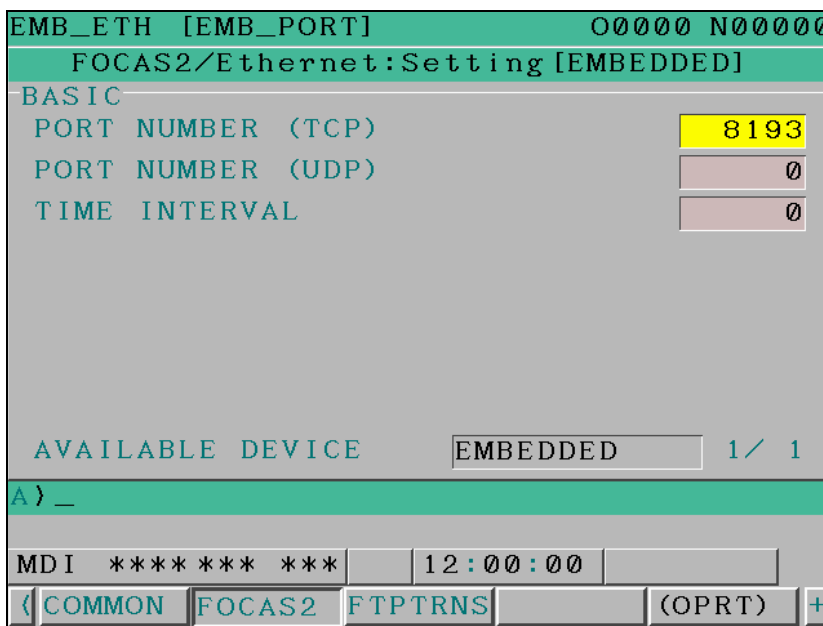
```
EMB_ETH  [EMB_PORT]                    O0000 N00000
    FOCAS2/Ethernet:Setting[EMBEDDED]
 BASIC
  PORT  NUMBER  (TCP)                        8193
  PORT  NUMBER  (UDP)                           0
  TIME  INTERVAL                                0




  AVAILABLE  DEVICE        EMBEDDED          1/ 1
 A}_


 MDI  **** *** ***        12:00:00
 { COMMON  FOCAS2  FTPTRNS          (OPRT)  +
```
FOCAS2 screen

Setting items

Item	Description
PORT NUMBER (TCP)	Specify a port number to be used with the FOCAS2/Ethernet function. The valid input range is 5001 to 65535.
PORT NUMBER (UDP)	Set this item to 0 when it is used as the FOCAS2/Ethernet function.
TIME INTERVAL	Set this item to 0 when it is used as the FOCAS2/Ethernet function.

NOTE
1　When a connection to the CIMPLICITY *i* CELL is established, set the UDP port number and time interval above as described in the FANUC CIMPLICITY *i* CELL Operator's Manual (B-75074).
2　The unit of the time interval is 10 ms. The allowable range is between 10 and 65535.   A time interval less than 100ms cannot be set.
3　Decreasing the time interval setting increases the communication load and can affect the network performance.
　　Example) If the interval is set to 100 (100 x 10 ms = 1 second), broadcast data
　　　　　　is sent every 1 second.

Initial setting of the PCMCIA Ethernet card
The PCMCIA Ethernet card is factory-set to the following default values, for ease of connection with SERVO GUIDE or FANUC LADDER-III.
　　IP ADDRESS : 192.168.1.1
　　SUBNET MASK　　　　　: 255.255.255.0
　　ROUTER IP ADDRESS　: None
　　PORT NUMBER (TCP)　: 8193
　　PORT NUMBER (UDP)　: 0
　　TIME INTERVAL　　　　: 0
If a specified IP address is changed to a blank (space), the specified setting is reset to the default value.
The embedded Ethernet port does not have a default value.

7.2.1.2   Example of setting the FOCAS2/Ethernet function

The following shows a setting example required for the FOCAS2/Ethernet function to operate.
In this example, one personal computer is connected to two CNCs through FOCAS2/Ethernet.
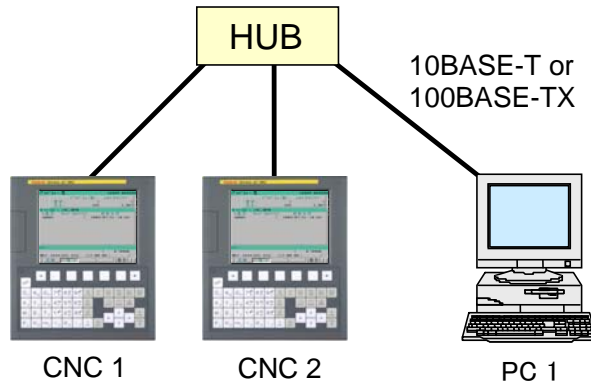
	CNC 1	CNC 2
IP address	192.168.0.100	192.168.0.101
Subnet mask	255.255.255.0	255.255.255.0
Router IP address	None	None
TCP port number	8193	8193
UDP port number	0	0
Time interval	0	0

The Ethernet parameter screen is used for setting.

		PC 1
IP address		192.168.0.200
Subnet mask		255.255.255.0
Default gateway		None
CNC 1	NC IP address	192.168.0.100
	NC TCP port number	8193
CNC 2	NC IP address	192.168.0.101
	NC TCP port number	8193

"Microsoft TCP/IP property" of the personal computer (Windows 2000/XP/Vista) is used for setting.

The arguments of the data window library function cnc_allclibhndl3 are used for setting.

7.2.2   Setting of the FTP File Transfer Function

This section describes the settings required for the FTP file transfer function to operate using the embedded Ethernet function.

Notes on using the FTP file transfer function for the first time

NOTE
1   When using the FTP file transfer function, use the embedded Ethernet port.
2   The number of FTP communications to which one CNC can be connected using the FTP file transfer function is one.

7.2.2.1   Operation on the FTP file transfer setting screen

On the Ethernet setting screen, set the parameters for operating the FTP file transfer function.

Procedure

1   Press the function key [⬨ SYSTEM].

2   Soft keys [EMBED] appear.
(When there is no soft keys, press the continue key.)

3   By pressing the [EMBED] soft key, the Ethernet Setting screen for the embedded Ethernet port is displayed.

4   Press soft keys [COMMON] and [FTPTRNS] and then enter parameters for the items that appear.

> **NOTE**
> The parameters for the embedded Ethernet port and the parameters for the PCMCIA Ethernet card are independent of each other.
> If the [PCMCIA] soft key is pressed, the PCMCIA Ethernet card can be set up. However, the card setup is carried out for maintenance and is not necessary usually.

COMMON screen (BASIC)

Press soft key [COMMON].   The COMMON screen (BASIC) is displayed.

```
EMB_ETH [EMB_PORT]              O0000 N00000
        COMMON: Setting[EMBEDDED]
 BASIC
  MAC ADDRESS              00E0E4000001
  IP ADDRESS              192. 168. 0. 100
  SUBNET MASK             255. 255. 255. 0
  ROUTER IP ADDRESS       192. 168. 0. 253




  AVAILABLE DEVICE       EMBEDDED      1/ 2
A} _

 MDI  **** *** ***      12:00:00
 {|COMMON  FOCAS2  FTPTRNS          (OPRT)  |+
```
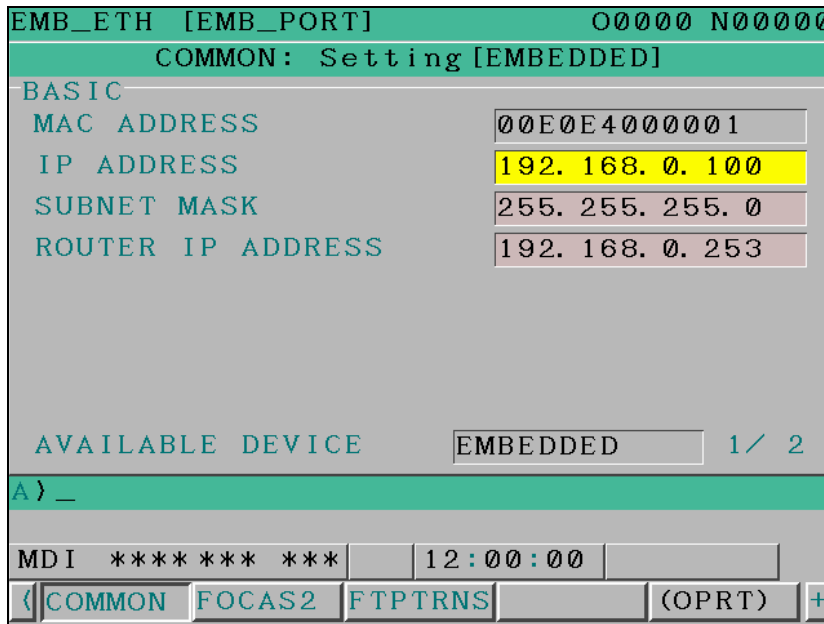
COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	Specify the IP address of the embedded Ethernet. (Example of specification format: "192.168.0.100")
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example of specification format: "192.168.0.253")

Display items

Item	Description
MAC ADDRESS	Embedded Ethernet MAC address
AVAILABLE DEVICE	Enabled device of the embedded Ethernet.
	Either the embedded Ethernet port or the PCMCIA Ethernet card is displayed.

FTP transfer screen (CONNECT1, CONNECT2, CONNECT3)

1 Press soft key [FTPTRNS].   The FTP transfer screen is displayed.

2 Page keys [↑PAGE] [PAGE↓] can be used to make settings for the three host computers for connection destinations 1 to 3.
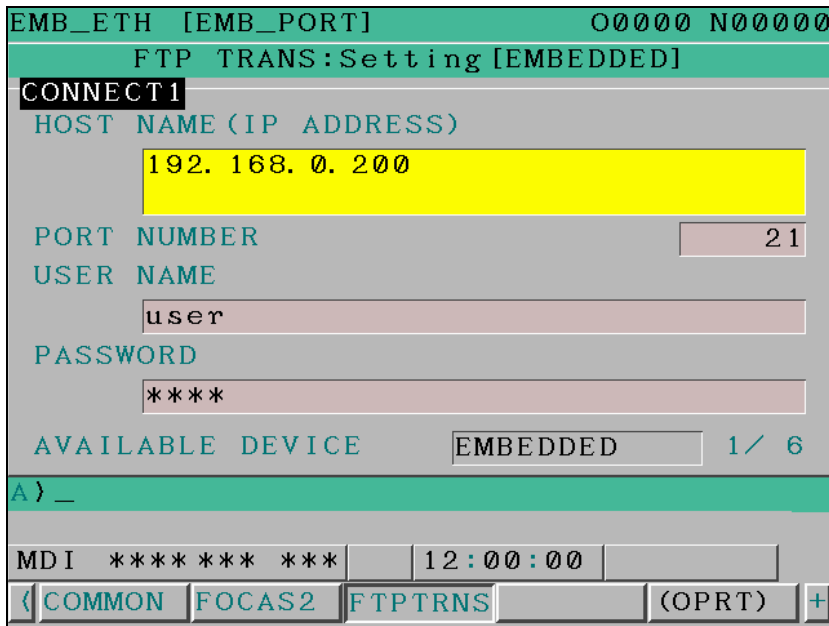
```
EMB_ETH [EMB_PORT]              O0000 N00000
        FTP  TRANS:Setting[EMBEDDED]
CONNECT1
 HOST NAME(IP ADDRESS)
       192. 168. 0. 200

 PORT NUMBER                            21
 USER NAME
       user
 PASSWORD
       ****
 AVAILABLE DEVICE      EMBEDDED     1/ 6
A}_

MDI  **** *** ***      12:00:00
{ COMMON  FOCAS2  FTPTRNS          (OPRT) +
```
FTP transfer screen (1st page)
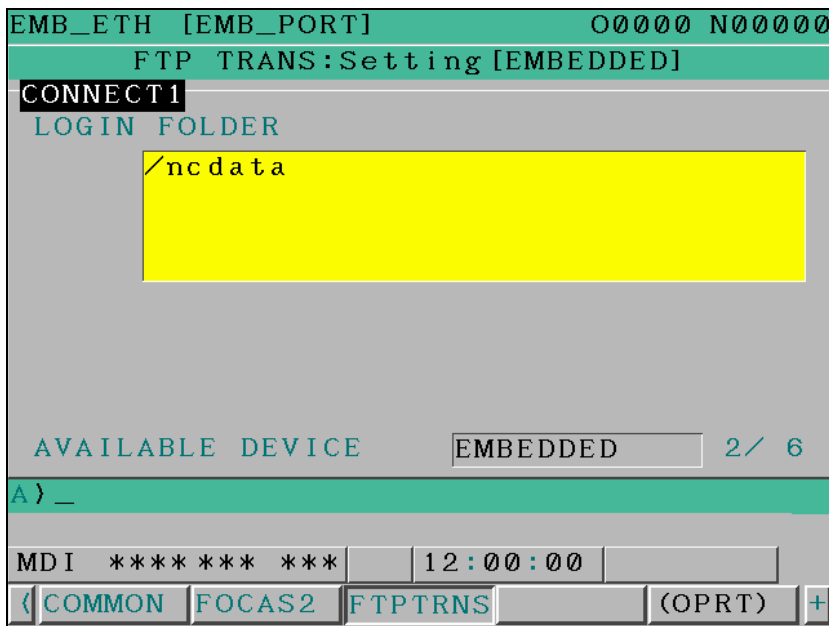
```
EMB_ETH [EMB_PORT]              O0000 N00000
        FTP  TRANS:Setting[EMBEDDED]
CONNECT1
 LOGIN FOLDER
       /ncdata




 AVAILABLE DEVICE      EMBEDDED     2/ 6
A}_

MDI  **** *** ***      12:00:00
{ COMMON  FOCAS2  FTPTRNS          (OPRT) +
```
FTP transfer screen (2nd page)

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Item	Description
HOST NAME	Specify the IP address of the host computer. (Example of specification format: "192.168.0.200")
PORT NUMBER	Specify a port number to be used with the FTP file transfer function. An FTP session is used, so that "21" is to be specified usually.
USERNAME	Specify a user name to be used for logging in to the host computer with FTP. (Up to 31 characters can be specified.)
PASSWORD	Specify a password for the user name specified above. (Up to 31 characters can be specified.) Be sure to set a password.
LOGIN FOLDER	Specify a work folder to be used when logging in to the host computer. (Up to 127 characters can be specified.) If nothing is specified, the home folder specified in the host computer becomes the log-in folder.

Operation

Select a destination.

1   Pressing the [(OPRT)] soft key causes soft key [HOST] to be displayed.   Pressing this soft key causes soft keys [CONECT 1], [CONECT 2], and [CONECT 3] to be displayed.
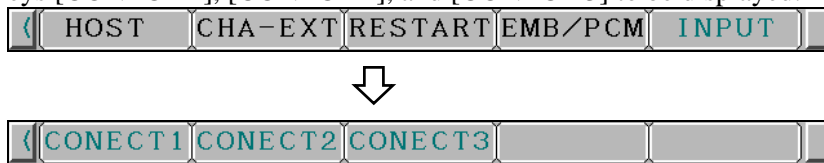
2   Depending on the host computer to be connected, press soft key [CONECT 1], [CONECT 2], or [CONECT 3].   Destination 1, 2, or 3 is highlighted in the screen title field.   The computer corresponding to the highlighted destination is selected as the target computer to be connected.

When destination 1 is selected

7.2.2.2   Related NC parameters

The NC parameters related to the FTP file transfer function are described below.

0020	I/O CHANNEL : Input/output device selection, or interface number for a foreground input device

   [Input type] Setting input
   [Data type] Byte
[Valid data range] 9 : Select the embedded Ethernet as the input/output device.

	#7	#6	#5	#4	#3	#2	#1	#0
13115			SI2	SI1				

   [Input type] Parameter input
   [Data type] Bit

   #4 SI1 Soft key input of the characters shown below and switching between the uppercase and lowercase input modes by a soft key are:
        0:    Disabled.
        1:    Enabled.
        < > ¥ % $! ~ : " '

    #5 SI2 Soft key input of the characters shown below and switching between the uppercase and lowercase input modes by a soft key are:
    0: Disabled.
    1: Enabled.
    ( ) ? * & @ _

For embedded Ethernet port

	#7	#6	#5	#4	#3	#2	#1	#0
14880							PCH	

    [Input type] Setting input
    [Data type] Bit

    #1 PCH When communication based on the FTP file transfer function starts, an FTP server presence check based on PING is:
    0: Made
    1: Not made

> **NOTE**
> Generally, set this parameter to 0 so that an FTP server presence check based on PING is performed.
> Otherwise, if the server is not present in the network, it takes several tens of seconds to detect an error.
> Some PCs are set not to response to the PING command mainly for security purposes. To communicate with such a PC, set this parameter to 1.

14890	Selects the host computer 1 OS.

14891	Selects the host computer 2 OS.

14892	Selects the host computer 3 OS.

    [Input type] Parameter input
    [Data type] Word
[Valid data range] 0 to 2
    0: Windows2000/XP/Vista.
    1: UNIX, VMS.
    2: Linux.

> **NOTE**
> Some FTP server software products do not depend on the OS. So, even when the above parameters are set, it is sometimes impossible to display a list of files properly.

7.2.2.3 Example of setting the FTP file transfer function

The following shows a setting example required for the FTP file transfer function to operate.
In this example, one personal computer is connected to two CNCs through the FTP file transfer function.
- On Personal Computer 1, the FTP server function operates.
- On CNC 1 and CNC 2, the FTP client operates as the FTP file transfer function.
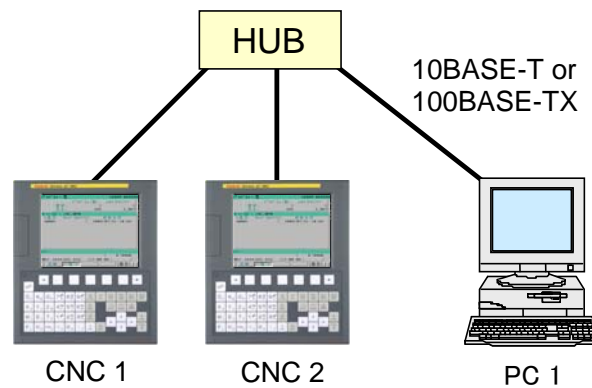
		CNC 1	CNC 2
IP address		192.168.0.100	192.168.0.101
Subnet mask		255.255.255.0	255.255.255.0
Router IP address		None	None
Connection host 1	Port number	21	21
	IP address	192.168.0.200	192.168.0.200
	User name	user	user
	Password	user	user
	Login DIR	None	None
NC parameter No. 20		9	9

The Ethernet parameter screen is used for setting.

The parameter screen is used for setting.

	PC 1
IP address	192.168.0.200
Subnet mask	255.255.255.0
Default gateway	None
User name	user
Password	user
Login DIR	Default

"Microsoft TCP/IP property" of the personal computer (Windows 2000 / XP / Vista) is used for setting.

"User acount of the personal computer (Windows 2000 / XP / Vista) is used for setting.

"Internet service manager" of the personal computer (Windows 2000 / XP) is used for setting.
"FTP Publishing Service" (Windows

7.2.3   Setting Up the DNS/DHCP Function

The DHCP/DNS function is set up by using the COMMON screen (DETAIL) and NC parameters.

7.2.3.1   Setting up DNS
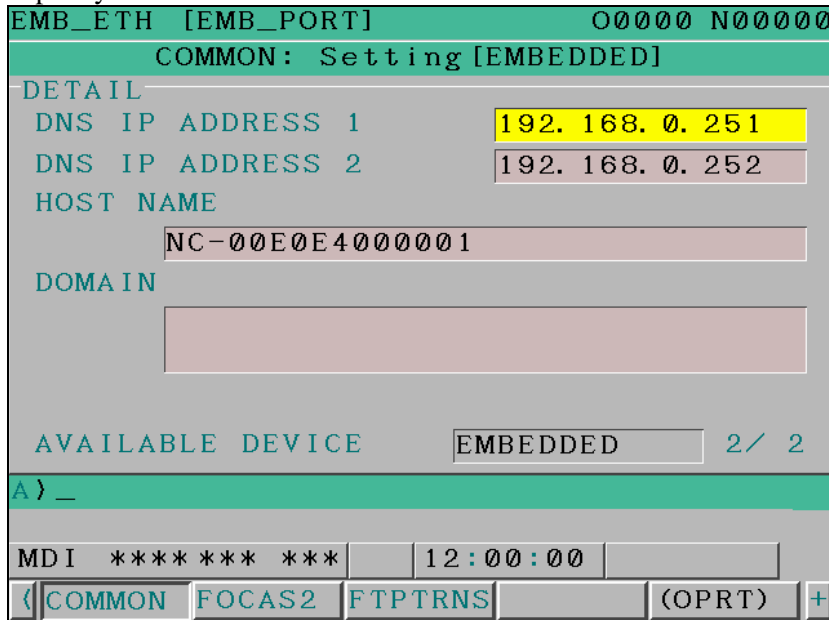
This subsection describes the procedure for setting up a DNS.

Procedure
1   Enable the DNS function, with reference to "Related NC Parameters," which will be seen later.
2   Set up the DNS server of the host computer.
3   Connect the host computer on which the DNS server is working (hereafter referred to as a DNS server), reboot the CNC, then press function key ⌨SYSTEM.
4   Press soft keys [EMBED] and [COMMON] in that order. The COMMON screen (DETAIL) appears.
5   Enter the IP address of the DNS server in the corresponding DNS IP address field.

COMMON screen (DETAIL)

After pressing soft key [COMMON], press either page key [↑ PAGE] [PAGE ↓] to call a desired COMMON screen (DETAIL). Specify a DNS IP address.

```
EMB_ETH  [EMB_PORT]              O0000 N00000
          COMMON: Setting[EMBEDDED]
DETAIL
  DNS  IP  ADDRESS  1       192. 168. 0. 251
  DNS  IP  ADDRESS  2       192. 168. 0. 252
  HOST  NAME
          NC-00E0E4000001

  DOMAIN



  AVAILABLE  DEVICE         EMBEDDED        2/ 2
A}_


MDI  **** *** ***       12:00:00
{ COMMON  FOCAS2  FTPTRNS            (OPRT)  +
```

COMMON screen (DETAIL)

Setting items

Item	Description
DNS IP ADDRESS 1, 2	Up to two DNS IP addresses can be specified. The CNC searches for the DNS server using DNS IP addresses 1 and 2 in that order.

7.2.3.2   Setting up DHCP

This subsection describes the procedure for setting up a DHCP.

Procedure
1   Enable the DHCP function, with reference to "Related NC Parameters," which will be seen later.
2   Set up the DHCP server of the host computer.
3   Connect the host computer on which the DHCP server is working (hereafter referred to as a DHCP server), reboot the CNC, then press function key [SYSTEM].
4   Press soft keys [EMBED] and [COMMON] in that order.   The COMMON screen appears.
5   If the DHCP function of the CNC has been enabled and if the DHCP server is connected successfully, the DHCP server automatically specifies the following items.
     -    IP ADDRESS
     -    SUBNET MASK
     -    ROUTER IP ADDRESS
     -    DNS IP ADDRESS
     -    DOMAIN
     If the DHCP server cannot be connected, "DHCP ERROR" is displayed in each field.
6   If the DNS function has also been enabled and if the DHCP server and the DNS server work together (if the DNS server supports dynamic DNS), enter a host name.

COMMON screen (basic and detail)

After pressing soft key [COMMON], press either page key [↑PAGE] [PAGE↓] to call a desired Ethernet common setting screen (basic, detail).

If the DHCP server is connected successfully and if the setting data can be obtained, the screen is displayed as shown below.

```
EMB_ETH  [EMB_PORT]                    O0000 N00000
          COMMON: Setting[EMBEDDED]
BASIC
 MAC ADDRESS                    00E0E4000001
 IP ADDRESS                     192. 168. 0. 100
 SUBNET MASK                    255. 255. 255. 0
 ROUTER IP ADDRESS              192. 168. 0. 253




 AVAILABLE DEVICE             EMBEDDED        1/ 2
A}_


MDI   **** *** ***      12:00:00
{|COMMON  FOCAS2  FTPTRNS             (OPRT)  |+
```
When the DHCP server is connected successfully (1st page)

```
EMB_ETH  [EMB_PORT]                    O0000 N00000
          COMMON: Setting[EMBEDDED]
DETAIL
 DNS IP ADDRESS 1               192. 168. 0. 251
 DNS IP ADDRESS 2               192. 168. 0. 252
 HOST NAME
          DNC-1
 DOMAIN
          FACTORY



 AVAILABLE DEVICE             EMBEDDED        2/ 2
A}_


MDI   **** *** ***      12:00:00
{|COMMON  FOCAS2  FTPTRNS             (OPRT)  |+
```
When the DHCP server is connected successfully (2nd page)

If the host name is not specified, the CNC automatically assigns a host name in the "NC-<MAC-address>" format.

```
 HOST NAME
          NC-00E0E4000001
```
Example of automatically assigned host name

If the DHCP server cannot be connected, the screen is displayed as shown below.

```
EMB_ETH [EMB_PORT]              O0000 N00000
          COMMON: Setting[EMBEDDED]
 BASIC
  MAC ADDRESS              00E0E4000001
  IP ADDRESS              DHCP ERROR
  SUBNET MASK             DHCP  ERROR
  ROUTER  IP  ADDRESS     DHCP  ERROR




  AVAILABLE  DEVICE      EMBEDDED      1／ 2
A}_

 MDI  ****＊＊＊  ＊＊＊     12:00:00
 《 COMMON  FOCAS2  FTPTRNS            (OPRT)  +
```

When the DHCP server cannot be connected (1st page)

```
EMB_ETH [EMB_PORT]              O0000 N00000
          COMMON: Setting[EMBEDDED]
 DETAIL
  DNS  IP  ADDRESS  1     DHCP  ERROR
  DNS  IP  ADDRESS  2     DHCP  ERROR
  HOST  NAME
            DNC-1
  DOMAIN
        DHCP  ERROR



  AVAILABLE  DEVICE      EMBEDDED      2／ 2
A}_

 MDI  ****＊＊＊  ＊＊＊     12:00:00
 《 COMMON  FOCAS2  FTPTRNS            (OPRT)  +
```

When the DHCP server cannot be connected (2nd page)

Check items

Item	Description
IP ADDRESS	If the DHCP server is connected successfully, the items obtained from the DHCP server are displayed.
SUBNET MASK	
ROUTER IP ADDRESS	If the DHCP server cannot be connected, "DHCP ERROR" is displayed.
DNS IP ADDRESS 1,2	
DOMAIN	

Setting items

Item	Description
HOST NAME	Enter the host name of the CNC. If a DHCP server and a DNS server work together, the DHCP server notifies the DNS server of this host name. If the host name is left blank, a host name is automatically assigned in the "NC-<MAC-address>" format. Example of automatically assigned host name: NC-00E0E4000001

Display items

Item	Description
MAC ADDRESS	MAC address of embedded Ethernet

7.2.3.3 Related NC parameters

For embedded Ethernet port

	#7	#6	#5	#4	#3	#2	#1	#0
14880		DHC	DNS		D1E			

[Input type] Setting input
[Data type] Bit

 # 3   D1E When the DHCP function is used:
    0:    The default parameters for the FOCAS2/Ethernet function are specified.
        PORT NUMBER (TCP)   8193
        PORT NUMBER (UDP)   0
        TIME INTERVAL   0
    1:    The default parameters for CIMPLICITY *i* CELL are specified.
        PORT NUMBER (TCP)   8193
        PORT NUMBER (UDP)   8192
        TIME INTERVAL   50

 # 5   DNS The DNS function is:
    0:    Not used.
    1:    Used.

 # 6   DHC The DHCP function is:
    0:    Not used.
    1:    Used.

A change in these parameters becomes effective after the power is turned off and on or after the embedded Ethernet function is restarted.

7.2.4 Backing up and Restoring Communication Parameters

This section describes how to back up the embedded Ethernet communication parameters to a memory card and to restore them from the memory card.

1. Press the function key [SYSTEM].

2. The soft keys [EMBED] and [PCMCIA] appear. (If they do not appear, press the continuous menu key.)

3.   When the soft key [EMBED] or [PCMCIA] is pressed, the Ethernet Setting screen, respectively, for the embedded Ethernet port or the PCMCIA Ethernet card appears.

4.   Once the soft keys [COMMON] and [(OPRT)] are pressed, pressing the soft key [+] displays the soft keys [BACKUP], [RESTORE], [ALLBACK], and [ALL RES] for backing up or restoring communication parameters as shown below.

5.   Pressing the soft key [BACKUP], [RESTORE], [ALLBACK], or [ALL RES] displays the soft keys [EXECUTE] and [CANCEL].

6.   Once the name of a file to be backed up or restored is entered into a key-in buffer, pressing the soft key [EXECUTE] starts the respective operation.
     "EXECUTING" blinks while backup or restoration is in progress.
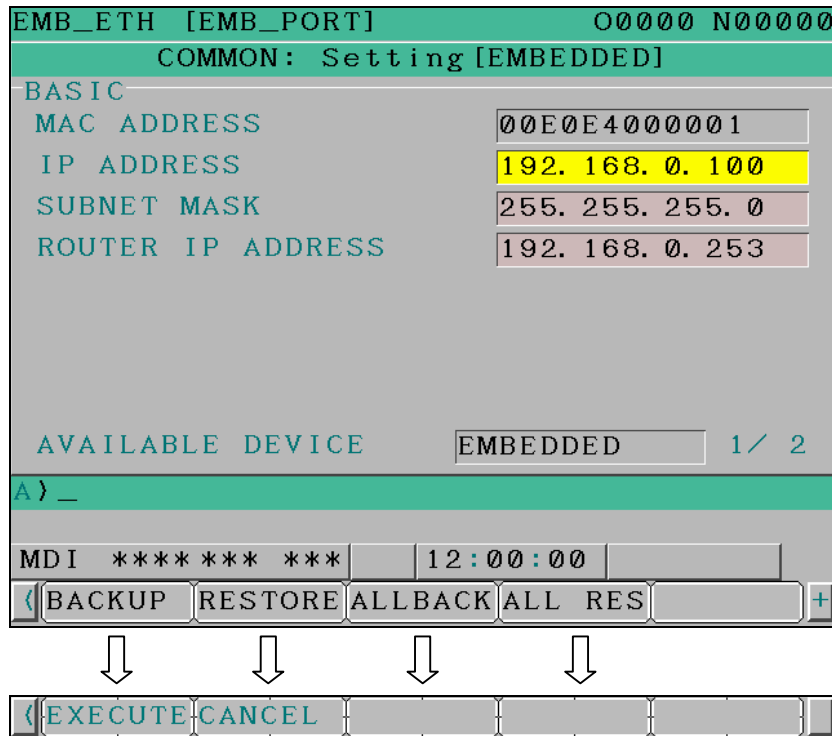
```
EMB_ETH [EMB_PORT]              O0000 N00000
        COMMON: Setting[EMBEDDED]
 BASIC
  MAC ADDRESS              00E0E4000001
  IP ADDRESS              192. 168. 0. 100
  SUBNET MASK            255. 255. 255. 0
  ROUTER IP ADDRESS     192. 168. 0. 253



  AVAILABLE DEVICE      EMBEDDED       1/ 2
A) _

 MDI  *** *** ***     12:00:00
《 BACKUP  RESTORE ALLBACK ALL RES         +
     ⇩        ⇩        ⇩        ⇩
《 EXECUTE CANCEL
```

BACKUP
The embedded Ethernet communication parameters are saved from the SRAM of the CNC main unit to the memory card.
If a file name is specified in the key-in buffer, the specified file name is used when the parameters are saved to the memory card.   If no file name is specified, the file name "EMBETHER.MEM" is used.

RESTORE
The embedded Ethernet communication parameters are read from the memory card and saved to the SRAM of the CNC main unit.
If a file name is specified in the key-in buffer, the specified file name is used when the parameters are read from the memory card.   If no file name is specified, the file name "EMBETHER.MEM" is used.

ALLBACK
All valid embedded Ethernet, Fast Ethernet/Fast Data server, PROFIBUS-DP master/slave, DeviceNet master/slave, and FL-net communication parameters are saved from the SRAM of the CNC main unit to the memory card.
If a file name is specified in the key-in buffer, the file name is used when the parameters are saved.   If no file name is specified, the file name "NETWORK.MEM" is used.

ALL RES

All valid embedded Ethernet, Fast Ethernet/Fast Data server, PROFIBUS-DP master/slave, DeviceNet master/slave, and FL-net communication parameters are read from the memory card and saved to the SRAM of the CNC main unit.

However, if a communication function related to a valid communication parameter is disabled in the CNC, that parameter is not saved to the SRAM.

If a file name is specified in the key-in buffer, the specified file name is used when the parameters are read from the memory card.   If no file name is specified, the file name "NETWORK.MEM" is used.

NOTE
1   Communication parameter backup and restoration are usable only in the MDI mode and at an emergency stop.
2   Performing communication parameter restoration leads to an alarm condition that requests to turn off the power.
3   When communication parameters are backed up or restored, the memory card is always used no matter what the external input/output device number (NC parameter No. 20) is.

7.3 SWITCHING BETWEEN THE EMBEDDED ETHERNET DEVICES

There are two types of embedded Ethernet devices: the embedded Ethernet port and PCMCIA Ethernet card.

Screen operation is required to switch between these two types of devices.

Procedure

1   Press the function key [⬦ SYSTEM].
2   Soft keys [EMBED] and [PCMCIA] appear.
    (When there is no soft keys, press the continue key.)
3   Press soft key [EMBED] or [PCMCIA], press soft key [COMMON], and then press [(OPRT)] to display soft key [EMB/PCM].
4   Pressing soft key [EMB/PCM] switches between enabled devices.
    •   If you want to execute the switchover, press soft key [EXECUTE].
    •   If you do not want to execute the switchover, press soft key [CANCEL].
5   The valid devices are switched each time Step 4 is performed.

NOTE
    Information on a switched device is stored in nonvolatile memory.
    On the next power-on, the device last selected can be used as is.

7.4 EMBEDDED ETHERNET OPERATIONS

7.4.1 FTP File Transfer Function

The operation of the FTP file transfer function is described below.

Host file list display

A list of the files held on the host computer is displayed.

Procedure

1   Press the function key [PROG] .

2   Press soft key [DIR+]. The program folder screen appears. (If the soft key does not appear, press the continuous menu key.)

```
PROGRAM DIRECTORY                    O0777 N00000
           PROGRAM(NUM. )  MEMORY(KBYTE)
      USED:            30             123
      FREE:           770           1,945
DEVICE  :  CNC_MEM
 O NO.              COMMENT
 O0001(TEST FOR CYCLIC                      )
 O0010(SIMULATION PROGRAM 0019807           )
 O0011(SIMULATION PROGRAM 0019814           )
 O0012(SIMULATION PROGRAM 001120            )
 O0013(TEST FOR SIMULATION                  )
 O0014(SIMULATION PROGRAM O0014             )
 O0016(SAMPLE001                            )

A)_
                                S      0 T0000
EDIT  ****  ***  ***   |  12:00:00   |
 | PROGRAM| DIR + |      |      | (OPRT) |
```
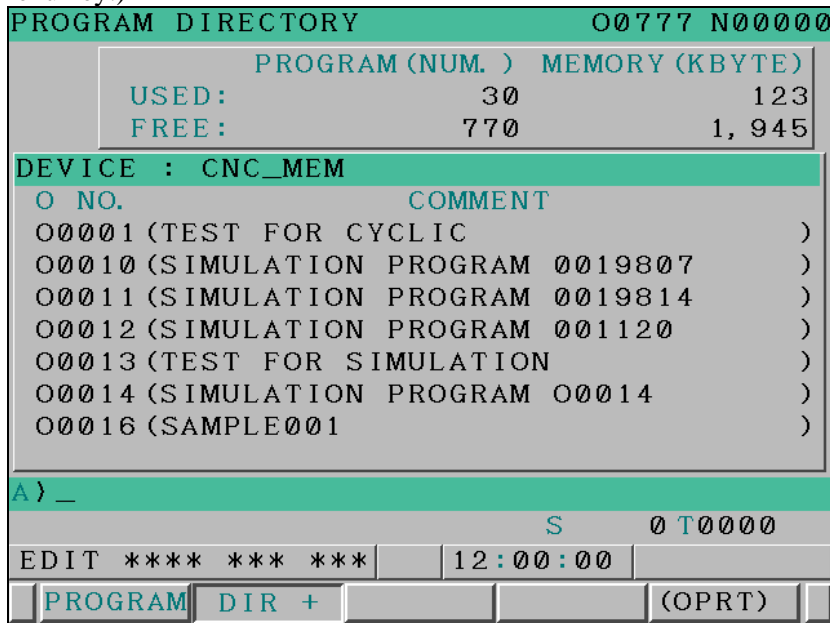
3   Press soft keys [(OPRT)] and [DEVICE] in that order.   The soft keys for selectable devices appear.

```
(|CNCMEM |MEMCARD|M-CARD |EMB ETH|      |
```

4   Pressing soft key [EMB ETH] displays the Embedded Ethernet host file list screen, on which a list of files in the host computer connected with the embedded Ethernet port is displayed.

```
EMB ETH HOST LIST                   O0777 N00000
                            DEVICE  |EMBEDDED|
CON HOST  |1 : HOST1|      REG NUM|        36|
DEVICE  :  EMB_ETHER ( / )
  O0006                                      △
  O0010
  O0011
  O0040
  O0044
  O0050
  O0111
  O0123
  O1234                                      ▽
A)_
                                S      0 T0000
EDIT  ****  ***  ***   |  12:00:00   |
(|      |      |SEARCH |      |      |      |+
```

```
(|DEVICE |F  INPUT|FOUTPUT|      |      |      |+
```

```
(|      |      |DELETE |RENAME |F  CREAT|+
```

‹	SELECT			REFRESH	+

‹		CHA-EXT	HOST			+
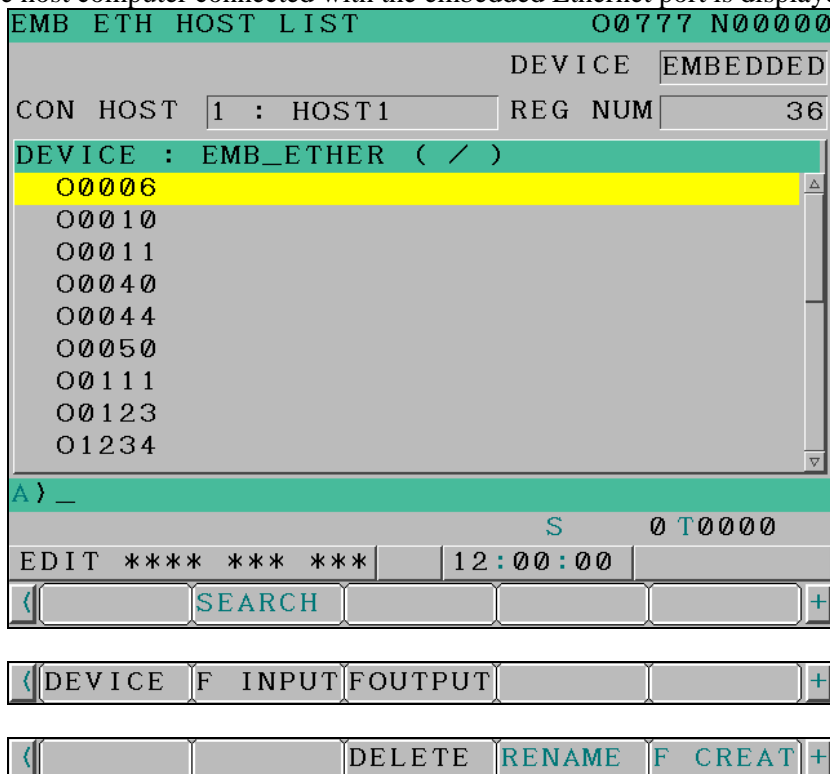
Embedded Ethernet host file list screen (8.4-inch LCD)

```
EMBEDDED ETHERNET HOST FILE LIST        O0777 N00000

                                  AVAILABLE DEVICE    EMBEDDED
CONNECT HOST    1 : HOST1         REGISTERED PROGRAM        36

DEVICE : EMB_ETHER  ( CURRENT FOLDER: / )
    00006                                              △
    00010
    00011
    00040
    00044
    00050
    00111
    00123
    01234
    02032
    07040
    07041
    07042
    07043
    07044                                              ▽

                            A>_
                                          S    0 T0000
                            EDIT **** *** ***    12:00:00
```

‹		SEARCH			DEVICE CHANGE	F INPUT	F OUTPUT			+

‹		DELETE	RENAME	CREATE FOLDER	SELECT START				REFRESH	+

‹					CHARA EXT	HOST CHANGE				+
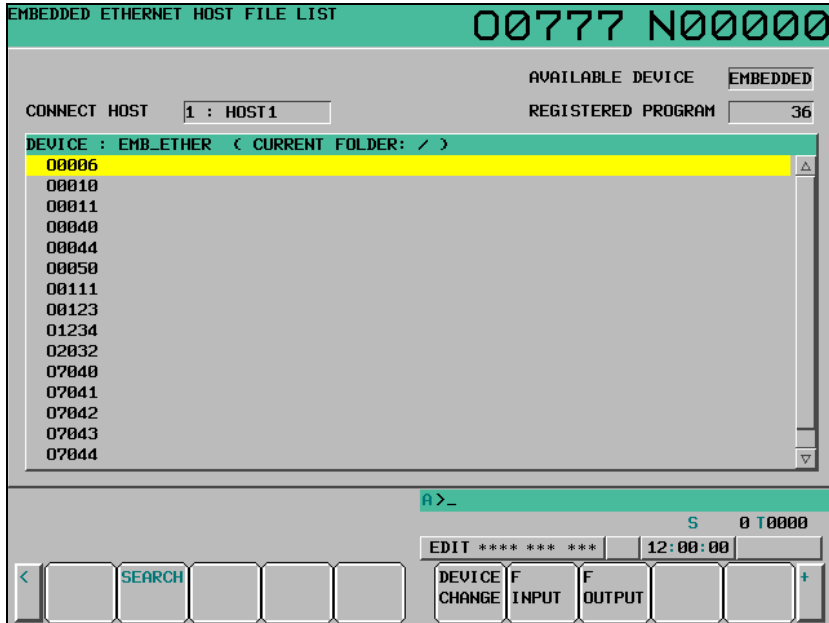
Embedded Ethernet host file list screen (10.4-inch LCD)

NOTE
When using the FTP file transfer function, check that the valid device is the embedded Ethernet port.
The two conditions below determine a connection destination on the host file list screen:
(1) Check that the valid device is the embedded Ethernet port.   To select a valid device, use soft key [EMB/PCM] on the Ethernet Setting screen.
(2) A host computer can be selected from connection destinations 1, 2, and 3. A computer to be connected is selected using the operation procedure described in Subsection 7.2.2.1, "Operation on the FTP file transfer setting screen" or "HOST CHANGE" explained later.

---

5   When a list of files is larger than one page, the screen display can be switched using the page keys
[↑ PAGE] [PAGE ↓].

Display item

DEVICE (AVAILABLE DEVICE)
The currently selected device is displayed.

CON HOST (CONNECT HOST)
Number of the currently connected host of the host computer

REG NUM (REGISTERED PROGRAM)
The number of files in the current folder.

DEVICE
Current device.   When the embedded Ethernet host file list is selected, "EMB_ETHER" is displayed.

CURRENT FOLDER
Current work folder in the host computer

FILE LIST
Information of the files and folders in the host computer

Operation list

DEVICE (DEVICE CHANGE)
Enables a device to be selected from the program folder screen.   To select the embedded Ethernet host file list, press soft key [EMB ETH].

DIR +
Switches between the outline and detailed file lists.

F CREAT (CREATE FOLDER)
Create a subfolder in the current work folder in the host computer.

DELETE
Deletes a file or folder in the host computer.

RENAME
Renames a file or folder in the host computer.

HOST (HOST CHANGE)
Changes the connected host computer.

SEARCH
Searches for a file through the current folder in the host computer.

REFRESH
Updates the information displayed on the embedded Ethernet host file list screen.

F INPUT
Transfers a program from the host computer to the CNC memory.

F OUTPUT
Transfers a program from the CNC memory to the host computer.

> **NOTE**
> The character strings enclosed in parentheses are those displayed when the 10.4-inch LCD unit is used.

7.4.1.1   Displaying and operating the file list

DETAIL ON, DETAIL OFF

Displays can be switched between outline and detailed file lists.
Either the outline or detailed file list display is selected each time soft key [DIR+] is pressed.
The outline file list display contains only file names, while the detailed file list display contains file sizes, creation dates, and other file information as well file names.

> **NOTE**
> 1 The items displayed in the detailed list depend on the FTP server setting on the host computer.
> 2 When files in the detailed file list are operated on, information displayed at the right edge of the screen is treated as a file name.   Therefore, it is likely that files may not be operated on properly depending on displays or file names.   If this is the case, use the outline file list display.

REFRESH

Update the contents of the file list.
Pressing soft key [REFRESH] causes the file list contents to be updated.

Moving a folder

Move a folder.

1   Select a folder you want to move using cursor keys ⬇ and ⬆ .

2   Press MDI key ⬙ .

CREATE FOLDER

Create a new folder.
1   Move to a folder in which you want to create a new folder.
2   Key in a folder name.
3   Press soft key [F CREAT] ([CREATE FOLDER]).

DELETE

Delete a file or folder.

1   Select a file or folder you want to delete using cursor keys ⬇ and ⬆ .

2   Press soft key [DELETE].
  •   To execute the deletion, press soft key [EXEC].
  •   To cancel the deletion, soft key [CANCEL].

DELETE (multiple files)

Delete multiple files at a time.
1   Press soft key [SELECT] ([SELECT START]).

2   Select a file or folder you want to delete using cursor keys ⬇ and ⬆ .

3   Press soft key [SELECT].
      The selected file is highlighted.
      Repeat steps 2 and 3 for each file you want to delete.
4   Press soft key [DELETE].

- To execute the deletion, press soft key [EXEC].
- To cancel the deletion, soft key [CANCEL].

NOTE
1 Up to 10 files can be selected at a time.
2 Only files can be specified.   If folders are specified, an error is reported when an attempt is made to delete the folders.

RENAME

Rename a file or folder.

1   Select a file or folder you want to rename using cursor keys [↓] and [↑] .

2   Enter a new file or folder name.
3   Press soft key [RENAME].

SEARCH

Search for a file or folder through the current work folder.   The file or folder found is displayed at the top of the file list.

1   Key in a file or folder name you want to search for.
2   Press soft key [SEARCH].

HOST CHANGE

Change the connected host computer.
1   Press soft key [HOST] ([HOST CHANGE]).
The connected host number changes from 1 to 2 to 3, then back to 1.

7.4.1.2   Transferring programs

How programs are transferred between the host computer and CNC is explained below.

NOTE
1   Inputting or outputting programs with the embedded Ethernet host requires setting NC parameter No. 20 with 9.
2   If an error occurs, check its cause on the Ethernet log screen.

Inputting programs

The following procedure can be used to transfer programs from the host computer to the CNC memory.

1   Press soft key [F INPUT].
2   Select a program in the host computer.
     In the host computer, place the cursor on the file you want to input and press soft key [F GET], or key in the file name.
3   Press soft key [F NAME].
4   If you want to rename a program when inputting it, key in the program number and press soft key [O SET].
5   Press soft key [EXEC].

The following table summarizes what operation occurs when the input file name [F NAME] and input program number [O SET] are omitted.

[F NAME]	[O SET]	Key input buffer	Input file name	Input program	Input program No.
–	–	–	Warning message "NO PROGRAM SELECTED" is displayed, and nothing is input.		
		Other than Oxxxx	Warning message "THE WRONG DATA IS USED" is displayed, and nothing is input.		
		Oxxxx	File name set in the key input buffer (NOTE)	All programs in the input file	Continuous program numbers starting at one (xxxx) set in the key input buffer
	-9999	No relation	Warning message "NO PROGRAM SELECTED" is displayed, and nothing is input.		
	O		Same file name as program No. set by [O SET] (NOTE)	All programs in the input file	Continuous program numbers starting at one set by [O SET]
O	–		File name set by [F NAME]	All programs in a file specified by [F NAME]	Program No. used when the program was saved
	-9999		Warning message "THE WRONG DATA IS USED" is displayed, and nothing is input.		
	O		File name set by [F NAME]	All programs in the file specified by [F NAME]	Continuous program numbers starting at one set by [O SET]

O: Specified
– :   Not specified

NOTE
> The input file name consists of "O" followed by a 4-digit number.
> If program input is executed by specifying program No. 1, for example, a file
> whose file name is "O0001" is input.
> If this operation is performed for path 2, the file name is suffixed with the file
> extension "P-2" (for this example, "O0001.P-2").

Outputting programs

The following procedure can be used to transfer programs from the CNC memory to the host computer.

1   Press soft key [FOUTPUT].
2   Select a program in the CNC.
    Key in the program No. of the program to be output.
3   Press soft key [O SET].
4   If you want to rename a program when outputting it, key in the file name and press soft key [F NAME].
5   Press soft key [EXEC].

The following table summarizes what operation occurs when the output file name [F NAME] and output program number [O SET] are omitted.

[F NAME]	[O SET]	Key input buffer	Output file name	Output program
–	–	–	Currently selected main program name (NOTE 1 and NOTE 2)	Currently selected main program (NOTE 1)
		Other than Oxxxx	Warning message "THE WRONG DATA IS USED" is displayed, and nothing is output.	
		Oxxxx	Program name set in the key input buffer (NOTE 2)	Program in the CNC memory set in the key input butter
	-9999	O-9999	ALL-PROG.TXT (NOTE 3)	All programs in the CNC memory
	O		Same file name as program No. set by [O SET] (NOTE 2)	Program in the CNC memory set by [O SET]
O	–	No relation	File name set by [F NAME]	Currently selected main program (NOTE 1)
	-9999			All programs in the CNC memory
	O			Program in the CNC memory set by [O SET]

O : Specified
– : Not specified

> **NOTE**
> 1 If a file is undergoing background editing, it is output.
> 2 The output file name consists of "O" followed by a 4-digit number.
>   If a program whose program No. is 1 is output, for example, it is output under the file name "O0001" to the host computer.
>   If this operation is performed for path 2, the file name is suffixed with the file extension "P-2" (for this example, "O0001.P-2").
> 3 If this operation is performed for path 2, the file name "ALL-PROG.P-2" is used.

7.4.1.3   Inputting special characters

Using bits 4 (SI1) and 5 (SI2) of NC parameter No. 13115 enables special characters and lowercase letters, which are not available on the MDI keypad, to be entered.
Setting this NC parameter displays soft key [CHA-EXT]([CHARA EXT]). Pressing this soft key displays the following soft keys:
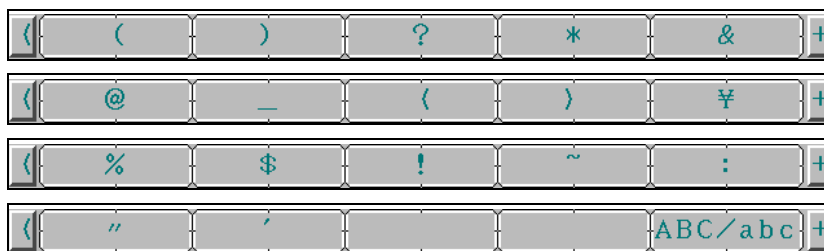
Pressing soft key [ABC/abc] switches between uppercase and lowercase characters for input. Which case can be currently input is indicated in the key input field.

Uppercase   Lowercase
letter input   letter input
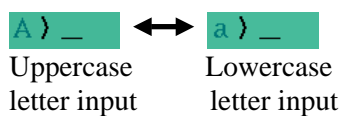
Related NC parameters

	#7	#6	#5	#4	#3	#2	#1	#0
13115			SI2	SI1				

[Input type] Parameter input
[Data type] Bit

 # 4   **SI1**   Soft key input of the characters shown below and switching between the uppercase and lowercase input modes by a soft key are:
0:   Disabled.
1:   Enabled.
< > ¥ % $! ~ : " '

 # 5   **SI2**   Soft key input of the characters shown below and switching between the uppercase and lowercase input modes by a soft key are:
0:   Disabled.
1:   Enabled.
( ) ? * & @ _

7.5   RESTART OF THE EMBEDDED ETHERNET

Communication using the embedded Ethernet can be restarted.

Procedure

1   Press the function key [SYSTEM].
2   Soft keys [EMBED] and [PCMCIA] appear.
(When there is no soft keys, press the continue key.)
3   Press soft key [EMBED] or [PCMCIA], press soft key [COMMON], and then press [(OPRT)] to display soft key [RESTART].
4   Pressing soft key [RESTART] resets embedded Ethernet communication and then restarts it.

NOTE
1   Pressing soft key [RESTART] forcibly interrupts communication even when it is in progress.
2   This function makes a restart by software.   An actual restart may be impossible under some conditions.

7.6   MAINTENANCE SCREEN FOR EMBEDDED ETHERNET FUNCTION

With the embedded Ethernet function, a dedicated maintenance screen is available.
The maintenance screen enables operations to be checked when the embedded Ethernet function operates abnormally.

Displaying and operating the PING screen

Procedure

1   Press the function key [SYSTEM].
2   Soft keys [EMBED] and [PCMCIA] appear.

(When there is no soft keys, press the continue key.)

3   By pressing the [EMBED] soft key, the Ethernet Setting screen for the embedded Ethernet is displayed.

     By pressing the [PCMCIA] soft key, the Ethernet Setting screen for the PCMCIA Ethernet card can be set.

4   Press soft key [PING] and then press [(OPRT)].

5   To send the PING command to connection destination 1 for FTP file transfer, press soft key [P.FTP1]. Similarly, to send the PING command to connection destination 2 or 3, press [P.FTP2] or [P.FTP3], respectively.

```
EMB_ETH [EMB_PORT]              O0000 N00000
              PING  [EMBEDDED]
 CONNECT STATE
  192. 168. 0. 251

  Response is received
  Response is received
  Response is received
  No response
  No response



  PING STATE            -------       1/ 2
 A) _

 MDI  **** ***  ***   12:00:00
 《   PING   COM STS TSK STS          (OPRT)  +
```

```
 《 P. FTP1  P. FTP2  P. FTP3   P. CAN  P. EXEC  +
```
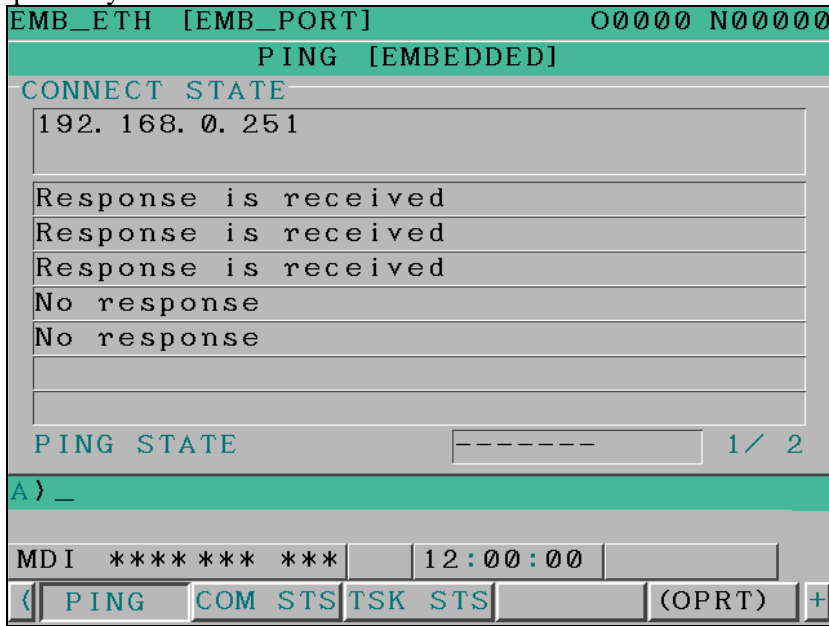
PING connection status screen

6   To send the PING command to the desired destination, enter the address of the destination on the PING setting screen. (Page keys [↑PAGE] [PAGE↓] are used for switching.)

```
EMB_ETH [EMB_PORT]              O0000 N00000
              PING  [EMBEDDED]
 SETTING
  HOST NAME(IP ADDRESS)
       192. 168. 0. 251

  REPEAT                               3




  AVAILABLE DEVICE      EMBEDDED      2/ 2
 A) _

 MDI  **** ***  ***   12:00:00
 《   PING   COM STS TSK STS          (OPRT)  +
```
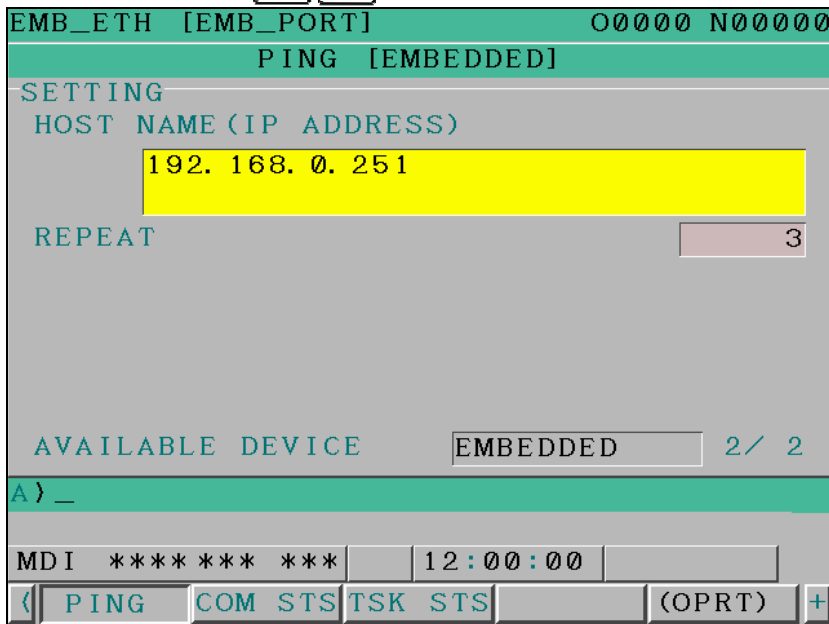
PING connection setting screen

7   After entering the address and the repeat count, press the soft key [P.EXEC].   The specified number of PING commands are sent to the specified destination.

8   To cancel the PING command currently being sent, press soft key [P.CAN].

Displaying Communication status screen

Procedure

1   Press the function key [SYSTEM].

2   Soft keys [EMBED] and [PCMCIA] appear.
     (When there is no soft keys, press the continue key.)

3   By pressing the [EMBED] soft key, the Ethernet Setting screen for the embedded Ethernet is displayed.
     By pressing the [PCMCIA] soft key, the Ethernet Setting screen for the PCMCIA Ethernet card can be set.

4   To display the communication status of the embedded Ethernet, press soft key [COM STS].

     Page keys [PAGE↑] [PAGE↓] can be used to switch between the sending state and the receiving state.

```
EMB_ETH  [EMB_PORT]              O0000 N00000
            COM STATE  [EMBEDDED]
COM STATE  :  SEND
  BAUDRATE              100Mbps / Full duplex
  SEND PACKET                              0
  COLLISION                                0
  CARRIER SENSE LOST                       0
  DELAYOVER                                0
  UNDERRUN                                 0
  SEND PARITY ERROR                        0


  AVAILABLE DEVICE      EMBEDDED         1/ 2
A}_


MDI  **** *** ***      12:00:00
(  PING   COM STS TSK STS         (OPRT) +
```
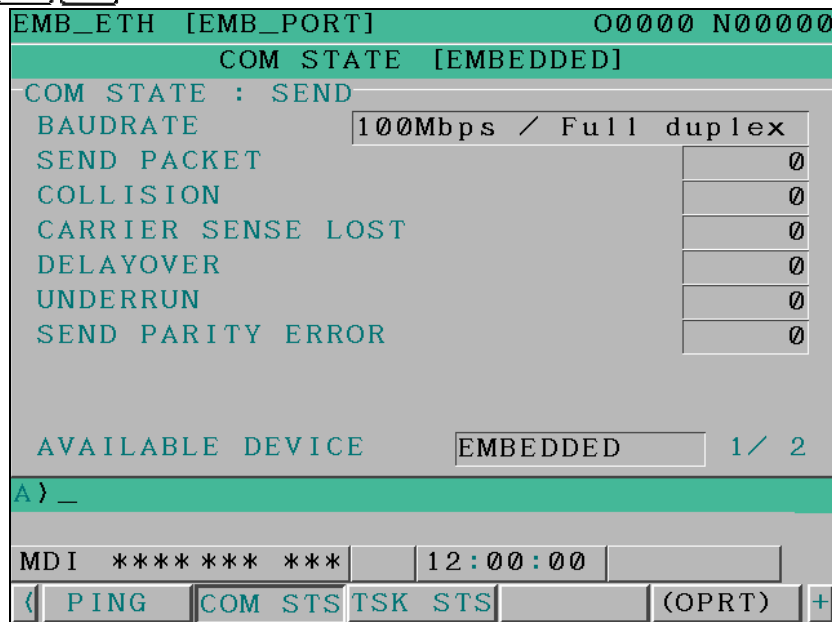
Communication status screen (1st page)

- 301 -

```
EMB_ETH [EMB_PORT]              O0000 N00000
            COM STATE [EMBEDDED]
COM STATE : RECEIVE
 BAUDRATE              100Mbps / Full duplex
 RECEIVE PACKET                              0
 ALIGNMENT ERROR                             0
 CRC ERROR                                   0
 OVERRUN ERROR                               0
 FRAME LENGTH ERROR                          0
 RECV PARITY ERROR                           0


 AVAILABLE DEVICE      EMBEDDED        2/ 2
A)_

MDI  **** *** ***       12:00:00
  (   PING   COM STS TSK STS           (OPRT) +
```
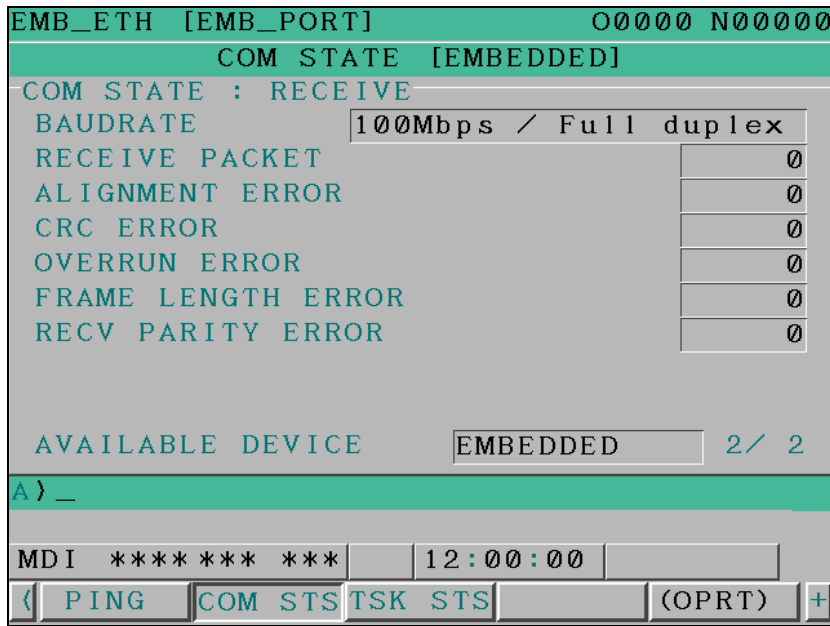
Communication status screen (2nd page)

Display items

Display item	Explanation
BAUDRATE	Indicates the communication speed and communication mode. Communication speed: 100 or 10 Mbps Communication mode: Full or half duplex --------: Not connected to HUB
SEND PACKET	Indicates the number of packets sent.
COLLISION CARRIER SENSE LOST DELAYOVER UNDERRUN SEND PARITY ERROR	Indicate the number of errors detected during packet transmission.
RECEIVE PACKET	Indicates the number of packets received.
ALIGNMENT ERROR CRC ERROR OVERRUN ERROR FRAME LENGTH ERROR RECV PARITY ERROR	Indicate the number of errors detected during packet reception.

Displaying Task status screen

Procedure

1   Press the function key ⬙SYSTEM.

2   Soft keys [EMBED] and [PCMCIA] appear.
     (When there is no soft keys, press the continue key.)

3   To display the Ethernet Setting screen for the embedded Ethernet port or the PCMCIA Ethernet card,
     press soft key [EMBED] or [PCMCIA], respectively.

4   Pressing soft key [TSK STS] causes the task status of the embedded Ethernet function to be
     displayed.

```
EMB_ETH [EMB_PORT]              O0000 N00000
          TASK STATE  [EMBEDDED]
  COMMON                 WDWWWDW
  FOCAS2 #0              C
  FOCAS2 #1              XXXXX
  FOCAS2 #2              XXXXX
  UDP                    X
  PMC                    X
  FTP                    C


                                      1／ 1

  A》_

  MDI  *****  ***  ***    12:00:00
  《   PING  │COM STS│TSK STS│        │        │ +
```
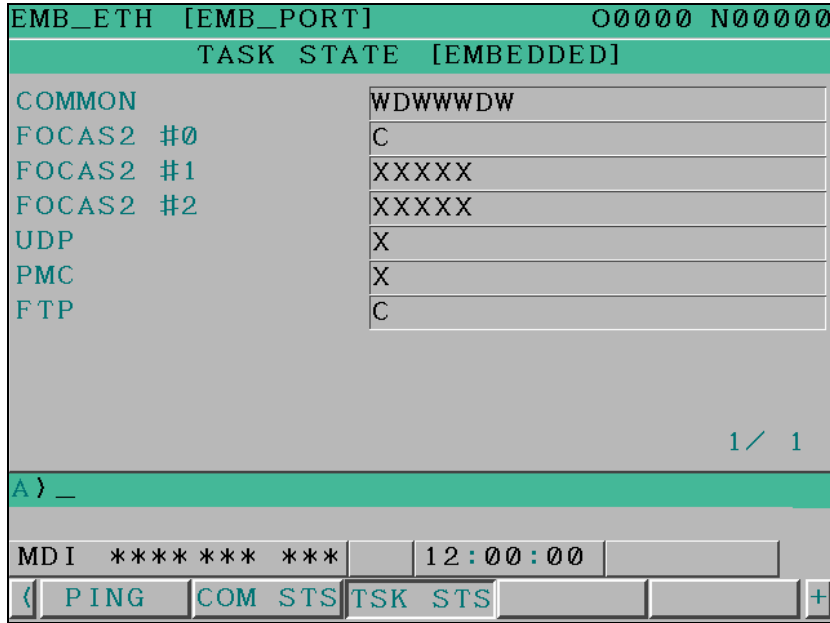
Task status screen

The following symbols are used.

	Symbol and meaning
FOCAS2 #0 (FOCAS2/Ethernet)	C: Waiting for a connection from the host W: Data processing in progress (1) D: Data processing in progress (2) N: FOCAS2 out of service
FOCAS2 #1,#2 (FOCAS2/Ethernet)	W: Data processing in progress (1) D: Data processing in progress (2) X: Not yet executed
PMC (FANUC LADDER-III)	W: Data processing in progress (1) D: Data processing in progress (2) X: Not yet executed
UDP (CIMPLICITY *i*CELL)	W: Data processing in progress (1) D: Data processing in progress (2) X: Not yet executed
FTP (FTP file transfer function)	C: Execution wait W: Data processing in progress (1) D: Data processing in progress (2) X: Not yet executed

7.7 LOG SCREEN OF THE EMBEDDED ETHERNET FUNCTION

This screen displays the log of the embedded Ethernet function.

> **NOTE**
> If alarm SR2032, "EMBEDDED ETHERNET/DATA SERVER ERROR" is issued
> during data transfer using the embedded Ethernet function, check the error
> details on the log screen of the embedded Ethernet function.

Displaying the log screen

Procedure

1   Press the function key [?/MESSAGE].

2   To display the log screen for the embedded Ethernet port or PCMCIA Ethernet card, press soft key [EMB LOG] or [PCM LOG], respectively. (When there is no soft keys, press the continue key.)

```
EMB_ETH  [EMB_PORT]              O0000 N00000
             ETHERNET LOG  [EMBEDDED]
ALL
E-0B02 Subnet mask is wrong
                        Jan. 28  12:28:17
E-0B01 The own IP address is not set
                        Jan. 28  12:28:17




                                PAGE: 1/30

A}_

MDI  **** ***  ***   │   12:00:00   │
  ‹│   ALL   │ COMMON │ FOCAS2 │ FTPTRNS │ (OPRT) │ │›
```
LOG screen

The newest error log appears at the top of the screen. The date and time when an error occurred are displayed at the right end of the line. The format of date and time data is "MMM.DD   hh:mm:ss" where MMM represents a month, DD represents a day, hh represents hours, mm represents minutes, and ss represents seconds.

The date and time of the upper item shown above is January 28, 12:28:17.

To clear the log, press soft keys [(OPRT)] and [CLEAR] in that order.

```
‹│       │       │       │       │ CLEAR │ │
```

The log for each function can be displayed by using soft keys on the embedded Ethernet log screen.

(1)   Soft key [ALL]
      Displays all log related to the embedded Ethernet.
(2)   Soft key [COMMON]
      Displays the log related to the parameter settings of the embedded Ethernet function and the basic communication function.
(3)   Soft key [FOCAS2]
      Displays the log related to the FOCAS2/Ethernet function.
(4)   Soft key [FTPTRNS]
      Displays the log related to FTP file transfer.

Error and message

Error No.	Log message	Description and necessary action
E-0118 E-0119	Error occurred while wait for FOCAS2 pdu	A communication error has occurred because of any of the following: → The network quality has been lowered to such a level that data cannot be received from a PC at the other end. The communication channel has been logically shut down. → Software running on a PC at the other end has logically shut down the communication channel. → The Ethernet cable has been disconnected.
E-011A	All communication paths are busy	All the FOCAS2/Ethernet communication channels are busy.
E-0200	Received message from FTP server	A message sent by the FTP server is directly displayed.
E-0202	Connection failed with FTP server	Software of the FTP server may not be running. Start the software of the FTP server.
E-0207	The router is not found	The specified IP address of the router may be wrong. Alternatively, the router may be turned off. Check whether the IP address of the router has been correctly specified and whether the router is turned on.
E-0208	The FTP server is not found	The specified IP address of the FTP server may be wrong. Alternatively, the FTP server may be turned off. Check whether the IP address of the FTP server has been correctly specified and whether the FTP server is turned on.
E-020B	Cannot login into FTP server	Check whether a correct user name and password are specified when logging into the FTP server.
E-020C	The parameters of FTP server are wrong	Check whether a correct user name and password are specified when logging into the FTP server.
E-020D	Changing a work folder of host failed	Check the work folder logging into the FTP server.
E-041A	Frame transmission failed (TCP)	A communication error has occurred because of any of the following: → The network quality has been lowered to such a level that data cannot be received from a PC at the other end. The communication channel has been logically shut down. → Software running on a PC at the other end has logically shut down the communication channel. → The Ethernet cable has been disconnected.
E-0901	Cannot read MAC address	The MAC address is not written in the hardware. Alternatively, the hardware has been damaged.
E-0A06	Network is too busy	An excessive amount of data is flowing over the network. One possible solution is to divide the network.
E-0B00	The own IP address is wrong	Specify a correct IP address in the designated format.
E-0B01	The own IP address is not set	Specify an IP address.
E-0B02	Subnet mask is wrong	Specify a correct subnet mask in the designated format.
E-0B03	Subnet mask is not set	Specify a subnet mask.
E-0B04	Router IP address is wrong	There may be class disagreement between the IP address of the local node and the IP address of the router.
E-0B05	IP address of DNS server is wrong	There may be class disagreement between the IP address of the local node and the IP address of the DNS server.
E-0B06	The own host name is wrong	Check whether a correct host name is specified.
E-0B07	The own domain name is wrong	Check whether a correct domain name is specified.

Error No.	Log message	Description and necessary action
E-0B08	TCP port number is wrong	A value beyond the permissible setting range may be specified.
E-0B09	UDP port number is wrong	A value beyond the permissible setting range may be specified.
E-0B0B	IP address of remote FTP server is wrong	Specify a correct IP address in the designated format.
E-0B0B	IP address of remote FTP server is wrong	Specify a correct IP address in the designated format.
E-0B0C	Port No of a remote FTP server is wrong	A value beyond the permissible setting range may be specified.
E-0B0D	User name of remote FTP server is wrong	The specified user name may contain a prohibited character.
E-0B0E	Password of remote FTP server is wrong	The specified password may contain a prohibited character.
E-0B0F	Login folder of remote FTP srv is wrong	The specified log-in folder name may contain a prohibited character.
E-0B18	Cannot set because DHCP is available	To allow a set-up, disable the DHCP client function.
E-0B19 E-0B1A	Embedded Ethernet hardware isn't found	The software or hardware of embedded Ethernet function cannot be recognized. Check whether the software has been incorporated. Check whether the hardware is sound.
E-XXXX	(No message)	An internal error has occurred. Make a notification of the error number.

8   DIGITAL SERVO

This chapter describes servo tuning screen required for maintenance of digital servo and adjustment of reference position.

8.1   INITIAL SETTING SERVO PARAMETERS

This section describes how to set initial servo parameters, which is used for field adjustment of machine tool.

1. Turn on power at the emergency stop condition.
2. Set parameters for displaying the servo setting screen and servo tuning screen.

	#7	#6	#5	#4	#3	#2	#1	#0
3111								SVS

[Input type] Setting input
[Data type] Bit path

   #0   SVS   Servo setting screen or servo tuning screen is:
        0:    Not displayed.
        1:    Displayed.

3. Set the parameter for the display format of the servo setting screen as required.

	#7	#6	#5	#4	#3	#2	#1	#0
13117						SVO		

[Input type] Parameter input
[Data type] Bit

   #2   SVO   On the servo setting screen,
        0:    Two screens, machine constant input screen and parameter input screen, are displayed.
        1:    Only the parameter input screen is displayed.

  Remark
      When bit 2 (SVO) of parameter No. 13117 is set to 0, after displaying the servo setting screen, press soft key [(OPRT)], continuous menu key [+], and soft key [SWITCH] to display the parameter input screen.
      When bit 2 (SVO) of parameter No. 13117 is set to 1, the parameter input screen is displayed directly by performing the procedure for displaying the servo setting screen.

      This section describes operations using the parameter input screen of the servo setting screen. Therefore, setting this parameter makes operations described in this section easy.

4. Turn off the power once then turn it on again.

5. Display the servo parameter setting screen by the following operation: Function key ![SYSTEM] → ▷
    → [SV.SET].

    When bit 2 (SVO) of parameter No. 13117 described above is set to 0, also press soft key [(OPRT)],
    continuous menu key [+], and soft key [SWITCH] to display the parameter input screen.

6. Input data required for initial setting using the cursor and page key.

```
SERVO SETING                          O0123 N00000

                        X    AXIS      Y    AXIS
INITIAL SET BITS     00000010       00000010        ←——— Parameter No.2000
MOTOR  ID NO.             262            262         ←——— Parameter No.2020
AMR                  00000000       00000000         ←——— Parameter No.2001
CMR                         2              2         ←——— Parameter No.1820
FEEDGEAR   N                1              1         ←——— Parameter No.2084
(N/M)      M              100            100         ←——— Parameter No.2085
DIRECTION SET            111            111          ←——— Parameter No.2022
VELOCITY PULSE  NO.     8192           8192          ←——— Parameter No.2023
POSITION PULSE  NO.    12500          12500          ←——— Parameter No.2024
REF. COUNTER           10000          10000          ←——— Parameter No.1821


A)_



MEM   **** *** ***   │ 20:15:08 │
(       │   ON:1   │ OFF:0   │         │   INPUT  │ +
```

(1) Initial set bit

	#7	#6	#5	#4	#3	#2	#1	#0
2000							DGPRM	PLC01

  #0 PLC01 0: Values of parameters Nos. 2023 and 2024 are used as they are:
              1 : Values of parameters Nos. 2023 and 2024 are multiplied by 10.
#1 DGPRM 0: Initial setting of digital servo parameter is done.
              1: Initial setting of digital servo parameter is not done.

(2) Motor ID No.
    Select the motor type No. of a servo motor to be used from the following table according to a motor
    model and specification (four digits in the middle part of "A06B-xxxx-Bxxx).

Table 8.1 (a) αiS series servo motor

Motor model	Motor specification	Motor type No.
αiS 2 /5000	0212	262
αiS 2 /6000	0218	284
αiS 4 /5000	0215	265
αiS 8 /4000	0235	285
αiS 8 /6000	0232	290
αiS 12 /4000	0238	288
αiS 22 /4000	0265	315
αiS 22 /6000	0262	452
αiS 30 /4000	0268	318

Motor model	Motor specification	Motor type No.
α*i*S 40 /4000	0272	322
α*i*S 50 /3000	0275-Bx0x	324
α*i*S 50 /3000 FAN	0275-Bx1x	325
α*i*S 100 /2500	0285-Bx0x	335
α*i*S 100 /2500 FAN	0285-Bx1x	330
α*i*S 200 /2500	0288-Bx0x	338
α*i*S 200 /2500 FAN	0288-Bx1x	334
α*i*S 300 /2000	0292	342
α*i*S 500 /2000	0295	345

The value for an x varies depending on whether an option is provided or not.

Table 8.1 (b) α*i*S (HV) series servo motor

Motor model	Motor specification	Motor type No.
α*i*S 2/5000HV	0213	263
α*i*S 2/6000HV	0219	287
α*i*S 4/5000HV	0216	266
α*i*S 8/4000HV	0236	286
α*i*S 8/6000HV	0233	292
α*i*S 12/4000HV	0239	289
α*i*S 22/4000HV	0266	316
α*i*S 22/6000HV	0263	453
α*i*S 30/4000HV	0269	319
α*i*S 40/4000HV	0273	323
α*i*S 50/3000HV	0276-Bx0x	327
α*i*S 50/3000HV FAN	0276-Bx1x	326
α*i*S 100/2500HV	0286-Bx0x	336
α*i*S 100/2500HV FAN	0286-Bx1x	331
α*i*S 200/2500HV	0289-Bx0x	339
α*i*S 200/2500HV FAN	0289-Bx1x	337
α*i*S 300/2000HV	0293	343
α*i*S 500/2000HV	0296	346
α*i*S 1000/2000HV	0298	348

The value for an x varies depending on whether an option is provided or not.

Table 8.1 (c) α*i*F series servo motor

Motor model	Motor specification	Motor type No.
α*i*F 1/5000	0202	252
α*i*F 2/5000	0205	255
α*i*F 4/4000	0223	273
α*i*F 8/3000	0227	277
α*i*F 12/3000	0243	293
α*i*F 22/3000	0247	297
α*i*F 30/3000	0253	303
α*i*F 40/3000	0257-Bx0x	307
α*i*F 40/3000 FAN	0257-Bx1x	308

The value for an x varies depending on whether an option is provided or not.

Table 8.1 (d) α*i*F (HV) series servo motor

Motor model	Motor specification	Motor type No.
α*i*F 4/4000HV	0225	275
α*i*F 8/3000HV	0229	279

Motor model	Motor specification	Motor type No.
αiF 12/3000HV	0245	295
αiF 22/3000HV	0249	299

Table 8.1 (e) βiS series servo motor

Motor model	Motor specification	Driver amp	Motor type No.
βiS 0.2/5000	0111	4A	260
βiS 0.3/5000	0112	4A	261
βiS 0.4/5000	0114	20A	280
βiS 0.5/6000	0115	20A	281
βiS 1/6000	0116	20A	282
βiS 2/4000	0061 [Note 1]	20A	253
		40A	254
βiS 4/4000	0063 [Note 1]	20A	256
		40A	257
βiS 8/3000	0075 [Note 1]	20A	258
		40A	259
βiS 12/2000	0077 [Note 1]	20A	269
		40A	268
βiS 12/3000	0078	40A	272
βiS 22/2000	0085	40A	274
βiS 22/3000	0082	80A	313

NOTE
If the motor specification is "A06B-XXXX-Bxx6", be sure to use parameters for "-Bxx6" shown in Table 8.1(g) below.

Table 8.1 (f) βiS series servo motor (energized at 400V)

Motor model	Motor specification	Driver amp	Motor type No.
βiS 2/4000HV	0062	10A	251
βiS 4/4000HV	0064	10A	264
βiS 8/3000HV	0076	10A	267
βiS 12/3000HV	0079	20A	270
βiS 22/2000HV	0086	20A	278
βiS 22/3000HV	0083	40A	314

Table 8.1 (g) βiS series servo motor (for -Bxx6)

Motor model	Motor specification	Driver amp	Motor type No.
βiS 2/4000	0061-Bxx6	20A	306
		40A	310
βiS 4/4000	0063-Bxx6	20A	311
		40A	312
βiS 8/3000	0075-Bxx6	20A	283
		40A	294
βiS 12/2000	0077-Bxx6	20A	298
		40A	300
βiS 22/1500	0084-Bxx6	20A	302
		40A	305

Table 8.1 (h) αCi series servo motor

Motor model	Motor specification	Motor type No.
αC4/3000i	0221	271
αC8/2000i	0226	276
αC12/2000i	0241	291
αC22/2000i	0246	296
αC30/1500i	0251	301

(3) Arbitrary AMR function

	#7	#6	#5	#4	#3	#2	#1	#0
2001	AMR7	AMR6	AMR5	AMR4	AMR3	AMR2	AMR1	AMR0

*   Set "00000000".

(4) CMR

1820	Command multiply ratio

1) When CMR is 1/2 to 1/27
$$\text{Set value} = \frac{1}{\text{CMR}} + 100$$

2) When CMR is 1 to 48
Set value=2×CMR

(5) Turn off the power then back on.

(6) N/M of flexible feed gear (F·FG)

2084	n for flexible feed gear

2085	m for flexible feed gear

Setting for the αi Pulsecoder in the semi-closed mode

$$\frac{\text{F·FG numerator } (\leq 32767)}{\text{F·FG denominator } (\leq 32767)} = \frac{\text{Necessary position feedback pulses per motor revolution}}{1,000,000 \text{ (Note 2)}} \quad \text{(as irreducible fraction)}$$
(Note 1)

NOTE
1   For both F·FG number and denominator, the maximum setting value (after reduced) is 32767.
2   αi Pulsecoders assume one million pulses per motor revolution, irrespective of resolution, for the flexible feed gear setting.
3   If the calculation of the number of pulses required per motor revolution involves p, such as when a rack and pinion are used, assume π to be approximately 355/113.

[Example]
    If the machine is set to detection in 1,000 degree units with a gear reduction ratio of 10:1 for the rotation axis, the table rotates by 360/10 degrees each time the motor makes one turn.
    1000 position pulses are necessary for the table to rotate through one degree.

The number of position pulses necessary for the motor to make one turn is:

$360/10 \times 1000 = 36000$ with reference counter $= 36000$

$$\frac{\text{F·FG numerator}}{\text{F·FG denominator}} = \frac{36000}{1,000,000} = \frac{36}{1000}$$

Other F·FG (numerator/denominator) setting examples (reduction ratio = 1:1)

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

Setting for use of a separate detector (full-closed)
$\dfrac{\text{F·FG numerator } (\leq 32767)}{\text{F·FG denominator } (\leq 32767)} = \dfrac{\text{Number of position pulses corresponding to a predetermined amount of travel}}{\text{Number of position pulses corresponding to a predetermined amount of travel from a separate detector}}$ (as irreducible fraction)

[Example]

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

$$\frac{\text{Numerator of F·FG}}{\text{Denominator of F·FG}} = \frac{L/1}{L/0.5} = \frac{1}{2}$$

Other F·FG (numerator/denominator) setting examples

Detection unit	Resolution of scale			
	1μm	0.5μm	0.1μm	0.05μm
1μm	1／1	1／2	1／10	1／20
0.5μm	—	1／1	1／5	1／10
0.1μm	—	—	1／1	1／2

(7) Direction of travel

2022	Rotational direction of motor

111 : Normal (clockwise) / -111 : Reverse (counterclockwise)

(8)   Number of speed pulses, Number of position pulses

	Semi-closed loop	Closed loop		
		Parallel type	Serial linear scale	Serial rotary scale
Command unit (μm)	1/0.1	1/0.1	1/0.1	1/0.1
Initial bit setting	Bit 0=0	Bit 0=0	Bit 0=0	Bit 0=0
Number of speed pulses	8192	8192	8192	8192
Number of position pulses	12500(*1)	(*2 - Example 1)	(*2 - Example 1)	(*2 - Example 2)

Set 8192 as the number of speed pulses.

NOTE

1 Setting of the number of position pulses for the semi-closed loop (indicated by (*1) in the above table)
  Set 12500.

2 As the number of position pulses, set the number of pulses fed back from a separate detector when the motor makes one revolution. (The flexible feed gear has no relevance to the calculation of the number of position pulses.)
  Example 1:
  When a ball screw (direct connection) with a 10-mm lead and a separate detector with a resolution of 0.5 μm per pulse are used
  When the motor makes one revolution, the following pulses are fed back from the separate detector:
  10/0.0005 = 20,000
  Accordingly,
  Number of position pulses = 20,000
  Example 2:
  When a serial rotary scale with a resolution of 1,000,000 pulses per revolution is used, the number of position feedback pulses is exceptionally calculated by the following:
  12500 × (deceleration ratio between the motor and table)
  When the deceleration ratio between the motor and table is 10:1, for example, the number of position pulses is:
  12,500 × (1/10) = 1250

3 When the set number of position pulses is greater than 32767
  Using the position feedback pulse conversion coefficient makes setting easier as described on the following page.

With a position feedback pulse conversion coefficient, the number of position pulses is set using the product of two parameters.

2024	Number of position pulses

2185	Conversion coefficient for the number of position feedback pulses

(Example of setting)
When a linear scale with a minimum resolution of 0.1 (m is used and the travel distance per motor revolution is 16 mm:
Ns = (travel distance per motor revolution (mm))/(minimum resolution of detector (mm))
= 16 mm/0.0001 mm = 160000 (>32767) = 10000 × 16
So, set the following:
A: 10000
B: 16

NOTE

If the detector of the motor is an αi Pulsecoder (the number of speed pulses = 8192), select a power of 2 (such as 2, 4, 8, and so on) as a conversion coefficient whenever possible. (The position gain value used inside the software becomes more accurate.)

---

(9)   Reference counter

1821	Reference counter capacity for each axis (0 to 99999999)

(a)   For the semi-closed loop

Reference counter
 = Number of position pulses required per motor revolution or the same number divided by an integer

---

NOTE
  If the rotation ratio between the motor and table is not an integer when a rotation
  axis is used, a reference counter capacity needs to be set so that the point
  where reference counter = 0 (grid point) always appears at the same position
  relative to the table.

Example of setting)
αi Pulsecoder, semi-closed loop (1 μm detection)

Lead of ball screw (mm/revolution)	Required number of position pulses (pulses/revolution)	Reference counter	Grid width (mm)
10	10000	10000	10
20	20000	20000	20
30	30000	30000	30

If there is an error between the required number of position pulses per motor revolution and the setting of
the reference counter, the reference position varies, depending on the start point.
Such an error needs to be eliminated by changing the detection unit. In this case, a reference counter
capacity may be set using a fraction.

Example of setting)
System with detection unit = 1 μm, ball screw lead = 20 mm/revolution, and deceleration ratio = 1/17

(i)   Method of setting a reference counter capacity as a fraction
      Required number of position pulses per motor revolution = 20000/17
      Set the following parameters:

1821	Reference counter capacity of each axis (numerator) (0 to 99999999)

2179	Reference counter capacity of each axis (denominator) (0 to 100)

   The parameter for a denominator is not displayed on the servo setting screen. So, a denominator
   needs to be set on the parameter screen.
   In this example, set numerator = 20000, and denominator = 17.

NOTE
  The reference counter assumes only an integer. So, if a fraction is set for a
  reference counter capacity, the gap to the point where reference counter = 0 is
  compensated for.
  (In pulse control theory, a position less than one pulse cannot be controlled. So,
  grid interval compensation is performed so that a grid point error is less than one
  detection unit at all times.)

(ii)   Method of changing the detection unit
       Required number of position pulses per motor revolution = 20000/17

The values of all of the following parameters are multiplied by 17 to change the detection unit to 1/17 μm:

Parameter to be changed	
FFG × 17	Can be changed on the servo setting screen.
CMR × 17	Can be changed on the servo setting screen.
Reference counter × 17	Can be changed on the servo setting screen.
Effective area × 17	No.1826, No.1827
Positional deviation limit value during movement × 17	No.1828
Positional deviation limit value during a stop × 17	No.1829
Backlash amount × 17	No.1851, No.1852

As the detection unit is changed from 1 μm to 1/17 μm, the values of all parameters to be set using the detection unit must be multiplied by 17.

> ⚠ **CAUTION**
> In addition to the parameters listed above, there are parameters to be set using the detection unit.
> For detailed descriptions, refer to [Unit of data] in each parameter description in the Parameter Manual (B-64310EN).

This change eliminates an error between the required number of position pulses per motor revolution and the reference counter.
Required number of position pulses per motor revolution = 20000
Reference counter = 20000

(b)   For the closed loop

Reference counter = Z phase (reference position) interval/detection unit or the same number divided by an integer

If the reference counter does not assume an integer, see the example of semi-closed loop.

> **NOTE**
> If the rotation ratio between the separate detector and table is not an integer when a rotation axis is used, a reference counter capacity needs to be set so that the point where reference counter = 0 (grid point) always appears at the same position relative to the table.

Example of setting)
Example 1)
    When Z phase interval = 50 mm and detection unit = 1 μm
    Reference counter = 50,000/1 = 50,000
Example 2)
    When detection unit = 0.001° with a rotation axis
    Reference counter = 360/0.001 = 360,000
Example 3)
    When there is only one Z phase as in the case of a linear scale
    Set a simple number such as 10000 and 50000 for the reference counter.

7.   Turn off the power then back on.

8.2   FSSB DISPLAY AND SETTING SCREEN

Connecting the CNC control unit to servo amplifiers via a high-speed serial bus (FANUC Serial Servo Bus, or FSSB), which uses only one fiber optics cable, can significantly reduce the amount of cabling in machine tool electrical sections.

Using the FSSB setting screen to specify axis-to-amp relationships enables axis settings to be calculated automatically; that is, if bit 0 (DFS) of parameter No. 14476 = 0, parameters Nos. 1023, 1905, 1936, 1937, 14340 to 14349, and 14376 to 14391 are set automatically, and if bit 0 (DFS) of parameter No. 14476 = 1, parameters Nos. 1023, 1905, 1910 to 1919, 1936, and 1937 are set automatically.

Display

The FSSB setting screen displays FSSB-based amplifier and axis information. This information can also be specified by the operator.

1   Press function key ⬙ SYSTEM .

2   To display [FSSB], press continuous menu key ▷ several times.

3   Pressing soft key [FSSB] causes the AMP SET screen (or the previously selected FSSB setting screen) to appear, with the following soft keys displayed.

| 《| | AMP | AXIS | MAINTE | | | (OPRT) | |

The FSSB setting screens include: AMP SET, AXIS SET, and AMP MAINTENANCE.

Pressing soft key [AMP] causes the AMP SET screen to appear.
Pressing soft key [AXIS] causes the AXIS SET screen to appear.
Pressing soft key [MAINTE] causes the AMP MAINTENANCE screen to appear.

<1> Amplifier setting screen
The amplifier setting screen consists of two sections: the first section displays information about the slave, while the second section displays information about the separate detector interface units.

Page keys ⬆ PAGE and PAGE ⬇ can be used to switch between the sections.

```
AMP  SETTING                           O0000 N00000
 NO.   AMP   SERIES UNIT CUR.   AXIS   NAME
1-01  A1-L    α i    SVM  20A   │01│    X
1-02  A1-M    α i    SVM  20A   │02│    Y
1-03  A1-N    α i    SVM  20A   │03│    Z
1-04  A2-L    α i    SVM  20A   │04│    B
1-05  A2-M    α i    SVM  20A   │05│    C




A》_

MDI  ****  ***  ***  │20:19:12│
《|  AMP    AXIS   MAINTE          (OPRT)  |
```

```
AMP  SETTING                    O0000 N00000
  NO. EXTRA  TYPE  PCB  ID
 1-7    M1      A    SDU  (4AXES)




















A)_



MDI   ****  ***  ***      20:19:27
 《    AMP      AXIS    MAINTE           (OPRT)
```

The amplifier setting screen consists of the following items:
- NO. (slave number)
  For slaves connected by the FSSB, up to 10 continuous slave numbers (up to 8 for amps and up to 2 for interface units) assigned with the one nearest to the CNC as the lowest slave number are displayed.
  Each slave number displayed on the amp setting screen consists of "1" indicating the FSSB1 line, "-" (hyphen) that follows it, and the slave unit number of the connected slave arranged in ascending order with the one nearest to the CNC as the lowest number.
- AMP (amplifier type)
  The amplifier type display consists of the letter A, which stands for "amplifier," a number that indicates the placing of the amplifier, as counted from that nearest to the CNC, and a letter such as L (first axis), M (second axis), or N (third axis) indicating the placing of the axis in the amplifier.
- AXIS NO. (controlled axis number)
  Each controlled axis number displayed is a value set in parameter Nos. 14340 to 14349 plus 1 if bit 0 (DFS) of parameter No. 14476 = 0 or a value set in parameter Nos. 1910 to 1919 plus 1 if bit 0 (DFS) of parameter No. 14476 = 1.
- NAME (controlled axis name)
  The axis name assigned to a parameter (No. 1020) corresponding to a particular controlled axis number is displayed. If the controlled axis number is 0, - is displayed.
- The following items are displayed as amplifier information:
  - SERIES (servo amplifier name)
  - UNIT (servo amplifier unit type)
  - CURRENT (maximum rating)
- The following items are displayed as separate detector interface unit information:
  - SEPARATE
    This display consists of the letter M, which stands for "separate detector interface unit" and a number indicating the placing of the pulse module, as counted from that nearest to the CNC.
  - TYPE
    This display is a letter indicating the type of the separate detector interface unit.

- PCB ID
This display consists of four digits indicating the separate detector interface unit ID (hexadecimal). The separate detector interface unit ID is followed by SDU (8-AXES) for the eight-axis separate detector module or SDU (4-AXES) for the four-axis separate detector module.

<2> Axis setting screen
The axis setting screen displays the information shown below:

```
AXIS  SETTING                         O0000 N00000
  AXIS   NAME    AMP      M     1-  CS   TNDM
                       1 2 3 4  DSP
      1      X    A1-L   0 0 0 0  0   0    0 0
      2      Y    A1-M   0 0 0 0  0   0    0 0
      3      Z    A1-N   0 0 0 0  0   0    0 0
      4      B    A2-L   0 0 0 0  0   0    0 0
      5      C    A2-M   0 0 0 0  0   0    0 0




A)_

MDI   ****  ***  ***|     20:19:41  |
(    AMP  |   AXIS  | MAINTE  |       |  (OPRT)  |  |
```

This axis setting screen displays the following items:
- AXIS (controlled axis number)
  This item is the placing of the NC controlled axis.
- NAME (controlled axis name)
- AMP (type of the amplifier connected to each axis)
- M1 (connector number for separate detector interface unit 1)
  The connector number for separate detector interface unit 1 stored in the SRAM is displayed.
- M2 (connector number for separate detector interface unit 2)
  The connector number for separate detector interface unit 2 stored in the SRAM is displayed.
- 1-DSP
  If the number of servo HRV3 controlled axes that can be controlled by one DSP is limited, the number of axes controllable by one DSP stored in the SRAM is displayed. When 0 is displayed, no limitation is imposed.
- Cs (Cs contour controlled axis)
  The value stored in the SRAM is displayed. It is spindle number for the Cs contour controlled axis.
- TNDM
  The value stored in the SRAM is displayed. Consecutive odd and even numbers are displayed for the master and slave axes for tandem control.

<3> Amplifier maintenance screen
The amplifier maintenance screen displays maintenance information for servo amplifiers. This

screen consists of the following two pages, either of which can be selected by pressing the [↑ PAGE] or

[PAGE ↓] key.

```
AMPLIFIER  MAINTENA              O0000 N00000
  AXIS   NAME    AMP    SERIES UNIT AXES CUR.
     1      X    A1-L    α i    SVM    3    20A
     2      Y    A1-M    α i    SVM    3    20A
     3      Z    A1-N    α i    SVM    3    20A
     4      B    A2-L    α i    SVM    3    20A
     5      C    A2-M    α i    SVM    3    20A




A〉_

MDI    ****  ***  ***      20:19:59
 〈│   AMP   │  AXIS  │MAINTE│       │       │  │
```

```
AMPLIFIER  MAINTENA              O0000 N00000
  AXIS   NAME EDITION    TEST    MAINTE-NO.
     1      X      2B    050906        0
     2      Y      2B    050906        0
     3      Z      2B    050906        0
     4      B      2B    050906        0
     5      C      2B    050906        0




A〉_

MDI    ****  ***  ***      20:20:13
 〈│   AMP   │  AXIS  │MAINTE│       │       │  │
```

The amplifier maintenance screen displays the following items:
- AXIS (controlled axis number)
- NAME (controlled axis name)
- AMP (type of amplifier connected to each axis)
- SERIES (servo amplifier series of an amplifier connected to each axis)
- UNIT (unit type of a servo amplifier connected to each axis)
- AXES (maximum number of axes controlled by an amplifier connected to each axis)
- CUR. (maximum rating for amplifiers connected to each axis)
- EDITION (unit version number of an amplifier connected to each axis)
- TEST (date of test performed on an amplifier connected to each axis)
  Example) 090123 = January 23, 2009
- MAINTE-NO. (engineering change number for an amplifier connected to each axis)

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Setting

On an FSSB setting screen (other than the amplifier maintenance screen), pressing soft key [(OPRT)] displays the following operation selection soft keys:

| SETING | | CANCEL | | | INPUT | |

To enter data, place the machine in MDI mode or the emergency stop state, position the cursor to the point where a desired item is to be input, then enter the desired data and press soft key [INPUT] (or the

[↓ INPUT] key on the MDI panel).

When soft key [SETING] is pressed after data is entered, a warning message is displayed if the entered data is incorrect. When the entered data is correct, it is set in parameters Nos. 1023, 1905, 1936, 1937, 14340 to 14349, and 14376 to 14391 if bit 0 (DFS) of parameter No. 14476 = 0 or parameter Nos. 1023, 1905, 1910 to 1919, 1936, and 1937 if bit 0 (DFS) of parameter No. 14476 = 1.
To restore the previous value of a parameter if, for example, an entered value is incorrect, press soft key [CANCEL].
When the power is turned on, values are read from the parameters and displayed on the screen.

⚠ **CAUTION**
1 For the parameters to be specified on the FSSB setting screen, do not attempt to enter values on the parameter screen using the MDI or a G10 command. Use only the FSSB screen to enter values for these parameters.
2 If pressing soft key [SETING] results in a warning being issued, re-enter the data or press soft key [CANCEL] to reset the warning. Pressing the reset key cannot reset the warning.

<1> Amplifier setting screen

```
AMP  SETTING                      O0000 N00000

 NO.   AMP   SERIES UNIT CUR.   AXIS   NAME

1-01  A1-L   α i    SVM  20A    [01]    X
1-02  A1-M   α i    SVM  20A    [02]    Y
1-03  A1-N   α i    SVM  20A    [03]    Z
1-04  A2-L   α i    SVM  20A    [04]    B
1-05  A2-M   α i    SVM  20A    [05]    C




A ) _

MDI    ****  ***  ***    20:22:12
( SETING       CANCEL            INPUT
```

The amplifier setting screen displays the following items:
- NO. (controlled axis number)
  For this item, enter a value of between 1 and the maximum number of controlled axes. If a number that falls outside this range is entered, the warning message "INVALID FORMAT" appears. If the entered controlled axis number is duplicate or 0, the warning message "SPECIFIED DATA IS OUT OF RANGE" appears when soft key [SETING] is pressed to assert the entered value. In this case, no value can be entered for the parameter.

<2> Axis setting screen

```
AXIS  SETTING                          O0000 N00000

   AXIS   NAME    AMP      M      1-   CS   TNDM
                         1 2 3 4   DSP

      1     X     A1-L   0 0 0 0    0    0    00
      2     Y     A1-M   0 0 0 0    0    0    00
      3     Z     A1-N   0 0 0 0    0    0    00
      4     B     A2-L   0 0 0 0    0    0    00
      5     C     A2-M   0 0 0 0    0    0    00




A)_


MDI   ****  ***  ***      20:22:29
 SETING          CANCEL          INPUT
```

On the axis setting screen, the following items can be specified:
- M1 (connector number for separate detector interface unit 1)
  M2 (connector number for separate detector interface unit 2)
  For an axis on which to use each separate detector interface unit, enter a connector number with a number 1 to 8 (maximum number of connectors on a separate detector interface unit).
  When a separate detector interface unit is not connected and a number that falls outside the valid range is entered, the warning message "ILLEGAL DATA" is displayed. When a separate detector interface unit is connected and a number that falls outside the valid range is entered, the warning message "DATA IS OUT OF RANGE" is displayed.
- 1-DSP
  If the number of servo HRV3 controlled axes that can be controlled by one DSP is limited, set the number of axes controllable by one DSP.
  Number of servo HRV3 controlled axes   Setting: 3
  The same value is set for axes other than Cs contour controlled axes.
  If a value other than 0, 1, and 3 is input, the warning "INVALID FORMAT" is output.
- Cs (Cs contour controlled axis)
  Enter spindle number (1 to 2) for the Cs contour controlled axis. If a number other than 0 to 2 is entered, the warning message "DATA IS OUT OF RANGE" is displayed.
- TNDM (or M/S if EGB (T series) is enabled)
  Enter odd and even numbers for axes for tandem control or EGB (T series). These numbers must be consecutive and within a range between 1 and the number of controlled axes. If a number that falls outside the valid range is entered, the warning message "DATA IS OUT OF RANGE" is displayed.

When soft key [SETING] is pressed on the axis setting screen after data entry, the warning message "DATA IS OUT OF RANGE" is displayed if any of the following conditions is satisfied.
- The setting disables the connection of controlled axes with amplifiers and separate detector interface units.
- A value other than 0 is specified for both M1 and M2 for an axis.
- A value other than 0 is specified for both Cs and TNDM for an axis.
- 1-DSP is 1 and TNDM is not 0 for an axis.
- 1-DSP is 3 and TNDM is specified for a multiple of four for an axis.
- A duplicate value is specified for M1.
- A duplicate value is specified for M2.
- A duplicate value is specified for Cs.

- A duplicate value is specified for TNDM.
- An invalid master/slave axis pair is specified for TNDM.

8.3 SERVO TUNING SCREEN

8.3.1 Parameter Setting

Set a parameter to display the servo tuning screen.

		#7	#6	#5	#4	#3	#2	#1	#0
3111									SVS

[Input type] Setting input
[Data type] Bit path

#0 SVS Servo setting screen or servo tuning screen is:
  0: Not displayed.
  1: Displayed.

8.3.2 Displaying Servo Tuning Screen

1 Press function key [SYSTEM] key, continuous menu key [▷], and soft key [SV.SET] in this order.

2 Press soft key [SV.TUN] to select the servo tuning screen.

```
SERVO MOTOR SETTIN            O0000 N00000
X   AXIS
      (PARAMETER)           (MONITOR)
<1>  FUNC.  BIT  00001000  ALARM 1    00000000  <9>
<2>  LOOP GAIN       3000  ALARM 2    00101010  <10>
<3>  TUNING ST.         0  ALARM 3    10100000  <11>
<4>  SET PERIOD         0  ALARM 4    00000000  <12>
<5>  INT. GAIN         39  ALARM 5    00000000  <13>
<6>  PROP. GAIN      -350  LOOP GAIN         0  <14>
<7>  FILTER             0  POS ERROR         0  <15>
<8>  VELOC. GAIN      100  CURRENT(%)        1  <16>
                          CURRENT(A)        0  <17>
                          SPEED(RPM)        0  <18>


A)_

MDI   **** *** ***    20:24:26
 (|         ON:1   OFF:0              INPUT  |+
```

(1) Function bit : Parameter No.2003
(2) Loop gain : Parameter No.1825
(3) Tuning start :
(4) Set period :
(5) Integral gain : Parameter No.2043
(6) Proportional gain : Parameter No.2044
(7) Filter : Parameter No.2067
(8) Velocity gain Set value $\dfrac{(\text{Parameter No.2021})+256}{256}\times100$

(9) Alarm 1 : Diagnosis No.200
(10) Alarm 2 : Diagnosis No.201
(11) Alarm 3 : Diagnosis No.202
(12) Alarm 4 : Diagnosis No.203
(13) Alarm 5 : Diagnosis No.204
(14) Loop gain : Actual loop gain
(15) Position error : Actual position error (Diagnosis No.300)
(16) Current(%) : Indicate current with % to the rated value.
(17) Current(A) : Indicate current with A (peak value).
(18) Speed RPM : Number of motor actual rotation

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm 1	OVL	LVA	OVC	HCA	HVA	DCA	FBA	OFA
Alarm 2	ALD			EXP				
Alarm 3		CSA	BLA	PHA	RCA	BZA	CKA	SPH
Alarm 4	DTE	CRC	STB	PRM				
Alarm 5		OFS	MCC	LDM	PMS	FAN	DAL	ABF

NOTE
The empty fields do not represent alarm codes.

8.3.3 Alarms Related to Amplifiers and Motors

An alarm is identified from the data of alarms 1, 2, and 5. The meaning of each bit is indicated below.

Alarm 1							Alarm 5		Alarm 2		Description	Action
OVL	LVA	OVC	HCA	HVA	DCA	FBA	MCC	FAN	ALD	EXP		
			1						0	0	Overcurrent alarm (PSM)	
			1						0	1	Overcurrent alarm (SVM)	1
			1						0	1	Overcurrent alarm (software)	1
				1							Overvoltage alarm	
					1						Excessive regenerative discharge alarm	
	1								0	0	Power supply undervoltage (PSM)	
	1								1	0	DC link undervoltage (PSM)	
	1								0	1	Control power supply undervoltage (SVM)	
	1								1	1	DC link undervoltage (SVM)	
1									0	0	Overheat (PSM)	2
1									1	0	Motor overheat	2
							1				MCC welding, precharge	

Alarm 1							Alarm 5		Alarm 2		Description	Action
OVL	LVA	OVC	HCA	HVA	DCA	FBA	MCC	FAN	ALD	EXP		
								1	0	0	Fan stop (PSM)	
								1	0	1	Fan stop (SVM)	
		1									OVC alarm	3

> **NOTE**
> For the alarms with no action number, see the maintenance manual of the servo amplifier.

Action 1: Related to overcurrent alarms

An overcurrent alarm is issued when an excessively large current flows in the main circuit.

If an overcurrent alarm is always issued after the emergency stop state is canceled or at the time of gradual acceleration/ deceleration, the cause may be a defective amplifier, cable connection error, broken cable, or parameter setting error.

First, check if the servo parameters indicated below are set to the standard values. If the servo parameters Nos. 2004, 2040, and 2041 are set to the standard values, check the amplifier and cable connections according to the maintenance manual of the amplifier.

If an overcurrent alarm is issued only at the time of abrupt acceleration/deceleration, the use condition is too severe. Increase the time constant and see what happens.

> ⚠ **CAUTION**
> If the emergency stop state is canceled when the power line to the motor is disconnected, an overcurrent alarm (software) may be issued. If this poses a problem, set the following parameter to 1:
> Bit 0 of parameter No. 2207: Ignores an overcurrent alarm (software).

Action 2: Related to overheat alarms

If an overheat alarm is issued after a long-time continuous operation, the temperature of the motor or amplifier may be high. Stop the operation for a while and see what happens. If an overheat alarm is still issued about 10 minutes after the power is turned off, the hardware is probably faulty.

If an overheat alarm is issued intermittently, increase the time constant or increase stop times in the program to suppress an increase in temperature.

Action 3: Related to an OVC alarm

If an OVC alarm is issued, check if the parameters indicated below are set to the standard values.
No.1877, No.1878, No.1893
No.2062, No.2063, No.2065
No.2161, No.2162, No.2163, No.2164
If the parameters are set to the standard values, increase the time constant or increase stop times in the program to suppress an increase in temperature.

8.3.4   Alarms related to the α*i* Pulsecoder

An alarm is identified from the data of alarms 1, 2, 3, and 5. The meaning of each bit is indicated below.

Alarm 3							Alarm 5	1	Alarm 2		Description	Action
CSA	BLA	PHA	RCA	BZA	CKA	SPH	LDM	PMS	FBA	ALD	EXP		
						1						Soft phase alarm	2
				1								Battery voltage zero	1
			1						1	1	0	Count error alarm	2
		1										EEPROM error alarm	

Alarm 3							Alarm 5	1	Alarm 2		Description	Action
CSA	BLA	PHA	RCA	BZA	CKA	SPH	LDM	PMS	FBA	ALD	EXP		
	1											Battery undervoltage (warning)	1
								1				Pulse error alarm	
							1					LED error alarm	

⚠ **CAUTION**
The alarms with no action number are considered to be caused by a Pulsecoder failure. Replace the Pulsecoder.

Action 1: Battery-related alarms
> Check if a battery is connected. When the power is turned on for the first time after a battery is connected, a battery voltage zero alarm is issued. In such a case, turn off the power then turn on the power again. If a battery voltage zero alarm is still issued, check the battery voltage. If a battery undervoltage alarm is issued, check the voltage and replace the battery.

Action 2: Alarms that may be caused by noise
> If an alarm is issued intermittently or an alarm is issued after the emergency stop state is canceled, the cause of the alarm is probably noise. In this case, provide sufficient noise protection. If an alarm is issued even after noise protection is provided, replace the Pulsecoder.

8.3.5 Alarms Related to Serial Pulsecoder Communication

An alarm is identified from the data of alarm 4. The meaning of each bit is indicated below.

Alarm 4				Description
DTE	CRC	STB	PRM	
1				
	1			Serial Pulsecoder communication alarm
		1		

Action:
> An error occurred in serial communication. Check if the cable is connected correctly and also check if the cable is not disconnected and broken. If CRC or STB is 1, it is likely that the cause is noise. Take an antinoise measure. If an alarm is always issued after the power is turned on, the Pulsecoder or amplifier control board may be faulty.

8.3.6 Alarms Related to Disconnection

An alarm is identified from the data of alarms 1 and 2. The meaning of each bit is indicated below.

Alarm 1							Alarm 2		Description	Action
OVL	LVA	OVC	HCA	HVA	DCA	FBA	ALD	EXP		
						1	1	1	Hard disconnection (separate A/B phase disconnection)	1
						1	0	0	Soft disconnection (closed loop / αi Pulsecoder)	2

Action 1:
> This alarm is issued when a separate A/B phase scale is used. Check if the A/B phase detector is connected correctly.

Action 2:   Full-closed
This alarm is issued when the position feedback pulse change is smaller than the velocity feedback pulse change. This means that this alarm is not issued in a semi-closed loop. Check if the separate detector outputs position feedback pulses correctly. If the separate detector outputs position feedback pulses correctly, such a situation that only the motor makes turns in the reverse direction at the start of machine movement because of a large backlash between the motor position and scale position is considered to have occurred.

	#7	#6	#5	#4	#3	#2	#1	#0
2003							TGAL	

#1   TGAL 1:   The parameter-set detection level is used for a soft disconnection alarm.

2064	Soft disconnection alarm level

Standard setting 4:   An alarm is issued when the motor makes a 1/8 revolution.
Increase the setting of this parameter.

Action 2:   α*i* Pulsecoder
This alarm is issued when synchronization between phase data and absolute position data sent from the built-in Pulsecoder is lost. While the power to the NC is turned off, unplug the Pulsecoder cable, then plug the cable once again after about 10 minutes. If this alarm is still issued, replace the Pulsecoder.

8.3.7   Alarm Related to Invalid Parameter Settings

An alarm is identified from the data of alarm 4. The meaning of the PRM bit is defined as follows:

Alarm 4				Description
DTER	CRC	STB	PRM	
			1	Invalid parameter detected by the servo software

When PRM = 1, an invalid parameter is detected by the servo software. Read the value indicated by diagnosis 352, and troubleshoot according to "FANUC AC SERVO MOTOR α*is*/α*i* series Parameter Manual (B-65270EN)".

When PRM = 0, read the bit value indicated by diagnosis 280, and determine the cause according to the following:
Diagnosis 280#0 = 1 : In parameter No. 2020 used for motor module specification, a value not within the specifiable range is specified.
Diagnosis 280#2 = 1 : In parameter No. 2023, an incorrect value such as a value equal to or less than 0 is set.
Diagnosis 280#3 = 1 : In parameter No. 2024, an incorrect value such as a value equal to or less than 0 is set.
Diagnosis 280#4 = 1 : In parameter No. 2022, a correct value (111 or -111) is not set.
Diagnosis 280#6 = 1 : In parameter No. 2023, an incorrect value is set.

8.3.8   Others

An alarm is identified from the data of alarm 5.   The meaning of each bit is indicated below.

Alarm 5							Description	Action
OFS	MCC	LDM	PMS	FAN	DAL	ABF		
						1	Feedback mismatch alarm	1
					1		Semi-closed/closed loop excessive error alarm	2
1							Current offset error alarm	3

Action 1:
   This alarm is issued when the move direction of the position detector becomes opposite to the move direction of the speed detector. Check the rotation direction of the separate detector. If the rotation direction of the separate detector is opposite to the rotation direction of the motor, take the following action:
   For the A/B phase detector:
       Exchange the connections of A and $\overline{A}$ with each other.
   For the serial detector:
       Reverse the following signal direction setting for the separate detector.
   Even with the A/B phase detector, the signal direction can be reversed by setting the parameter below. This method cannot be used when absolute position communication is required.

	#7	#6	#5	#4	#3	#2	#1	#0
2018								RVRSE

   #0   RVRSE Whether to reverse the signal direction of the separate detector can be set.
       0:    Does not reverse the signal direction of the separate detector.
       1:    Reverses the signal direction of the separate detector.

If there is a large distortion between the motor and separate detector, it is likely that the signal direction may be reversed when the motor accelerates or decelerates steeply. In such a case, change the detection level.

	#7	#6	#5	#4	#3	#2	#1	#0
2018							RNLV	

   #1   RNLV The detection level of a feedback mismatch alarm can be changed.
       0:    Detected at 600 mm^{-1} or more
       1:    Detected at 1000 min^{-1} or more

Action 2:
   This alarm is issued when the difference between the motor position and separate detector position exceeds the semi-closed/closed loop excessive error level. Check if the dual position feedback conversion coefficient is set correctly. If the dual position feedback conversion coefficient is set correctly, increase the alarm level. If this alarm is still issued after changing the level, check the connection direction of the scale.

2078	Dual position feedback conversion coefficient (numerator)

2079	Dual position feedback conversion coefficient (denominator)

2118	Dual position feedback semi-closed/full-closed loop error level

   [Setting] Detection unit. When 0 is set, no detection operation is performed.

Action 3:

> The current offset value (equivalent to the current value during an emergency stop) of the current detector becomes abnormally high. If this alarm is still issued after the power is turned off then back on, the current detector is considered to be faulty. When using the α*i* series, replace the amplifier.

8.4 ADJUSTING REFERENCE POSITION (DOG METHOD)

Overview
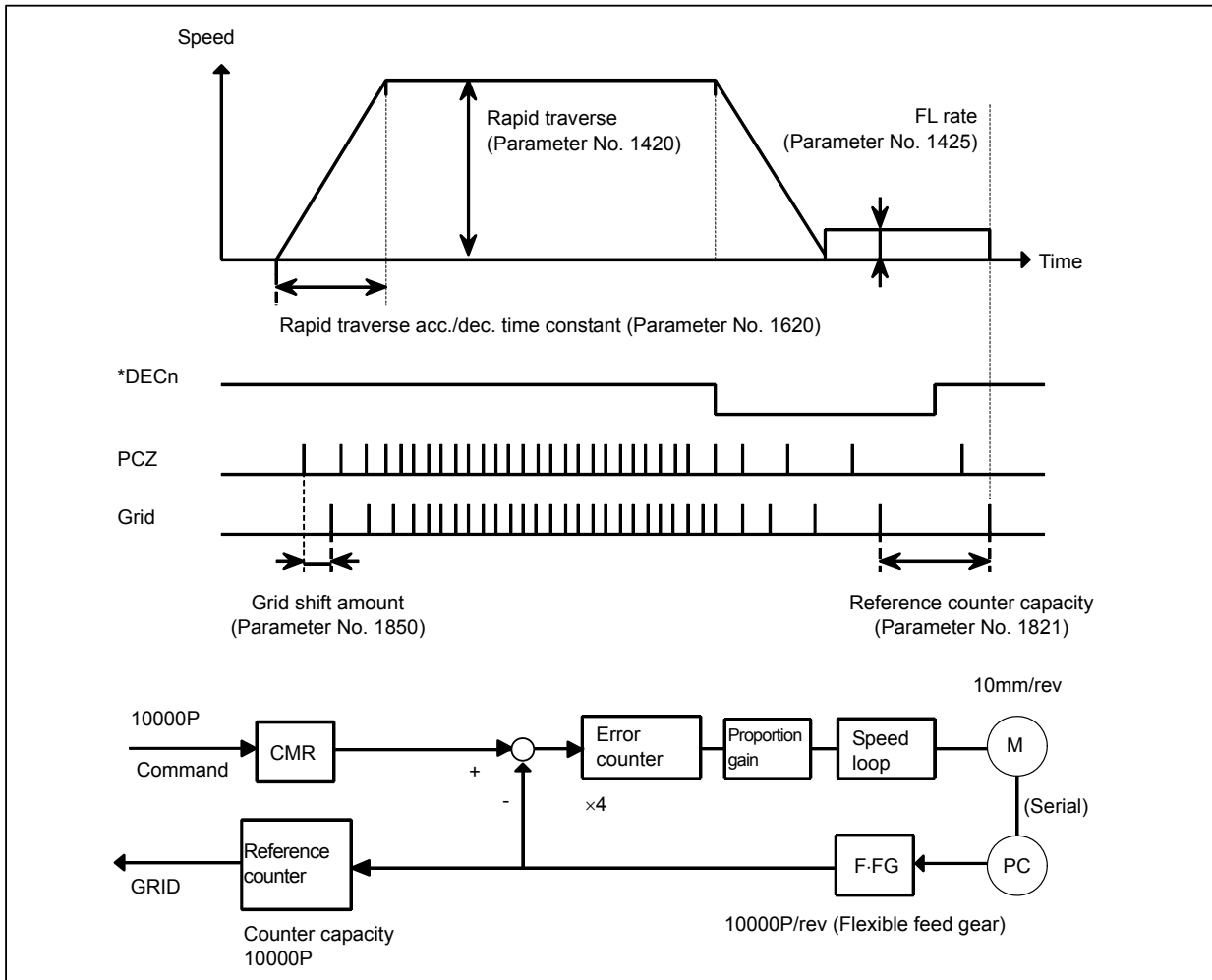
Parameter

There are the following related parameters.

	#7	#6	#5	#4	#3	#2	#1	#0
1005							DLZx	

[Input type] Parameter input
[Data type] Bit axis

#1   DLZx Function for setting the reference position without dogs
   0:   Disabled
   1:   Enabled

1821	Reference counter size for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Input type] Parameter input
[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] 0 to 999999999

Set a reference counter size.

As a reference counter size, specify a grid interval for reference position return based on the grid method.

When a value less than 0 is set, the specification of 10000 is assumed.

When a linear scale with absolute address reference marks is used, set the interval of mark 1.

1850	Grid shift and reference position shift for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Input type] Parameter input
[Data type] 2-word axis
[Unit of data] Detection unit
[Valid data range] -99999999 to 99999999

To shift the reference position, the grid can be shifted by the amount set in this parameter. Up to the maximum value counted by the reference counter can be specified as the grid shift.

In case of parameter SFDx(No.1008#4) is 0: Grid shift
In case of parameter SFDx(No.1008#4) is 1: Reference point shift

> **NOTE**
> For setting the reference position without dogs, only the grid shift function can be used.
> (The reference position shift function cannot be used.)

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

[Input type] Parameter input
[Data type] Bit axis

> **NOTE**
> When at least one of these parameters is set, the power must be turned off before operation is continued.

#1 OPTx Position detector
　　　　0:　A separate Pulsecoder is not used.
　　　　1:　A separate Pulsecoder is used.

> **NOTE**
> Set this parameter to 1 when using a linear scale with reference
> marks or a linear scale with an absolute address zero point
> (full-closed system).

 # 4   APZx Machine position and position on absolute position detector when the absolute position
detector is used
0:    Not corresponding
1:    Corresponding
When an absolute position detector is used, after primary adjustment is performed or after
the absolute position detector is replaced, this parameter must be set to 0, power must be
turned off and on, then manual reference position return must be performed. This
completes the positional correspondence between the machine position and the position
on the absolute position detector, and sets this parameter to 1 automatically.

 # 5   APCx Position detector
0:    Other than absolute position detector
1:    Absolute position detector (absolute Pulsecoder)

-   Separate type Pulsecoder or linear scale is used

1821	1821
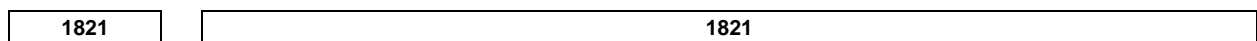
Normally, the number of feedback pulses per motor revolution is set to the reference counter capacity.

*   When plural reference marks are on a linear scale, a quotient of the distance between the reference
marks divided by an integer may be used as a reference counter capacity:

(Example)

300mm ⇒ reference counter

(1μm)
30000
20000
15000
10000   etc
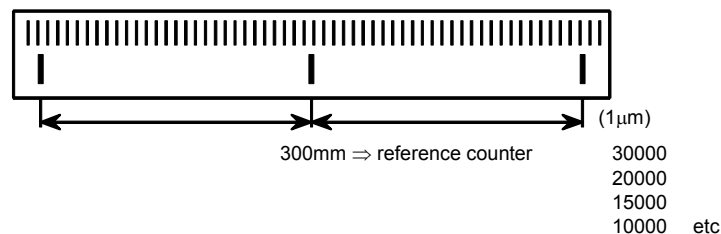
8.5   DOGLESS REFERENCE POSITION SETTING

When there are no dog nor limit switch for reference position return, this function enables the tool to
return the reference position that is set by MTB.
When the absolute position detector is used, the reference position once set remains also during power off.
When the absolute detector is replaced or absolute
position is lost, perform this setting.

Overview
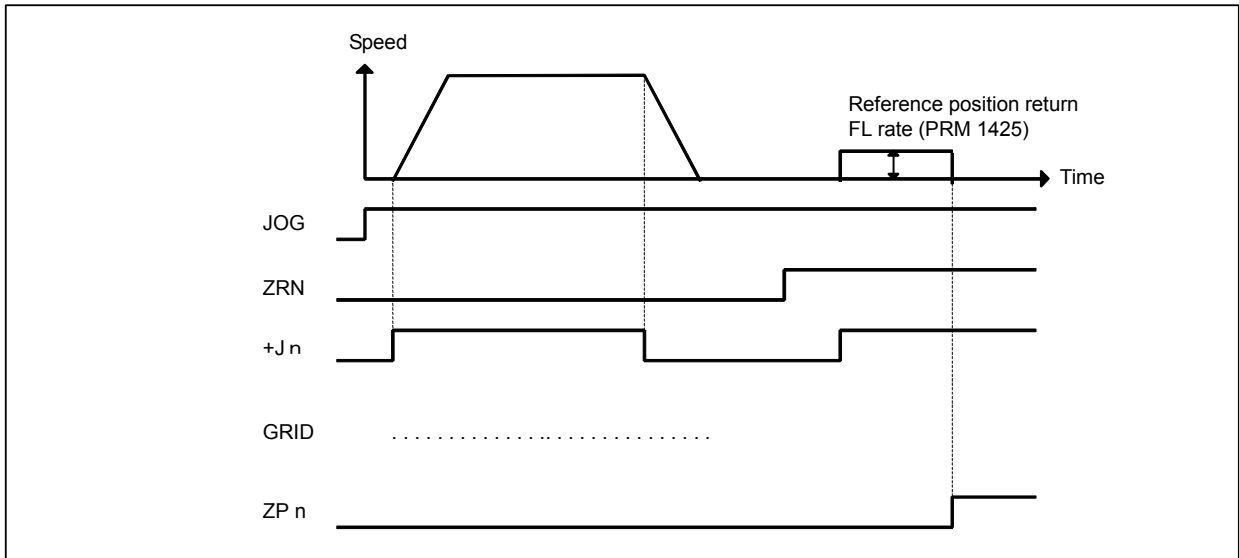
Operation

<1> Jog-feed the axis for which you want to set a reference position in the reference position return direction and stop it a little short of the reference position.

<2> Select the manual reference position return mode and set the feed axis and direction select signal (+ or – direction) for the axis for setting the reference position to 1.

<3> The tool is positioned at the nearest grid (electric grid based on the one-rotation signal of the position detector) in the reference position return direction specified in bit 5 (ZMIx) of parameter No. 1006 from the current position.   This position is set as the reference position.

<4> After the in-position status is confirmed, the reference position return completion signal (ZPn) and reference position establishment signal (ZRFn) are set to 1.

*   Once a reference position is set up, simply providing the axis direction signal manually with the ZRN signal set to "1" causes the axis to return to the reference position.

Parameter

There are the following related parameters.

	#7	#6	#5	#4	#3	#2	#1	#0
1005							DLZx	

[Input type] Parameter input
[Data type] Bit axis

#1   DLZx Function for setting the reference position without dogs
     0:    Disabled
     1:    Enabled

	#7	#6	#5	#4	#3	#2	#1	#0
1006			ZMIx					

[Input type] Parameter input
[Data type] Bit axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

#5   ZMIx The direction of manual reference position return is:
  0:   + direction
  1:   - direction

8.6   α*i* SERVO WARNING INTERFACE

Overview

The α*i* servo system can report the warning status before one of the following target alarms occurs.
When the warning status is entered, a report to the PMC is issued.
For example, this signal can be used by the machine for retracting tools from the time a warning occurs by the time a servo alarm occurs.

Signal

Servo warning detail signals   SVWRN1 to 4 <F093.4 to F093.7>

[Classification] Output signal
    [Function] Reports the warning signal corresponding to the state of the servo amplifier.
[Output condition] The following table shows the warning statuses of the servo amplifier and their corresponding warning signals.

Corresponding alarm messages	Warning status signals				Time from when a warning state signal is issued to until an alarm occurs
	SVWRN4 (F093.7)	SVWRN3 (F093.6)	SVWRN2 (F093.5)	SVWRN1 (F093.4)	
444 n AXIS: INV. COOLING FAN FAILURE	1	0	0	0	Until overheat occurs (inconstant)
601 n AXIS: INV. RADIATOR FAN FAILURE	1	0	0	1	Until overheat occurs (inconstant)
443 n AXIS: CNV. COOLING FAN FAILURE	1	1	0	0	Until overheat occurs (inconstant)
606 n AXIS: CNV. RADIATOR FAN FAILURE	1	1	0	1	Until overheat occurs (inconstant)
431 n AXIS: CNV. OVERLOAD	1	1	1	0	One minute
607 n AXIS: CNV. SINGLE PHASE FAILURE	1	1	1	1	PSMR: Five seconds, PSM: One minute

A timing chart for handling a warning is shown below.
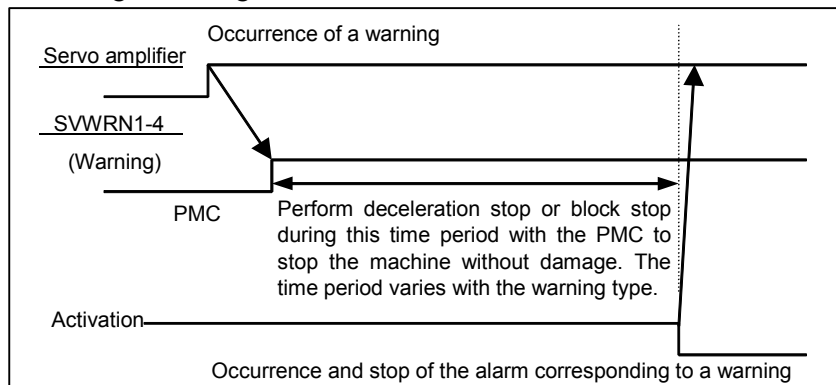
Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F093	SVWRN4	SVWRN3	SVWRN2	SVWRN1				

8.7   α*i* SERVO INFORMATION SCREEN

Overview

In the α*i* servo system, ID information output from each of the connected units is obtained and output to the CNC screen.

The units that have ID information are shown below.

(Remark: Some instances of these units do not have ID information.)

- Servo motor
- Pulsecoder
- Servo amplifier module
- Power supply module

ID information is automatically read from each of the connected units during first startup of the CNC and then recorded. Next time (and the subsequent time) the CNC is started, the ID information that can be read is compared with one recorded at the first startup time in order to monitor any change to the connected units. (If there is a difference between them, the alarm mark (*) appears.)

The recorded ID information can be edited. Therefore, the ID information of an unit that does not have ID information can be displayed. (However, the alarm mark (*) indicating a difference between these IDs appears.)

Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
13112							SVI	IDW

    [Input type] Parameter input
    [Data type] Bit path

    #0   IDW   Editing on the servo or spindle information screen is:
                0:   Prohibited.
                1:   Not prohibited.

    #1   SVI   The servo information screen is:
                 0:   Displayed.
                 1:   Not displayed.

Displaying the servo information screen

1   Press the ⬡ function key, then press the [SYSTEM] soft key.

2   Press the [SERVO] soft key to display the screen as shown below.

```
SERVO  INFORMATION                    O0000 N00000
   X    AXIS
 SERVO MOTOR SPEC A06B-0212-B002
 SERVO MOTOR S/N  C077F5538
 PULSECODER SPEC. A860-2001-T301
 PULSECODER S/N   07070914
 SERVO AMP SPEC.  A06B-6114-H303
 SERVO AMP S/N    V07740377
 PSM SPEC.        A06B-6110-H015
 PSM S/N          V07738432



A}_


MDI   **** *** ***       20:25:16
 {SYSTEM    SERVO  SPINDLE         (OPRT)
```

    *   Servo information is stored in flash ROM. If there is a difference between the ID information in screen and the actual ID information, the corresponding items are preceded by *, as shown below.

```
SERVO  INFORMATION                    O0000 N00000
   X    AXIS
 SERVO MOTOR SPEC A06B-0212-B002
 SERVO MOTOR S/N  C077F5538
 PULSECODER SPEC. A860-2001-T301
 PULSECODER S/N   07070914
*SERVO AMP SPEC.  A06B-6114-H303
*SERVO AMP S/N    V07740377
 PSM SPEC.        A06B-6110-H015
 PSM S/N          V07738432



A}_


MDI   **** *** ***       20:25:16
 {SYSTEM    SERVO  SPINDLE         (OPRT)
```

Additional Information

Even if replacement is performed reasonably such as for repairing, this function incorrectly indicates the * mark when it detects the replacement.
To clear the * mark, follow the steps below to update the registered data, as described in the editing section later.
(1) Make the registered data editable. (Bit 0 (IDW) of parameter No. 13112 = 1)
(2) On the edit screen, place the cursor on the item from which you want to delete the * mark.
(3) Operate the soft keys [READ ID], [INPUT], and [SAVE] in that order.

Editing the servo information screen

1   Assume that bit 0 (IDW) of parameter No. 13112 = 1.
2   Press the MDI switch on the machine operator's panel.
3   Follow the steps shown in "Displaying the servo information screen" to display the screen as shown
    below.

```
SERVO  INFORMATION              O0000 N00000
   X    AXIS
 SERVO  MOTOR  SPEC A06B-0212-B002
 SERVO  MOTOR  S/N  C077F5538
 PULSECODER  SPEC.  A860-2001-T301
 PULSECODER  S/N    07070914
 SERVO  AMP  SPEC.  A06B-6114-H303
 SERVO  AMP  S/N    V07740377
 PSM  SPEC.         A06B-6110-H015
 PSM  S/N           V07738432



A〉_

MDI   **** *** ***      20:26:46
〈  INPUT  READ   I  SAVE   RELOAD          +
```
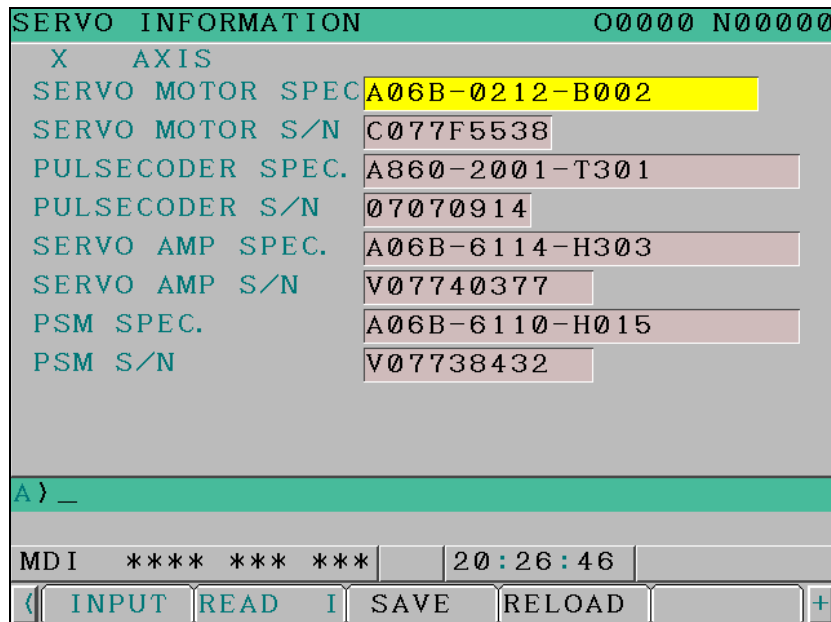
4   To move the cursor on the screen, use the [↑] and [↓] keys.

Screen operation

Mode	Key operation	Use
Viewing (*1)	Page key	Scrolls up or down on a screen-by-screen basis.
Editing (*2)	Soft key	
	[INPUT]	Replace the selected ID information at the cursor position with the character string in key-in buffer.
	[CANCEL]	Deletes the character string in key-in buffer.
	[READ ID]	Transfers the ID information the connected device at the cursor has to the key-in buffer. Only the items preceded by * (*3) are valid.
	[SAVE]	Saves the ID information that has been changed on the servo information screen in flash ROM.
	[RELOAD]	Cancels the ID information that has been changed on the servo information screen and loads ID information from flash ROM.
	Page key	Scrolls up or down on a screen-by-screen basis.
	Cursor key	Scrolls up or down the selection of ID information.

*1   Viewing mode: when bit 0 (IDW) of parameter No. 13112 = 0
*2   Editing mode: when bit 0 (IDW) of parameter No. 13112 = 1
*3   If there is a difference between the ID information in screen and the actual ID information, the
     corresponding items are preceded by *.

```
SERVO INFORMATION              O0000 N00000
  X    AXIS
 SERVO MOTOR SPEC A06B-0212-B002
 SERVO MOTOR S/N  C077F5538
 PULSECODER SPEC. A860-2001-T301
 PULSECODER S/N   07070914
*SERVO AMP SPEC.  A06B-6114-H303
*SERVO AMP S/N    V07740377
 PSM SPEC.        A06B-6110-H015
 PSM S/N          V07738432




A}_

MDI   **** *** ***     20:26:46
{  INPUT  READ   I  SAVE   RELOAD            +
```

NOTE
  For axes that are not used by the αi servo system, ID information of connected units cannot be obtained.

9   AC SPINDLE

This chapter outlines the serial interface spindle amplifiers and explains related parameters.

9.1   SERIAL INTERFACE AC SPINDLE

9.1.1   Outline of Spindle Control
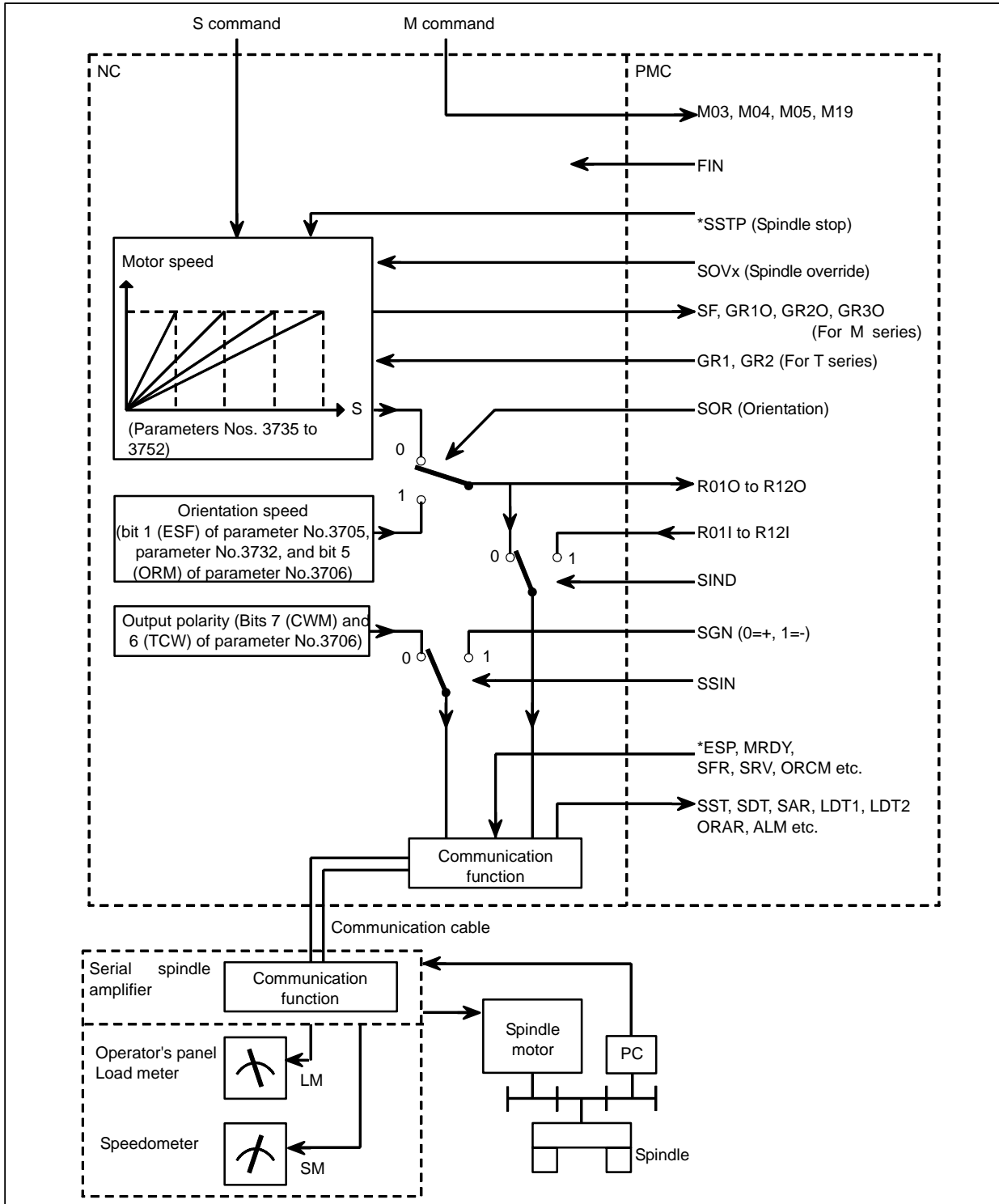
9.1.1.1   Method A of gear change for M series
(Bit 2 (SGB) of Parameter No.3705 = 0)
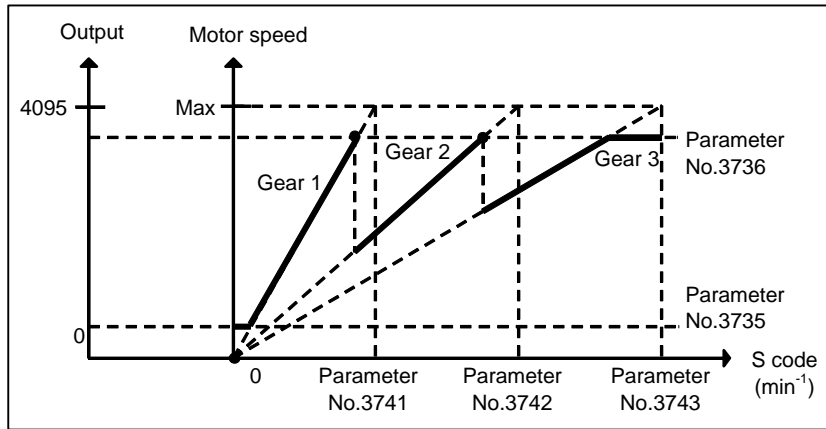
9.1.1.2   Method B of gear change for M series
(Bit 2 (SGB) of Parameter No.3705 = 1)
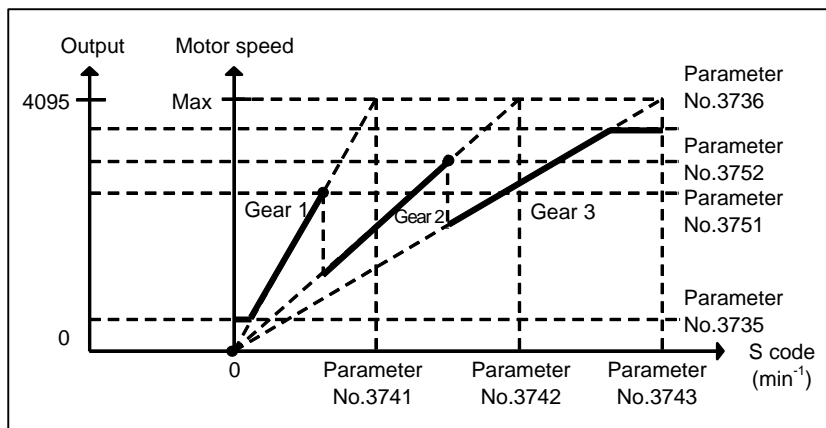
9.1.1.3   T series
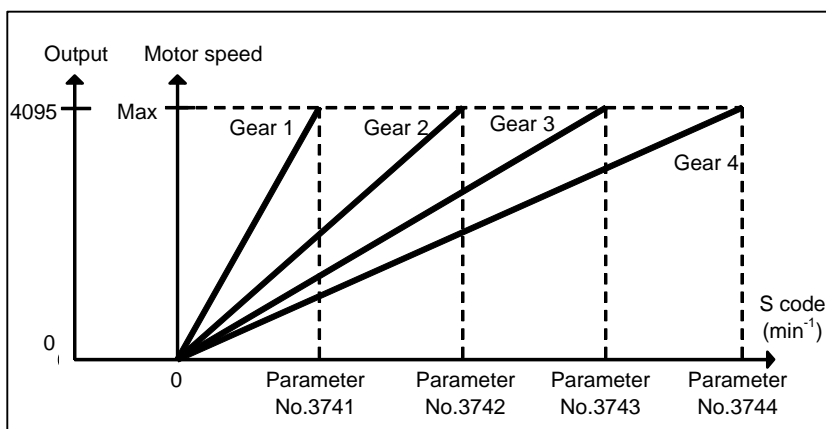
9.1.2 Spindle Setting and Tuning Screen

9.1.2.1 Display method

(1)   Confirm the parameters

	#7	#6	#5	#4	#3	#2	#1	#0
3111							SPS	

[Input type] Setting input
[Data type] Bit path

#1 SPS The spindle setting screen is:
0:    Not displayed.
1:    Displayed.

(2)   Press the function key [⬦ SYSTEM] to select the screen for setting parameters and other data.

(3)   Press the continuous menu key [▷].

(4)   Press the soft key [SP.SET]. Then, the spindle setting and tuning screen appears.

(5)   The following screens are provided. These screens can be selected using soft keys.
<1> [SP.SET] : Spindle setting screen
<2> [SP.TUN] : Spindle tuning screen
<3> [SP.MON] : Spindle monitor screen

(6)   With the page keys [↑ PAGE] [PAGE ↓], a spindle to be displayed can be selected (only when multiple serial spindles are connected).

9.1.2.2 Spindle setting screen

```
SPINDLE SETTING                O0123 N00000
GEAR SELECT          :1
SPINDLE              :S11

(PARAMETER)
GEAR RATIO                   100
MAX SPINDLE SPEED          10000
MAX MOTOR SPEED            10000
MAX C AXIS SPEED             100




A}_

MEM    **** *** ***   20:32:29
(                                    INPUT  +
```
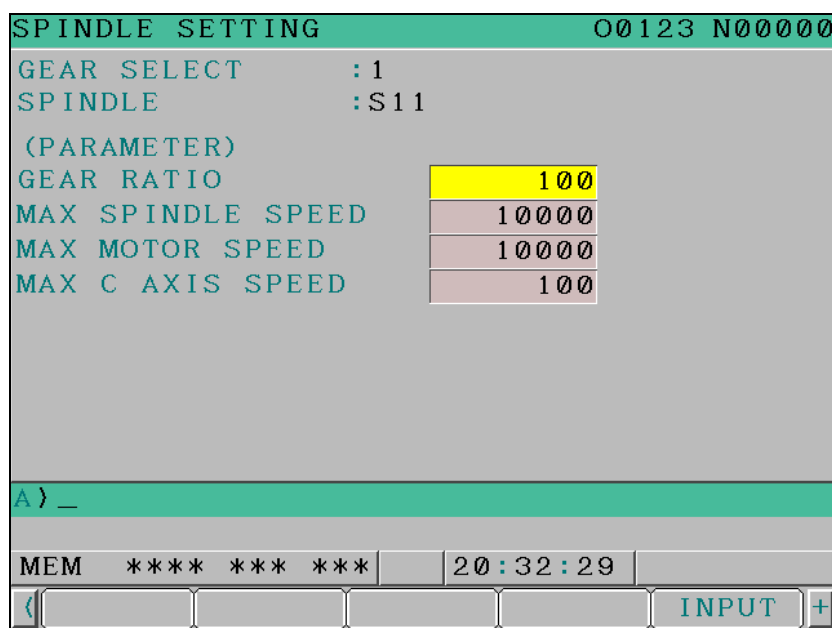
-   Gear selection
The gear select status on the machine side is displayed.

Indication	Clutch/gear signal	
	CTH1n	CTH2n
1	0	0
2	0	1
3	1	0
4	1	1

-   Spindle

Select a spindle for which data is to be set.

S11 :   1st spindle
S21 :   2nd spindle
S31 :   3rd spindle

-   Parameters

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Gear ratio (HIGH)	4056	4056	4056
Gear ratio (MEDIUM HIGH)	4057	4057	4057
Gear ratio (MEDIUM LOW)	4058	4058	4058
Gear ratio (LOW)	4059	4059	4059
Max. spindle speed (gear1)	3741	3741	3741
Max. spindle speed (gear2)	3742	3742	3742
Max. spindle speed (gear3)	3743	3743	3743
Max. spindle speed (gear4)	3744	3744	3744
Max. motor speed	4020	4020	4020
Max. Cs axis speed	4021	4021	4021

9.1.2.3   Spindle tuning screen

```
SPINDLE TUNING                    O0123 N00000
OPERATION        :SPEED CONTROL
GEAR SELECT      :1
SPINDLE          :S11
    (PARAMETER)            (MONITOR)
PROP. GAIN          10 MOTOR            0
INT. GAIN           10 SPINDLE          0
MOTOR VOLT          30
REGEN. PW           90




A}_

MEM    ****  ***  ***     20:33:11
(                                     INPUT
```
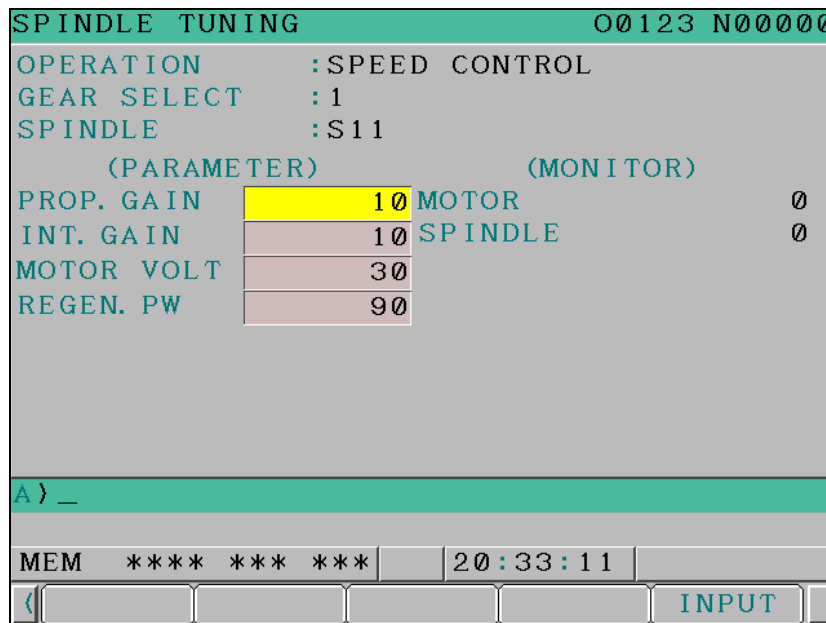
-   Operation mode

1   : SPEED CONTROL
2   : SPINDLE ORIENTATION
3   : SYNCHRONIZATION CONTROL
4   : RIGID TAPPING
5   : SP.CONTOURING CONTROL
6   : SP.POSITIONING CONTROL (T series)

- Gear selection
- Spindle
The descriptions of these two items are the same as those for the spindle setting screen.

- Displayed parameters
The displayed parameters vary depending on the operation mode.

Normal operation	Orientation	Synchronous control	Rigid tapping	Cs contour control	Spindle positioning control (T series)
Proportional gain Integral gain Motor voltage Regenerative power	Proportional gain Integral gain Loop gain Motor voltage ORAR gain (%) Shift spindle stop position Shift reference position	Proportional gain Integral gain Loop gain Motor voltage Acceleration/ deceleration constant Shift reference position	Proportional gain Integral gain Loop gain Motor voltage ZRN gain (%) Shift reference position	Proportional gain Integral gain Loop gain Motor voltage ZRN gain (%) Shift reference position	Proportional gain Integral gain Loop gain Motor voltage ZRN gain (%) Shift reference position

*1) For the parameter numbers corresponding to the displayed parameter items, see Section 9.1.2.5.

- Displayed monitoring items
The displayed monitoring items vary depending on the operation mode.

Normal operation	Orientation	Synchronous control	Rigid tapping	Cs contour control	Spindle positioning control (T series)
Motor speed Spindle speed	Motor speed Spindle speed Position deviation S	Motor speed Spindle speed Position deviation S1 Position deviation S2 Synchronous deviation	Motor speed Spindle speed Position deviation S Position deviation Z Synchronous deviation	Motor speed Spindle speed Position deviation S	Motor speed Feedrate Position deviation S

*1)

$$\text{Motor speed } [\text{min}^{-1}] = \frac{|\text{Spindle data}|}{16383} \times \text{Max. motor speed (*)}$$

(*) Parameter No. 4020

9.1.2.4   Spindle monitor screen

```
SPINDLE MONITOR                    O0000 N00000
ALARM              :
OPERATION          :SPEED CONTROL
SPINDLE SPEED  :          2000 RPM
MOTOR SPEED    :          2000 RPM
SPINDLE            :S1
                    0    50   100   150   200(%)
LOAD METER
   1%
CONTROL  INPUT :SFR   MRDY *ESP

CONTROL  OUTPUT:SAR



A)_


MDI    **** *** ***     20:34:01
 (|SP. SET|SP. TUN|SP. MON|          |          |     |
```

- Spindle alarm

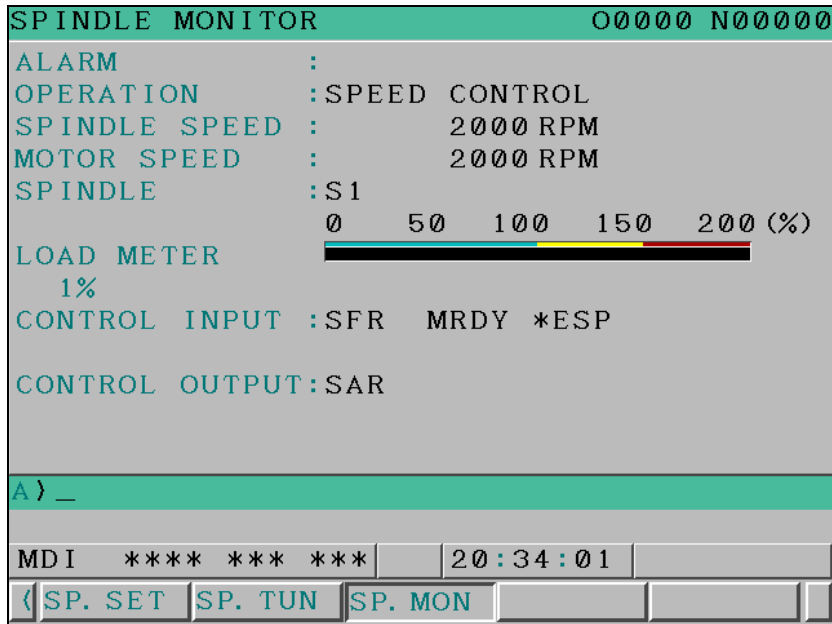|		
1 : Motor overheat	51 : Converter DC link overvoltage	86 : Spindle sensor one-rotation signal undetected
2 : Excessive speed deviation	52 : ITP signal error I	87 : Spindle sensor signal error
3 : DC link fuse blown	53 : ITP signal error II	88 : Radiator cooling fan stopped
4 : Input fuse blown	54 : Overload current alarm	89 : SSM error
6 : Temperature sensor disconnection	55 : Power line switch state error	90 : Abnormal rotation
7 : Excessive speed	56 : Internal cooling fan stopped	91 : Magnetic pole position count error
9 : Main circuit overload	57 : Excessive converter deceleration power	92 : Velocity command dependent acceleration
11 : DC link overvoltage	58 : Converter main circuit overload	110 : Error in communication between amplifiers
12 : DC link overcurrent	59 : Converter cooling fan stopped	111 : Converter control power supply undervoltage
13 : CPU internal data memory error	61 : Alarm of position feedback error between semi-closed and closed modes	112 : Excessive converter regenerative power
14 : Amplifier ID not registered		
15 : Output switch/spindle switch alarm		113 : Converter cooler radiation fan stopped
16 : RAM error	65 : Travel distance error during magnetic pole determination	120 : Communication data alarm
17 : Amplifier ID data error		121 : Communication data alarm
18 : Sum check error	66 : Error in communication between spindle amplifiers	122 : Communication data alarm
19 : Excessive U phase current offset		123 : Spindle switch circuit error
20 : Excessive V phase current offset	67 : Reference position return command error in FSC/EGB mode	124 : Invalid speed specified for learning control
21 : Position sensor polarity setting error		
22 : Spindle amplifier overload current	69 : Safety speed exceeded	125 : Invalid degree of dynamic characteristic compensation element for learning control
24 : Transfer data error/stop	70 : Axis data error	
27 : Position coder disconnection	71 : Safety parameter error	
29 : Short-time overload	72 : Motor speed found mismatching	126 : Spindle speed exceeded
30 : Input section overcurrent	73 : Motor sensor disconnection	127 : Invalid learning cycle
31 : Speed detection disconnection	74 : CPU test alarm	128 : Excessive speed deviation alarm on spindle synchronous control
32 : Transfer RAM error	75 : CRC test alarm	
33 : DC link charge error	76 : Safety function unexecuted	129 : Excessive positional deviation alarm on spindle synchronous control
34 : Parameter setting error	77 : Axis number found mismatching	
36 : Error counter overflow	78 : Safety parameter found mismatching	
37 : Speed detector setting error		130 : Speed polarity error in torque tandem operation
41 : Position coder one-rotation signal detection error	79 : Initial test operation error	
	80 : Alarm in spindle amplifier communication destination	131 : Spindle adjustment function alarm
42 : Position coder one-rotation signal undetected		132 : Serial data error
	81 : Motor sensor one-rotation signal detection error	133 : Data transfer error
43 : Signal of the differential speed control position coder disconnected		134 : Soft phase
	82 : Motor sensor one-rotation signal undetected	135 : Safety speed zero monitoring error
46 : Threading position sensor one-rotation signal detection error		
	83 : Motor sensor signal error	136 : Safety speed zero monitoring mismatch
47 : Position coder signal error	84 : Spindle sensor disconnection	
49 : Overflow of converted motor speed for differential spindle speed control	85 : Spindle sensor one-rotation signal detection error	137 : Device communication error
		139 : Pulse error
50 : Excessive speed command calculation value under spindle synchronization		140 : Count error
		141 : Serial sensor one-rotation signal undetected

- Operation

Following 6 modes are available:
a. Normal operation
b. Orientation
c. Synchronous control
d. Rigid tapping
e. Cs contour control

f.   Spindle positioning control (T series)

- Load meter
The load meter displays spindle load in a unit of 10%.

Load meter [%] = $\dfrac{\text{Load meter data}}{32767}$ × Max. output value of load meter (*)

(*)   Parameter No. 4127: High-speed winding
       Parameter No. 4093: Low-speed winding

- Control input signal
Max.10 signals those are ON are displayed from the following signals:

TLML	Torque limit command (low)	*ESP	Emergency stop
TLMH	Torque limit command (high)	SOCN	Soft start/stop
CTH1	Gear signal 1	RSL	Output switching request
CTH2	Gear signal 2	RCH	Power line state confirm
SRV	Spindle reverse rotation	INDX	Orientation stop pos. change
SFR	Spindle forward rotation	ROTA	Rotation direction of ORCM
ORCM	Spindle orientation	NRRO	Short-cut of ORCM
MRDY	Machine ready	INTG	Speed integral control signal
ARST	Alarm reset signal	DEFM	Differential mode command

- Control output signals
Signals those are ON are displayed from the following signals:

ALM	Alarm signal	LDT2	Load detecting signal 2
SST	Speed zero signal	TLM5	Torque limitation
SDT	Speed detecting signal	ORAR	Orientation end signal
SAR	Speed arrival signal	RCHP	Output switch signal
LDT1	Load detecting signal 1	RCFN	Output switch complete signal

9.1.2.5   Correspondence between operation mode and parameters on spindle tuning screen

- Normal operation mode

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Proportional gain (HIGH)	4040	4040	4040
Proportional gain (LOW)	4041	4041	4041
Integral gain (HIGH)	4048	4048	4048
Integral gain (LOW)	4049	4049	4049
Motor voltage	4083	4083	4083
Regenerative power	4080	4080	4080

- Orientation mode

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Proportional gain (HIGH)	4042	4042	4042
Proportional gain (LOW)	4043	4043	4043
Integral gain (HIGH)	4050	4050	4050
Integral gain (LOW)	4051	4051	4051
Loop gain (HIGH)	4060	4060	4060
Loop gain (MED.HIGH)	4061	4061	4061

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Loop gain (MED.LOW)	4062	4062	4062
Loop gain (LOW)	4063	4063	4063
Motor voltage	4084	4084	4084
Gain change upon completion of orientation	4064	4064	4064
Stop position shift	4077	4077	4077
PC-type orientation stop position	4031	4031	4031

-   Synchronization control mode

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Proportional gain (HIGH)	4044	4044	4044
Proportional gain (LOW)	4045	4045	4045
Integral gain (HIGH)	4052	4052	4052
Integral gain (LOW)	4053	4053	4053
Loop gain (HIGH)	4065	4065	4065
Loop gain (MED.HIGH)	4066	4066	4066
Loop gain (MED.LOW)	4067	4067	4067
Loop gain (LOW)	4068	4068	4068
Motor voltage	4085	4085	4085
Acc./Dec. time constant	4032	4032	4032
Shift amount	4034	4034	4034

-   Rigid tapping mode

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Proportional gain (HIGH)	4044	4044	4044
Proportional gain (LOW)	4045	4045	4045
Integral gain (HIGH)	4052	4052	4052
Integral gain (LOW)	4053	4053	4053
Loop gain (HIGH)	4065	4065	4065
Loop gain (MED.HIGH)	4066	4066	4066
Loop gain (MED.LOW)	4067	4067	4067
Loop gain (LOW)	4068	4068	4068
Motor voltage	4085	4085	4085
ZRN gain %	4091	4091	4091
Grid shift amount at servo mode	4073	4073	4073

-   Cs contour control mode

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Proportional gain (HIGH)	4046	4046	4046
Proportional gain (LOW)	4047	4047	4047
Integral gain (HIGH)	4054	4054	4054
Integral gain (LOW)	4055	4055	4055
Loop gain (HIGH)	4069	4069	4069
Loop gain (MED.HIGH)	4070	4070	4070
Loop gain (MED.LOW)	4071	4071	4071
Loop gain (LOW)	4072	4072	4072
Motor voltage	4086	4086	4086
ZRN gain %	4092	4092	4092
Reference position shift	4135	4135	4135

- Spindle positioning control mode (T series)

	S11: 1st spindle	S21: 2nd spindle	S31: 3rd spindle
Proportional gain (HIGH)	4044	4044	4044
Proportional gain (LOW)	4045	4045	4045
Integral gain (HIGH)	4052	4052	4052
Integral gain (LOW)	4053	4053	4053
Loop gain (HIGH)	4065	4065	4065
Loop gain (MED.HIG)	4066	4066	4066
Loop gain (MED.LOW)	4067	4067	4067
Loop gain (LOW)	4068	4068	4068
Motor voltage	4085	4085	4085
ZRN gain %	4091	4091	4091
Reference position shift	4073	4073	4073

9.1.3   Automatic Setting of Standard Parameters

The standard parameters related to each motor model can be set automatically.
* The specifications used to control the motor vary with the machine tool builder, but this function also sets the parameters that determine the specifications to their default values (initial values) again. Therefore, be sure to set the parameters correctly again with reference to a list of parameters Nos. 4000 to 4999 before performing automatic operation.

1   Turn on the power in the emergency stop state.
2   Set bit 7 of parameter 4019 to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
4019	LDSP							

[Input type] Parameter input
[Data type] Bit spindle

#7 LDSP The parameters for the serial interface spindle are:
0:   Not set automatically.
1:   Set automatically.

3   Set a motor model code.

4133	Motor model code

Code	Motor model	Amplifier
336	βiI 3/10000 (2000/10000$\min^{-1}$)	βiSVSP*-7.5
337	βiI 3/10000 (2000/10000$\min^{-1}$)	βiSVSP*-11
338	βiI 3/10000 (2000/10000$\min^{-1}$)	βiSVSP*-15
333	βiI 6/10000 (2000/10000$\min^{-1}$)	βiSVSP*-11
339	βiI 6/10000 (2000/10000$\min^{-1}$)	βiSVSP*-15
341	βiI 8/10000 (2000/10000$\min^{-1}$)	βiSVSP*-11
342	βiI 8/10000 (2000/10000$\min^{-1}$)	βiSVSP*-15
343	βiI 12/8000 (2000/8000$\min^{-1}$)	βiSVSP*-15
350	βiIP 15/6000 (1200/6000$\min^{-1}$)	βiSVSP*-11
351	βiIP 15/6000 (1200/6000$\min^{-1}$)	βiSVSP*-15
353	βiIP 18/6000 (1000/6000$\min^{-1}$)	βiSVSP*-11
352	βiIP 18/6000 (1000/6000$\min^{-1}$)	βiSVSP*-15

Code	Motor model	Amplifier
301	αiI 0.5/10000 (3000/10000min^{-1})	αiSP2.2
302	αiI 1/10000 (3000/10000min^{-1})	αiSP2.2
304	αiI 1.5/10000 (1500/10000min^{-1})	αiSP5.5
305	αiI 1.5/15000 (3000/150000min^{-1})	αiSP15
306	αiI 2/10000 (1500/10000min^{-1})	αiSP5.5
307	αiI 2/15000 (3000/15000min^{-1})	αiSP22
308	αiI 3/10000 (1500/10000min^{-1})	αiSP5.5
309	αiI 3/12000 (1500/12000min^{-1})	αiSP11
310	αiI 6/10000 (1500/10000min^{-1})	αiSP11
311	αiI 0.5/10000HV (3000/10000min^{-1})	αiSP5.5HV
312	αiI 8/8000 (1500/8000min^{-1})	αiSP11
313	αiI 1/10000HV (3000/10000min^{-1})	αiSP5.5HV
314	αiI 12/7000 (1500/7000min^{-1})	αiSP15
315	αiI 1.5/10000HV (1500/10000min^{-1})	αiSP5.5HV
316	αiI 15/7000 (1500/7000min^{-1})	αiSP22
317	αiI 2/10000HV (1500/10000min^{-1})	αiSP5.5HV
318	αiI 18/7000 (1500/7000min^{-1})	αiSP22
319	αiI 3/10000HV (1500/10000min^{-1})	αiSP5.5HV
320	αiI 22/7000 (1500/7000min^{-1})	αiSP26
321	αiI 6/10000HV (1500/10000min^{-1})	αiSP11HV
322	αiI 30/6000 (1150/6000min^{-1})	αiSP45
323	αiI 40/6000 (1500/6000min^{-1})	αiSP45
324	αiI 50/4500 (1150/4500min^{-1})	αiSP55
325	αiI 8/8000HV (1500/8000min^{-1})	αiSP11HV
326	αiI 12/7000HV (1500/7000min^{-1})	αiSP15HV
327	αiI 15/7000HV (1500/7000min^{-1})	αiSP30HV
328	αiI 22/7000HV (1500/7000min^{-1})	αiSP30HV
329	αiI 30/6000HV (1150/6000min^{-1})	αiSP45HV
401	αiI 6/12000 (1500/12000, 4000/12000min^{-1})	αiSP11
402	αiI 8/10000 (1500/10000, 4000/10000min^{-1})	αiSP11
403	αiI 12/10000 (1500/10000, 4000/10000min^{-1})	αiSP15
404	αiI 15/10000 (1500/10000, 4000/10000min^{-1})	αiSP22
405	αiI 18/10000 (1500/10000, 4000/10000min^{-1})	αiSP22
406	αiI 22/10000 (1500/10000, 4000/10000min^{-1})	αiSP26
407	αiIP 12/6000 (500/1500, 750/6000min^{-1})	αiSP11
408	αiIP 15/6000 (500/1500, 750/6000min^{-1})	αiSP15
409	αiIP 18/6000 (500/1500, 750/6000min^{-1})	αiSP15
410	αiIP 22/6000 (500/1500, 750/6000min^{-1})	αiSP22
411	αiIP 30/6000 (400/1500, 575/6000min^{-1})	αiSP22
412	αiIP 40/6000 (400/1500, 575/6000min^{-1})	αiSP26
413	αiIP 50/6000 (575/1500, 1200/6000min^{-1})	αiSP26
414	αiIP 60/4500 (400/1500, 750/4500min^{-1})	αiSP30
415	αiI 100/4000HV (1000/3000, 2000/4000min^{-1})	αiSP75HV
418	αiIP 40/6000HV (400/1500, 575/6000min^{-1})	αiSP30HV

4   Turn off the power then back on. Then, the parameters are read.

9.1.4 Warning Interface

Overview

The warning state can be reported before an alarm is issued. When the warning state is entered, a report to the PMC is sent.

For example, this signal can be used for retracting tools or reducing cutting load from the time a warning occurs by the time an overheat alarm occurs. In addition, diagnostic information also contains warning numbers.

Signal

Spindle warning detailed signals SPWRN1 to SPWRN9 <F264.0 to F264.7, F265.0>

[Classification] Output

   [Function] Reports the warning number corresponding to the state of the αi spindle amplifier.

[Output condition] When the αi spindle is in the warning state, a warning number consisting of SPWRN1 to SPWRN9 is output as nine-bit binary data.

If warnings occurred on multiple αi spindle amplifiers, the warning number of the αi spindle having the smallest axis number is output.

The warning numbers and their descriptions are shown below.

Warning number	Contents	Details
01	Motor overheat	When the motor temperature increases beyond the overheat warning detection level (set by a parameter), a warning signal is output. At this time, spindle operation is continued. So, perform necessary processing with the PMC. An alarm is issued when the motor temperature has reached the overheat alarm detection level.
04	Open-phase detected in the converter main power supply	If an open-phase is detected in the main power supply, the warning signal is output. Since the spindle continues to operate at this time, use the PMC to perform processing as needed. About one minute (for the αiPS) or about five seconds (for the αiPSR) after the warning signal is output, an alarm occurs.
06	Temperature sensor error	Coolant entered the spindle motor, probably reducing insulating resistance. Remove coolant. Take measures to prevent coolant from entering the motor. If insulating resistance is in advanced stages, the motor needs to be replaced.
56	Internal fan stopped	If the internal fan stops, the warning signal is output. Since the spindle continues to operate at this time, use the PMC to perform processing as needed. About one minute after the warning signal is output, an alarm occurs.
58	Converter main circuit overloaded	If the main circuit of the Power Supply (PS) is overloaded, the warning signal is output. Since the spindle continues to operate at this time, use the PMC to perform processing as needed. About one minute after the warning signal is output, an alarm occurs.
59	Converter cooling fan stopped	If the Power Supply (PS) cooling fan stops, the warning signal is output. Since the spindle continues to operate at this time, use the PMC to perform processing as needed. About one minute after the warning signal is output, an alarm occurs.
88	Radiator cooling fan stopped	If the radiator cooling fan stops, the warning signal is output. Since the spindle continues to operate at this time, use the PMC to perform processing as needed. If the main circuit overheats, an alarm occurs.
113	Converter radiator cooling fan stopped	If the Power Supply (PS) radiator cooling fan stops, the warning signal is output. Since the spindle continues to operate at this time, use the PMC to perform processing as needed. If the Power Supply (PS) main circuit overheats, an alarm occurs.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F264	SPWRN8	SPWRN7	SPWRN6	SPWRN5	SPWRN4	SPWRN3	SPWRN2	SPWRN1

F265								SPWRN9

Diagnosis screen

The status of a warning is displayed on the following diagnostic screen.

712	Warning status of spindle

[Data type] Word spindle

The number of a warning caused on each spindle is indicated.

If there is no warning, 0 is indicated.

9.1.5 Spindle Information Screen

Overview

ID information output from each of the connected units is obtained and output to the CNC screen.

The units that have ID information are shown below.

- Spindle amplifier (SP)
- Power Supply (PS)

ID information is automatically read from each of the connected units during first startup of the CNC and then recorded. During second or later startup, the ID information recorded during first startup can be compared with the ID information read this time on the screen to check whether the configuration of the connected units is changed. (If there is a difference between them, the alarm mark (*) appears.)

The recorded ID information can be edited. Therefore, the ID information of an unit that does not have ID information can be displayed. (However, the alarm mark (*) indicating a difference between these IDs appears.)

Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
13112						SPI		IDW

[Input type] Parameter input
[Data type] Bit path

#0 IDW Editing on the servo or spindle information screen is:
  0: Prohibited.
  1: Not prohibited.

#2 SPI The servo information screen is:
  0: Displayed.
  1: Not displayed.

Displaying the spindle information screen

1 Press the [⬦SYSTEM] function key, then press the [SYSTEM] soft key.

2 Press the [SPINDLE] soft key to display the screen as shown below.

```
┌─────────────────────────────────────────────────────┐
│SPINDLE  INFORMATIO          O0000 N00000│
│  S1                                                 │
│ SP MOTOR SPEC.   [                      ]           │
│ SP MOTOR S/N     [          ]                       │
│ SP AMP  SPEC.    [A06B-6112-H002#H570]              │
│ SP AMP  S/N      [V05643589    ]                    │
│ PSM SPEC.        [A06B-6110-H011    ]               │
│ PSM S/N          [V05908775    ]                    │
│                                                     │
│                                                     │
│                                                     │
│                                                     │
│A}_                                                  │
│                                                     │
│MDI   **** *** ***     │20:37:01│                    │
│{│SYSTEM │ SERVO │SPINDLE│       │ (OPRT) │          │
└─────────────────────────────────────────────────────┘
```

    *   Spindle information is stored in flash ROM. If there is a difference between the ID information in screen and the actual ID information, the corresponding items are preceded by *, as shown below.

```
┌─────────────────────────────────────────────────────┐
│SPINDLE  INFORMATIO          O0000 N00000│
│  S1                                                 │
│ SP MOTOR SPEC.   [                      ]           │
│ SP MOTOR S/N     [          ]                       │
│*SP AMP  SPEC.    [A06B-6112-H002#H570]              │
│*SP AMP  S/N      [V05643589    ]                    │
│ PSM SPEC.        [A06B-6110-H011    ]               │
│ PSM S/N          [V05908775    ]                    │
│                                                     │
│                                                     │
│                                                     │
│                                                     │
│A}_                                                  │
│                                                     │
│MDI   **** *** ***     │20:37:01│                    │
│{│SYSTEM │ SERVO │SPINDLE│       │ (OPRT) │          │
└─────────────────────────────────────────────────────┘
```

┌───┐
│ **Additional Information**   │
│   Even if replacement is performed reasonably such as for repairing, this function │
│   incorrectly indicates the * mark when it detects the replacement. │
│   To clear the * mark, follow the steps below to update the registered data, as │
│   described in the editing section later.   │
│   (1) Make the registered data editable. (Bit 0 (IDW) of parameter No. 13112 = 1) │
│   (2) On the edit screen, place the cursor on the item from which you want to │
│   delete the * mark.   │
│   (3) Operate the soft keys [READ ID], [INPUT], and [SAVE] in that order. │
└───┘

Editing the spindle information screen

1 Assume that bit 0 (IDW) of parameter No. 13112 = 1.
2 Press the MDI switch on the machine operator's panel.
3 Follow the steps shown in "Displaying the spindle information screen" to display the screen as shown below.

```
SPINDLE INFORMATIO            O0000 N00000
  S1
 SP MOTOR SPEC.    [                    ]
 SP MOTOR S/N      [        ]
 SP AMP SPEC.      A06B-6112-H002#H570
 SP AMP S/N        V05643589
 PSM SPEC.         A06B-6110-H011
 PSM S/N           V05908775




A}_

 MDI   **** *** ***     20:36:30
{  INPUT  READ  I  SAVE   RELOAD       +
```
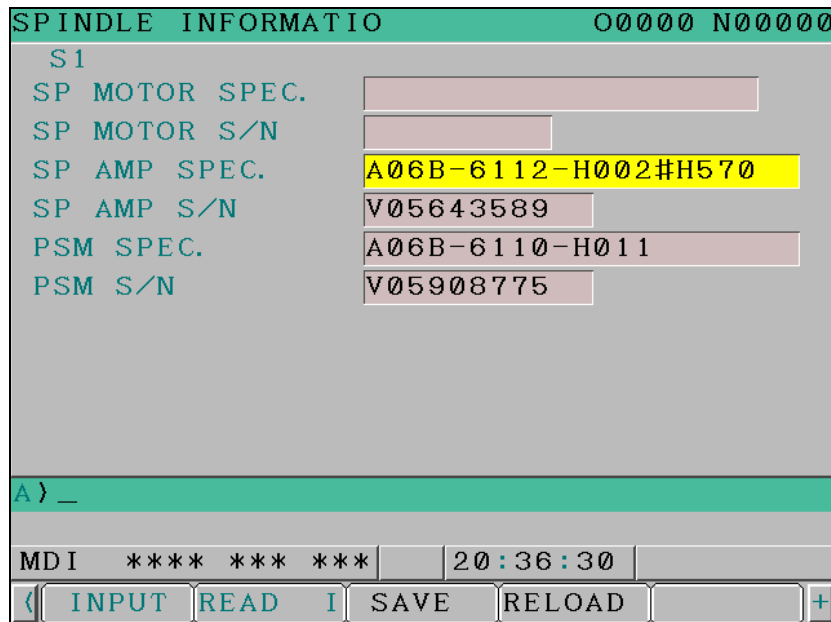
4 To move the cursor on the screen, use cursor keys [↑] [↓].

Screen operation

Mode	Key operation	Use
Viewing (*1)	Page key	Scrolls up or down on a screen-by-screen basis.
Editing (*2)	Soft key	
	[INPUT]	Replace the selected ID information at the cursor position with the character string in key-in buffer.
	[CANCEL]	Deletes the character string in key-in buffer.
	[READ ID]	Transfers the ID information the connected device at the cursor has to the key-in buffer. Only the items preceded by * (*3) are valid.
	[SAVE]	Saves the ID information that has been changed on the spindle information screen in flash ROM.
	[RELOAD]	Cancels the ID information that has been changed on the spindle information screen and loads ID information from flash ROM.
	Page key	Scrolls up or down on a screen-by-screen basis.
	Cursor key	Scrolls up or down the selection of ID information.

*1 Viewing mode: when bit 0 (IDW) of parameter No. 13112 = 0
*2 Editing mode: when bit 0 (IDW) of parameter No. 13112 = 1
*3 Spindle information is stored in flash ROM. If there is a difference between the ID information in screen and the actual ID information, the corresponding items are preceded by *.

```
┌─────────────────────────────────────────────────────────────┐
│ SPINDLE  INFORMATIO              O0000 N00000                 │
│   S1                                                          │
│  SP  MOTOR  SPEC.    [                    ]                   │
│  SP  MOTOR  S/N      [           ]                            │
│ *SP  AMP  SPEC.      [A06B-6112-H002#H570]                    │
│ *SP  AMP  S/N        [V05643589  ]                            │
│  PSM  SPEC.          [A06B-6110-H011    ]                     │
│  PSM  S/N            [V05908775  ]                            │
│                                                               │
│                                                               │
│                                                               │
│                                                               │
│ A }_                                                          │
│                                                               │
│ MDI    ****  ***  ***  │ 20:36:30 │                           │
│ ⟨│ INPUT │READ  I│ SAVE │RELOAD │         │ +                 │
└─────────────────────────────────────────────────────────────┘
```

┌──┐
│ **NOTE**   │
│   The ID information of the spindle motor is not displayed automatically.   To │
│   display the ID information, enter it manually in the edit mode. │
└──┘

10   TROUBLESHOOTING

This chapter describes troubleshooting procedure.

10.1 CORRECTIVE ACTION FOR FAILURES

When a failure occurs, it is important to correctly grasp what kind of failure occurred and take appropriate action, to promptly recover the machine.
Check for the failure according to the following procedure :
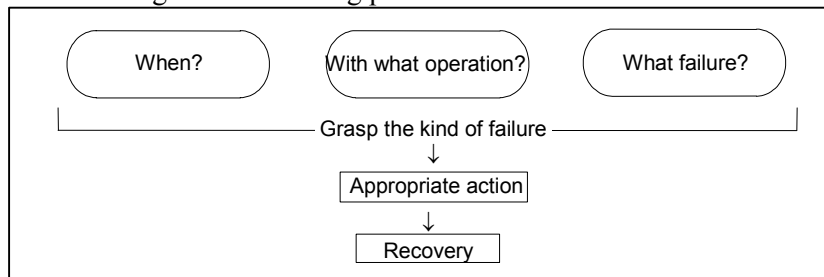
10.1.1 Investigating the Conditions under which Failure Occurred

(1) When and how many times (frequency of occurrences)
(2) With what operation
(3) What failure occurred

1   When did the failure occur?
- Date and time?
- Occurred during operation? (how long was the operation?)
- Occurred when the power was turned on?
- Was there any lightening surge, power failure, or other disturbances to the power supply?

How many times has it occurred
- Only once?
- Occurred many times ? (How many times per hour, per day, or per month?)

2   With what operation did it occur ?
- What was the NC mode when the failure occurred?
  Jog mode, memory operation mode, MDI mode, reference position return mode and so on
- If during program operation,
  (1) Where in the program ?
  (2) Which program No. and sequence No. ?
  (3) What program ?
  (4) Occurred during axial movement ?
  (5) Occurred during the execution of an M/S/T code ?
  (6) Failure specific to the program ?
- Does the same operation cause the same failure ?
  (Check the repeatability of the failure.)
- Occurred during data input/output ?
- For a failure related to servo
  (1) Occurred at both low feedrate and high feedrate ?
  (2) Occurred only for a certain axis ?
- For a failure related to spindle
  (1) When did the failure occur ? (during power-on, acceleration, deceleration, or constant rotation)

3   What failure occurred ?
- Which alarm was displayed on the alarm display screen?
  (Check the axis along which an alarm has occurred for alarms SV alarms, OT alarms, or SP alarms.)

- Is the screen correct ?
- If machining dimensions are incorrect
  (1) How large is the error ?
  (2) Are the coordinates (dimensions) of the position display screen also incorrect?
  (3) Are the offsets correct ?

4   Other information
- Is there noise origin around machine?
  If the failure has not occurred frequently, the cause may be external noise to the power supply or inductive noise on machinery cables.
  Operate other machines connected to the same power line and see if noise come from the relays or compressors.
- Is it taken any countermeasure for noise in machine side?
  See Item, "COUNTERMEASURES AGAINST NOISE."
- Check the following for the input power supply voltage :
  (1) Is there variation in the voltage ?
  (2) Are the voltages different depending on the phase ?
  (3) Is the standard voltage supplied ?
- How high is the ambient temperature of the control unit?
  Refer to manual about noise.
- Has excessive vibration been applied to the control unit?

5   When you contact FANUC
- Check the following.
  (1) Name of the NC unit
  (2) Name of the machine tool builder and type of machine
  (3) Software series/version of the NC
  (4) Specifications of the servo amplifier and motor
     (for a failure related to the servo)
  (5) Specifications of the spindle amplifier and spindle motor
     (for a failure related to a spindle)
- See the drawing issued by the machine tool builder for the locations of the NC unit and servo/spindle amplifiers.
- We use the following specification codes :
  (1) Servo/spindle amplifier   : A06B-xxxx-Hxxx
  (2) Servo/spindle motor   : A06B-xxxx-Bxxx

NOTE
   The mark 'x' represents a number.

10.2   NO MANUAL OPERATION NOR AUTOMATIC OPERATION CAN BE EXECUTED

Points
(1) Check whether position display shows correct position
(2) Check CNC status display
(3) Check CNC internal status using diagnosis function

Causes and Countermeasures
1   Position display (relative, absolute, machine coordinate) does not change
(1) Check CNC status display (Refer to Section 1.4, "CNC STATE DISPLAY" for detail.)
   (a) Check the emergency stop state (the emergency stop signal is on).

If status display shows **EMG** the emergency stop signal is input. Check the following signal using the PMC's diagnosis function (PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
X0008				*ESP				

	#7	#6	#5	#4	#3	#2	#1	#0
G0008				*ESP				

*ESP　:　　ESP=0 indicates that emergency stop signal is input.

(b) Check the reset state (a reset is on).
When RESET is displayed, any of a reset is functioned. Check the following signal using the PMC's diagnosis function (PMCDGN).
(i) Check the input signal from PMC.

	#7	#6	#5	#4	#3	#2	#1	#0
G0008	ERS	RRW						

ERS　:　　When ERS is 1, external reset signal is input.
RRW　:　　When RRW is 1, reset & rewind signal is input.

(ii) Check the RESET key on the MDI keyboard.
When the signals in 1) are 0, <RESET> key may be functioning. Check the contact of <RESET> key using a tester.
When it is abnormal, change the keyboard.
(c) Confirm the status of modes
Operation mode status is displayed on the lower part of screen as follows :
If nothing is displayed, mode select signal is not input. Check mode select signal using PMC's diagnosis function (PMCDGN).
For details, refer to section 1.4, "CNC STATE DISPLAY".

(Example of display)
JOG :　　Manual operation (JOG) mode
HND:　　Manual handle (MPG) mode
MDI :　　Manual data input (MDI) mode
MEM :　　Automatic operation (Memory) mode
EDIT :　　EDIT (Memory edit) mode

<Mode select signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1
						↓	↓	↓
Manual operation (JOG) mode						1	0	1
Manual handle (MPG) mode						1	0	0
Manual data input (MDI) mode						0	0	0
Automatic operation (Memory) mode						0	0	1
EDIT (Memory edit) mode						0	1	1

(2) Check diagnosis functions 0000 and 1010 of the CNC. Check the items for which 1 is displayed at right side.

```
0000
  A.    Inposition Check              0
        Feedrate Override 0%          0
  B.    Jog Feed Override 0%          0
  C.    Inter/Start Lock on           1
        Speed Arrival on              0
        Wait Revolution               0
        Stop Position Coder           0
        Feed Stop                     0
```

```
1010                        RST ERS RRW ESP
     D.   0    0    0    0    0    0    0    0
```
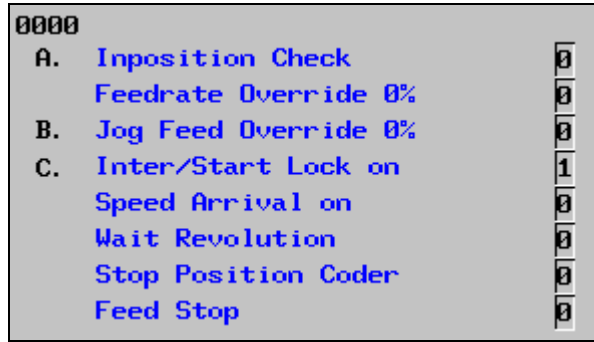
*   Items with (a) to (d) relate with manual and automatic operation and its detail is shown below.

(a)   In-position check is being done

It shows that positioning is not yet completed. Check the contents of the following diagnosis number. (It is 1 in the following condition)

DGN0300 Position Error > Parameter No.1826 In-position width

    (i)   Check the parameters according to the parameter list.

1825	Servo loop gain per axis (Normal : 3000)

(b)   Jog feedrate override is 0%

Check the signals using the PMC's signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0

	#7	#6	#5	#4	#3	#2	#1	#0
G0011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8

When the override is 0% all bits of the above address becomes
1111 . . . . 1111 or 0000 . . . . 0000.

*JV15 . . . . *JV0	Override
1111 1111 1111 1111	0.00%
1111 1111 1111 1110	0.01%
:	:
1101 1000 1110 1111	100.00%
:	:
0000 0000 0000 0001	655.34%
0000 0000 0000 0000	0.00%

(c)   Interlock or start lock signal is input

There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
3003				DAU	DIT	ITX		ITL
					DIT	ITX		ITL

  #0 (ITL)   ITL=0 shows interlock signal *IT is effective. To i)
  #2 (ITX)   ITX=0 shows interlock signal *ITn is effective. To ii)
  #3 (DIT)   DIT=0 shows interlock signal +MITn/-MITn is effective. To iii)

#4 (DAU) Interlock signal +MITn/-MITn is
            0:Valid only in manual operation
            1:Valid either manual operation or automatic operation   To iii)

Check the interlock signals selected by the above parameters on the PMC signal status screen.

(i) Interlock signals (*IT, *CSL, and *BSL) are input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0008					*BSL		*CSL	*IT

*IT=0, *CSL=0, and *BSL=0 show that interlock signal is input.

(ii) Axis interlock signal (*ITn) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0130				*IT5	*IT4	*IT3	*IT2	*IT1

*ITn=0 shows interlock signal is input.

(iii) Axis interlock signal (+MITn/-MITn) is input.

M series

	#7	#6	#5	#4	#3	#2	#1	#0
G0132				+MIT5	+MIT4	+MIT3	+MIT2	+MIT1

	#7	#6	#5	#4	#3	#2	#1	#0
G0134				-MIT5	-MIT4	-MIT3	-MIT2	-MIT1

+MITn/-MITn=1 shows interlock signal is input.

T series

	#7	#6	#5	#4	#3	#2	#1	#0
X004			-MIT2	+MIT2	-MIT1	+MIT1		

	#7	#6	#5	#4	#3	#2	#1	#0
X013			-MIT2[#2]	+MIT2[#2]	-MIT1[#2]	+MIT1[#2]		

+MITn/-MITn=1 shows interlock signal is input.

(d) The NC is in the reset state.
     In this state, "RESET" is display as the state indication of the previous item 1-(1)-(b). So, not only manual operation but also all automatic operations are disabled. So, referring to the Section 10.2, "Manual and Automatic Operations are Disabled", make an investigation.

2   When machine coordinate value does not update on position display

Machine lock signal (MLK/MLKn) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0044							MLK	

	#7	#6	#5	#4	#3	#2	#1	#0
G0108				MLK5	MLK4	MLK3	MLK2	MLK1

MLK :   All axes machine lock
MLKn :   Each axis machine lock

When the signal is 1, the corresponding machine lock signal is input.

10.3   JOG OPERATION CANNOT BE DONE

Points

(1) Check whether position display is operating.
(2) Check CNC status display.
(3) Check internal status using Diagnostic function.

Causes and Countermeasures
1   Position display (relative, absolute, machine coordinate) does not change

(1) Check mode selection status.
      When status display shows JOG, it is normal.
      When status display does not show JOG, mode select signal is not selected correctly. Confirm the
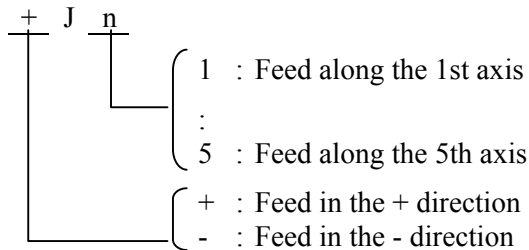   mode select signal using the PMC's signal status screen.

<Mode select signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1
						↓	↓	↓
	Manual operation (JOG) mode					1	0	1

(2) Check the input signal from PMC.
      Check the signal using the PMC's signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0100				+J5	+J4	+J3	+J2	+J1

	#7	#6	#5	#4	#3	#2	#1	#0
G0102				-J5	-J4	-J3	-J2	-J1

   +Jn, -Jn When a bit is "1", the corresponding feed axis direction selection signal has been entered.

      + J n

      1 : Feed along the 1st axis
      :
      5 : Feed along the 5th axis
      + : Feed in the + direction
      - : Feed in the - direction

      Example)
         In the normal state, pressing the "+X" button on the operator's panel causes the signal +Jn to be
         displayed as "1".

      *   This signal becomes effective when the rise of the signal is detected. If, therefore, the direction
           selection signal has been entered before jog mode selection, axis movement is not performed;
           set the bit "0" and then re-check the signal.

(3) Check diagnosis functions 0000 and 1010 of the CNC. Check the items for which 1 is displayed at
      right side.

```
0000
  A.  Inposition Check              0
      Feedrate Override 0%          0
  B.  Jog Feed Override 0%          0
  C.  Inter/Start Lock on           1
      Speed Arrival on              0
      Wait Revolution               0
      Stop Position Coder           0
      Feed Stop                     0
```

```
1010                    RST ERS RRW ESP
  D.    0    0    0    0    0   0   0   0
```

      *   Items with (a) to (d) relate with manual and automatic operation and its detail is shown below.

(a) In-position check is being done
It shows that positioning is not yet completed.   Check the following diagnostic number.   (It is 1 in the following condition)
DGN0300 Position Error >Parameter No.1826 In-position width

(i)   Check the parameters according to the parameter list.

1825	Servo loop gain per axis (Normal : 3000)

(b) Jog feedrate override is 0%
Check the signals using the PMC's signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0

	#7	#6	#5	#4	#3	#2	#1	#0
G0011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8

When the override is 0% all bits of the above address becomes
1111 . . . . 1111 or 0000 . . . . 0000.

*JV15 . . . . *JV0	Override
1111 1111 1111 1111	0.00%
1111 1111 1111 1110	0.01%
:	:
1101 1000 1110 1111	100.00%
:	:
0000 0000 0000 0001	655.34%
0000 0000 0000 0000	0.00%

(c) Interlock or start lock signal is input
There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
3003						ITX		ITL

#0 (ITL) ITL=0 shows interlock signal *IT is effective. To i)
#2 (ITX) ITX=0 shows interlock signal *ITn is effective. To ii)

Check the interlock signals selected by the above parameters on the PMC signal status screen.

(i)   Interlock signal (*IT) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0008								*IT

*IT=0 shows that interlock signal is input.

(ii)   Axis interlock signal (*ITn) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0130				*IT5	*IT4	*IT3	*IT2	*IT1

*ITn=0 shows interlock signal is input.

(d) NC is in a reset state
In this state, not only manual operation but also automatic operation is disabled. Make an investigation according to the Section 10.2, "Manual Operation and Automatic Operation are Disabled."

(4) Check the manual feedrate (parameter).

1423	Jog feedrate per axis

(5) Check that manual feed per revolution is not selected.
The manual feed per revolution function feeds an axis at a speed in sync with the revolution of the spindle and is enabled by the following parameter.

	#7	#6	#5	#4	#3	#2	#1	#0
1402				JRV				

JRV Jog feed and incremental feed are :
- 0 : Of feed per minute
- 1 : Of feed per revolution

(a) Check the revolution of the spindle.
Since the feedrate of an axis is calculated based on the revolutions of the spindle when this parameter is set to 1, rotate the spindle.

(b) Check the detector and cables.
If the axis does not move even when the spindle is rotated, check the detector of the spindle (position coder) and the cable between the position coder and the CNC if it is short-circuited or ungrounded.

M

(6) Check that the axis is not the index table indexing axis.
For the index table indexing axis (B-axis), jog feed, incremental feed, and manual handle feed cannot be performed.

10.4   HANDLE OPERATION CANNOT BE DONE

Points
(1) Check that the servo is activated.
(2) Check that the manual pulse generator is properly connected to the I/O module.
(3) Check that the I/O Link allocation of the I/O module is properly performed.
(4) Check that the related parameters are set and the related signals are input.
(5) Check the internal state with the CNC diagnosis function.

Causes and Countermeasures
### 1   Checking the activation of the servo
Check that the LED on the servo amplifier indicates "0". If a number other than "0" is indicated, the servo is not activated. In this state, even JOG operation and automatic operation cannot be operated.
Check the servo-related parameters and the wiring.

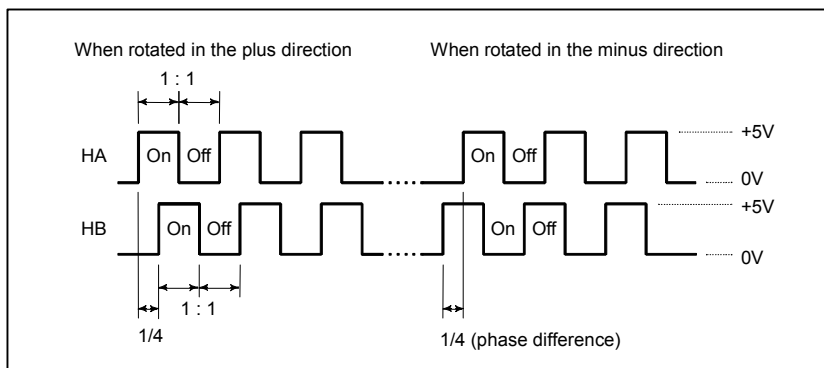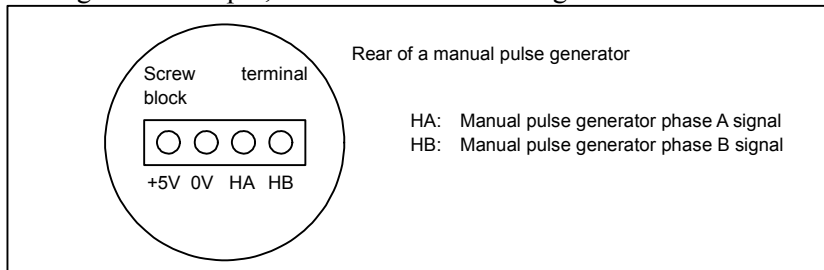### 2 Checking the manual pulse generators
(1) Cable failures (such as breaks)
Examine the cables for faults such as breaks and short-circuits, referring to the figure below.
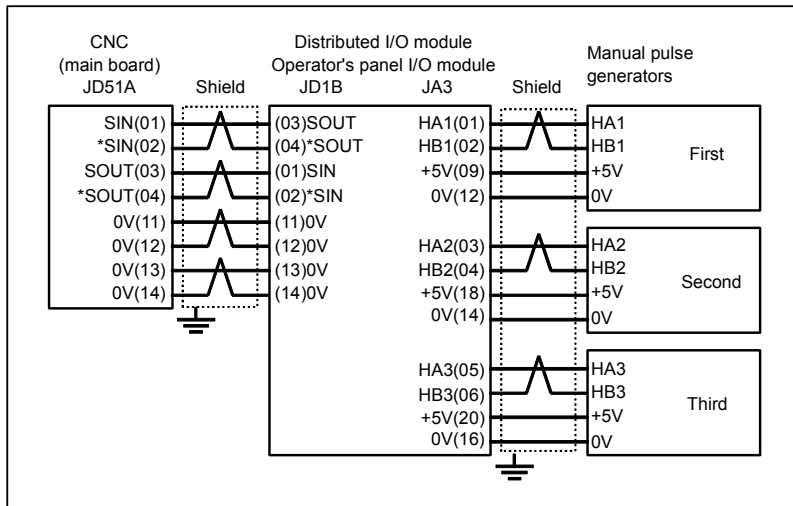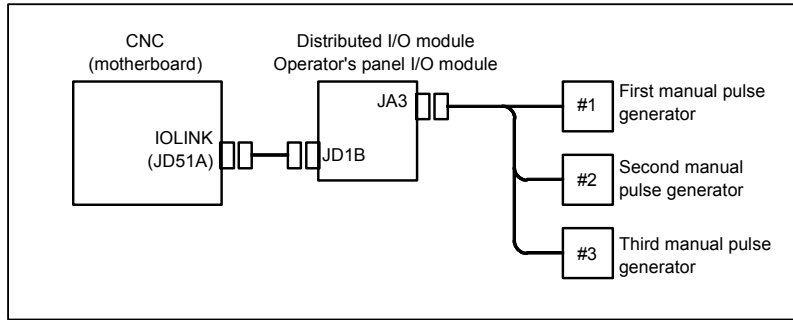
(2) Manual pulse generator failures

When rotated, a manual pulse generator generates the signals shown below.
Using an oscilloscope, measure the signals from the screw terminal block located at the rear of a manual pulse generator. If no signals are output, measure the +5 V voltage.

Check the on/off ratio and the phase difference between HA and HB.

(3) Checking the I/O Link allocation

The signals generated from a manual pulse generator are input to the X address of the PMC allocated to the manual pulse generator.   (This X address is a parameter (No.12300 to 12302) set value.)

On the PMC SIGNAL STATUS screen (see Section 6.4.1), confirm that when a manual pulse generator is rotated, the X address (parameter (No.12300 to 12302) set value) signal is counted up or down. If the signal does not change when the manual pulse generator is rotated, check the connection of the manual pulse generator and I/O Link allocation.

3   Checking the parameters and input signals

See Section 1.4, "CNC STATE DISPLAY."

(1) Checking the basic parameter

Check that the following parameter, which enables manual handle feed, is set to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
8131								HPG

  # 0   HPG   Manual handle feed is:
    0:    Not Used.
    1:    Used.

Check the following parameter for the X address of the PMC allocated to the manual pulse generator.

	#7	#6	#5	#4	#3	#2	#1	#0
7105							HDX	

  #1   HDX   Manual handle for I/O Link connection is:
    0:    Automatically set.
    1:    Manually set.

NOTE

 In manual setting, parameters Nos.12300 to 12302 must be set by manual to connect Manual Pulse Generator with I/O Link.

12300	X address of the 1st. manual pulse generator

12301	X address of the 2nd. manual pulse generator

12302	X address of the 3rd. manual pulse generator

NOTE

 When these parameters are set, the power must be turned off before operation is continued.

---

(2) Checking the CNC status display (shown at the lower-left of the screen)

When the status display shows HND, mode selection is correct.

If it is not HND, mode select signal is not input correctly. Check the mode select signal using the PMC's signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1
						↓	↓	↓
		Manual handle mode				1	0	0

(3) Checking the manual handle feed axis select signal

Check the signals using the PMC's signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0018		HS2C	HS2B	HS2A		HS1C	HS1B	HS1A
G0019						HS3C	HS3B	HS3A

When axis select switch for manual handle feed is selected on the machine operator's panel, if the signals are input as follows, it is normal.

Selected axis	HSnC	HSnB	HSnA
no selection	0	0	0
1st axis	0	0	1
2nd axis	0	1	0
3rd axis	0	1	1
4th axis	1	0	0
5th axis	1	0	1

NOTE
   The number n indicates a manual pulse generator (MPG) number.   A manual handle feed axis can be selected for up to three manual pulse generators for the M series, or up to two or three (0i-TD only, optional function) manual pulse generators for the T series. A feed axis is selected by 3-bit code of A to C.

---

(4) Checking the magnification of manual handle feed
Check the following signals using the PMC's signal status screen. Also confirm the following parameters based on the parameter list.

	#7	#6	#5	#4	#3	#2	#1	#0
G0019			MP2	MP1				

In handle mode, the travel distance per step can be changed.

MP2	MP1	Step feed	Handle feed
0	0	× 1	× 1
0	1	× 10	× 10
1	0	× 100	× Mn
1	1	× 1000	× Nn

	#7	#6	#5	#4	#3	#2	#1	#0
7100			MPX					

#5   MPX In Manual handle feed mode, manual handle feed amount selection signal is
   0 :   same for all manual pulse generator, and it is set by signals MP1 and MP2<Gn019.4,.5>.
   1 :   differ to each other manual pulse generator, and it's setting signal as follow:
      1st. Manual Pulse Generator : MP1,MP2<Gn019.4,.5>
      2nd. Manual Pulse Generator : MP21,MP22<Gn087.0,.1>
      3rd. Manual Pulse Generator : MP31,MP32<Gn087.3,.4> (M series only)

	#7	#6	#5	#4	#3	#2	#1	#0
7102								HNGx

#0   HNGx Axis movement direction for rotation direction of manual pulse generator
      0:   Same in direction
      1:   Reverse in direction

7113	Manual handle feed magnification m

7114	Manual handle feed magnification n

7131	Manual handle feed magnification m2 / 2nd. manual pulse generator

7132	Manual handle feed magnification n2 / 2nd. manual pulse generator

7133	Manual handle feed magnification m3 / 3rd. manual pulse generator

7134	Manual handle feed magnification n3 / 3rd. manual pulse generator

M

(5) Checking the index table indexing axis

For the index table indexing axis (B-axis), jog feed, incremental feed, and manual handle feed cannot be performed.

4   Check by the CNC diagnosis function

(1)   Check diagnosis functions 0000 and 1010 of the CNC. Check the items for which 1 is displayed at right side.

```
0000
  A.  Inposition Check              0
      Feedrate Override 0%          0
      Jog Feed Override 0%          0
  B.  Inter/Start Lock on           1
      Speed Arrival on              0
      Wait Revolution               0
      Stop Position Coder           0
      Feed Stop                     0
```

```
1010                    RST  ERS  RRW  ESP
  C.   0    0    0    0    0    0    0    0
```
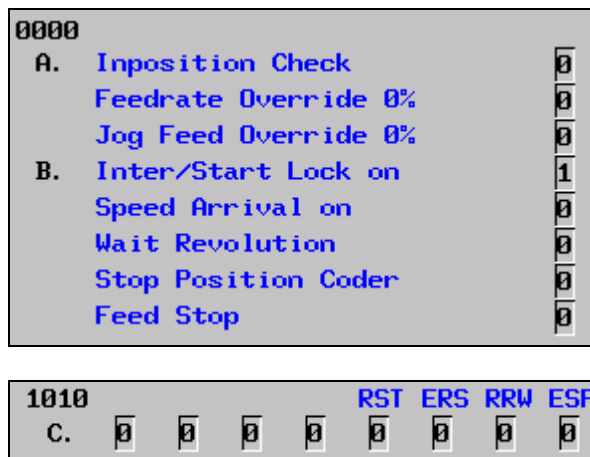
*   Items with (a) to (c) relate with manual and automatic operation and its detail is shown below.

(a)   In-position check is being done
       It shows that positioning is not yet completed. Check the following diagnostic number. (It is 1 in the following condition)
DGN0300 Position Error>Parameter No.1826 In-position width

       (i)   Check the parameters according to the parameter list.

1825	Servo loop gain per axis (Normal : 3000)

(b)   Interlock or start lock signal is input
       There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
3003						ITX		ITL

       #0 (ITL) ITL=0 shows interlock signal *IT is effective. To 1)

#2 (ITX) ITX=0 shows interlock signal *ITn is effective. To 2)

Check the interlock signals selected by the above parameters on the PMC signal status screen.

(i)   Interlock signal (*IT) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0008								*IT

*IT=0 shows that interlock signal is input.

(ii)   Axis interlock signal (*ITn) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0130				*IT5	*IT4	*IT3	*IT2	*IT1

*ITn=0 shows interlock signal is input.

(c)   NC is in a reset state
       In this state, not only manual operation but also automatic operation is disabled. Make an
       investigation according to the Section 10.2, "Manual Operation and Automatic Operation are
       Disabled."

10.5   AUTOMATIC OPERATION CANNOT BE DONE

Points
(1)   Check manual operation is possible.
(2)   Check the status of cycle start LED on machine operator's manual.
(3)   Check status of CNC.

Causes and Countermeasures
When manual operation is either impossible, perform countermeasure, based on the Section 10.3, "Jog
Operation cannot be Done".
Confirm that a correct mode is selected according to the mode select status of CNC status display. Also,
by confirming the automatic operation status it is possible to identify cycle operation, feed hold and cycle
stop state.

1   When cycle operation is not started (Cycle start LED does not light)
"****" is displayed at status display on screen.

(1)   Check the mode select signal.
       When the mode select signal is input correctly, following status display is done.
       MDI   : Manual data input (MDI) mode
       MEM   : Automatic operation (MEM) mode
       RMT   : Remote operation mode
       If status display does not show a correct status, check the mode signal with following PMC's signal
       status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0043			DNCI			MD4	MD2	MD1

DNCI	MD4	MD2	MD1	Mode select
-	0	0	0	Manual data input mode
0	0	0	1	Automatic operation (memory) mode
1	0	0	1	Remote operation mode

(2) Check the automatic operation start signal.
The automatic operation start signal is set to 1 when the automatic operation start button is pressed or 0 when the automatic operation start button is released.   Automatic operation is started when this signal is changed from 1 to 0, so check the status of the signal on the PMC signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0007						ST		

ST :   Cycle start signal

(3) Check the automatic operation stop (feed hold) signal.
During normal operation, when the automatic operation stop button is not pressed, the automatic operation stop (feed hold) signal is 1.   So, check the signal status on the PMC signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0008			*SP					

*SP :   Feed hold signal

2   When an automatic operation is in progress (Cycle start LED is lit)
CNC's status display shows "STRT" on the screen.

(1) Check information displayed with CNC diagnosis number 0000. Check the items for which 1 is displayed on the right side.

Diagnosis	0000	CNC internal state 1

[Data type] Bit

	NAME	Internal state when "1" is displayed
(a)	In-position Check	In-position check is being done.
(b)	Feedrate Override 0%	Feedrate override is 0%.
(c)	Jog Feed Override 0%	Jog feedrate override is 0%.
(d)	Inter/Start Lock on	Interlock/start lock is on.
(e)	Speed Arrival on	The system is waiting for the speed arrival signal to turn on.
	Wait Revolution	The system is waiting for the spindle one-rotation signal in threading.
	Stop Position Coder	The system is waiting for the rotation of the position coder in spindle feed per revolution.
	Feed Stop	A feed stop was made.

*   Items with (a) to (e) relate with an automatic operation and their details are as follows :

(a) In-position check (confirming positioning) is being done
In positioning (G00) of the corresponding axis, the specified position is not reached.
Whether positioning is completed or not is checked as the servo position error amount.   So, use the following diagnosis function to check this.
DGN 300 Position error > Parameter No.1826 In-position width
Position error amount almost becomes 0, when positioning of an axis completes and when the amount becomes within the in-position width, it is assumed that positioning completes and the next block is executed.

(b) Feedrate override is at 0%
Actual feedrate is overridden by the override signals to a programmed feedrate. Check the override signals using the PMC's signal status screen.

● **Feedrate override signal**

	#7	#6	#5	#4	#3	#2	#1	#0
G0012	*FV7	*FV6	*FV5	*FV4	*FV3	*FV2	*FV1	*FV0

*FVn :   Feedrate override

- • **State of override signal**

*FV7 . . . . . *FV0	
1 1 1 1 1 1 1 1	0%
1 1 1 1 1 1 1 0	1%
:	:
1 0 0 1 1 0 1 1	100%
:	:
0 0 0 0 0 0 0 1	254%
0 0 0 0 0 0 0 0	0%

- (c) Manual feedrate override is 0% (dry run)
  Normally manual feedrate override function is used for jog feed.
  But when DRN(dry run) signal turns on during an automatic operation, override values set with
  these signals become valid to the following speed set by a parameter.

	#7	#6	#5	#4	#3	#2	#1	#0
G0046	DRN							

Dry run signal is input with this signal being 1.

1410	Dry run rate

When the value of the following override signal is 100%, the set feedrate is achieved.

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0

	#7	#6	#5	#4	#3	#2	#1	#0
G0011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8

When override value is 0%, all bits of the above address is
[1111 . . . . 1111] or [0000 . . . . 0000].

*JV15 . . . . *JV0	Override
1111 1111 1111 1111	0.00%
1111 1111 1111 1110	0.01%
:	:
1101 1000 1110 1111	100.00%
:	:
0000 0000 0000 0001	655.34%
0000 0000 0000 0000	0.00%

- (d) Interlock signal is input
  Some interlock functions are provided; the interlock signal to be used is set by the machine tool
  builder with the parameter.   So, check the following settings first.

	#7	#6	#5	#4	#3	#2	#1	#0
3003						ITX		ITL

#0 (ITL) ITL=0 shows interlock signal *IT is effective. To i)
#2 (ITX) ITX=0 shows interlock signal *ITn is effective. To ii)

Check the interlock signals selected by the above parameters on the PMC signal status screen.

- (i) Interlock signals (*IT, *CSL, and *BSL) are input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0008					*BSL		*CSL	*IT

*IT=0, *CSL=0, and *BSL=0 show that interlock signal is input.

- (ii) Interlock signal per each axis (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130				*IT5	*IT4	*IT3	*IT2	*IT1

When the bit is 0, the corresponding axis's interlock signal is input.

(iii) The axis for which the movement command is executed is detached.

* This function is valid when parameter RMBx (No.1005#7)=1.

Check whether the control axis is being detached using the following input signal or parameter.

1) The control axis detach signal (DTCHn) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0124				DTCH5	DTCH4	DTCH3	DTCH2	DTCH1

DTCHn If it is 1, the corresponding axis is detached.

2) The corresponding axis is detached by the following parameter.

	#7	#6	#5	#4	#3	#2	#1	#0
0012	RMVx							

RMVx Releasing the assignment of the control axis for each axis
0: Not released
1: Released
(Equivalent to the control axis detachment signals DTCH1, DTCH2, and so forth)

(e) CNC is waiting for spindle speed arrival signal to be input
Actual spindle speed does not arrive at a speed specified in a program.
Confirm the signal state using the PMC's signal status screen.

	#7	#6	#5	#4	#3	#2	#1	#0
G0029				SAR				

When this signal is 0, spindle speed does not arrive at the specified speed.

* This function is enabled only when bit 0 (SAR) of parameter No. 3708 is 1.

(2) If it does not operate only during positioning, check items (a) and (b) below.

(a) Check the setting of the rapid traverse rate.

1420	Rapid traverse rate per axis

(b) Check the rapid traverse override.

	#7	#6	#5	#4	#3	#2	#1	#0
G0014							ROV2	ROV1

	#7	#6	#5	#4	#3	#2	#1	#0
G0096	HROV	*HROV6	*HROV5	*HROV4	*HROV3	*HROV2	*HROV1	*HROV0

(HROV=0)

ROV2	ROV1	Override
0	0	100%
0	1	50%
1	0	25%
1	1	F0

(HROV=1)

*HROV6······*HROV0	Override
1 1 1 1 1 1 1	0%
1 1 1 1 1 1 0	1%
:	:
0 0 1 1 0 1 1	100%

1421	Rapid traverse override F0 rate

(3) If it does not operate only during cutting feed, check items (a) to (d) below.

(a) Check the setting of the maximum cutting rate.

Feedrate is clamped at this upper feedrate.

1430	Maximum feedrate in each axis

(b) For feed per revolution (mm/rev), check the position coder.
(i) Position coder does not rotate
Check the connection between spindle and position coder
The following failure is considered:
- Timing belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened
(ii) Position coder failed or connection error occurred
Check the connection of the position coder as described in (ii) in (c) below.

(c) For threading, check the position coder.
(i) Position coder does not rotate
Check the connection between spindle and position coder
The following failure is considered:
- Timing belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened
(ii) Position coder failed or connection error occurred
Position coder is connected to the spindle amplifier when serial interface is used or connected to the CNC when analog interface is used.

- For serial interface
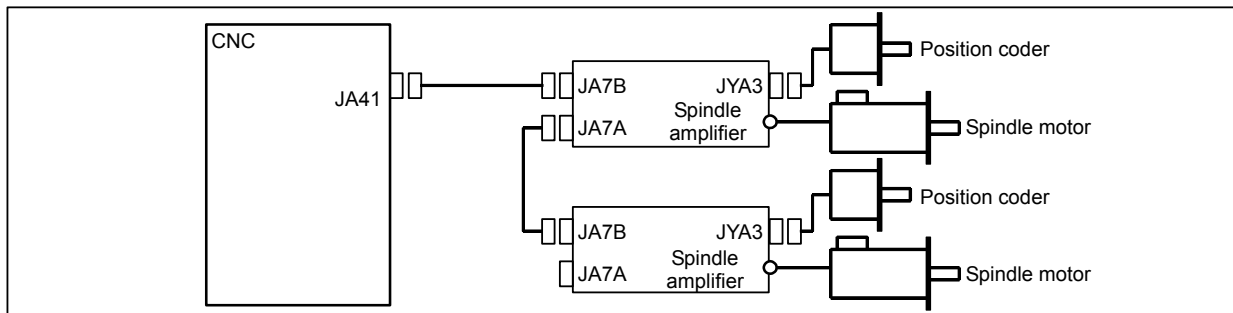
- For analog interface
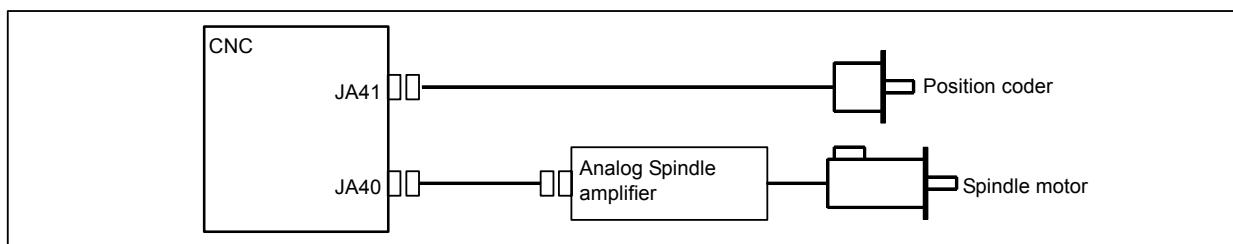
Whether A/B phase signals from the position coder are read correctly, can be judged also by the spindle speed display on the position display screen.
(When bit 2 (DPS) of parameter No. 3105 is 0, the actual speed of the spindle is not displayed.)

(d) Check a feedrate command (F command) is not zero.
If the bit 7 (FCO) of parameter No. 1404 is set to 1, alarm PS0011 is not issued even if a feedrate command (F command) with a feedrate of 0 is issued.

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10.6   CYCLE START LED SIGNAL HAS TURNED OFF

Points
(1)   Confirm cycle start LED on machine operator's panel.
(2)   Check the signal status of PMC.

Causes and Countermeasures
Check the states of the related signals on the signal status screen of PMC.

a.   Checking the emergency stop signal

	#7	#6	#5	#4	#3	#2	#1	#0
X0008				*ESP				

	#7	#6	#5	#4	#3	#2	#1	#0
G0008				*ESP				

*ESP=0   : Emergency stop signal is input :

b.   Checking the external reset signal

	#7	#6	#5	#4	#3	#2	#1	#0
G0008	ERS							

#7(ERS) : When the bit is 1, external reset signal is input.

*   This signal may be used as a confirmation signal from the PMC side when M02 is specified during program termination or other situations.   In this case, a state in which the external reset signal is input is entered.

c.   Checking the pressing of the reset button on the MDI panel

Automatic operation was reset because the ⌈RESET⌋ key on the MDI panel is pressed during automatic operation.

d.   Checking the reset & rewind signal

	#7	#6	#5	#4	#3	#2	#1	#0
G0008		RRW						

#6(RRW) :   When this signal is 1, the reset & rewind signal is input.

*   This signal may be used as a confirmation signal from the PMC side when M30 is specified during program termination or other situations.   In this case, a state in which the reset & rewind signal is input is entered.

e.   Checking the occurrence of a servo alarm
Automatic operation was reset because any servo alarm occurred during automatic operation.

f.   Checking the suspend state
Automatic operation enters the suspend state when:
(1)   Modes are switched from an automatic operation mode to a manual operation mode.
(2)   Feed hold signal is input.

- **Mode select signal**

		#7	#6	#5	#4	#3	#2	#1	#0
G0043							MD4	MD2	MD1
							↓	↓	↓

		#2	#1	#0
Automatic operation	Memory edit(EDIT)	0	1	1
	Automatic operation (AUTO)	0	0	1
	Manual data input (MDI)	0	0	0
Manual operation	Jog feed (JOG)	1	0	1
	Handle/step	1	0	0
	TEACH IN HANDLE	1	1	1
	TEACH IN JOG	1	1	0

- **Feed hold signal**

		#7	#6	#5	#4	#3	#2	#1	#0
G0008				*SP					

#5(*SP) : When this signal is 0, the feed hold signal is input.

g. Checking single block stop

		#7	#6	#5	#4	#3	#2	#1	#0
G0046								SBK	

#1(SBK) :   When this signal is 1, the single block signal is input.

10.7 NOTHING IS DISPLAYED ON THE LCD WHEN THE POWER IS TURNED ON

Causes and Countermeasures

If nothing is displayed on the LCD after power-on or data displayed immediately after power-on is still displayed, possible causes include the following:

- The LCD cable or backlight cable is defective or connector connection is poor.
- The necessary software is not installed.
- The motherboard or inverter board is defective.

- For the LCD-mounted type

- The LCD cable or backlight cable is not connected.
- The necessary software is not installed.
- The main board or inverter board is defective.

- For the stand-alone type

- The display unit is not connected to the power supply.
- The display unit is not connected to the CNC with the optical cable or the cable is broken.
- The necessary software is not installed.
- The main board or display unit is defective.

- Checking LED indication

Referring to Sections 2.4, "LED display of main board" and 3.4, "CONFIGURATION OF PRINTED CIRCUIT BOARD CONNECTORS AND CARDS," check the LED on/off status of the main board.

If the motherboard has started up normally and the LED display indicates normal operation, a probable cause is a fault of the display system, such as a cable not connected or a defective inverter board.

If the LED display is locked in the middle of the startup process, the probable causes include defective hardware (or installation failure) and the necessary software not installed.

- **Checking the LCD cable and backlight cable**

Check that the LCD and backlight cables are connected firmly to the corresponding connectors.
These cables are connected before shipment from FANUC. This check is, however, required because the cables may be disconnected during maintenance.

- **Checking the installation of the necessary software**

If necessary software is not stored in the FROM module, the CNC may not start up.

- **Checking a failure of printed-circuit boards**

If the main board fails, the CNC may not start up.
Confirm that printed-circuit boards are securely connected through connectors.
If any of the above actions does not solve the problem, replace the inverter board or main board.

10.8 INPUT FROM AND OUTPUT TO I/O DEVICES CANNOT BE PERFORMED, INPUT/OUTPUT CANNOT BE PERFORMED PROPERLY

Causes and Countermeasures

If the I/O Link is not established, if the signals from an I/O device cannot be input normally to the CNC, or if the signals from the CNC cannot be output to an I/O device, the probable causes include the following:

- The I/O device is not turned on, or the power supply is not at the appropriate voltage.
- The I/O Link cable is not connected correctly or appropriately.
- The grounding is not correct.
- The input/output signals are not connected correctly.
- I/O Link allocation is not performed, or is not performed properly.

- **Checking PMC alarms**
  ER32 NO I/O DEVICE

If "ER32 NO I/O DEVICE" is displayed on the alarm screen of the PMC, no I/O devices are recognized.

  ER97 IO LINK FAILURE

If "ER97 I/O LINK CONNECTION ERROR CHxx yyGROUP" appears on the PMC alarm screen, the setting of the I/O device connection count in channel xx of I/O Link does not match the I/O Link connection count that was allocated actually.

- **Checking the PMC I/O Link screen**

Press function key [SYSTEM], soft key [PMCMNT], and soft key [I/O LNK]. The I/O devices recognized by the CNC are displayed. From this screen, the devices that are connected normally can be determined.

<Screen display example>

```
PMC MAINTENANCE                          RUN ***
PMC I/O LINK MONITOR                 CHANNEL  1
   GROUP   ID I/O UNIT TYPE
    00    83  I/O-B3
    01
    02
    03
    04
    05
    06
    07
    08
    09

A) _

MDI   **** *** ***        20:38:28
  STATUS  I/OLNK   ALARM    I/O   (OPRT)  +
```

This example indicates that the I/O Link is as shown in the figure below.
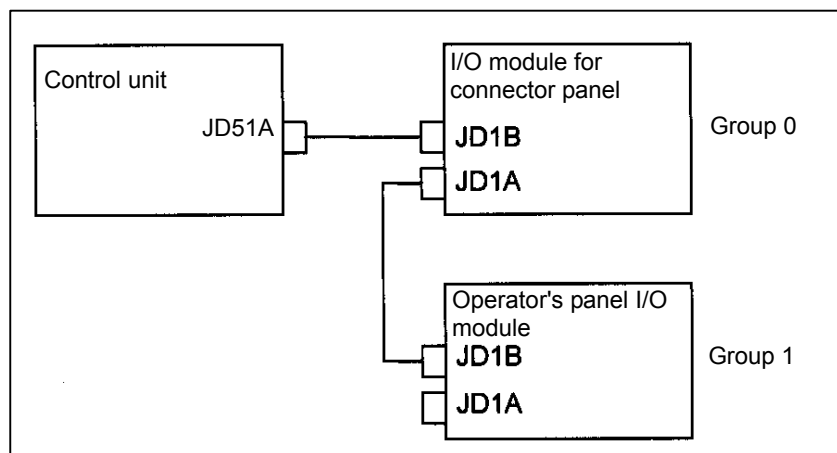
- Checking the power supplies of the I/O devices
Check that the connected I/O devices are connected properly to the power supplies and that the voltages are as prescribed.
Check that the power-on sequence is correct.
    <Time at which an I/O device is to be turned on>
        Before the CNC is turned on or within 500 ms after the CNC is turned on
If the CNC is turned off, the I/O device needs to be turned off once.

- Checking cable connection
As in the example shown on the previous page, I/O Link cables are used to connect JD1A (JD51A) and JD1B.
JD1A (JD51A) represents an upper unit while JD1B represents a lower unit.
Check that the cables are connected correctly.

- Checking ground connection
Check that the ground wires are connected and are not loose.

-   Checking I/O connection

Check that the input/output signals to be connected to each I/O device are connected correctly.

For operator's panel I/O modules and for connector panel I/O modules, also check that the 0 V or +24 V input signal is connected to the common pin and that the +24 V output signal is connected to the DO common pin.

-   Checking I/O Link allocation

Check that I/O Link allocation has been performed correctly.

Press function key [⬦ SYSTEM], soft key [PMCCNF], soft key [MODULE], and soft key [EDIT].   The allocation edit screen appears.

After editing allocation, be sure to write the sequence program onto the flash ROM using the PMC data I/O screen.   Otherwise, the changes will be lost when the power is turned off.

10.9   IN A CONNECTOR PANEL I/O UNIT, DATA IS INPUT TO AN UNEXPECTED ADDRESS

If data is input to an invalid address in a connector panel I/O unit (for example, data that should be input to X004 is actually input to X010 in a connector panel I/O unit), the most likely causes are as follows:

(1)   The I/O Link allocation is wrong.
→   Perform the check described in Section 10.8.

(2)   The unit-to-unit cables (CA52-to-CA53) are not connected correctly.
If the connection is wrong, expansion unit 1 is allocated the address of expansion unit 3, as shown below.
→   Connect the unit-to-unit cables as shown below:
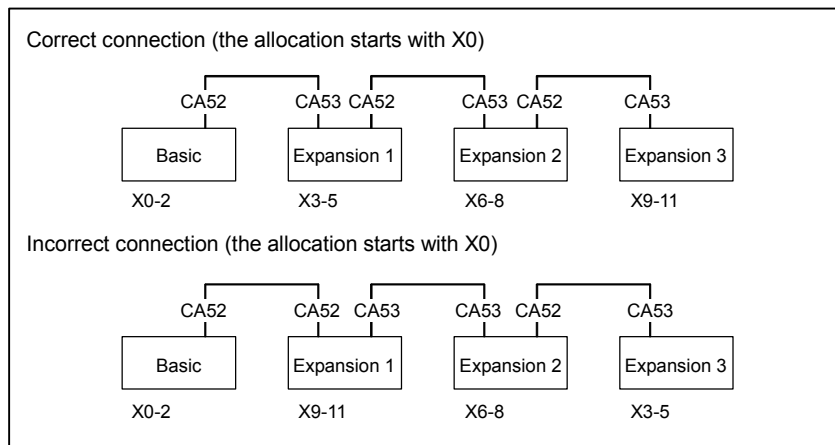
(3)   The setting of the rotary switch on an expansion unit is wrong
If the rotary switch is set to 1, one unit number is skipped. If set to 2, two unit numbers are skipped. Usually, the setting must be 0. (For those units without a rotary switch, unit numbers cannot be skipped.)
→   See the following example and refer to the Section 4.6, "SETTING I/O MODULES."

Example) Rotary switch setting on expansion unit 1=1

CA52   CA53

Basic		Expansion 1

X0-2   X6-8   ⇐ X3 to X5 are skipped.
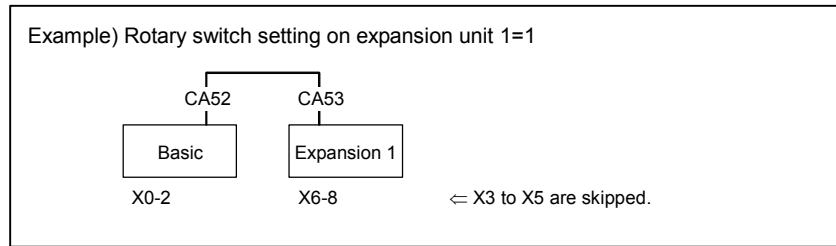
10.10   IN A CONNECTOR PANEL I/O UNIT, NO DATA IS OUTPUT TO AN EXPANSION UNIT

The most likely cause is that power is not being supplied to the expansion unit.
→   Check whether +24-V power is supplied to No. 18 pin and No. 50 pin of the expansion unit, DI and DO signals are not input and output.
→   Check whether +24-V power is supplied to No. 1 pin and No. 33 pin of the expansion unit, when DI signals are input and DO signals are not output.

10.11 ALARM SR0085 TO SR0087 (READER/PUNCHER INTERFACE ALARM)
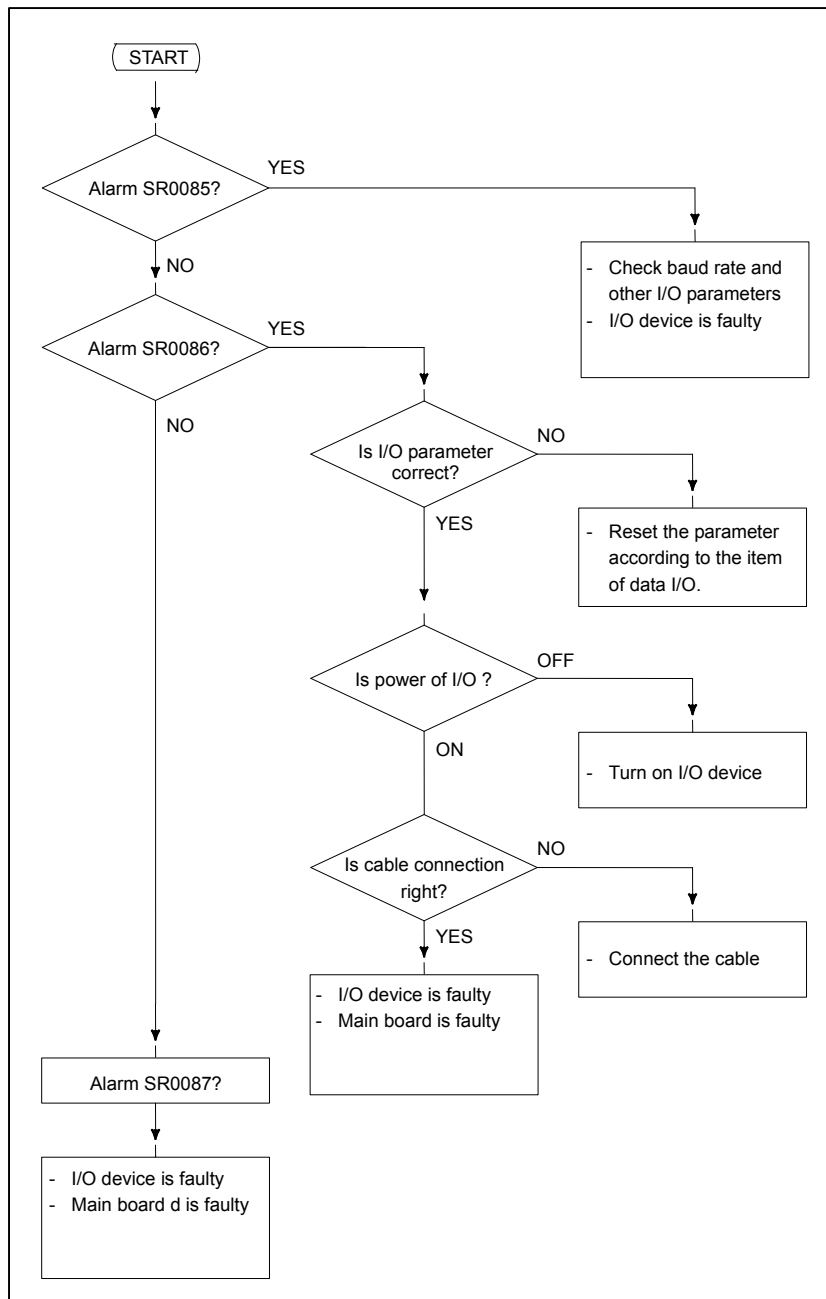
```
                    ( START )
                        |
                        v
        /Alarm SR0085?\ ----YES---->  [ -  Check baud rate and
        \            /                     other I/O parameters
            | NO                      -  I/O device is faulty ]
            v
        /Alarm SR0086?\ ----YES---->
        \            /                   /Is I/O parameter\ ---NO--> [ - Reset the parameter
            | NO                         \   correct?    /                according to the item
            |                                  | YES                       of data I/O. ]
            |                                  v
            |                            /Is power of I/O ?\ ---OFF--> [ - Turn on I/O device ]
            |                            \               /
            |                                  | ON
            |                                  v
            |                            /Is cable connection\ --NO--> [ - Connect the cable ]
            |                            \     right?       /
            |                                  | YES
            v                                  v
    [ Alarm SR0087? ]                   [ - I/O device is faulty
            |                             - Main board is faulty ]
            v
    [ -  I/O device is faulty
      -  Main board d is faulty ]
```

Causes
  (a) Parameters on reader/puncher interface are not correct.
      Check the following setting data and parameters.
  (b) External I/O device or host computer is faulty.
  (c) Main board is faulty.
  (d) Cable between NC and I/O device is faulty.

Countermeasures
  (a) Parameters on reader/puncher interface are not correct.
      Check the following setting data and parameters:

- **Setting data**

PUNCH CODE=0 OR 1 (0: EIA,1:ISO)

Select ISO or EIA according to the type of I/O device.

If punch code does not match, alarm SR0086 will generate.

- **Parameter**

Value of parameter No. 0020 / Function		0	1	2
Feed		0101#7	0111#7	0121#7
Data input/output code		0101#3	0111#3	0121#3
Stop bit		0101#0	0111#0	0121#0
Type of I/O device		102	112	122
Baud rate		103	113	123
Communication method	0135#3	-	-	-
		RS-232C		
Connector		MAIN BOARD		
		JD36A		JD36B

	#7	#6	#5	#4	#3	#2	#1	#0
0101	**NFD**				**ASI**			**SB2**
0111								
0121								

NFD 0: Feed is output before and after data in data output
(FANUC PPR)

1: Feed is not output (standard).

ASI 0: EIA or ISO is used during input/output.
(Input: The code used is identified automatically.
Output: The code used depends on the punch code of setting data.)

1: ASCII codes are used during output.
(The punch code of setting data needs to be set to 1.)

SB2 0: No. of stop bits is 1.

1: No. of stop bits is 2.

0102	**Type of I/O device**
0112	
0122	

Value	TYPE OF I/O DEVICE
0	RS–232–C (Used control codes DC1 to DC4)
1	FANUC CASSETTE ADAPTOR 1 (FANUC CASSETTE B1/ B2)
2	FANUC CASSETTE ADAPTOR 3 (FANUC CASSETTE F1)
3	FANUC PROGRAM FILE Mate, FANUC FA CARD ADAPTOR FANUC FLOPPY CASSETTE ADAPTOR, FANUC Handy File, FANUC SYSTEM P-MODEL H
4	RS–232–C (Not used control codes DC1 to DC4)
5	Portable tape reader
6	FANUC PPR, FANUC SYSTEM P-MODEL G, FANUC SYSTEM P-MODEL H

0103	Baud rate					
0113						
0123	**Value**	**Baud rate**		**Value**	**Baud rate**	
	7	600		10	4800	
	8	1200		11	9600	
	9	2400		12	19200	

(b) External I/O device or Host computer is in trouble
   (i) Check whether the setting on communication of external I/O device or host computer is the same as that of the CNC. (baud rate, stop bits, etc.)
      If they are not the same, change the setting.
   (ii) When spare I/O device presents, check whether it is possible to realize communication using the spare I/O device.

(c) Main board is faulty
   (i) When parameter No.0020 is 0, 1, or 2 (JD36A, JD36B of Main board)
      Replace the module since main board may be faulty.

(d) Cable between CNC and I/O device is faulty.
   Check the cable for disconnection or wrong connection.

- **Connection**

- **Cable connection**

RS-232-C   (JD36A)
            (JD36B)

Punch panel

Pin	Signal		Pin	Signal

RD   (01)   (03) RD
0V   (02)
DR   (03)   (06) DR
0V   (04)
CS   (05)   (05) CS
0V   (06)
CD   (07)   (08) CD
0V   (08)
      (09)
+24V (10)
SD   (11)   (02) SD
0V   (12)
ER   (13)   (20) ER
0V   (14)
RS   (15)   (04) RS
0V   (16)   (07) SG
      (17)
      (18)
+24V (19)   (25) +24V
      (20)   (01) FG

Shield

Connector : Half-pitch   Connector :DBM-25S
20-pins (PCR)
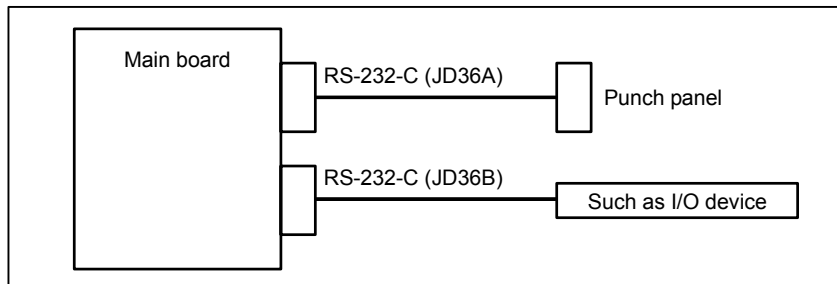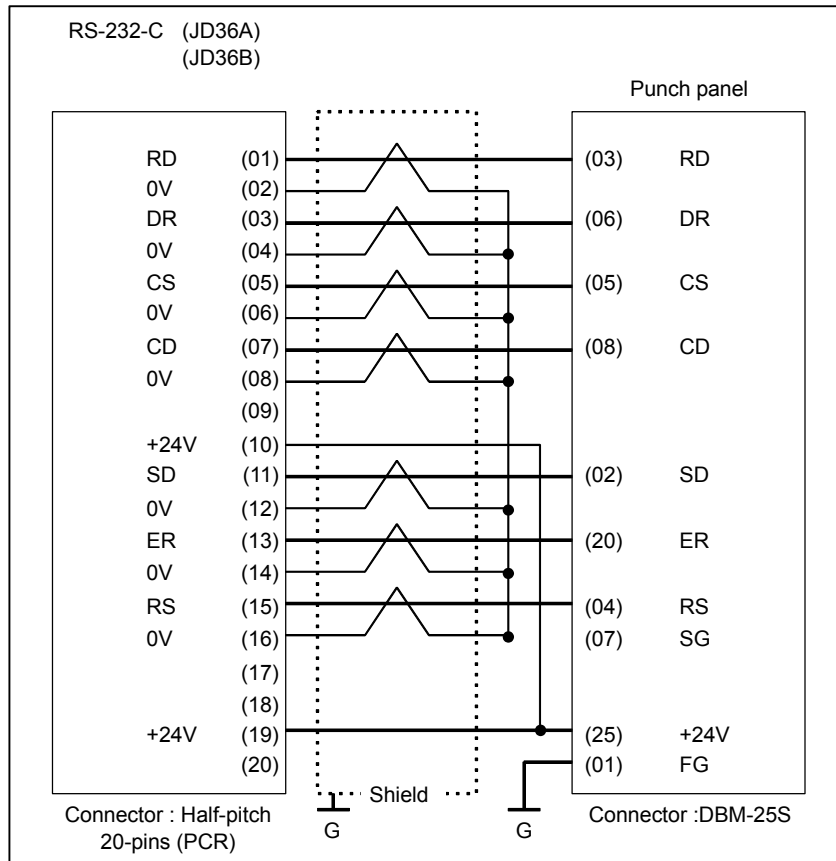
10.12 ALARM PS0090 (REFERENCE POSITION RETURN IS ABNORMAL)

Contents

A reference position return was performed when the condition "the one turn signal is received more than once when an axis is fed in the reference position return direction at a speed at which the positional deviation (DGN.300) is 128 pulses or more" was not satisfied.

Countermeasures

```
                    ┌──────────────┐
                    │    START     │
                    └──────┬───────┘
                           │
┌────────────────────────────────────────────────────┐  ┌──────────────┐
│ Check whether the positional error amount (No. 300  │  │ Position error│
│ value on the diagnosis screen) in the reference     │  │ amount : DGN  │
│ position return direction is 128 or more during a   │  │ 300           │
│ reference position return or during axis movement   │  └──────────────┘
│ before a reference position return                  │
└────────────────────────┬───────────────────────────┘
                         │
                   ┌────────────┐       YES
                   │ 128 or more│────────────────►  (1) Next page
                   └─────┬──────┘
                         │ NO
```

Raise the speed

Check feed rate command:
  Parameter No. 1420 F   :   Rapid traverse rate   [mm/min]
  Parameter No. 1424   Manual rapid traverse rate   [mm/min]
  Parameter No. 1825 G   :   Servo loop gain [0.01sec^{-1}]

$$\text{Position error} = \frac{F \times 5000/3}{G \times \text{detection unit } [\mu m/PULSE]}$$

Detection unit : Move amount to a command pulse

Check rapid traverse override signals :
  ROV1 G014.0

  ROV2 G014.1

  Parameter No. 1421 F0 rate

ROV1	ROV2	Override
0	0	100%
0	1	50%
1	0	25%
1	1	F0 rate

Check reference position return deceleration signal
*DEC1 to *DEC5   X009.0 to X009.4
   When reference position return is started from deceleration signal 0, feed
   rate becomes FL rate.
   Parameter No. 1425 FL rate

```
                              (1)

        ┌─────────────────────────────────────────┐
        │ Check whether the motor rotated more than │
        │ one rotation (one rotation signal is      │
        │ issued ) at faster than 128 pulses of     │
        │ position error amount.                    │
        └─────────────────────────────────────────┘

                        NO        ┌─────────────────────────────────────┐
            ╱╲  ────────────────▶ │ Return start position is too close   │
          ╱ Rotated ? ╲           ├─────────────────────────────────────┤
          ╲          ╱            │ -  Move the return start position    │
            ╲╱                    │    away.                             │
             │ YES                │ -  Move the machine at faster that   │
             │                    │    128 pulses for more than one      │
             │                    │    rotation to wards RP.             │
             │                    └─────────────────────────────────────┘

        ┌─────────────────────────────────────────────────────────────┐
        │ Check that voltage of Pulsecoder is higher than 4.75 V.       │
        │ To measure Pulsecoder voltage, remove the motor cover and     │
        │ measure on pulse coder PCB at across + and - or +5V and 0V    │
        │ terminals.                                                    │
        └─────────────────────────────────────────────────────────────┘

                         NO
            ╱╲  ──────────────────────────────┐
          ╱ More than ╲                        │
          ╲  4.75V    ╱                        │
            ╲╱                                 │
             │ YES                             ▼
   ┌──────────────────────┐      ┌─────────────────────────────────┐
   │ Hardware failure     │      │ Pulse coder power voltage is low │
   ├──────────────────────┤      └─────────────────────────────────┘
   │ -  Change Pulsecoder │
   │    or motor          │
   └──────────────────────┘
```

⚠ **CAUTION**
1 After replacing the pulse coder or motor, be sure to set the reference position again.
2 A speed more than 128 pulses is required because if speed is lower that this, one-rotation signal does not function stably, causing improper position detection.
3 If bit 0(PLC0) of parameter No. 2000 is set to 1, a speed corresponding to a positional deviation of 1280 pulses or more is required.
4 Parameter No. 1836 can be set to 128 or less, as the minimum positional deviation with which reference position return is possible. (If the parameter is set to 0, 128 is assumed as the minimum positional deviation.   When bit 0 (PLC0) of parameter No. 2000 is 1, set the minimum positional deviation with which reference position return is possible to 10 times the setting of parameter No. 1836.)

10.13 ALARM DS0300 (REQUEST FOR REFERENCE POSITION RETURN)

Absolute position data in the serial Pulsecoder was lost.
(This alarm will be generated when serial Pulsecoder is exchanged or position feedback signal cable of the serial Pulsecoder is disconnected).

Countermeasures
Machine position must be memorized using the following method:

- When the deceleration dog is present

1   Execute manual reference position return only for an axis for which this alarm was generated.   If manual reference position return cannot be executed because another alarm occurs, clear the alarm and then execute reference position return.

2   Press ⟦RESET⟧ key at the end of reference position return to release the alarm.

- When the deceleration dog is not present

Execute dogless reference position setting to memorize the reference position.

- When serial Pulsecoder is changed

Since the reference position is different from the former one, change the grid shift value (parameter No. 1850) to correct the position.

Related parameters

	#7	#6	#5	#4	#3	#2	#1	#0
1815			APCx	APZx				

#4   APZx Machine position and position on absolute position detector when the absolute position detector is used
　　　0:　Not corresponding
　　　1:　Corresponding
When an absolute position detector is used, after primary adjustment is performed or after the absolute position detector is replaced, this parameter must be set to 0, power must be turned off and on, then manual reference position return must be performed. This completes the positional correspondence between the machine position and the position on the absolute position detector, and sets this parameter to 1 automatically.

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

10.14   ALARM SV0401 (V READY OFF)

Causes and Countermeasures

This alarm is issued if the servo ready signal VRDY of a servo amplifier does not turn on or if the signal turns off during operation.
There are cases in which this alarm is issued because another servo alarm is issued. If this occurs, first take the action for the first alarm.
Check the power magnetic circuit around the amplifier. The servo amplifier or the axis cards on the CNC may be defective.

- **VRDY**
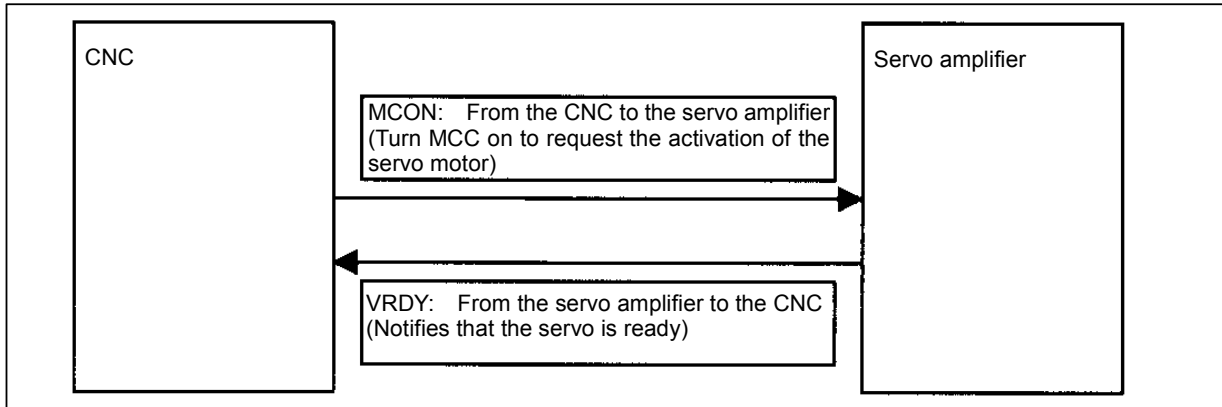
The exchange of this information is performed via the FSSB (optical cable).

- **Example of connection around the amplifier (Typical example)**
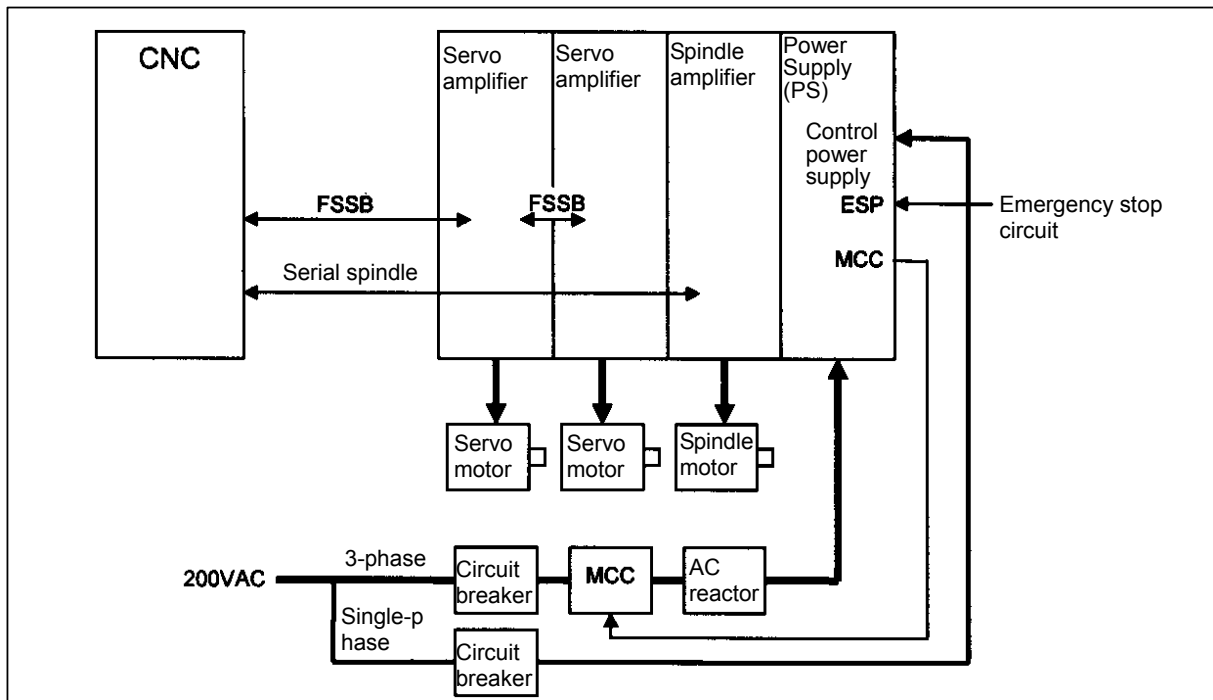
Check items
- Check the value of diagnosis information No. 358 (V ready-off information), identify the possibly faulty location according to the instructions of the information, and check the following items.
  (For details of diagnosis information No. 358, see Subsection 1.3.2, "Contents Displayed," in Section 1.3, "DIAGNOSIS FUNCTION," in this manual.)

  - Is the Power Supply (PS) control power supply on?
  - Has an emergency stop been canceled?
  - Is MCC on? If there is an external MCC sequence in addition to the MCC contact of the Power Supply (PS), check that sequence also.
  - Is the power for driving MCC supplied?
  - Is the breaker on?
  - Has some alarm been issued in the Power Supply (PS) or spindle amplifier?

- **Replacing the servo amplifier**
If no problem is found in the power magnetic circuit around the amplifier, replace the servo amplifier.

- **Replacing the axis cards**

If the above action does not solve the problem, replace the axis cards.

10.15 ALARM SV0404 (V READY ON)

Causes and Countermeasures

This alarm is issued if the servo ready signal (VRDY) of a servo amplifier remains on.
The servo amplifier or the axis cards on the CNC may be defective.
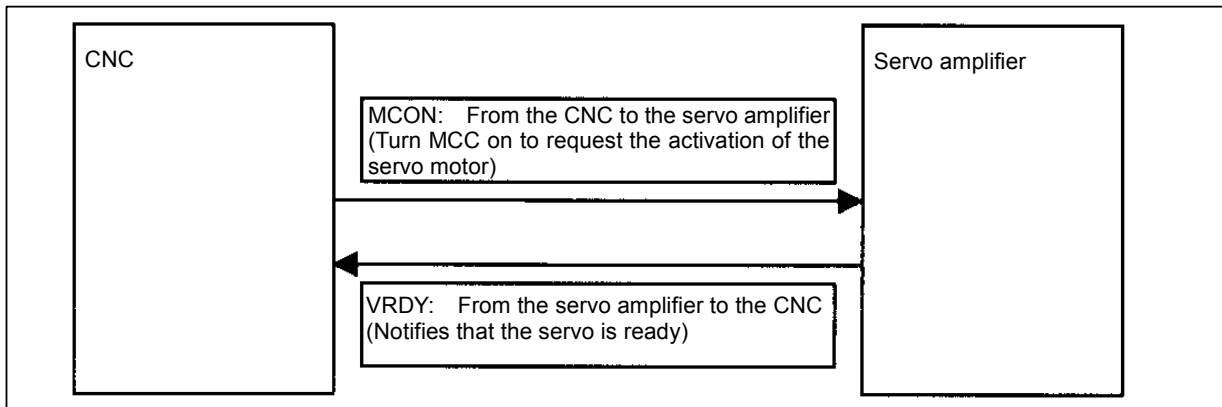
- **VRDY**

The exchange of this information is performed via the FSSB (optical cable).
This alarm is issued if VRDY remains on when the CNC turns MCON off or if VRDY turns on before the CNC turns MCON on.

- **Replacing the servo amplifier**

The servo amplifier may be defective. Replace the servo amplifier.

- **Replacing the axis cards**

If replacing the servo amplifier does not solve the problem, replace the axis cards.

10.16 ALARM SV0462 (SEND CNC DATA FAILED)
ALARM SV0463 (SEND SLAVE DATA FAILED)

Causes and Countermeasures

Alarm SV0462 is issued if a slave (servo amplifier) cannot receive correct data due to an FSSB communication error.
Alarm SV0463 is issued if the CNC cannot receive correct data due to an FSSB communication error.
If these alarms are issued, the alarm message indicates the number of the defective axis (axis name).

- **Servo amplifier or optical cable**

Any of the optical cables between the amplifier corresponding to the axis number indicated by the alarm message and the CNC controller may be defective.
Or, any of the first amplifier to the amplifier corresponding to that axis number may be defective.

- **Axis cards**

The axis cards installed on the CNC may be defective.

10.17 ALARM SV0417 (DIGITAL SERVO SYSTEM IS ABNORMAL)

Digital servo parameters are abnormal.
(Digital servo parameters are set incorrectly.)

Countermeasures

1   Confirm the setting value of the following parameters:
     Parameter No. 2020   : Motor format number
     Parameter No. 2022   : Motor rotation direction
     Parameter No. 2023   : Number of pulses of velocity feedbacks
     Parameter No. 2024   : Number of pulses of position feedback
     Parameter No. 1023   : Servo axis number
     Parameter No. 2084   : Flexible feed gear ratio
     Parameter No. 2085   : Flexible feed gear ratio
     Confirm the details with diagnosis function of CNC side.

2   Change the setting of this parameter to 0.
     Parameter No. 2047   : Observer parameter

10.18 ALARM OH0700 (OVERHEAT: CONTROL UNIT)

Causes and Countermeasures

This alarm is issued if the ambient temperature of the CNC control unit is abnormally high. As an installation condition, the ambient temperature of the CNC must not exceed 58°C (for LCD-mounted type CNC) or 55°C (for stand-alone type CNC).

- Ambient temperature

A temperature monitoring circuit is installed on the main board, and causes this alarm to be issued if the ambient temperature is abnormally high.
Take appropriate action to the cabinet that houses the CNC control unit so that the temperature falls within the proper temperature range (0 to 58°C (for LCD-mounted type CNC) or 0 to 55°C (for stand-alone type CNC)).
If it is obvious that the ambient temperature is not abnormal, the main board may be defective.

10.19 ALARM OH0701 (OVERHEAT: FAN MOTOR)

Causes and Countermeasures

This alarm is issued if a fault occurs in any of the fan motors, such as the stoppage of a fan motor during the operation of the CNC.

- Fan motors

Fan motors are installed in the uppermost portion of the CNC control unit.   This alarm is issued if a fault such as a stoppage occurs.
If this alarm is issued, replace the fan motor according to "2.9 REPLACING FAN MOTORS" or "3.8 REPLACING A FAN UNIT".

10.20 ALARM SV5134 (FSSB: OPEN READY TIME OUT)
ALARM SV5137 (FSSB: CONFIGURATION ERROR)
ALARM SV5197 (FSSB: OPEN TIME OUT)

Causes and Countermeasures

These alarms are issued due to a failure in the optical cable, axis card, or a slave such as a servo amplifier connected to the FSSB.

No.	Message	Description
SV5134	FSSB:OPEN READY TIME OUT	In the initialization, the FSSB could not be in an open ready sate. The axis card is thought to be defective.
SV5137	FSSB:CONFIGURATION ERROR	An FSSB configuration error occurred. The connecting amplifier type is incompatible with the FSSB setting value.
SV5197	FSSB:OPEN TIME OUT	The FSSB cannot be opened even though the CNC allowed the FSSB to be opened. Or, the connection between the CNC and the amplifier in is incorrect.

- Checking the parameter settings
Check that the FSSB-related parameters are set correctly.

- Power supplies of the servo amplifiers
Check the power supplies of the servo amplifiers connected to the FSSB.

- Replacing the axis cards, optical cables, and servo amplifiers
Replace the axis cards on the CNC.
Replace the optical cables and servo amplifiers connected to the FSSB, one at a time, to identify the defective item.

10.21 ALARM SV5136 (FSSB: NUMBER OF AMPS IS SMALL)

Causes and Countermeasures

The number of servo amplifiers recognized by the FSSB is insufficient, compared with the number of controlled axes.

- FSSB setting screen
If this alarm is issued, display the amplifier setting screen from the FSSB setting screen. Only the servo amplifiers recognized on the FSSB are displayed.

- Optical cable or servo amplifier
The optical cable that connects together the last recognized amplifier and the next one may be defective. Or, either of the amplifiers connected together with that optical cable may be defective. Check the power supplies of the amplifiers.

- Power fault of a servo amplifier
This alarm may be issued if a power fault occurs in a servo amplifier. A power fault occurs if the amplifier control power supply voltage drops, if the +5 V conductor of the Pulsecoder cable is ground, or for other reasons.

- Axis cards
The axis cards installed on the CNC may be defective.

10.22 SERVO ALARMS (SV04**, SV06**)

For an explanation of the following servo alarms, refer to the FANUC AC SERVO MOTOR α*i* series, AC SPINDLE MOTOR α*i* series, SERVO AMPLIFIER α*i* series Maintenance Manual (B-65285EN).

Number	Message	Description
SV0417	ILL DGTL SERVO PARAMETER	A digital serve parameter setting is incorrect. [When bit 4 of diagnosis information No. 203 is 1.] An illegal parameter was detected by the servo software. Identify the cause with reference to diagnosis information No. 352. [When bit 4 of diagnosis information No. 203 is 0.] The CNC software detected an illegal parameter. Probable causes are given below (see diagnosis information No. 280). 1) The value specified in parameter No. 2020 as the motor model falls outside the specified range. 2) The motor rotation direction in parameter No. 2022 is not set to a correct value (111 or -111). 3) The speed feedback pulse count per motor rotation in parameter No. 2023 is set to a negative or other incorrect value. 4) The position feedback pulse count per motor rotation in parameter No. 2024 is set to a negative or other incorrect value.
SV0420	SYNC TORQUE EXCESS	In feed axis control , for synchronization, the difference value of torque between a master and slave axes exceeded the parameter (No. 2031) setting value. This alarm occurs for a master axis.
SV0421	EXCESS ERROR(SEMI-FULL)	The difference between the feedback from the semi and full sides exceeded the setting of parameter No.1729.
SV0422	EXCESS VELOCITY IN TORQUE	In torque control, the commanded permissible velocity was exceeded.
SV0423	EXCESS ERROR IN TORQUE	In torque control, the total permissible move value specified as a parameter was exceeded.
SV0430	SV MOTOR OVERHEAT	The servo motor has overheated.
SV0431	CNV. OVERLOAD	Power Supply (PS) : Overheat Servo Amplifier : Overheat
SV0432	CNV. LOW VOLT CONTROL	Power Supply (PS) : The control power supply voltage has dropped. Servo Amplifier : The control power supply voltage has dropped.
SV0433	CNV. LOW VOLT DC LINK	Power Supply (PS) : Low DC link voltage Servo Amplifier : Low DC link voltage
SV0434	INV. LOW VOLT CONTROL	Servo Amplifier : Low control power voltage
SV0435	INV. LOW VOLT DC LINK	Servo Amplifier : Low DC link voltage
SV0436	SOFTTHERMAL(OVC)	The digital servo software detected a software thermal (OVC).
SV0437	CNV. OVERCURRENT POWER	Power Supply (PS) : Overcurrent on input circuit section.
SV0438	INV. ABNORMAL CURRENT	Servo Amplifier : Motor overcurrent
SV0439	CNV. OVER VOLT DC LINK	Power Supply (PS) : The DC link voltage is too high. Servo Amplifier : The DC link voltage is too high.
SV0440	CNV. EX DECELERATION POW.	Power Supply (PS) : Excessive generative discharge Servo Amplifier : Excessive generative discharge, or abnormal error in generative power circuit
SV0441	ABNORMAL CURRENT OFFSET	The digital servo software detected an abnormality in the motor current detection circuit.
SV0442	CNV. CHARGE FAILURE	Power Supply (PS) : The spare charge circuit for the DC link is abnormal.
SV0443	CNV. COOLING FAN FAILURE	Power Supply (PS) : Internal cooling fan failure. Servo Amplifier : Internal cooling fan failure.
SV0444	INV. COOLING FAN FAILURE	Servo Amplifier : Internal cooling fan failure.

Number	Message	Description
SV0445	SOFT DISCONNECT ALARM	The digital servo software detected a disconnected Pulsecoder.
SV0446	HARD DISCONNECT ALARM	The hardware detected a disconnected built–in Pulsecoder.
SV0447	HARD DISCONNECT(EXT)	The hardware detected a disconnected separate detector.
SV0448	UNMATCHED FEEDBACK ALARM	The sign of the feedback signal from the standalone detector is opposite to that from the feedback signal from the built–on Pulsecoder.
SV0449	INV. IPM ALARM	Servo Amplifier　　　：The IPM (Intelligent Power Module) detected an alarm.
SV0453	SPC SOFT DISCONNECT ALARM	Software disconnection alarm of the α Pulsecoder. Turn off the power to the CNC, then remove and insert the Pulsecoder cable. If this alarm is issued again, replace the Pulsecoder.
SV0454	ILLEGAL ROTOR POS DETECT	The magnetic pole detection function terminated abnormally. The magnetic pole could not be detected because the motor did not run.
SV0456	ILLEGAL CURRENT LOOP	An attempt was made to set the current loop that could not be set. The amplifier pulse module in use does not comply with HIGH SPEED HRV. Or, requirements to control are not satisfied in the system.
SV0458	CURRENT LOOP ERROR	The specified current loop differs from the actual current loop.
SV0459	HI HRV SETTING ERROR	For two axes whose servo axis numbers (parameter No. 1023) are consecutively even and odd numbers, HIGH SPEED HRV control is possible for one axis and impossible for the other.
SV0460	FSSB DISCONNECT	The FSSB connection was discontinued. Probable causes are: 1) The FSSB connection cable was disconnected or broken. 2) The amplifier was turned off . 3) In the amplifier, the low-voltage alarm occurred.
SV0462	SEND CNC DATA FAILED	The correct data could not be received on a slave side because of the FSSB communication error.
SV0463	SEND SLAVE DATA FAILED	The correct data could not be received in the servo software side because of the FSSB communication error.
SV0465	READ ID DATA FAILED	A read of the ID information for the amplifier has failed at power-on.
SV0466	MOTOR/AMP. COMBINATION	The maximum current of an amplifier is different to that of a motor. Probable causes are: 1) The connection command for an amplifier is incorrect. 2) The parameter (No.2165) setting is incorrect
SV0468	HI HRV SETTING ERROR(AMP)	An attempt was made to set up HIGH SPEED HRV control for use when the controlled axis of an amplifier for which HIGH SPEED HRV control could not be used.
SV0600	INV. DC LINK OVER CURRENT	DC link overcurrent.
SV0601	INV. RADIATOR FAN FAILURE	External radiator cooling fan failure.
SV0602	INV. OVERHEAT	The servo motor has overheated.
SV0603	INV. IPM ALARM(OH)	The IPM (Intelligent Power Module) detected an overheat alarm.
SV0604	AMP. COMMUNICATION ERROR	The communication between Servo amplifier and Power Supply (PS) is in error.
SV0605	CNV. EX. DISCHARGE POW.	Power Supply (PS)：The motor regenerative power is too much.
SV0606	CNV. RADIATOR FAN FAILURE	Power Supply (PS)：External radiator cooling fan failure.
SV0607	CNV. SINGLE PHASE FAILURE	Power Supply (PS)：The input power supply has a missing phase.

If the hardware on the CNC is suspected to be defective as a result of examination, replace the axis cards.

10.23 SPC ALARMS (SV03**)

For an explanation of the following SPC alarms (serial Pulsecoder alarms), refer to the FANUC AC SERVO MOTOR α*i* series, AC SPINDLE MOTOR α*i* series, SERVO AMPLIFIER α*i* series Maintenance Manual (B-65285EN).

Number	Message	Description
SV0360	ABNORMAL CHECKSUM(INT)	The checksum alarm occurred on the built–in Pulsecoder.
SV0361	ABNORMAL PHASE DATA(INT)	The phase data abnormal alarm occurred on the built–in Pulsecoder.
SV0362	ABNORMAL REV. DATA(INT)	The speed count abnormal alarm occurred on the built-in Pulsecoder.
SV0363	ABNORMAL CLOCK(INT)	The clock alarm occurred on the built–in Pulsecoder.
SV0364	SOFT PHASE ALARM(INT)	A digital servo soft detected an abnormality on the built in Pulsecoder.
SV0365	BROKEN LED(INT)	The digital servo software detected abnormal data on the built–in Pulsecoder.
SV0366	PULSE MISS(INT)	A pulse error occurred on the built–in Pulsecoder.
SV0367	COUNT MISS(INT)	A count error occurred on the built–in Pulsecoder.
SV0368	SERIAL DATA ERROR(INT)	The communications data could not be received from the built–in Pulsecoder.
SV0369	DATA TRANS. ERROR(INT)	A CRC error or stop bit error occurred in the communications data from the built–in Pulsecoder.
SV0380	BROKEN LED(EXT)	Separate detector error
SV0381	ABNORMAL PHASE (EXT)	An abnormal alarm in the position data occurred on the separate detector.
SV0382	COUNT MISS(EXT)	A count error occurred on the separate detector.
SV0383	PULSE MISS(EXT)	A pulse error occurred on the separate detector.
SV0384	SOFT PHASE ALARM(EXT)	The digital servo software detected abnormal data on the separate detector.
SV0385	SERIAL DATA ERROR(EXT)	The communications data could not be received from the separate detector.
SV0386	DATA TRANS. ERROR(EXT)	A CRC error or stop bit error occurred in the communications data from the standalone detector.
SV0387	ABNORMAL ENCODER(EXT)	An abnormality occurred on a separate detector. For more information, contact the scale manufacturer.

10.24 SPINDLE ALARMS (SP90**)

For an explanation of the following spindle alarms, refer to the FANUC AC SERVO MOTOR α*i* series, AC SPINDLE MOTOR α*i* series, SERVO AMPLIFIER α*i* series Maintenance Manual (B-65285EN).

Number	Contents
SP9001 to later: Spindle_n	n-th spindle alarm (Spindle alarm display 01 or larger)

10.25 SYSTEM ALARMS (SYS ALM***)

10.25.1 Overview

The CNC makes a transition to the special processing state called the system alarm state when a state that disables the continuation of normal system operation is detected.

When the system alarm state is entered, the CNC screen display is switched and the following operations are performed:

- Servo and spindle amplifier excitation is turned off.
- Disconnection of I/O link communication

Example of system alarm screen

Types of System Alarms

System alarms are classified into three types according to the following causes:

- Software causes
- Hardware causes
- Others

- Software causes

Mainly, the CNC system software detects software errors.

Typical causes are as follows:

- Conflict in processing/data detected by the internal state monitoring software
- Access to outside of the valid data/instruction ranges
- Division by zero
- Stack overflow
- Stack underflow
- DRAM checksum error

- Hardware causes

Mainly, hardware detects hardware errors.

Typical causes are as follows:

- Parity error (DRAM, SRAM, cache)
- Bus error
- Power supply alarm
- FSSB cable disconnection

- Others

Moreover, system alarms are caused by the following:

- Causes detected by peripheral software
- Servo software (such as watchdog)

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- PMC software (such as an I/O link communication error)

10.25.2 Operations on the System Alarm Screen

Description of system alarm screen

When a system alarm is issued, the screen display is switched to a screen as shown below.
This screen is referred to as the system alarm screen.

The system alarm screen consists of several pages of information.
The following key operations are used:
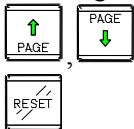
  Switches between pages.

  Executes the IPL monitor.

Saving of system alarm information

Various information items related to a system alarm are automatically saved in the SRAM.
The SRAM can store information about the latest two system alarms.
If a third system alarm is issued when information about the latest two system alarms is stored, the information about the oldest system alarm is discarded, and information about the new system alarm is saved.

Output of system alarm information

The system alarm information, which was automatically saved in the SRAM, can be output to a memory card with the IPL monitor.

1. Start the IPL monitor.
    If the system alarm screen is displayed when a system alarm is issued, press the reset key.
    If the power is turned off, turn on the power while holding down "-" and ".".

2. On the IPL monitor screen, enter 5 to select "5. SYSTEM ALARM UTILITY".

```
D4F1-06.0
COPYRIGHT FANUC LTD 2008
IPL MENU
  0. END IPL
  1. DUMP MEMORY
  4. MEMORY CARD UTILITY
  5. SYSTEM ALARM UTILITY
  6. FILE SRAM CHECK UTILITY
  7. MACRO COMPILER UTILITY
  8. SYSTEM SETTING UTILITY
 10. DUMP SP
? 5
```

3.   Enter 2 to select "2. OUTPUT SYSTEM ALARM FILE".

```
D4F1-06.0
COPYRIGHT FANUC LTD 2008
SYSTEM ALARM UTILITY MENU
  0. END
  1. DISPLAY SYSTEM ALARM
  2. OUTPUT SYSTEM ALARM FILE
? 2
```

4.   If the IPL monitor is executed on the system alarm screen, enter 2 to select "2. OUTPUT SYSTEM ALARM FILE FROM DRAM".
     If the power is turned off, enter 1 to select "1. OUTPUT SYSTEM ALARM FILE FROM FILE-RAM".

```
D4F1-06.0
COPYRIGHT FANUC LTD 2008
CHECK SYSTEM LABEL : END
OUTPUT SYSTEM ALARM FILE MENU
 0. END
 1. OUTPUT SYSTEM ALARM FILE FROM FILE-RAM
 2. OUTPUT SYSTEM ALARM FILE FROM DRAM
 ?
```

5. If 1 is selected in step 4, a list of saved system alarms is displayed.   Enter the number of a file to be output.

```
D4F1-06.0
COPYRIGHT FANUC LTD 2008
CHECK SYSTEM LABEL : END
OUTPUT SYSTEM ALARM FILE MENU
 0. END
 1. OUTPUT SYSTEM ALARM FILE FROM FILE-RAM
 2. OUTPUT SYSTEM ALARM FILE FROM DRAM
 ? 1

SYSTEM ALARM FILE INFORMATION
 0. END
 1. SYS_ALM103 DRAM SUM ERROR
    ERROR OCCURRED AT 2009/03/05 14:44:01
 2. SYS_ALM103 DRAM SUM ERROR
    ERROR OCCURRED AT 2009/03/05 14:48:07
 ? 1
```

6.   Enter the name of a file to be output to the memory card and output the file.

```
D4F1-06.0
COPYRIGHT FANUC LTD 2008
CHECK SYSTEM LABEL : END
OUTPUT SYSTEM ALARM FILE MENU
 0. END
 1. OUTPUT SYSTEM ALARM FILE FROM FILE-RAM
 2. OUTPUT SYSTEM ALARM FILE FROM DRAM
 ? 1

SYSTEM ALARM FILE INFORMATION
 0. END
 1. SYS_ALM103 DRAM SUM ERROR
    ERROR OCCURRED AT 2009/03/05 14:44:01
 2. SYS_ALM103 DRAM SUM ERROR
    ERROR OCCURRED AT 2009/03/05 14:48:07
 ? 1

MEM_CARD FILE NAME ? SYS_ALM1.TXT
OUTPUT FILE OK ? (NO=0,YES=1)
```

10.25.3 System Alarms Detected by Hardware

System alarm 400 and subsequent system alarms indicate errors detected by hardware.
The basic screen configuration is shown below:

```
(1) D4F1-01.0
(2) SYS_ALM401 EXTERNAL BUS INVALID ADDRESS
(3) MAIN BOARD
(4) 2008/04/22 17:09:53

(5) PROGRAM COUNTER : 1000B52CH
 │  ACT TASK        : 01000010H
 │  ACCESS ADDRESS  :     -
 │  ACCESS DATA     :     -
 ↓  ACCESS OPERATION :     -


(6) BUS MASTER PCB  : ETC
 │    +--+----------+-------------------------------------------------+
 │     02 ETC        03012003 22110000 80010000 00000000 00010000 00000000
 │                   FFFFFFFF FFFFFFFF 68C08216 70FE0000 00000000 00000000
 │                   00000000 00000000 00000000 00000000 00000000
 │
 │   BUS SLAVE PCB   : CPU
 │    +--+----------+-------------------------------------------------+
 │     00 CPU        02071004 20100000 00000000 00000000 00000000 00000000
 │                   FFFFFFFF FFFFFFFF 10B0FC00 CFF90001 68C30061 82160010
 │                   000000F0 00000000 00010000 00000000 00000000
 │
 │   INFORMATION REGISTER
 │    +--+----------+-------------------------------------------------+
 ↓    02 ETC        00000000 00000000 00000000 00000000

                                      PAGE UP OR DOWN (PAGE  1/8)
```

[Description of the message screen]
(1):   Device name, and series and edition of CNC system software
(2):   System alarm number and error message
(3):   Most possibly faulty component
(4):   Date and time when the error occurred

(5):   Software error and other information when the error occurred
(6):   Bus information when the error occurred

Item (3) indicates the most possibly faulty component.   Mainly, check the
component to see whether it is defective.

Information on the system alarm screen can be output as a text file through the PCMCIA port of the
display unit.   Contact the FANUC service department after obtaining the information.
For the method of outputting it, see Section 10.25.2, "Operations on the System Alarm Screen".
Main errors are described on the following pages.

System Alarm 401 (EXTERNAL BUS INVALID ADDRESS)

```
D4F1 - 01.0
SYS_ALM401 EXTERNAL BUS INVALID ADDRESS
MAIN BOARD
2008/04/21 20:34:16

PROGRAM COUNTER : 1000B52CH
ACT TASK        : 01000010H
ACCESS ADDRESS  :     -
ACCESS DATA     :     -
ACCESS OPERATION:     -


BUS MASTER PCB  : ETC
  +--+---------+-----------------------------------------------------+
   02 ETC        03012003 22110000 80010000 00000000 00010000 00000000
                 FFFFFFFF FFFFFFFF 68C08216 70FE0000 00000000 00000000
                 00000000 00000000 00000000 00000000 00000000

BUS SLAVE PCB   : CPU
  +--+---------+-----------------------------------------------------+
   00 CPU        02071004 20100000 00000000 00000000 00000000 00000000
                 FFFFFFFF FFFFFFFF 10B0FC00 CFF90001 68C30061 82160010
                 000000F0 00000000 00010000 00000000 00000000

INFORMATION REGISTER
  +--+---------+-----------------------------------------------------+
   02 ETC        00000000 00000000 00000000 00000000

                                    PAGE UP OR DOWN (PAGE  1/8)
```

Description
A problem occurred on a CNC bus.

Causes
The printed circuit board may be defective or external noise may affect the bus.

Countermeasures
Replace the displayed most possibly faulty component.   In addition, the main board, or the part shown as
"BUS MASTER PCB" or "BUS SLAVE PCB" displayed on the system alarm screen may be defective.
This error may also be caused by external noise.
Check whether there is a noise origin around the machine and whether the machine is grounded properly.

System Alarm 403 (S-BUS TIME OUT ERROR)

```
D4F1‒01.0
SYS_ALM403 S-BUS TIME OUT ERROR
MAIN BOARD
2008/04/21 21:24:12

PROGRAM COUNTER : 102FD028H
ACT TASK        : 01000010H
ACCESS ADDRESS  :      -
ACCESS DATA     :      -
ACCESS OPERATION:      -


BUS MASTER PCB  : CPU
  +--+----------+----------------------------------------------------+
  00 CPU        02071004 20100000 00000000 00000000 00040000 00000000
                FFFFFFFF FFFFFFFF 00A88820 C3F90000 00000000 00000000
                00000000 00000000 00000000 00000000 00000000

BUS SLAVE PCB   : ETC
  +--+----------+----------------------------------------------------+
  02 ETC        03012003 22110000 A0000000 00000000 00000000 00000000
                FFFFFFFF FFFFFFFF 00A88820 C3010000 00000000 00000000
                00000000 00000000 00000000 00000000 00000000

INFORMATION REGISTER
  +--+----------+----------------------------------------------------+
  02 ETC        00000000 00000000 00000000 00000000

                                    PAGE UP OR DOWN (PAGE  1/8)
```

Description
A problem occurred on a CNC bus.

Causes
The printed circuit board may be defective.

Countermeasures
Replace the displayed most possibly faulty component.   In addition, the main board, or the part shown as "BUS MASTER PCB" or "BUS SLAVE PCB" displayed on the system alarm screen may be defective.

System Alarm 404 (ECC UNCORRECTABLE ERROR)

```
D4F1‐01.0
SYS_ALM404 ECC UNCORRECTABLE ERROR
MAIN BOARD
2008/04/22 17:09:53

PROGRAM COUNTER : 100DB2E0H
ACT TASK        : 0100FFFBH
ACCESS ADDRESS  :      -
ACCESS DATA     :      -
ACCESS OPERATION:      -


BUS MASTER PCB  : ETC
  +--+---------+-------------------------------------------------+
   02 ETC        03012003 22110000 80010000 00000000 00080000 00000000
                 FFFFFFFF FFFFFFFF 68C08216 70FE0000 00000000 00000000
                 00000000 00000000 00000000 00000000 00000000

BUS SLAVE PCB   : CPU
  +--+---------+-------------------------------------------------+
   00 CPU        02071004 20100000 00000000 00000000 00000000 00000000
                 FFFFFFFF FFFFFFFF 10B0FC00 CFF90001 68C30061 82160010
                 000000F0 00000000 00010000 00000000 00000000

INFORMATION REGISTER
  +--+---------+-------------------------------------------------+
   02 ETC        00000000 00000000 00000000 00000000

                                  PAGE UP OR DOWN (PAGE  1/8)
```

Description
A problem occurred on a CNC bus.

Causes
The printed circuit board may be defective or external noise may affect the bus.

Countermeasures
Replace the displayed most possibly faulty component.
This error may also be caused by external noise.
Check whether there is a noise origin around the machine and whether the machine is grounded properly.

System Alarm 500 (SRAM DATA ERROR(SRAM MODULE))

```
D4F01-1.0
SYS_ALM500 SRAM DATA ERROR(SRAM MODULE)
FROM/SRAM MODULE
2008/04/21 21:26:52

PROGRAM COUNTER : 1000C0C4H
ACT TASK       : 30000001H
ACCESS ADDRESS :      -
ACCESS DATA    :      -
ACCESS OPERATION:     -


BUS MASTER PCB  : ETC
  +--+---------+------------------------------------------------+
   02 ETC       03012003 22110000 A0000000 00000000 00002000 00000000
                FFFFFFFF FFFFFFFF 822088A3 C3FE0001 00000000 00000000
                00000000 00000000 00000000 00000000 00000000

BUS SLAVE PCB   : ETC
  +--+---------+------------------------------------------------+
   02 ETC       03012003 22110000 A0000000 00000000 00004000 00000000
                FFFFFFFF FFFFFFFF 822088A3 C3FE0001 00000000 00000000
                00000000 00000000 00000000 00000000 00000000

INFORMATION REGISTER
  +--+---------+------------------------------------------------+
   02 ETC       00000000 00000000 00000000 00000000
                                  PAGE UP OR DOWN (PAGE  1/8)
```

Description
Data could not be transferred to the SRAM on the FROM/SRAM module normally.

Causes
The module may be defective or the connector may not be connected securely.

Countermeasures
First, act SRAM all clear operation or restore SRAM backup data, and confirm this alarm will be dissolved. If this alarm is dissolved with this operation, a temporary destruction of SRAM data is supposable cause.
If this alarm does not dissolve by above operation, replace the FROM/SRAM module.
If the machine does not recover after replacement of FROM/SRAM module, replace the main board.

System Alarm 502 (NOISE ON POWER SUPPLY)

```
D4F1‒01.0
SYS_ALM502 NOISE ON POWER SUPLY
POWER SUPPLY
2008/04/21 21:26:52

PROGRAM COUNTER : 1000C0C4H
ACT TASK        : 30000001H
ACCESS ADDRESS  :     -
ACCESS DATA     :     -
ACCESS OPERATION:     -


BUS MASTER PCB  : ETC
  +--+----------+--------------------------------------------------+
   02 ETC        03012003 22110000 A0000000 00000000 00001000 00000000
                 FFFFFFFF FFFFFFFF 822088A3 C3FE0001 00000000 00000000
                 00000000 00000000 00000000 00000000 00000000

BUS SLAVE PCB   : ETC
  +--+----------+--------------------------------------------------+
   02 ETC        03012003 22110000 A0000000 00000000 00004000 00000000
                 FFFFFFFF FFFFFFFF 822088A3 C3FE0001 00000000 00000000
                 00000000 00000000 00000000 00000000 00000000

INFORMATION REGISTER
  +--+----------+--------------------------------------------------+
   02 ETC        00000000 00000000 00000000 00000000

                                       PAGE UP OR DOWN (PAGE  1/8)
```

Description
Noise or an instantaneous power failure occurred in the CNC power supply.

Causes
A power fault occurs.

Countermeasures
Find and remove the cause of the error.
This error may damage SRAM data.

System Alarm 503 (ABNORMAL POWER SUPPLY)

```
D4F1 - 01.0
SYS_ALM503 NOISE ON POWER SUPLY
ABNORMAL POWER SUPPLY
2008/04/21 21:26:52

PROGRAM COUNTER : 1000C0C4H
ACT TASK        : 30000001H
ACCESS ADDRESS  :     -
ACCESS DATA     :     -
ACCESS OPERATION:     -


BUS MASTER PCB  : ETC
  +--+---------+-------------------------------------------------------+
  02 ETC        03012003 22110000 A0000000 00000000 00001000 00000000
                FFFFFFFF FFFFFFFF 822088A3 C3FE0001 00000000 00000000
                00000000 00000000 00000000 00000000 00000000

BUS SLAVE PCB   : ETC
  +--+---------+-------------------------------------------------------+
  02 ETC        03012003 22110000 A0000000 00000000 00004000 00000000
                FFFFFFFF FFFFFFFF 822088A3 C3FE0001 00000000 00000000
                00000000 00000000 00000000 00000000 00000000

INFORMATION REGISTER
  +--+---------+-------------------------------------------------------+
  02 ETC        00000000 00000000 00000000 00000000

                                   PAGE UP OR DOWN (PAGE  1/8)
```

Description
A fault occurred in the power supply on the main board.

Causes
The power supply is defective.

Countermeasures
Replace the power supply.

10.25.4 System Alarms 114 to 137 (Alarms on the FSSB)

Causes
An alarm was detected on the FSSB.

NOTE
When the message is followed by /LINE1, it indicates the number (COP10A-1) of the optical connector on the axis card.

SYS_ALM114 FSSB DISCONNECTION (MAIN -> AMP1) /LINE1 SYS_ALM115 FSSB DISCONNECTION (MAIN -> PULSE MODULE1) /LINE1 SYS_ALM116 FSSB DISCONNECTION (AMPn -> AMPm) /LINE1 SYS_ALM117 FSSB DISCONNECTION (AMPn -> PULSE MODULEm) /LINE1 SYS_ALM118 FSSB DISCONNECTION (PULSE MODULEn -> AMPm) /LINE1 SYS_ALM119 FSSB DISCONNECTION (PULSE MODULE1 -> PULSE MODULE2) /LINE1 SYS_ALM120 FSSB DISCONNECTION (MAIN <- AMP1) /LINE1 SYS_ALM121 FSSB DISCONNECTION (MAIN <- PULSE MODULE1) /LINE1 SYS_ALM122 FSSB DISCONNECTION (AMPn <- AMPm) /LINE1 SYS_ALM123 FSSB DISCONNECTION (AMPn <- PULSE MODULEm) /LINE1 SYS_ALM124 FSSB DISCONNECTION (PULSE MODULEn <- AMPm) /LINE1 SYS_ALM125 FSSB DISCONNECTION (PULSE MODULE1 <- PULSE MODULE2) /LINE1	114: Communication between the axis card and 1st servo amplifier failed. 115: Communication between the axis card and 1st separate detector interface unit failed. 116: Communication between the nth and mth servo amplifiers failed. 117: Communication between the nth servo amplifier and mth separate detector interface unit failed. 118: Communication between the nth separate detector interface unit and mth servo amplifier failed. 119: Communication between the 1st and 2nd separate detector interface units failed. 120: Communication between the axis card and 1st servo amplifier failed. 121: Communication between the axis card and 1st separate detector interface unit failed. 122: Communication between the nth and mth servo amplifiers failed. 123: Communication between the nth servo amplifier and mth separate detector interface unit failed. 124: Communication between the nth separate detector interface unit and mth servo amplifier failed. 125: Communication between the 1st and 2nd separate detector interface units failed. Replace the optical cable for the relevant connection. If the alarm persists, replace the axis card, corresponding servo amplifier, and corresponding separate detector interface unit. When the arrow points to the left, a power fault may occur in the servo amplifier or separate detector interface unit at the base of the arrow. Check the +24 V power supply input to the relevant unit and the +5 V power supply for the pulse coder output from the relevant unit for an error such as a ground fault.
SYS_ALM126 FSSB INTERNAL DISCONNECTION (AMPn) -> /LINE1 SYS_ALM127 FSSB INTERNAL DISCONNECTION (AMPn) <- /LINE1	126: Internal communication in the nth servo amplifier failed. 127: Internal communication in the nth servo amplifier failed. Replace the relevant servo amplifier.
SYS_ALM129 ABNORMAL POWER SUPPLY (SERVO:AMPn) /LINE1 SYS_ALM130 ABNORMAL POWER SUPPLY (SERVO:PULSE MODULEn) /LINE1	129: A fault was detected in the power supply of the nth servo amplifier. 130: A fault was detected in the power supply of the nth separate detector interface unit. Check the power supply of the relevant servo amplifier or separate detector interface unit.

SYS_ALM134 FSSB LINE DATA ERROR
    (AMPn) > .. > MAIN /LINE1
SYS_ALM135 FSSB LINE DATA ERROR
    (PULSE MODULEn) > .. > MAIN /LINE1
	134: A data error occurred on the FSSB line and the nth servo amplifier received abnormal data.
	135: A data error occurred on the FSSB line and the nth separate detector interface unit received abnormal data.
	
	Replace the relevant servo amplifier or separate detector interface unit. If the machine does not recover from the error after replacement, also replace the slave preceding the relevant slave. If the error still occurs, replace the servo card.

SYS_ALM136 FSSB SEND SLAVE DATA FAILED
    (AMPn -> MAIN)
SYS_ALM137 FSSB SEND CNC DATA FAILED
    (AMPn <- MAIN)
	136 : The correct data could not be received in the servo software because of an FSSB communication error.
	137 : The correct data could not be received on a slave side because of an FSSB communication error.
	
	Replace the relevant servo amplifier or separate detector interface unit. If the machine does not recover from the error after replacement, also replace the slave preceding the relevant slave. If the error still occurs, replace the servo card.

10.26   SYSTEM ALARMS RELATED TO THE PMC AND I/O Link (SYS_ALM197)

If system alarm 197 is issued, the cause may be an error related to the PMC or I/O Link.   Possible causes include an I/O link communication error and a fault in the PMC control circuit.

For details, see alarm number "PCxxx" on line 3 of the system alarm screen and then the PC alarm number table later.

```
D4F1 - 01.0
SYS_ALM197 EMBEDDED SOFTWARE SYSTEM ERROR
PC050 IOLINK ER1 CH1:GR00:03
2008/06/06 14:06:06
PROGRAM COUNTER : 1000EF2CH
ACT TASK        : 10000001H
ACCESS ADDRESS  :    -          +-----------------------------+
ACCESS DATA     :    -          |  Check this number.         |
ACCESS OPERATION :   -          +-----------------------------+


        +------------------------------------------------------------+
        +  THE SYSTEM ALARM HAS OCCURRED, THE SYSTEM HAS STOPPED.    +
        +------------------------------------------------------------+




                                      PAGE UP OR DOWN (PAGE  1/8)
```

Page 1 of the system alarm screen

```
D4F1 - 1.0
SYS_ALM197 EMBEDDED SOFTWARE SYSTEM ERROR
CPU CARD
2008/04/21 21:26:52

EMBEDDED SOFTWARE SYSTEM ERROR:(40B0-0001)
    PCxxx xxxxxxxxxxxxxxxxxxxxxxxxxxx
```

Check this number.

```
                                     PAGE UP OR DOWN (PAGE  2/8)
```

Page 2 of the system alarm screen

Alarm number	Contents	Faulty location/corrective action
PC004 CPU ERR xxxxxxxx:yyyyyyyy PC006 CPU ERR xxxxxxxx:yyyyyyyy PC009 CPU ERR xxxxxxxx:yyyyyyyy PC010 CPU ERR xxxxxxxx:yyyyyyyy PC012 CPU ERR xxxxxxxx:yyyyyyyy	A CPU error occurred in the PMC system. xxxxxxxx and yyyyyyyy are internal error codes.	This alarm may be due to a software/hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.
PC030 RAM PARI xxxxxxxx:yyyyyyyy	A RAM parity error occurred in the PMC system. xxxxxxxx and yyyyyyyy are internal error codes.	This alarm may be due to a hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.

Alarm number	Contents	Faulty location/corrective action
PC050 IOLINK ER1 CHz:GRyy:xx	A communication error occurred in I/O Link. The symbol z indicates a channel number (1 to 3). The symbol yy indicates the group number (0 to 15) of the slave unit in which a problem may be caused. The symbol xx indicates an internal error code. This alarm is issued if communication with the slave unit of channel number z and group number yy is interrupted. The interruption may be caused by: (1) Instantaneous power interruption, a change in voltage, or a defective power cable in the slave unit (2) Defective communication cable or poor contact (3) Failure in the slave unit Group number yy indicated in this alarm may be incorrect depending on the state in which the alarm occurred, so the defective position may not always be identified.	(1) Check whether instantaneous power interruption or changes in voltage occurred in the slave unit of group number yy (0 to 15) connected to the I/O link line of channel number z (1 to 3). (2) Check whether there is no failure or no poor contact on the cable between JD1A of group number yy-1 (0 to 15) and JD1B of group number yy (0 to 15), which are connected to the I/O link line of channel number z (1 to 3). (3) Check whether the slave unit of group number yy (0 to 15) connected to the I/O Link line of channel number z (1 to 3) is not defective.

Alarm number	Contents	Faulty location/corrective action
PC051 IOLINK ER2 CHz:yy:xx:ww:vv	A communication error occurred in I/O Link. A communication error occurred on channel z of I/O Link. Symbol z indicates a channel number (1 to 3). Symbols yy, xx, ww, and vv are internal error codes. This alarm is issued by various factors related to I/O Link. The cause of the communication error needs to be considered in view of this message and other situations. Therefore, please notify FANUC of the situation in which the error occurred (such as the displayed message, system configuration, operation, occurrence timing, and frequency of occurrence) and the internal error code displayed.	(1) When using the I/O Unit-MODEL A, even though the base expansion has been allocated, no base is not connected. Check whether the units actually connected follow the I/O Link allocation. (2) When the Power Mate or Servo Motor b series I/O Link option was connected as an I/O slave unit, check whether a system alarm occurred first in any of these units. (3) Check whether noise is generated on the communication line. Check the grounding state of I/O Link slave units and the shielding state of connected cables. (4) Check whether the DO output of I/O units is not short-circuited. (5) Check whether instantaneous power interruption or changes in voltage occurred in the power for I/O Link master and slave units. (6) Check that there is no failure in cable connection. (7) Check that there is no defect in cables. (8) Check that the ground terminals of I/O units and the shield wires of communication cables are properly grounded. (9) Replace the I/O Link slave units. (10) Replace the PMC module.] (For information on noise and grounding, refer to the antinoise measure chapter in the Connection Manual (Hardware) (B-64303EN).
PC060 BUS xxxxxxxx:yyyyyyyy	A bus error occurred in the PMC system.	This alarm may be due to a software/hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.
PC070 LADDER SPE (PMCn)	A stack error occurred with the SPE functional instruction of the ladder program of n path.	Check the correspondence between the CALL or CALLU instruction and the SPE instruction.
PC097 LADDER PARITY ERR(PMCn) PC098 CODE PARITY ERR	A RAM check error occurred.	This alarm may be due to a hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.).

Alarm number	Contents	Faulty location/corrective action
PC501 NC/PMC INTERFACE ERR PATHn	The read or write operation between CNC and PMC failed.	Contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.).
PC502 LADDER SUBaaa (PMCn)	The sequence program uses the SUBaaa functional instruction that is not supported in PMCn.	Correct the sequence program so that the SUBaaa functional instruction will not be used.

11 MOTOR/DETECTOR/AMPLIFIER PREVENTIVE MAINTENANCE

This chapter contains the basic information about the preventive maintenance of motors, detectors, and amplifiers.

11.1   LIST OF MANUALS RELATED TO MOTORS AND AMPLIFIERS

Details of individual motors and amplifiers are described in the manuals listed in the table below. Before performing periodic inspection or any other maintenance work, consult with the machine tool builder and, if necessary, obtain the latest version of the corresponding manual shown in the list. The information about the specifications of each device, such as the weight and winding resistance value, is given in the relevant "DESCRIPTIONS" manual.

Manual name	Type of manual	Specification number
FANUC AC SERVO MOTOR αi series	DESCRIPTIONS	B-65262EN
FANUC AC SERVO MOTOR βis series	DESCRIPTIONS	B-65302EN
FANUC SYNCHROUNOUS BUILT-IN SERVO MOTOR DiS series	DESCRIPTIONS	B-65332EN
FANUC LINEAR MOTOR LiS series	DESCRIPTIONS	B-65382EN
FANUC AC SPINDLE MOTOR αi series	DESCRIPTIONS	B-65272EN
FANUC AC SPINDLE MOTOR βi series	DESCRIPTIONS	B-65312EN
FANUC BUILT-IN SPINDLE MOTOR BiI series	DESCRIPTIONS	B-65292EN
FANUC SYNCHROUNOUS BUILT-IN SPINDLE MOTOR BiS series	DESCRIPTIONS	B-65342EN
FANUC - NSK SPINDLE UNIT series	DESCRIPTIONS	B-65352EN
FANUC SERVO AMPLIFIER αi series	DESCRIPTIONS	B-65282EN
FANUC SERVO AMPLIFIER βi series	DESCRIPTIONS	B-65322EN
FANUC AC SERVO MOTOR αi series FANUC AC SERVO MOTOR βi series FANUC LINEAR MOTOR LiS series FANUC SYNCHRONOUS BUILT-IN SERVO MOTOR DiS series	PARAMETER MANUAL	B-65270EN
FANUC AC SPINDLE MOTOR $\alpha i/\beta i$ series BUILT-IN SPINDLE MOTOR Bi series	PARAMETER MANUAL	B-65280EN
FANUC AC SERVO MOTOR $\alpha is/\alpha i$ series AC SPINDLE MOTOR αi series SERVO AMPLIFIER αi series	MAINTENANCE MANUAL	B-65285EN
FANUC AC SERVO MOTOR βis series AC SPINDLE MOTOR βi series SERVO AMPLIFIER βi series	MAINTENANCE MANUAL	B-65325EN
FANUC SERVO AMPLIFIER βi series	MAINTENANCE MANUAL	B-65395EN
FANUC SERVO GUIDE	OPERATOR'S MANUAL	B-65404EN
FANUC AC SERVO MOTOR $\alpha is/\alpha i/\beta is$ series	SERVO TUNING PROCEDURE (BASIC)	B-65264EN

11.2   PREVENTIVE MAINTENANCE OF MOTORS AND DETECTORS

11.2.1   Warnings, Cautions, and Notes on Preventive Maintenance of Motors and Detectors

This subsection contains the safety precautions for motor and detector preventive maintenance, which are classified into "warnings", "cautions", and "notes" according to their bearing on safety. Make sure that you understand and comply with these precautions when carrying out the maintenance work.

⚠ WARNING

- **Make sure that you are safely dressed and have a safe working environment when performing preventive maintenance for a motor.**
    - Be dressed safely, e.g. by wearing gloves and safety shoes, to protect against injury due to an edge or protrusion and electric shock.
    - Have the work done by more than one person, where possible, so that immediate action can be taken if an accident occurs when handling a motor.
    - A motor is heavy. When moving it, use a crane or other appropriate equipment to protect against injury. For information about the weight of the motor, refer to its DESCRIPTIONS manual (shown earlier).
    - Clothes or fingers can be caught in a rotating motor or come into contact with a moving part of it. Standing in the direction of motor rotation (direction of motion) can pose a risk of injury. Before rotating a motor, check that there is no object that is thrown away by motor rotation.

- **Be careful about electric shock, fire, and other accidents.**
    - Do not handle a motor with a wet hand.
    - To prevent electric shock, make sure that no conductive object, such as a terminal, is exposed when the motor is powered on.
    - Before touching a motor or any surrounding part, check that the power is shut off and take appropriate safety precautions.
    - High voltage remains across power line terminals of a motor even after the power is shut off (for at least five minutes). Do not touch a motor in such a condition or connect it to other equipment.
    - A loose or disconnected terminal, short-circuited terminals, or a terminal connected to the ground can cause overheating, spark, fire, or damage to the motor. Take appropriate precautions to prevent these accidents.
    - When placed near any inflammable object or material, a motor can be ignited, catch fire, or explode. Avoid placing it near such object or material.

- **Do not disassemble or modify a motor.**
    Motors such as linear motors, synchronous built-in servo motors, and synchronous built-in spindle motors contain very strong magnets. If electronic medical apparatus comes near, these motors can cause the apparatus to malfunction, potentially putting the user's life in danger. Also, disassembling or modifying a motor can cause a failure, regardless of the type of motor. Do not disassemble or modify a motor in any way not specified by FANUC.

⚠ **CAUTION**

- **Ensure that the specified cooling conditions are met.**
  If the specified cooling conditions are not met (the motor is insufficiently or excessively cooled), the motor can fail. Problems that can cause a motor failure, such as liquid piping clog, leakage, and fan motor trouble, should be eliminated through periodic inspection. Do not drive the motor when the cooling system is in an abnormal condition.

- **Do not change the system configuration.**
  Do not change the configuration of the system when it is running normally. Doing so can cause an accident or failure. If you disconnect a cable for maintenance or some other purpose, take an appropriate measure, such as putting a mark on it, to ensure you can restore the original state.

- **Use the tapped holes of a motor only to move the motor.**
  Do not use the tapped holes of a motor to lift or move any other object along with the motor. Doing so can damage the motor. Depending on the type of motor, the place and direction in which the motor can be lifted may be predetermined. For details, refer to the DESCRIPTIONS manual of the motor (shown earlier).

- **Do not touch a motor when it is running or immediately after it stops.**
  A motor may get hot when it is running. Do not touch the motor before it gets cool enough. Otherwise, you may get burned.

NOTE

- **Do not remove a nameplate from a motor.**
  The nameplate is used to identify the motor during maintenance work. If a nameplate comes off, be careful not to lose it.

- **Do not step or sit on a motor, and avoid applying shock to a motor.**
  Any of these acts can deform or break the motor or affect its component, crippling the normal motor operation. Do not put a motor on top of another motor.

- **Comply with the specified conditions when conducting an electric test (winding resistance test, insulation resistance test, etc.) for a motor or other device or supplying power.**
  - Conduct an electric test according to the specified method. Conducting such a test by any method that is not specified can damage the motor.
  - Do not conduct a dielectric strength test or insulation test for a Pulsecoder or other detector, or do not apply a commercial power source voltage. Doing so can destroy the internal elements.

- **Perform preventive maintenance (inspection of the external appearance, measurement of winding resistance, insulation resistance, etc.) and cleaning on a regular basis.**
  To use a motor safely throughout its entire service life, perform preventive maintenance and cleaning on a regular basis. Be careful, however, because excessively severe inspection (dielectric strength test, etc.) can damage its windings. For information about winding resistance values, refer to the DESCRIPTIONS manual of the motor (its specification number is shown in this manual). Information about insulation resistance is given later in this manual.

NOTE
- This manual is focused on the preventive maintenance work to be performed for a single FANUC motor or detector alone. The information contained herein may not apply depending on the type or configuration of the machine. When reading this manual, refer to the manual of the machine as well. If you have any questions or doubts, do not act on your own; please contact the machine tool builder or FANUC.
- For detailed information about a motor, see the manual list shown earlier and, if necessary, obtain the latest version of the corresponding manual.

11.2.2   Preventive Maintenance of a Motor (Common to All Models)

This subsection describes the common preventive maintenance items to be handled regardless of the model of the motor. For the items specific to a particular motor model, see one of the subsequent subsections that pertains to that particular motor model.

⚠ **CAUTION**
- The preventive maintenance method differs from machine to machine in many respects. Depending on the machine in use, it may be difficult for the user to perform periodic inspection or cleaning. If you are not sure about anything as to preventive maintenance, consult with the machine tool builder and ensure that you can perform periodic inspection and cleaning.
- The machine should be used within the scope of specification defined by the machine tool builder. Using the machine in any way that is outside the specified scope can reduce the motor's service life or cause a failure.

11.2.2.1   Main inspection items

The following table summarizes the main inspection items for a motor. If any of these items **is found to be abnormal, stop the use of the machine immediately and fix the abnormal part** by repairing or replacing it. At the same time, **identify and remove the cause and take a measure to prevent its recurrence**. If it is difficult to take a preventive measure or to prevent its recurrence, consult with the machine tool builder or FANUC.

Appearance of the motor	Crack or deformation	- Check the motor for any scar, crack, deformation, bulge, etc. - If the interior of the motor is visible or there is interference with a peripheral component, it is imperative to replace the motor or the peripheral component. - A light peel-off or scar of the surface may be repairable; consult with FANUC.
	Wet or dirty part	- If you find any wet or dirty part, clean it immediately. - A preventive measure is needed if the part in question remains wet continually due to cutting fluid or dew condensation.
Operating conditions	Temperature, humidity, etc.	- Comply with the operating conditions of the machine. For details of the operating conditions of a specific motor, refer to the corresponding DESCRIPTIONS manual. Generally, the ambient temperature should be 0°C to 40°C (or 30°C for a spindle unit) and dew condensation is not allowed. In a place subject to severe vibration, the components of the motor may be broken.

Connection state	Cable	- Check for any cable sheath damage, exposed conductor, damaged conduit or cable bearing, abnormal bending, loose terminal, etc. - If there is any trace of fluid flowing, the fluid may have entered the inside of the motor or connector. It is necessary to make a check and take a measure to prevent recurrence.
	Connector/terminal	- Check for any cracked, exposed, loose, or removed terminal or connector, etc. - Fluid causes a failure; be sure to remove fluid. - A scarred or damaged connector or terminal needs to be replaced. In the case of a resin molded motor, such as a linear motor, the motor needs to be replaced.
Operation of the motor	Noise/vibration	- Check for any abnormal noise or vibration not only when the motor is running (the spindle is rotating) but also when it is stopped. - Abnormal noise heard when the motor is rotating indicates an abnormality of the bearing or a failure inside the motor.
	Movement	- Check that the motor operates normally and smoothly. - If the circuit breaker trips at the same time the motor starts to operate, it indicates abnormal motor windings.
	Heat	Check whether the motor does not overheat during the normal operation cycle. Note: While the motor is running or immediately after it is stopped, the motor surface may become very hot. Instead of touching the motor directly by hand, use a thermolabel, surface thermometer, etc.
Electric characteristics of the motor	Winding resistance	If the resistance value exceeds the specified range, the motor needs to be replaced. Note: When conducting winding resistance measurement, disconnect the motor from the amplifier and measure the resistance at the power line or connector closest to the motor.
	Insulation resistance	For the measuring method and judgment criteria, see the table that follows.
Cooling fan (for a model with a fan motor)	Noise/vibration	- Check that the fan blows air normally without causing abnormal noise or vibration. - If abnormal noise is heard even when the motor is stopped, it indicates a fan motor failure.
	Movement	- If the power is on and if the fan does not operate or the fan blades cannot be moved even manually, or if the fan blades are rotating but no cooling wind is blown out, the fan motor may have cutting chips or sludge accumulated in it and needs to be cleaned. - If the fan does not operate normally for any other reason, the fan motor needs to be replaced.
Forcible cooling unit (when using an external cooling unit such as liquid cooling unit)	Dew condensation (over-cooling)	- Check that forcible cooling does not cause dew condensation on the motor surface. Dew condensation is likely particularly when the cooling unit continues to run after the machine is stopped. In that case, be sure to make this check. - Dew condensation or water drop on the motor surface can reduce the motor's service life. It is necessary to wipe it dry and take a measure to prevent recurrence.
	Liquid leakage/clog	- Check the cooling pipe for leakage or clog. Do not drive the motor unless the leakage or clog is fixed. - Liquid leakage from a spindle motor with a through hole indicates a failure of the coolant joint. In this case, the joint needs to be replaced. - In the case of liquid leakage from a linear motor (coil slider), the linear motor (coil slider) needs to be replaced. - If the motor gets wet due to liquid leakage or any other cause, it is necessary to clean and dry the motor and perform electric characteristic checks (winding resistance/insulation resistance).

Insulation resistance measurement

The following table shows the judgment criteria to be applied when measuring insulation resistance between winding and frame using a megohmmeter (500 VDC).

Insulation resistance	Judgment
100 Ω or higher	Acceptable
10 to 100 Ω	The winding has begun deteriorating. There is no problem with the performance at present. Be sure to perform periodic inspection.
1 to 10 Ω	The winding has considerably deteriorated. Special care is in need. Be sure to perform periodic inspection.
Lower than 1 Ω	Unacceptable. Replace the motor.

If insulation resistance drops sharply during a short period of time or if the circuit breaker trips, the cutting fluid or other foreign matter may have entered the inside of the motor or cable. In that case, contact the machine tool builder or FANUC for instructions.

⚠ **CAUTION**
- Let the motor dry and cool to room temperature before winding or insulation resistance is measured. Otherwise, not only an accurate measurement cannot be performed but also the motor may be damaged.
- The winding or insulation resistance measurement should be performed on the motor alone, with its power line disconnected.
  Measuring insulation resistance with the motor connected to the amplifier may damage the amplifier.
- During insulation resistance measurement, applying voltage to the motor for a long time may further deteriorate the insulation of the motor. Therefore, the measurement of insulation resistance should be performed in a minimum amount of time where possible.
- When disconnecting the power line and other cables, take an appropriate measure, such as labeling, to ensure that they can be restored to their original state.

11.2.2.2 Periodic cleaning of a motor

Periodic cleaning is necessary to remove an accumulation of cutting chips or sludge that may eventually cause a failure. Also, leaving the cutting fluid or other chemical substance attached for a long time can reduce the motor's service life substantially. When forcible cooling is provided by a liquid or air cooling unit, check the unit for pipe clog, fan failure, etc. and perform cleaning periodically to ensure that the coolant flows smoothly and that the motor is cooled properly.

⚠ **WARNING**
Depending on the type of motor, the handling may involve a risk and require safety education in advance. Also, some machines are difficult for users to clean on their own. If you are to clean the motor, consult with the machine tool builder in advance with regard to the cleaning method, safety education, etc.

11.2.2.3 Notes on motor cleaning

A motor is an electric product, which is incompatible with most kinds of fluid. When removing cutting chips, sludge, cutting fluid, etc. during cleaning, note the following.

Note on cleaning	Measure
Do not sprinkle fluid. Do not wash by submerging.	Do not sprinkle or spray detergent or any other fluid over the motor (including its peripheral components), or do not wash the motor by submerging it in such fluid. When cleaning the motor, use a cloth moistened with a small amount of neutral detergent so that the fluid does not enter the inside the motor.
Do not use solvent.	Solvent may damage the motor; do not use one. If the dirt is difficult to remove with neutral detergent, use a cloth moistened with a small amount of industrial alcohol (e.g., IPA). Be careful, however, because rubbing with force or repeatedly may damage the coated or resin surface.
Do not leave the motor wet or moistened.	If the motor is wet or moistened after cleaning, dry it before supplying power and before performing electric tests. When drying the motor in an oven, make sure that the temperature is below 40°C and that hot air does not blow directly against the motor.

11.2.2.4 Notes on the cutting fluid (informational)

Depending on the type of cutting fluid used, the motor and amplifier may be affected greatly. Take due care because, even if you ensure that they do not come into direct contact with the fluid, a mist or atmosphere of the fluid can cause the problems described below.

Type of cutting fluid requiring care	Expected problem
Cutting fluid containing highly active sulfur	Some types of cutting fluid contain highly active sulfur. If such cutting fluid enters the inside of the motor or amplifier, it causes copper, silver, and other kinds of metal to corrode, leading to a component failure.
Synthetic cutting fluid with high permeability	Some types of cutting fluid containing such substance as polyalkylene glycol have very high permeability. Such cutting fluid permeates into the inside of the motor, causing insulation deterioration or component failure.
Highly alkaline, water-soluble cutting fluid	Some types of cutting fluid that enhance their alkaline property using such substance as alkanolamine remain highly alkaline - pH10 or higher - when diluted. If such cutting fluid is left attached for a long time, its chemical change will deteriorate the resin and other materials of the motor and amplifier.

Other types of cutting fluid not mentioned above may cause various unexpected problems. If any problem arises for which the cutting fluid is thought to be responsible, consult with the machine tool builder or FANUC.

11.2.3　Preventive Maintenance of a Built-in Spindle Motor and Spindle Unit

This subsection contains the safety precautions you need to bear in mind when performing preventive maintenance for a built-in spindle motor (BiI or BiS Series) or the FANUC-NSK spindle unit. In some cases, the work may involve a life-threatening risk or cause substantial damage. Make sure that you fully understand these safety precautions before carrying out the work.

> ⚠ **WARNING**
> - Do not disassemble the spindle. Particularly, the rotor of a synchronous built-in spindle motor (BiS Series) uses strong permanent magnets. The strong magnet force may cause injury or medical appliance malfunction.
> - Do not operate a synchronous built-in spindle motor with an external engine. Doing so is very dangerous because it makes the motor act as a power generator, generating high voltage. A power outage is also dangerous because the motor runs freely and, again, generates high voltage. As a safety precaution, a sub module SM (SSM) is connected between motor and amplifier. Do not disconnect the SSM under any circumstances. Also, connect the machine frame to the ground to prevent electric shock.
> - A synchronous built-in spindle motor may perform a pole position detection operation when it receives the first rotation command after it is powered on or recovers from an alarm. The pole position detection operation takes 20 to 60 seconds to complete, during which the spindle behaves oddly, e.g., rotating clockwise and counterclockwise alternately in rapid succession. This phenomenon is not abnormal. During the detection operation, do not touch or look down at the spindle, which is a dangerous act.

> ⚠ **CAUTION**
> Performing a test run described in Chapter 3, "TEST RUN METHOD", in Part IV, of "FANUC - NSK SPINDLE UNIT series DESCRIPTIONS (B-65352)" and the inspection and maintenance work described in this manual is the condition for guaranteeing the operation of the FANUC-NSK spindle unit. Be sure to perform the test run and inspection and maintenance work as instructed.

11.2.3.1　Routine inspection of the FANUC-NSK spindle unit

Perform the following routine inspections every day at the start of operation so that stable performance can be obtained from the spindle.

	Item	Check
1	Check if the axis, when turned manually, rotates lightly and smoothly. ⚠ **WARNING**　When turning the axis manually, be sure to turn off the power to the machine.	
2	Check if cuttings and coolant residuals are attached to the periphery of a slinger.	
3	Check if dust such as cuttings is attached to the spindle taper portion.	
4	For operation at 15,000 min^{-1} or more immediately after turning on, increase the speed gradually by using the spindle override function. (This substitutes for a simple test run.)	
5	Check if an abnormal sound is generated.	
6	Check if an abnormal vibration is generated.	
7	Check if an abnormal heat is generated.	

11.2.3.2   Maintenance of the FANUC-NSK spindle unit

A FANUC-NSK spindle unit with a grease unit requires periodical maintenance for consumable/wear parts, such as supplying grease. Depending on the use frequency of and damage to parts, **maintenance generally becomes necessary after two years of machine operation or 10,000 hours of spindle operation**. Contact FANUC or the machine tool builder when maintenance becomes necessary. Also, an effective way to reduce the machine down time due to maintenance is to prepare spare parts; consult with the machine tool builder.

11.2.3.3   Test run of the FANUC-NSK spindle unit

If any of the following cases applies, be sure to contact the machine tool builder and perform a test run as described in **Chapter 3, "TEST RUN METHOD", in Part IV, of "FANUC - NSK SPINDLE UNIT series DESCRIPTIONS (B-65352EN)"**.

-   If the spindle unit is rotated for the first time after it is unpacked or attached to the machine
-   If the machine or spindle unit has undergone transportation or relocation
-   If the spindle unit alone has been stored for a period longer than six months or has not been used for one month or more after installation

> ⚠ **CAUTION**
> FANUC assumes no responsibility for any damage resulting from the failure to perform a test run or improper use of the spindle unit.

11.2.3.4   Storage method of the FANUC-NSK spindle unit

Apply rust-proof oil to the surface of the spindle unit, pack the spindle unit, and store the packed spindle unit at a location that satisfies the conditions described below. Also, follow the "This Side Up" and "No Pile Up" instructions indicated on the pack surface.
-   Indoor well ventilated place not exposed to direct sunlight (place where the temperature varies little, the room temperature is within 5°C to 40°C, and the humidity is 35% to 85% RH)
-   Place on the shelf subject to little vibration and dust (Do not place the spindle unit directly on the floor; vibration and dust can damage the bearing or other parts of the spindle.)
Before using the spindle unit after a storage period of one month or more, make necessary checks, such as measuring winding and insulation resistance, examining the appearance for rust and other problems, and checking whether the axis can be turned manually. Depending on the storage period, a test run may be necessary (described earlier).

11.2.4   Preventive Maintenance of a Linear Motor

The magnet plate of a linear motor contains very strong magnets. When performing the maintenance work, make sure all those engaged in the work fully understand the potential risks involved.

> ⚠ **WARNING**
> - The FANUC linear motors use very strong magnets. Improper handling of the motor is very dangerous and can lead to a serious accident. Particularly, a person wearing a pacemaker or other medical apparatus should stay away from the linear motor; otherwise, the apparatus may malfunction, potentially resulting in a life-threatening accident.
> - Those who will come near or touch a linear motor for maintenance work should receive safety education in advance. For details, contact the machine tool builder or FANUC.

11.2.4.1 Appearance inspection of the linear motor (magnet plate)

Perform an appearance inspection as well during cleaning or other maintenance work. A crack, chip, deformation, or any other abnormality in appearance of the motor can lead to a serious failure in the not-so-distant future. If you find any such abnormality, be sure to report it to the machine tool builder. A scratch or other slight scar on the motor surface can also be a sign of future trouble and needs to be addressed with care. Some suggested appearance inspection items for the magnet plate are described below.

*   For the coil slider (the side to which the power line is connected), see "Main inspection items" earlier in this manual.

Appearance of the magnet plate (which may have a stainless cover)

Appearance inspection item	Measure
Crack or chip in the magnet plate resin Deformation or bulge of the magnet plate or softening of the resin	The magnet plate needs to be replaced. If unattended, it can cause trouble in the not-so-distant future. If the problem is extremely minor, consult with the machine tool builder or FANUC.
The magnet is exposed, or the resin or magnet is floating	The magnet plate needs to be replaced urgently.
Scratch on the magnet plate	Foreign matter may have entered into the motor, or interference between parts is likely. It is necessary to eliminate the cause and take a measure to prevent recurrence.
Floating, bulging, or deformed stainless cover	The cover or magnet plate needs to be replaced.

11.2.5 Maintenance of a Detector

> ⚠ **CAUTION**
> - Detectors such as Pulsecoders are precision equipment. When handling a detector, avoid applying shock to it. Also, exercise care to prevent cutting powder, dust, cutting fluid, or other foreign matter from attaching to it.
> - Make sure that all connectors are connected properly and securely. A connection failure can cause an alarm or some other problem.
> - If the detector and/or connectors are not installed securely, cutting fluid may enter the inside of the detector, making it necessary to replace the detector. In that case, contact the machine tool builder or FANUC.

> **NOTE**
> If you use a detector not manufactured by FANUC, contact the machine tool builder or detector manufacturer for detailed information on the detector.

11.2.5.1   Alarms for built-in detectors (αi and βi Pulsecoders) and troubleshooting actions

These alarms concern built-in detectors that are connected directly to the control unit (CNC/servo amplifier).

Based on the alarm number and description, take an appropriate action as described in the following subsection, "Detailed troubleshooting methods".

Alarm No.: Alarm	Description	Possible cause	Action	Detailed troubleshooting method
361: ABNORMAL PHASE DATA(INT)	- Communication error in the Pulsecoder - ID data error	- Pulse coder failure - Noise	Replace the Pulsecoder.	(3) (4)
364: SOFT PHASE ALARM(INT)	Position data alarm	- Noise - Entry of cutting fluid	Check the effect of noise. Replace the Pulsecoder.	(1) (3)
365: BROKEN LED(INT)	LED disconnection	- Pulse coder failure	Replace the Pulsecoder.	(3)
366: PULSE MISS(INT)	Small internal signal amplitude	- Pulse coder failure - Noise	Replace the Pulsecoder.	(3) (4)
367: COUNT MISS(INT)	Position data count error	- Pulse coder failure - Noise	Replace the Pulsecoder.	(3) (4)
368: SERIAL DATA ERROR(INT)	Communication interruption	- Cable disconnection - Pulse coder failure - Noise	Check the cable. Replace the Pulsecoder.	(2) (3) (4)
369: DATA TRANS. ERROR(INT)	Communication data alarm	- Noise	Check the effect of noise.	(1)
453: SPC SOFT DISCONNECT ALARM	Position - pole data error	- Pulse coder failure - Entry of cutting fluid	Replace the Pulsecoder.	(3)

11.2.5.2   Alarms for separate detectors and troubleshooting actions

These alarms concern separate detectors that are connected to the control unit via a separate detector interface unit (SDU).

Based on the alarm number and description, take an appropriate action as described in the following subsection, "Detailed troubleshooting methods".

Alarm No.: Alarm	Description	Possible cause	Action	Detailed troubleshooting method
380: BROKEN LED(EXT)	LED disconnection	- Detector failure	Replace the detector.	(4)
382: COUNT MISS(EXT)	Position data count error			
383: PULSE MISS(EXT)	Small internal signal amplitude			
384: SOFT PHASE ALARM(EXT)	Position data alarm			
385: SERIAL DATA ERROR(EXT)	Communication interruption	- Cable disconnection - Noise - Detector failure	Check the cable. Check the effect of noise. Replace the detector.	(2) (1) (4)

Alarm No.: Alarm	Description	Possible cause	Action	Detailed troubleshooting method
386: DATA TRANS. ERROR(EXT)	Communication data alarm	- Noise	Check the effect of noise.	(1)
381: ABNORMAL PHASE (EXT) 387: ABNORMAL ENCODER(EXT)	For details, contact the machine tool builder or detector manufacturer.			

11.2.5.3   Detailed troubleshooting methods

(1) Checking the effect of noise

Check the value on the diagnostics screen DGN356 (for a built-in detector) or DGN357 (for a separate detector) of the CNC unit.

Normally, 0 is displayed. However, if the position data from the Pulsecoder becomes unstable due to noise or some other factor, this value is incremented. The value is cleared when the CNC unit is powered off. Immediately after the power is turned on, 0 is displayed.

(2) Checking the cable

Check whether the feedback cable is not disconnected and whether the connector is properly plugged.

(3) Replacing the Pulsecoder

(3)-1 Pulse coder replacement procedure

<1> Remove the four M4 hexagon socket head cap screws fastening the Pulsecoder. The M3 bolts fastening the Pulsecoder cover do not need to be loosed. (See the figure at right.)

× Do not loosen
Bolt fastening the Pulsecoder cover   M3

○ Remove
Bolt fastening the Pulsecoder   M4
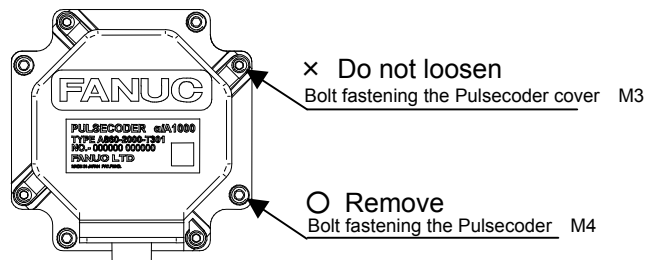
<2> Remove the Pulsecoder and Oldham's coupling (see the following figure).

<3> Set the new Pulsecoder and Oldham's coupling on the motor. Adjust the direction of the mate Oldham's coupling to that of the Oldham's coupling so that the teeth are engaged.

Push in the Pulsecoder until the O ring fits in the joint between the motor and Pulsecoder. Take care so that the O ring of the Pulsecoder is not bitten.

Oldham's coupling

O ring

Mate Oldham's coupling
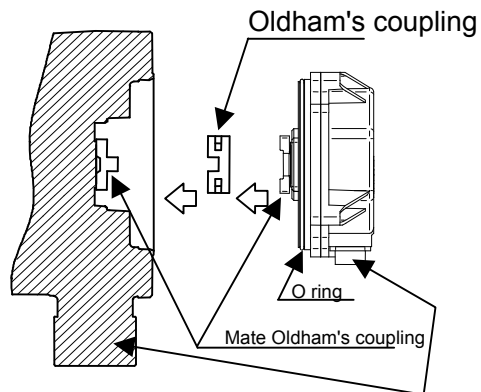
Adjust the connector direction
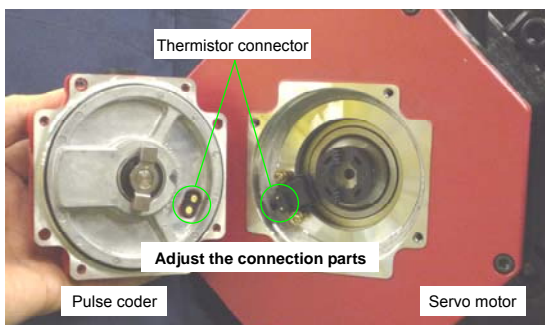
Attach the Pulsecoder in such a direction that the power connector of the servo motor and the feedback cable of the Pulsecoder face the same direction or that the thermistor connection parts of the servo motor and Pulsecoder match each other (see the figure at left).

Thermistor connector

Adjust the connection parts

Pulse coder

Servo motor

<4> Fastening the Pulsecoder with the four M4 hexagon socket head cap screws in the reverse order of removing the Pulsecoder (<1>). (Appropriate torque: 1.5 Nm)

(3)-2 Feedback cable plugging procedure

Plug in the feedback cable connector, as instructed in the procedure below, and check that the connector is securely connected.

Main key   Coupling nut
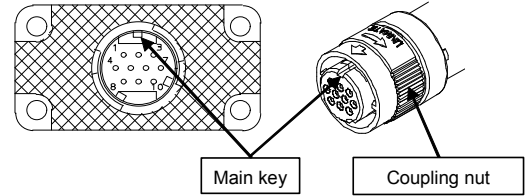
<1> Check the plugging side and key direction.
Check that the plugging side is free of foreign matter, such as dirt and oil.

<2> Plug in the feedback cable connector.
Hold the connector, as shown in the figure at right. Plug in the connector until you hear a click.

Straight type   Right angle type

Caution)
Do not hold the coupling nut.
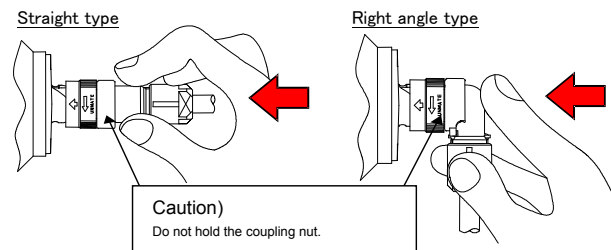
<3> Check the connection condition.
1. Check that the arrow mark of the connector is at the center, as shown in the figure at right. If the arrow mark is not at the center, turn the coupling nut manually until the mark comes to the appropriate position.

1 mm or less
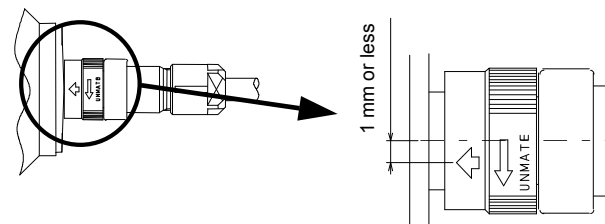
2. Hold the connector by the same part as in <2>, and pull it lightly toward you to check that the connector does not come off. Do not pull the connector with force.

(4) If troubleshooting is difficult for the user

If the problem is difficult for the user to troubleshoot because it is due to a detector failure or noise, consult with the machine tool builder or FANUC.

11.2.5.4   Maintenance of β*i*S motor Pulsecoders

Problems concerning the Pulsecoders of the motors listed in the table below require the maintenance (replacement) of the entire motor (it is not possible to maintain the Pulsecoder alone).

Motor model	Motor specification	Remarks
β*i*S 0.2/5000	A06B-0111-Bx03	x=1,2,4,5
β*i*S 0.3/5000	A06B-0112-Bx03	
β*i*S 0.4/5000	A06B-0114-Bx03#0y00	x=1,2,4,5 y=0,1
β*i*S 0.5/6000	A06B-0115-Bx03#0y00	
β*i*S 1/6000	A06B-0116-Bx03#0y00	

11.3   PREVENTIVE MAINTENANCE OF SERVO AMPLIFIERS

11.3.1   Warnings, Cautions, and Notes on Preventive Maintenance of Servo Amplifiers

This subsection contains the safety precautions on preventive maintenance of a servo amplifier (a generic term to refer to the power supply, servo amplifier, spindle amplifier, and other sub modules of a motor drive unit). These precautions are classified into "warnings", "cautions", and "notes" according to their bearing on safety. Make sure that you understand and comply with these precautions when carrying out the maintenance work.

⚠ WARNING

- **Make sure that you are safely dressed and have a safe working environment when performing preventive maintenance for a servo amplifier.**
    - Be dressed safely, e.g. by wearing gloves and safety shoes, to protect against injury due to an edge or protrusion and electric shock.
    - Have the work done by more than one person, where possible, so that immediate action can be taken if an accident occurs when handling a motor.
    - A servo amplifier and AC reactor contain heavy components. Be careful when transporting them or mounting them on the power magnetic cabinet. Also be careful not to get your fingers caught between the power magnetics cabinet and servo amplifier.

- **Before turning on the power, check that the door of the power magnetics cabinet and all other doors.**
    - Ensure that the door of the power magnetics cabinet containing the servo amplifier, as well as all other doors, are closed and locked except during maintenance work.

- **When the need arises to open the door of the power magnetics cabinet, only a person trained in the maintenance of the corresponding machine or equipment should do the task after shutting off the power supply to the power magnetics cabinet by opening both the input circuit breaker of the power magnetics cabinet and the factory switch used to supply power to the cabinet.**

- **Be careful about electric shock, fire, and other accidents.**
    - If the machine must be operated with the door open for adjustment or some other purpose, the operator must keep his or her hands and tools well away from any dangerous voltages. Such work must be done only by a person trained in the maintenance of the machine or equipment.
    - Ensure that the door of the power magnetics cabinet is locked so that the door cannot be opened by anyone, except service personnel or a qualified person trained in maintenance to prevent electric shock, when the servo amplifier is powered on.
    - When the need arises for an operator to open the door of the power magnetics cabinet and perform an operation, ensure that the operator is sufficiently educated in safety or that a protective cover is added to prevent the operator from touching any dangerous part.
    - The servo amplifier contains a large-capacity electrolytic capacitor in it and remains charged for a while after the power is shut off. Before touching the servo amplifier for maintenance or some other purpose, measure the residual voltage of the DC link connection using a tester and check that the red LED for indicating charging is in progress is not lit, in order to ensure safety.
    - After wiring, be sure to close the servo amplifier cover.
    - A loose screw or poor connector contact can cause a motor malfunction or overheating, connection to ground, or short-circuit. Be extremely careful with power supply lines, motor power lines, and DC link connections through which a large electric current flows, because a loose screw or poor connector contact may lead to a fire. Tighten screws and connectors using the specified screw tightening torque.

- The surfaces of the regenerative discharge unit and heat radiator may become very hot. Do not touch them directly by hand.

- **When operating the machine for the first time after preventive maintenance, check that the machine operates as instructed.**
  - To check whether the machine operates as instructed, first specify a small value for the motor and then increase the value gradually. If the motor operates abnormally, perform an emergency stop immediately.
  - When pressing the emergency stop button, check that the motor stops immediately and that the power being supplied to the amplifier is shut off by the magnetic contactor.

- **Notes on alarms**
  - If the machine stops due to an alarm, check the alarm number. Depending on the alarm issued, if the power is supplied without replacing the failed component, another component may be damaged, making it difficult to identify the original cause of the alarm.
  - Before resetting an alarm, ensure that the original cause of the alarm has been removed.

- **If the motor causes any abnormal noise or vibration while operating, stop it immediately.**
  - Using the motor in spite of the abnormal noise or vibration may damage the servo amplifier.

- **Do not disassemble or modify a servo amplifier.**
  Do not disassemble or modify a servo amplifier in any way not specified by FANUC; doing so can lead to a failure.

⚠ CAUTION

- **Notes on servo amplifier replacement and wiring**
  - The work of servo amplifier replacement and wiring should be carried out by a person trained in the maintenance of the machine and equipment concerned.
  - When replacing a servo amplifier, check that the combination of the amplifier and the motor is appropriate.
  - Check that the servo amplifier is securely mounted on the power magnetics cabinet. If there is any clearance between the power magnetics cabinet and the surface on which the amplifier is mounted, dust entering the gap may hinder the normal operation of the servo amplifier.
  - Ensure that the power supply lines, motor power lines, and signal lines are each connected to the correct terminal or connector.
  - Unless otherwise instructed, do not unplug a connector and plug it back with the power on; doing so may cause the servo amplifier to fail.
  - When mounting or unmounting the servo amplifier, exercise care not to get your fingers caught between the servo amplifier and power magnetics cabinet.
  - Take care not to lose track of removed screws. Turning on the power with any lost screw left in the unit may damage the machine.
  - Exercise care to prevent the power supply lines and motor power lines from being connected to the ground or being short-circuited.
  - Protect the lines from any stress such as bending. Handle the line ends appropriately.

- **Be careful about the handling of a servo amplifier.**
  - Do not disassemble a servo amplifier. Doing so poses the risk of electric shock, because the capacitor may remain charged.
  - Do not apply shock to a servo amplifier. Doing so may damage its components, potentially causing the amplifier to malfunction.

-    Do not apply an excessively large force to plastic parts. If a plastic section breaks, it may damage internal parts, thus hindering normal operation or leading to a risk of injury due to a broken section.

- **Be careful about the operating environment of a servo amplifier.**
    -    Prevent conductive, combustible, or corrosive foreign matter, mist, or drops of water from entering the inside of the unit. The entry of any such material may cause the unit to explode, break, malfunction, etc.
    -    Exercise care to prevent cutting fluid, oil mist, cutting chips, or other foreign matter from attaching to the radiator or fan motor exposed to the outside of the power magnetics cabinet. Otherwise, the servo amplifier may become unable to meet its specifications. The service lives of the fan motor and semiconductors can also be reduced.

- **Clean the heat sink and fan motor on a regular basis.**
    -    Replace the filter of the power magnetics cabinet on a regular basis.
    -    Before cleaning the heat sink, shut down the power and ensure that the temperature of the heat sink is as cool as the room temperature. The heat sink is very hot immediately after power shutdown, touching it may cause burn injury.
    -    When cleaning the heat sink by blowing air, be careful about dust scattering. Conductive dust attached to the servo amplifier or its peripheral equipment can lead to a failure.

NOTE

- **Make sure that there is sufficient maintenance clearance around the doors of the machine and equipment.**

- **Do not step or sit on the servo amplifier, or do not apply shock to it.**

- **Do not remove a nameplate from a motor.**
    -    The nameplate is necessary to identify the servo amplifier during maintenance work.
    -    If a nameplate comes off, be careful not to lose it.

NOTE
- This manual is focused on the preventive maintenance work to be performed for a FANUC servo amplifier. The information contained herein may not apply depending on the type or configuration of the machine. When reading this manual, refer to the manual of the machine as well. If you have any questions or doubts, do not act on your own; please contact the machine tool builder or FANUC.
- For detailed information about a servo amplifier, see the manual list shown earlier and, if necessary, obtain the latest version of the corresponding manual.

11.3.2   Preventive Maintenance of a Servo Amplifier

To use a servo amplifier safely throughout its entire service life, perform daily and periodic inspections.

⚠ CAUTION
- The preventive maintenance method differs from machine to machine in many respects. Depending on the machine in use, it may be difficult for the user to perform periodic inspection or cleaning. If you are not sure about anything as to preventive maintenance, consult with the machine tool builder and ensure that you can perform periodic inspection and cleaning.
- The machine should be used within the scope of specification defined by the machine tool builder. Using the machine in any way that is outside the specified scope can reduce the servo amplifier's service life or cause a failure.

Inspection part	Inspection item	Inspection interval		Judgment criterion
		Routine	Periodic	
Operating environment	Ambient temperature	V		Around the power magnetics cabinet: 0°C - 45°C Inside the power magnetics cabinet: 0°C - 55°C
	Humidity	V		90% or below RH (dew condensation not allowed)
	Dust/oil mist	V		There shall be no dust or oil mist attached near the servo amplifier.
	Cooling air path	V		The cooling fan shall be operating normally without the air flow being interrupted.
	Abnormal vibration/noise	V		- No abnormal noise or vibration shall be present that has not been experienced in the past. - Vibration near the servo amplifier shall be 0.5 G or less.
	Supply voltage	V		200-V input type: Within 200 - 240 V 400-V input type: Within 400 - 480 V
Servo amplifier	General	V		There shall be no abnormal noise or smell, and there shall be no dust or oil mist attached.
	Screw		V	There shall be no loose screw.
	Fan motor (NOTE 1, 2)	V		- There shall be no abnormal vibration or noise, and the fan blades shall be rotating normally. - There shall be no dust or oil mist attached.
	Connector		V	There shall be no loose or broken connector.
	Cable		V	There shall be no sign of overheating or sheath deterioration (discoloration pr crack).
CNC	Absolute (NOTE 2) Pulse coder battery	V		The machine operator's panel or screen shall not display the alarm indicating the battery voltage of the absolute Pulsecoder is low.
External equipment	Magnetic contactor		V	The contactor shall not rattle or chatter.
	Ground fault interrupter		V	The interrupter shall be able to trip.
	AC reactor		V	There shall be no hum.

NOTE
1 Fan motors are periodic-replacement parts. It is recommended to inspect fan motors on a routine basis and replace them in a preventive manner.
2 Fan motors and batteries are periodic-replacement parts. It is recommended to keep spare parts.

11.3.3   Maintenance of a Servo Amplifier

11.3.3.1   Display of the servo amplifier operation status
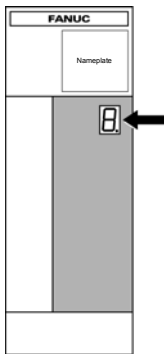
The STATUS LEDs on the front of the servo amplifier indicate the operation status of the servo amplifier (whether it is operating normally, the type of alarm, etc.). Use these LEDs for maintenance, inspection, troubleshooting, etc.
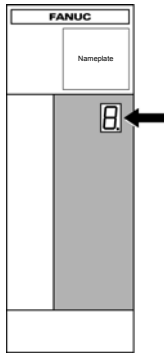
> ⚠ **CAUTION**
> A servo amplifier failure may arise from a combination of multiple causes, in which case it can be difficult to identify all those causes. Handling the failure in an improper way may worsen the problem. It is therefore important to analyze the failure status minutely and identify the true cause or causes of the failure. There may be cases in which the failure appears to have been fixed but later recurs or cause a more serious trouble. If you are not sure about the root cause of or corrective action for a failure, do not act on your own; please contact the machine tool builder or FANUC for instructions on proper action.

[α*i* series]
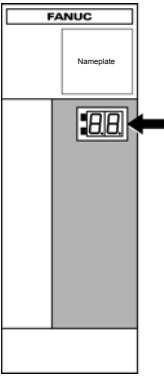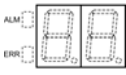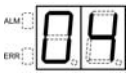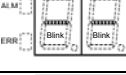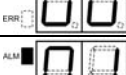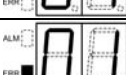
(1) Power supply

STATUS LED position	STATUS display	Description
		The STATUS LED is off. Control power has not been supplied, cable is faulty, or control power circuit is defective.
		Not ready status The main circuit is not supplied with power (magnetic contactor is off); emergency stop state.
		Ready status The main circuit is supplied with power (magnetic contactor is on); the power supply is ready for operation.

		Warning state (The dot at the lower right lights.)
		    The power supply has failed; an alarm has occurred after a certain time of operation.
		    The warning type is indicated by the character displayed.

		Alarm status The alarm type is indicated by the character displayed.

(2) Servo amplifier

STATUS LED position	STATUS display	Description
		The STATUS LED is off. Control power has not been supplied, cable is faulty, or control power circuit is defective.
	Blink	The control power is short-circuited (- blinks). Cable failure
		Waiting for the READY signal from the CNC.
		Ready status The servo motor is excited.
		Alarm status The alarm type is indicated by the character displayed.

(3) Spindle amplifier

STATUS LED position	STATUS display	Description
		The STATUS LED is off. Control power has not been supplied, cable is faulty, or control power circuit is defective.
	50	After control power is turned on, the spindle software series is displayed (for approx. 1 second). The last two digits of the spindle software series number are displayed.
	04	The spindle software version is displayed (for approx. 1 second following the display of the spindle software series). [Display] 01,02,03, ... → [Version] A, B, C, ...
	Blink Blink	The CNC is not powered on (- - blinks). Waiting for serial communication and parameter loading completion.
		Parameter loading completed The motor is not excited.
	00	Ready status The spindle motor is excited.
	01	Alarm status The alarm type is indicated by the character displayed.
	01	Error status (invalid sequence or parameter setting error) The error type is indicated by the character displayed.

[β*i* SV series]

ALM LED (yellow)
LINK LED (yellow)
POWER LED(green)

ALM LED (yellow)
LINK LED (yellow)
POWER LED(green)
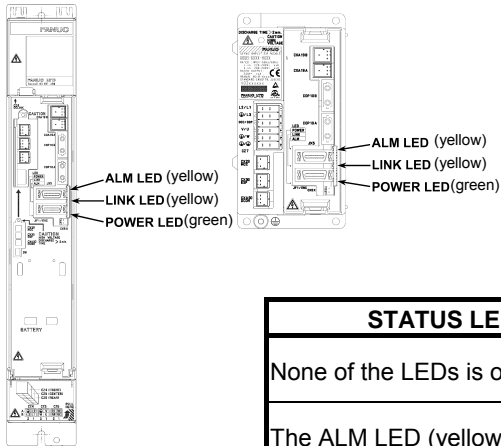
STATUS LED	Description
None of the LEDs is on.	Control power has not been supplied, cable is faulty, or control power circuit is defective.
The ALM LED (yellow) is on.	Alarm status The alarm type is indicated by the character displayed.
The LINK LED (green) is on.	Communication between CNC and servo amplifier is progressing normally.
The POWER LED (green) is on.	The control power of the servo amplifier (5 V) is normal.

[β*i* SVSP series]
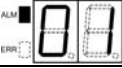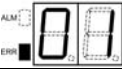
β*i* SVSP (#A/ #C)   β*i* SVSP (#D/ #H560/ #H580)

STATUS 1
(Spindle)
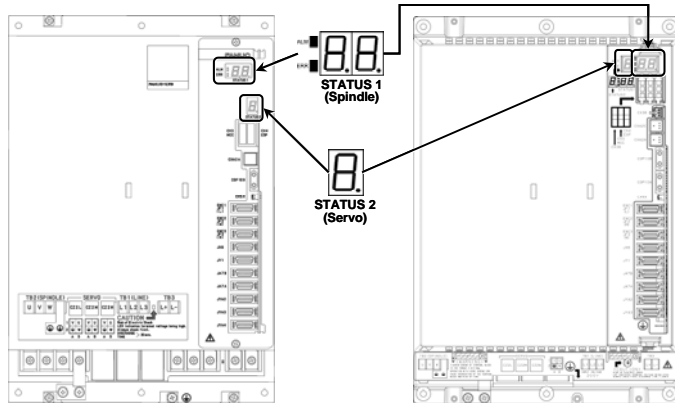
STATUS 2
(Servo)

Note) The locate or the shape of the connector and
so on may be different from the real amplifier.

STATUS1 display (Spindle)	Description
	The STATUS LED is off. Control power has not been supplied, cable is faulty, or control power circuit is defective.
	After control power is turned on, the spindle software series is displayed (for approx. 1 second). The last two digits of the spindle software series number are displayed.
	The spindle software version is displayed (for approx. 1 second following the display of the spindle software series). [Display] 01,02,03, ... → [Version] A, B, C, ...
	The CNC is not powered on (- - blinks). Waiting for serial communication and parameter loading completion.
	Parameter loading completed The motor is not excited.
	Ready status The spindle motor is excited.

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STATUS1 display (Spindle)	Description
	Alarm status The alarm type is indicated by the character displayed.
	Error status (invalid sequence or parameter setting error) The error type is indicated by the character displayed.

STATUS2 display (Servo)	Description
	The STATUS LED is off. Control power has not been supplied, cable is faulty, or control power circuit is defective.
	Waiting for the READY signal from the CNC.
	Ready status The servo motor is excited.
	Alarm status The alarm type is indicated by the character displayed.

11.3.3.2   Replacement of a fan motor

[α*i* series]

(1) Fan motor for internal cooling
Replace the internal fan motor, according to the procedure shown in the figure below.
When replacing the fan motor, be careful about the direction of the fan motor (air blow direction), the direction of the connector, etc.

* Be careful about the fan motor and connector directions.
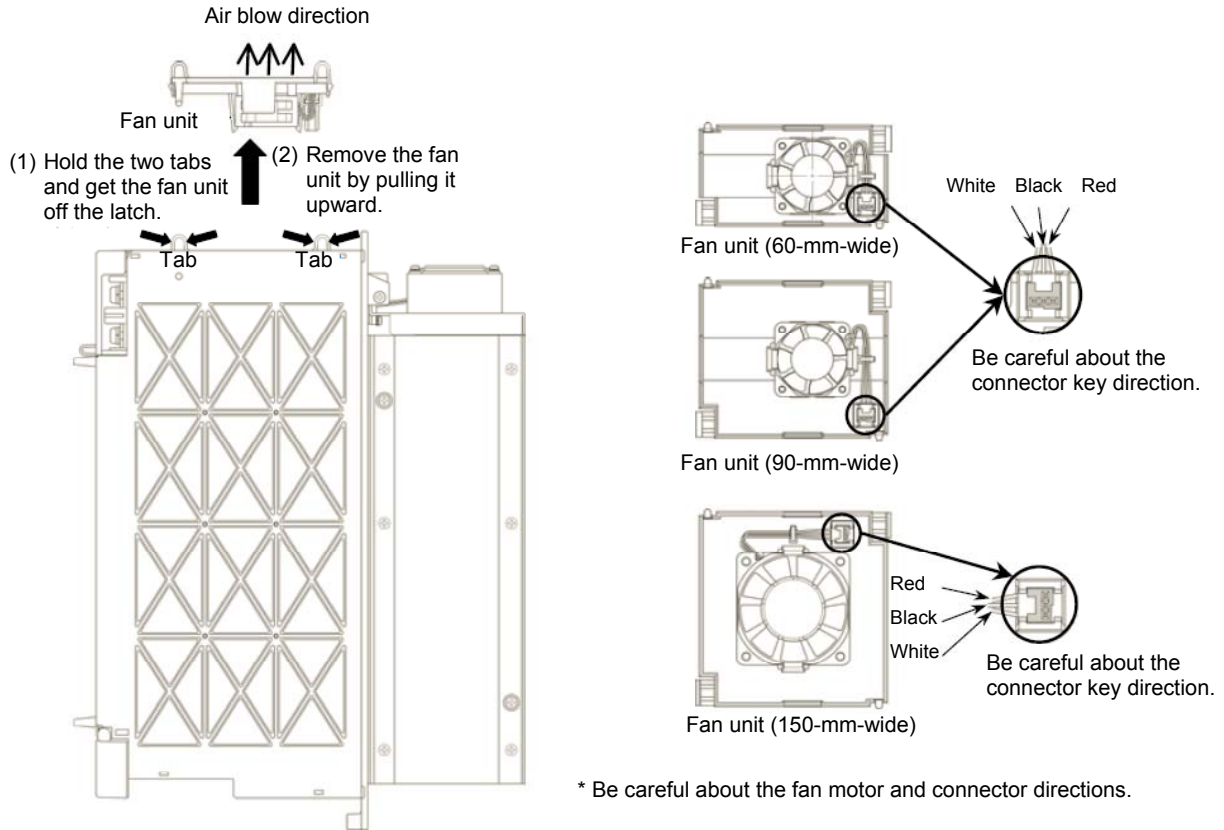
(2) Fan motor for cooling external heat sink
  <1> Remove the two sheet metal mounting screws (for the 60-mm-wide model only), and detach the fan motor from the unit together with the sheet metal.
  <2> Remove the fan motor mounting screws (two for one fan motor and four for two fan motors).
  <3> Remove the connector mounting screws (two and four for the 300-mm-wide model).
  When replacing the fan motor, be careful about the direction of the fan motor (air blow direction), the direction of the connector, etc.

60 mm wide/90 mm wide   150 mm wide   300 mm wide
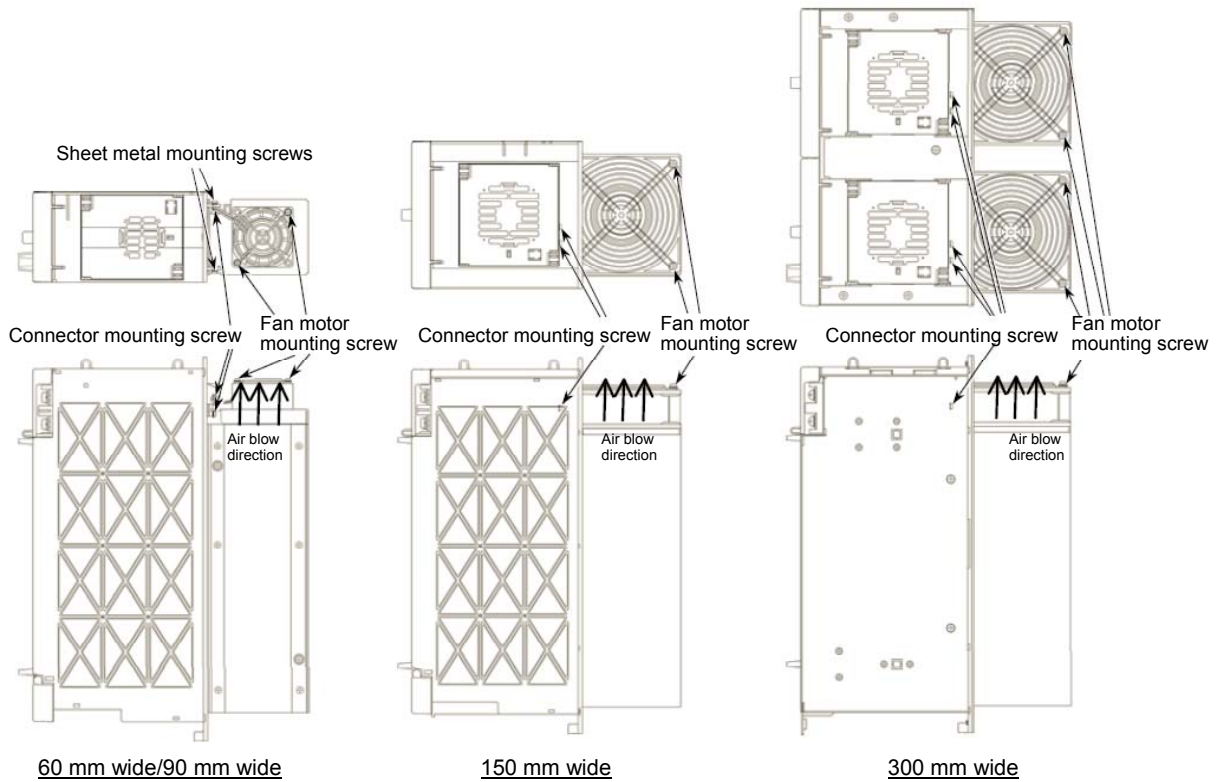
[β*i* series]
  Replace the fan motor, according to the procedure shown in the figure below.
  When replacing the fan motor, be careful about the direction of the fan motor (air blow direction), the direction of the connector, etc.

β*i*SV4, 20 (internal fan)   β*i*SV40, 80 (internal fan)   β*i*SV40, 80 (external fan)

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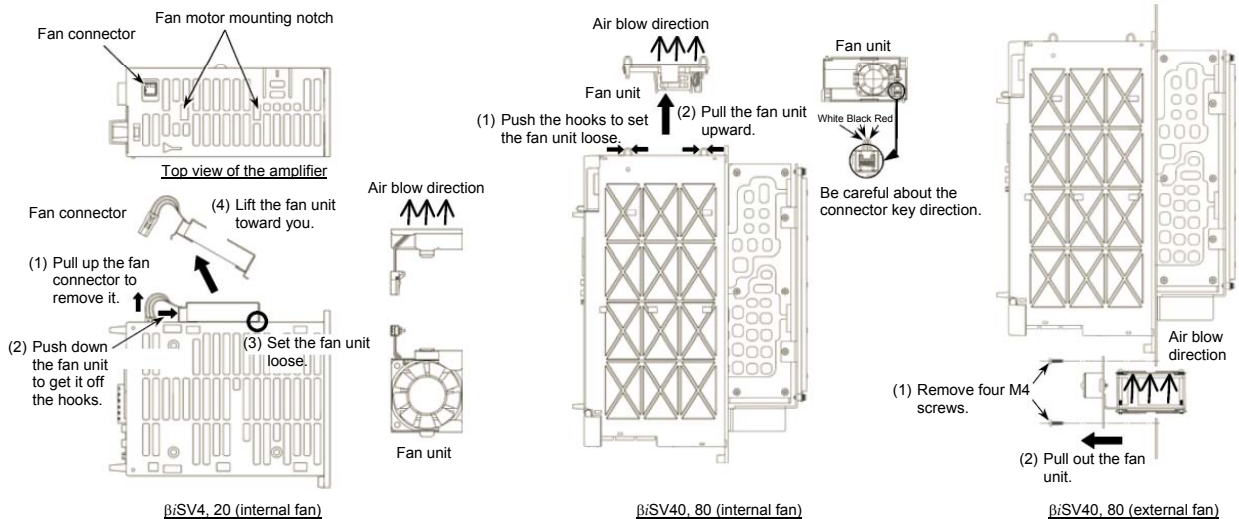
APPENDIX

A ALARM LIST

Appendix A, "ALARM LIST", consists of the following sections:

A.1 ALARM LIST (CNC)

(1) Alarms on program and operation (PS alarm)
(2) Background edit alarms (BG alarm)
(3) Communication alarms (SR alarm)

Alarm numbers are common to all these alarm types.
Depending on the state, an alarm is displayed as in the following examples:
PS"alarm number"   Example: PS0003
BG"alarm number"   Example: BG0085
SR"alarm number"   Example: SR0001

Number	Message	Description
0001	TH ERROR	A TH error was detected during reading from an input device. The read code that caused the TH error and how many statements it is from the block can be verified in the diagnostics screen.
0002	TV ERROR	An error was detected during the single–block TV error. The TV check can be suppressed by setting TVC parameter No. 0000#0 to "0".
0003	TOO MANY DIGIT	Data entered with more digits than permitted in the NC instruction word. The number of permissible digits varies according to the function and the word.
0004	ADDRESS NOT FOUND	NC word(s) address + numerical value not in word format. This alarm is also generated when a custom macro does not contain a reserved word, or does not conform to the syntax.

Number	Message	Description
0005	NO DATA AFTER ADDRESS	NC word(s) address + numerical value not in word format. This alarm is also generated when a custom macro does not contain a reserved word, or does not conform to the syntax.
0006	ILLEGAL USE OF MINUS SIGN	A minus sign (–) was specified at an NC instruction word or system variable where no minus signal may be specified.
0007	ILLEGAL USE OF DECIMAL POINT	A decimal point (.) was specified at an address where no decimal point may be specified, or two decimal points were specified.
0009	IMPROPER NC-ADDRESS	An illegal address was specified, or parameter 1020 is not set.
0010	IMPROPER G-CODE	An unusable G code is specified.
0011	FEED ZERO (COMMAND)	The cutting feedrate instructed by an F code has been set to 0. This alarm is also generated if the F code instructed for the S code is set extremely small in a rigid tapping instruction as the tool cannot cut at the programmed lead.
0015	TOO MANY SIMULTANEOUS AXES	A move command was specified for more axes than can be controlled by simultaneous axis control. Either divide the number of programmed move axes into two blocks.
0020	OVER TOLERANCE OF RADIUS	An arc was specified for which the difference in the radius at the start and end points exceeds the value set in parameter No. 3410. Check arc center codes I, J and K in the program. The tool path when parameter No. 3410 is set to a large value is spiral.
0021	ILLEGAL PLANE SELECT	The plane selection instructions G17 to G19 are in error. Reprogram so that same 3 basic parallel axes are not specified simultaneously. This alarm is also generated when an axis that should not be specified for plane machining is specified, for example, for circular interpolation. **T** In the 0i -TD, the helical interpolation option is needed to enable the specification of 3 or more axes for the G02/G03 block.
0022	R OR I,J,K COMMAND NOT FOUND	The command for circular interpolation lacks arc radius R or coordinate I, J, or K of the distance between the start point to the center of the arc.
0025	CIRCLE CUT IN RAPID (F0)	**M** F0 (rapid traverse in one-digit F code feed or inverse feed) was specified during circular interpolation (G02, G03).
0027	NO AXES COMMANDED IN G43/G44	**M** No axis is specified in G43 and G44 blocks for the tool length offset type C. Offset is not canceled but another axis is offset for the tool length offset type C. Multiple axes were specified for the same block when the tool length compensation type is C.

Number	Message	Description
0028	ILLEGAL PLANE SELECT	The plane selection instructions G17 to G19 are in error. Reprogram so that same 3 basic parallel axes are not specified simultaneously. This alarm is also generated when an axis that should not be specified for plane machining is specified, for example, for circular interpolation. **T** In the 0*i* -TD, the helical interpolation option is needed to enable the specification of 3 or more axes for the G02/G03 block.
0029	ILLEGAL OFFSET VALUE	Illegal offset No.
0030	ILLEGAL OFFSET NUMBER	An illegal offset No. was specified.
0031	ILLEGAL P COMMAND IN G10	Data input for the L No. of G10 or the corresponding function is not enabled. A data setting address such as P or R is not specified. An address command not concerned with data setting was specified. An address varies with the L No. The sign or decimal point of the specified address is in error, or the specified address is out of range.
0032	ILLEGAL OFFSET VALUE IN G10	In setting an offset amount by G10 or in writing an offset amount by system variables, the offset amount was excessive.
0033	NO INTERSECTION AT G41/G42	The intersection cannot be obtained by the intersection calculation in tool radius/tool nose radius compensation. Modify the program.
0034	ONLY G00/G01 ALLOWED IN STUP/EXT BLK	An attempt was made to perform a start-up or cancel of cutter compensation or tool nose radius compensation not in the G00/G01 mode. Modify the program.
0035	CAN NOT COMMANDED G31	1) G31 cannot be specified. This alarm is generated when a G code (such as for tool radius/tool nose radius compensation) of group 07 is not canceled. 2) A torque limit skip was not specified in a torque limit skip command (G31P98 or P99). Specify the torque limit skip in the PMC window or the like.
0037	CAN NOT CHANGE PLANE IN G41/G42	The compensation plane G17/G18/G19 was changed during cutter or tool-nose radius compensation. Modify the program.
0038	INTERFERENCE IN CIRCULAR BLOCK	Overcutting will occur in tool radius/tool nose radius compensation because the arc start point or end point coincides with the arc center. Modify the program.
0039	CHF/CNR NOT ALLOWED IN G41,G42	**T** Chamfering or corner R was specified with a start-up, a cancel, or switching between G41 and G42 in G41 and G42 commands (tool nose radius compensation). The program may cause overcutting to occur in chamfering or corner R. Modify the program.
0041	INTERFERENCE IN G41/G42	In tool radius/tool nose radius compensation, excessive cutting may occur. Modify the program.
0042	G45/G48 NOT ALLOWED IN CRC	**M** Tool offset (G45 to G48) is commanded in tool radius compensation mode. Modify the program.
0044	G27-G30 NOT ALLOWED IN FIXED CYC	One of G27 to G30 (G29 is only for the M series) is commanded in canned cycle mode. Modify the program.
0045	ADDRESS Q NOT FOUND (G73/G83)	In a high-speed peck drilling cycle or peck drilling cycle, the amount of each-time cutting is not specified by address Q, or Q0 is specified. Modify the program.

Number	Message	Description
0046	ILLEGAL REFERENCE RETURN COMMAND	A command for a return to the second, third or fourth reference position is error. (The address P command is in error.)
0050	CHF/CNR NOT ALLOWED IN THRD BLK	The chamfering or corner R block is specified in a threading block. Modify the program.
0051	MISSING MOVE AFTER CNR/CHF	The travel or travel distance is incorrect in the block next to the chamfering or corner R. Modify the program.
0052	CODE IS NOT G01 AFTER CHF/CNR	<u>T</u> The block next to the chamfering or corner R block is not G01 (or vertical line). Modify the program.
0053	TOO MANY ADDRESS COMMANDS	<u>T</u> In the chamfering and corner R commands, two or more of I, J, K and R are specified.
0054	NO TAPER ALLOWED AFTER CHF/CNR	<u>T</u> A block in which chamfering in the specified angle or the corner R was specified includes a taper command. Modify the program.
0055	MISSING MOVE VALUE IN CHF/CNR	The travel distance specified in the chamfering or corner R block is smaller than the amount of the chamfering or corner R. Modify the program.
0056	NO END POINT & ANGLE IN CHF/CNR	<u>T</u> In direct dimension drawing programming, both an end point and an angle were specified in the block next to the block in which only an angle was specified (Aa). Modify the program.
0057	NO SOLUTION OF BLOCK END	<u>T</u> Block end point is not calculated correctly in direct dimension drawing programming. Modify the program.
0058	END POINT NOT FOUND	<u>T</u> Block end point is not found in direct dimension drawing programming. Modify the program.
0060	SEQUENCE NUMBER NOT FOUND	[External data input/output] The specified number could not be found for program number and sequence number searches. A request was issued for input/output of an offset amount for tool data, but a tool number has never been entered after power-up. The tool data corresponding to the entered tool number could not be found. [External workpiece number search] The program corresponding to the specified workpiece number could not be found. [Program restart] In the program restart sequence number specification, the specified sequence number could not be found.
0061	P OR Q COMMAND IS NOT IN THE MULTIPLE REPETIVE CYCLES BLOCK	<u>T</u> Address P or Q is not specified in multiple repetitive cycle (G70, G71, G72, or G73) command.
0062	THE CUTTING AMOUNT IS ILLEGAL IN THE ROUGH CUTTING CYCLE	<u>T</u> A zero or a negative value was specified in a multiple repetitive canned rough-cutting cycle (G71 or G72) as the depth of cut.
0063	THE BLOCK OF A SPECIFIED SEQUENCE NUMBER IS NOT FOUND	<u>T</u> The sequence number specified by addresses P and Q in multiple repetitive cycle (G70, G71, G72, or G73) command cannot be searched.

Number	Message	Description
0064	THE FINISHING SHAPE IS NOT A MONOTONOUS CHANGE(FIRST AXES)	$\boxed{\text{T}}$ In a shape program for the multiple repetitive canned rough-cutting cycle (G71 or G72), the command for the first plane axis was not a monotonous increase or decrease.
0065	G00/G01 IS NOT IN THE FIRST BLOCK OF SHAPE PROGRAM	$\boxed{\text{T}}$ In the first block of the shape program specified by P of the multiple repetitive canned cycle (G70, G71, G72, or G73), G00 or G01 was not specified.
0066	UNAVAILABLE COMMAND IS IN THE MULTIPLE REPETIVE CYCLES BLOCK	$\boxed{\text{T}}$ An unavailable command was found in a multiple repetitive canned cycle (G70, G71, G72, or G73) command block.
0067	THE MULTIPLE REPETIVE CYCLES IS NOT IN THE PART PROGRAM STORAGE	$\boxed{\text{T}}$ A multiple repetitive canned cycle (G70, G71, G72, or G73) command is not registered in a tape memory area.
0069	LAST BLOCK OF SHAPE PROGRAM IS AN ILLEGAL COMMAND	$\boxed{\text{T}}$ In a shape program in the multiple repetitive canned cycle (G70, G71, G72, or G73), a command for the chamfering or corner R in the last block is terminated in the middle.
0070	NO PROGRAM SPACE IN MEMORY	The memory area is insufficient. Delete any unnecessary programs, then retry.
0071	DATA NOT FOUND	1) The address to be searched was not found. 2) The program with specified program number was not found in program number search. 3) In the program restart block number specification, the specified block number could not be found. Check the data.
0072	DATA NOT FOUND	The number of programs to be stored exceeded 400 (1-path system) or 800 (2-path system of T series). Delete unnecessary programs and execute program registration again.
0073	PROGRAM NUMBER ALREADY IN USE	The commanded program number has already been used. Change the program number or delete unnecessary programs and execute program registration again.
0074	PROGRAM NUMBER ALREADY IN USE	The program number is other than 1 to 9999. Modify the program number.
0075	PROTECT	An attempt was made to register a program whose number was protected. In program matching, the password for the encoded program was not correct. An attempt was made to select a program being edited in the background as the main program. An attempt was made to call a program being edited in the background as a subprogram.
0076	PROGRAM NOT FOUND	The specified program is not found in the subprogram call or macro call. The M, G, or T codes are called by a P instruction other than that in an M98, M198, G65, G66, or interrupt type custom macro, and a program is called by a specific address. This alarm is also generated when a program is not found by these calls.
0077	TOO MANY SUB,MACRO NESTING	The total number of subprogram and macro calls exceeds the permissible range. Another subprogram call was executed during an external memory subprogram call.

Number	Message	Description
0078	SEQUENCE NUMBER NOT FOUND	The specified sequence No. was not found during sequence number search. The sequence No. specified as the jump destination in GOTO— and M99P— was not found.
0079	PROGRAM NOT MATCH	The program in memory does not match the program stored on tape. Multiple programs cannot be matched continuously when bit 6 (NPE) of parameter No. 3201 is set to "1". Set bit 6 (NPE) of parameter No. 3201 to "0" before executing a match.
0080	G37 MEASURING POSITION REACHED SIGNAL IS NOT PROPERLY INPUT	**M** When the tool length measurement function (G37) is performed, a measuring position reached signal goes 1 in front of the area determined by the ε value specified in parameter No.6254. Alternatively, the signal does not go 1. **T** When the automatic tool compensation function (G36, G37) is used, a measuring position reached signals (XAE1, XAE2) does not go 1 within the range determined by the ε value specified in parameters Nos.6254 and 6255.
0081	G37 OFFSET NO. UNASSIGNED	**M** The tool length measurement function (G37) is specified without specifying an H code. Correct the program. **T** The automatic tool compensation function (G36, G37) is specified without specifying an T code. Correct the program.
0082	G37 SPECIFIED WITH H CODE	**M** The tool length measurement function (G37) is specified together with an H code in the same block. Correct the program. **T** The automatic tool compensation function (G36, G37) is specified together with an T code in the same block. Correct the program.
0083	G37 IMPROPER AXIS COMMAND	**M** An error has been found in axis specification of the tool length measurement function (G37). Alternatively, a move command is specified as an incremental command. Correct the program. **T** An error has been found in axis specification of the automatic tool compensation function (G36, G37). Alternatively, a command is specified as an incremental command. Correct the program.
0085	OVERRUN ERROR	The next character was received from the I/O device connected to reader/punch interface 1 before it could read a previously received character. An overrun, parity error, or framing error occurred during the reading by reader/punch interface 1. The number of bits in the entered data, the baud rate setting, or the I/O unit specification number is incorrect.

Number	Message	Description
0086	DR OFF	During I/O process by reader/punch interface 1, the data set ready input signal of the I/O device (DR) was OFF. Possible causes are an I/O device not turn on, a broken cable, and a defective printed circuit board.
0087	BUFFER OVERFLOW	During a read by reader/punch interface 1, although a read stop command was issued, more than 10 characters were input. The I/O device or printed circuit board was defective.
0090	REFERENCE RETURN INCOMPLETE	1) The reference position return cannot be performed normally because the reference position return start point is too close to the reference position or the speed is too slow. Separate the start point far enough from the reference position, or specify a sufficiently fast speed for reference position return. 2) An attempt was made to set the zero position for the absolute position detector by return to the reference position when it was impossible to set the zero point. Rotate the motor manually at least one turn, and set the zero position of the absolute position detector after turning the CNC and servo amplifier off and then on again.
0091	MANUAL REFERENCE POSITION RETURN IS NOT PERFORMED IN FEED HOLD	Manual return to the reference position cannot be performed when automatic operation is halted. Perform the manual return to the reference position when automatic operation is stopped or reset.
0092	ZERO RETURN CHECK (G27) ERROR	The axis specified in G27 has not returned to reference position. Reprogram so that the axis returns to reference position.
0094	P TYPE NOT ALLOWED (COORD CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the coordinate system setting operation was performed.) Perform the correct operation according to the User's manual.
0095	P TYPE NOT ALLOWED (EXT OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the external workpiece origin offset amount changed.) Perform the correct operation according to the User's manual.
0096	P TYPE NOT ALLOWED (WRK OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the workpiece origin offset amount changed.) Perform the correct operation according to the User's manual.
0097	P TYPE NOT ALLOWED (AUTO EXEC)	P type cannot be directed when the program is restarted. (After power ON or alarms 0094 to 0097 reset, no automatic operation is performed.) Perform automatic operation.
0099	MDI EXEC NOT ALLOWED AFT. SEARCH	After completion of search in program restart, a move command is given with MDI.
0109	FORMAT ERROR IN G08	 boxed: **T** A value other than 0 or 1 was specified after P in the G08 code, or no value was specified.
0110	OVERFLOW :INTEGER	An integer went out of range during arithmetic calculations.
0111	OVERFLOW :FLOATING	A decimal point (floating point number format data) went out of range during arithmetic calculations.
0112	ZERO DIVIDE	An attempt was made to divide by zero in a custom macro.
0113	IMPROPER COMMAND	A function which cannot be used in custom macro is commanded. Modify the program.
0114	ILLEGAL EXPRESSION FORMAT	The format used in an expression in a custom macro statement is in error. The parameter tape format is in error.
0115	VARIABLE NO. OUT OF RANGE	A number that cannot be used for a local variable, common variable, or system variable in a custom macro is specified.

Number	Message	Description
0116	WRITE PROTECTED VARIABLE	An attempt was made in a custom macro to use on the left side of an expression a variable that can only be used on the right side of an expression.
0118	TOO MANY BRACKET NESTING	Too many brackets "[ ]" were nested in a custom macro. The nesting level including function brackets is 5.
0119	ARGUMENT VALUE OUT OF RANGE	The value of an argument in a custom macro function is out of range.
0122	TOO MANY MACRO NESTING	Too many macro calls were nested in a custom macro.
0123	ILLEGAL MODE FOR GOTO/WHILE/DO	A GOTO statement or WHILE–DO statement was found in the main program in the MDI or DNC mode.
0124	MISSING END STATEMENT	The END instruction corresponding to the DO instruction was missing in a custom macro.
0125	MACRO STATEMENT FORMAT ERROR	The format used in a macro statement in a custom macro is in error.
0126	ILLEGAL LOOP NUMBER	DO and END Nos. in a custom macro are in error, or exceed the permissible range (valid range: 1 to 3).
0127	DUPLICATE NC,MACRO STATEMENT	An NC statement and macro statement were specified in the same block.
0128	ILLEGAL MACRO SEQUENCE NUMBER	The specified sequence No. could not be found for sequence number search. The sequence No. specified as the jump destination in GOTO-- and M99P-- could not be found.
0129	USE 'G' AS ARGUMENT	G is used as an argument in a custom macro call. G cannot be used as an argument.
0130	NC AND PMC AXIS ARE CONFLICTED	The NC command and the PMC axis control command were conflicted. Modify the program or ladder.
0136	SPOS AXIS - OTHER AXIS SAME TIME	**T** The M code for spindle positioning and an axis address not for a spindle positioning axis were specified simultaneously. Alternatively, the axis addresses of a spindle positioning axis and non-spindle positioning axis were specified simultaneously in the spindle positioning mode.
0137	M-CODE & MOVE CMD IN SAME BLK.	**T** The M code for spindle positioning and the axis address of a spindle positioning axis were specified simultaneously.
0139	CANNOT CHANGE PMC CONTROL AXIS	The PMC axis was selected for the axis for which the PMC axis is being controlled.
0140	PROGRAM NUMBER ALREADY IN USE	In the background, an attempt was made to select or delete the program being selected in the foreground. Perform the correct operation for the background edition.
0142	ILLEGAL SCALE RATE	**M** The scaling rate is 0 times or 10000 times or more. Modify the setting of the scaling rate. (G51P_ … or G51I_J_K_ … or parameter No. 5411 or 5421)
0143	COMMAND DATA OVERFLOW	An overflow occurred in the storage length of the CNC internal data. This alarm is also generated when the result of internal calculation of scaling (M series), coordinate rotation (M series), and cylindrical interpolation overflows the data storage. It also is generated during input of the manual intervention amount.
0144	ILLEGAL PLANE SELECTED	**M** The coordinate rotation plane and arc or cutter compensation plane must be the same. Modify the program.

Number	Message	Description
0145	ILLEGAL USE OF G12.1/G13.1	**T** The axis No. of plane selection parameter No. 5460 (linear axis) and No. 5461(axis of rotation) in the polar coordinate interpolation mode is out of range (1 to number of controlled axes).
0146	ILLEGAL USE OF G-CODE	**T** The G code must be G40 modal when the polar coordinate interpolation mode is set or canceled. An illegal G code was specified while in the polar coordinate interpolation mode. Only the following G codes can be specified in this mode. G01,G02,G03,G04,G40,G41,G42,G65,G66,G67, (G90 and G91 for the G code system B or C), G98,G99
0148	SETTING ERROR	**M** Automatic corner override deceleration rate is out of the settable range of judgement angle. Modify the parameters Nos.1710 to 1714.
0149	FORMAT ERROR IN G10L3	In registration (G10L3 to G11) of tool life management data, an address other than Q1, Q2, P1, and P2 or an unusable address was specified.
0150	ILLEGAL LIFE GROUP NUMBER	The tool group number exceeded the maximum allowable value. The tool group number (P after specification of G10 L3;) or the group number given by the tool life management T code in a machining program.
0151	GROUP NOT FOUND AT LIFE DATA	The tool group specified in a machining program is not set in tool life management data.
0152	OVER MAXIMUM TOOL NUMBER	The number of tools registered in one group exceeded the maximum allowable registration tool number.
0153	T-CODE NOT FOUND	In registration of tool life data, a block in which the T code needs to be specified does not include the T code. Alternatively, in tool exchange method D, M06 is specified solely. Modify the program.
0154	NOT USING TOOL IN LIFE GROUP	The H99 command, D99 command, or the H/D code set by parameters Nos. 13265 and 13266 was specified when no tool belonging to a group is used.
0155	ILLEGAL T-CODE COMMAND	In a machining program, the T code specified in the same block as M06 does not correspond to the group in current use. Modify the program.
0156	P/L COMMAND NOT FOUND	The P and L commands are not specified in the beginning of a program for setting a tool group. Modify the program.
0157	TOO MANY TOOL GROUPS	In registration of tool life management data, the group setting command block counts of P (group number) and L (tool life) exceeded the maximum group count.
0158	TOOL LIFE VALUE OUT OF RANGE	The life value that is being set is too large. Change the setting.
0159	ILLEGAL TOOL LIFE DATA	Tool life management data is corrupted for some reason. Register the tool data in the tool group or the tool data in the group again by G10L3; or MDI input.
0160	MISMATCH WAITING M-CODE	A waiting M-code is in error. Different waiting M codes are specified for paths 1 and 2.
0163	ILLEGAL COMMAND IN G68/G69	**T** G68 and G69 are not independently commanded in balance cut.
0169	ILLEGAL TOOL GEOMETRY DATA	**T** Incorrect tool figure data in interference check. Set correct data, or select correct tool figure data.

Number	Message	Description
0175	ILLEGAL G07.1 AXIS	An axis which cannot perform cylindrical interpolation was specified. More than one axis was specified in a G07.1 block. An attempt was made to cancel cylindrical interpolation for an axis that was not in the cylindrical interpolation mode. In cylindrical interpolation mode, to specify circular interpolation including a rotation axis (when bit 0 (ROT) of parameter No. 1006 is 1 and parameter No. 1260 is set), the value of rotation axis parameter No. 1022 must not be 0 but 5, 6, or 7 for parallel axis specification.
0176	ILLEGAL G-CODE USE(G07.1 MODE)	A G code was specified that cannot be specified in the cylindrical interpolation mode. This alarm also is generated when an 01 group G code was in the G00 modal or code G00 was instructed. Cancel the cylindrical interpolation mode before instructing code G00.
0190	ILLEGAL AXIS SELECTED (G96)	An illegal value was specified in P in a G96 block or parameter No. 3770.
0194	SPINDLE COMMAND IN SYNCHRO-MODE	**T** A Cs contour control mode, spindle positioning command, or rigid tapping mode was specified during the spindle synchronous control mode. **M** A Cs contour control mode or rigid tapping mode was specified during the spindle synchronous control mode or simple spindle synchronous control mode.
0197	C-AXIS COMMANDED IN SPINDLE MODE	The program specified a movement along the Cs-axis when the Cs contour control switching signal was off.
0199	MACRO WORD UNDEFINED	Undefined macro word was used. Modify the custom macro.
0200	ILLEGAL S CODE COMMAND	In the rigid tap, an S value was out of range or was not specified. The parameters Nos. 5241 to 5243 setting is an S value which can be specified for the rigid tap. Correct the parameters or modify the program.
0201	FEEDRATE NOT FOUND IN RIGID TAP	The command F code for a cutting feedrate is a zero. If the value of F command is much smaller than that of the S command, when a rigid tap command is specified, this alarm is generated. This is because cutting is not possible by the lead specified by the program.
0202	POSITION LSI OVERFLOW	In the rigid tap, spindle distribution value is too large. (System error)
0203	PROGRAM MISS AT RIGID TAPPING	In the rigid tap, position for a rigid M code (M29) or an S command is incorrect. Modify the program.
0204	ILLEGAL AXIS OPERATION	In the rigid tap, an axis movement is specified between the rigid M code (M29) block and G84 (or G74) block. Modify the program.
0205	RIGID MODE DI SIGNAL OFF	Although a rigid M code (M29) is specified in rigid tapping, the rigid mode DI signal (DGN G061.0) is not ON during execution of the G84 (or G74) block. Check the PMC ladder diagram to find the reason why the DI signal is not turned on.
0206	CAN NOT CHANGE PLANE (RIGID TAP)	Plane changeover was instructed in the rigid mode. Modify the program.
0207	RIGID DATA MISMATCH	The specified distance was too short or too long in rigid tapping.

Number	Message	Description
0210	CAN NOT COMMAND M198/M99	1) The execution of an M198 or M99 command was attempted during scheduled operation. Alternatively, the execution of an M198 command was attempted during DNC operation. Modify the program. **T** 2) The execution of an M99 command was attempted by an interrupt macro during pocket machining in a multiple repetitive canned cycle.
0213	ILLEGAL COMMAND IN SYNCHRO-MODE	In feed axis control , the following errors occurred during the synchronous operation. 1) The program issued the move command to the slave axis. 2) The program issued the manual operation to the slave axis. 3) The program issued the automatic reference position return command without specifying the manual reference position return after the power was turned on.
0214	ILLEGAL COMMAND IN SYNCHRO-MODE	Coordinate system is set or tool length compensation (M series) of the shift type is executed in the synchronous control. Correct the program.
0217	DUPLICATE G51.2(COMMANDS)	**T** G51.2 is further commanded in the G51.2 mode. Modify the program.
0218	NOT FOUND P/Q COMMAND	**T** P or Q is not commanded in the G51.2 block, or the command value is out of the range. Modify the program. For a polygon turning between spindles, more information as to why this alarm occurred is indicated in DGN No. 471.
0219	COMMAND G51.2/G50.2 INDEPENDENTLY	**T** G51.2 and 50.2 were specified in the same block for other commands. Modify the program in another block.
0220	ILLEGAL COMMAND IN SYNCHR-MODE	In the synchronous operation, movement is commanded by the NC program or PMC axis control interface for the synchronous axis. Modify the program or check the PMC ladder.
0221	ILLEGAL COMMAND IN SYNCHR-MODE	**T** Polygon machining synchronous operation and Cs axis contour control or balance cutting are executed at a time. Modify the program.
0222	DNC OP. NOT ALLOWED IN BG-EDIT	Input and output are executed at a time in the background edition. Execute a correct operation.
0224	ZERO RETURN NOT FINISHED	1) A reference position return has not been performed before the start of automatic operation. (Only when bit 0 (ZRNx) of parameter No. 1005 is 0) Perform a reference position return. **T** 2) A command was specified for a spindle positioning axis not in the spindle positioning mode. Perform spindle orientation.
0230	R CODE NOT FOUND	**M** Cut depth R is not specified in the block including G161. Alternatively, the value specified for R is negative. Modify the program.
0231	ILLEGAL FORMAT IN G10 L52	Errors occurred in the specified format at the programmable-parameter input.
0232	TOO MANY HELICAL AXIS COMMAND	Three or more axes were specified as helical axes in the helical interpolation mode.

Number	Message	Description
0233	DEVICE BUSY	When an attempt was made to use a unit such as that connected via the RS-232-C interface, other users were using it.
0245	T-CODE NOT ALLOWED IN THIS BLOCK	One of the G codes, G04,G10,G28,G29 (M series),G30,G50 (T series), and G53, which cannot be specified in the same block as a T code, was specified with a T code.
0247	THE MISTAKE IS FOUND IN THE OUTPUT CODE OF DATA.	When an encrypted program is output, EIA is set for the output code. Specify ISO.
0250	TOOL CHANGE ILLEGAL Z AXIS COMMAND	A Z-axis move command was performed in the same block for M06 command.
0251	TOOL CHANGE ILLEGAL T COMMAND	An unusable T code was specified in M06Txx.
0300	ILLEGAL COMMAND IN SCALING	An illegal G code was specified during scaling. Modify the program.
0301	RESETTING OF REFERENCE RETURN IS INHIBITED	Although bit 0 (IDGx) of parameter No. 1012 was set to 1 to inhibit the reference position from being set again for a return to the reference position without a dog, an attempt was made to perform a manual return to the reference position.
0302	SETTING THE REFERENCE POSITION WITHOUT DOG IS NOT PERFORMED	The reference position could not be set for a return to the reference position without a dog. Possible causes are: - The axis was not moved in the direction of a return to the reference position for jog feeding. - The axis was moved in the direction opposite to the direction of a manual return to the reference position.
0304	G28 IS COMMANDED WITHOUT ZERO RETURN	Although a reference position was not set, an automatic return to the reference position (G28) was commanded.
0305	INTERMEDIATE POSITION IS NOT ASSIGNED	**M** Although a G28 (automatic return to the reference position) or G30 (return to the second, third, or fourth reference position) command was not issued after power-up, G29 (return from the reference position) was commanded.
0306	MISMATCH AXIS WITH CNR/CHF	**T** The correspondence between the moving axis and the I, J, or K command is incorrect in a block in which chamfering is specified.
0307	CAN NOT START REFERENCE RETURN WITH MECHANICAL STOPPER SETTING	An attempt was made to set a butt-type reference position for an axis for which to use the function to set a reference position without a dog.
0310	FILE NOT FOUND	The specified file could not be found during a subprogram or macro call.
0311	CALLED BY FILE NAME FORMAT ERROR	An invalid format was specified to call a subprogram or macro using a file name.
0312	ILLEGAL COMMAND IN DIRECT DRAWING DIMENSIONS PROGRAMMING	**T** Direct input of drawing dimensions was commanded in an invalid format. An attempt was made to specify an invalid G code during direct input of drawing dimensions. Two or more blocks not to be moved exist in consecutive commands that specify direct input of drawing dimensions. Although non-use of commas (,) (parameter No. 3405#4 = 1) was specified for direct input of drawing dimensions, a comma was specified.
0313	ILLEGAL LEAD COMMAND	**T** The variable-lead threading increment specified in address K exceeds the specified maximum value in variable-lead threading. Or, a negative lead value was specified.

Number	Message	Description
0314	ILLEGAL SETTING OF POLYGONAL AXIS	**T** An axis was specified invalidly in polygon turning. For polygon turning: 1) A tool rotation axis is not specified. (Parameter No. 7610) For polygon turning between spindles: 1) Valid spindles are not specified. (Parameters Nos. 7640 to 7643) 2) A spindle other than the serial spindle. 3) A spindle is not connected.
0315	ILLEGAL NOSE ANGLE COMMAND IS IN THE THREAD CUTTING CYCLE	**T** An invalid tool tip angle is specified in a multiple repetitive canned threading cycle (G76).
0316	ILLEGAL CUTTING AMOUNT IS IN THE THREAD CUTTING CYCLE	**T** An minimum depth of cut higher than the thread height is specified in a multiple repetitive canned threading cycle (G76).
0317	ILLEGAL THREAD COMMAND IS IN THE THREAD CUTTING CYCLE	**T** A zero or a negative value is specified in a multiple repetitive canned threading cycle (G76) as the thread height or the depth of cut.
0318	ILLEGAL RELIEF AMOUNT IS IN THE DRILLING CYCLE	**T** Although an escape directions is set in a multiple repetitive canned cutting-off cycle (G74 or G75), a negative value is specified for Δd.
0319	THE END POINT COMMAND IS ILLEGAL IN THE DRILLING CYCLE	**T** Although the Δi or Δk travel distance is set to 0 in a multiple repetitive canned cutting-off cycle (G74 or G75), a value other than 0 us specified for a U or W.
0320	ILLEGAL MOVEMENT AMOUNT/CUTTING AMOUNT IS IN THE DRILLING CYCLE	**T** A negative value is specified in a multiple repetitive canned cutting-off cycle (G74 or G75) as Δi or Δk (travel distance/the depth of cut).
0321	ILLEGAL REPEATED TIME IS IN THE PATTERN REPEATING CYCLE	**T** A zero or a negative value is specified in a multiple repetitive canned closed loop cycle (G73) as a repeated time.
0322	FINISHING SHAPE WHICH OVER OF STARTING POINT	**T** An invalid shape which is over the cycle starting point is specified in a shape program for a multiple repetitive canned rough-cutting cycle (G71 or G72).
0323	THE FIRST BLOCK OF SHAPE PROGRAM IS A COMMAND OF TYPE II	**T** Type II is specified in the first block of the shape program specified by P in a multiple repetitive canned rough-cutting cycle (G71 or G72). For G71, Z(W) is specified. For G72, X(U) is specified.
0324	THE INTERRUPTION TYPE MACRO WAS DONE IN THE MULTIPLE REPETIVE CYCLES	**T** An interruption type macro was issued during the multiple repetitive canned cycle (G70, G71, G72, or G73).
0325	UNAVAILABLE COMMAND IS IN SHAPE PROGRAM	**T** An usable command was issued in a shape program for a multiple repetitive canned cycle (G70, G71, G72, or G73).
0326	LAST BLOCK OF SHAPE PROGRAM IS A DIRECT DRAWING DIMENSIONS	**T** In a shape program in the multiple repetitive canned cycle (G70, G71, G72, or G73), a command for direct input of drawing dimensions in the last block is terminated in the middle.

Number	Message	Description
0327	MODAL THAT MULTIPLE REPETIVE CYCLES CANNOT BE DONE	**T** A multiple repetitive canned cycle (G70, G71, G72, or G73) was commanded in a modal state in which a multiple repetitive canned cycle could not be commanded.
0328	ILLEGAL WORK POSITION IS IN THE TOOL NOSE RADIUS COMPENSATION	**T** The specification for the blank side for a tool nose radius compensation (G41 or G42) is incorrect in a multiple repetitive canned cycle (G71 or G72).
0329	THE FINISHING SHAPE IS NOT A MONOTONOUS CHANGE(SECOND AXES)	**T** In a shape program for the multiple repetitive canned rough-cutting cycle (G71 or G72), the command of the second plane axis was not a monotonous increase or decrease.
0330	ILLEGAL AXIS COMMAND IS IN THE TURNING CANNED CYCLE	**T** An axis other than the plane is specified n a canned cycle(G90, G92, or G94).
0334	OFFSET IS OUT OF EFFECTIVE RANGE	An offset data which was out of the effective range was specified. (malfunction prevention function)
0336	TOOL COMPENSATION COMMANDED MORE TWO AXES	**M** For a tool length compensation C, an attempt was made to command the offset to other axes without canceling the offset. Or, for a tool length compensation C, multiple axes are specified in G43 or G44 block.
0337	EXCESS MAXIMUM INCREMENTAL VALUE	The command value exceeded the maximum amount of incremental. (malfunction prevention function)
0338	ILLEGAL EXEC SEQ OF BLOCK	An incorrect value was detected in a check sum. (malfunction prevention function)
0345	TOOL CHANGE ILLEGAL Z AXIS POS	A tool change position on the Z-axis is incorrect.
0346	TOOL CHANGE ILLEGAL TOOL NUM	A tool number for tool change is incorrect.
0347	TOOL CHANGE ILLEGAL COMMAND IN SAME BLK.	Tool changing is commanded twice or more in the same block.
0348	TOOL CHANGE Z AXIS POS NOT ESTABLISHED	A tool change spindle on the Z-axis is not set.
0349	TOOL CHANGE SPINDLE NOT STOP	A tool change spindle stop is not stopped.
0350	PARAMETER OF THE INDEX OF THE SYNCHRONOUS CONTROL AXIS SET ERROR.	**T** An illegal synchronous control axis number (parameter No. 8180) is set.
0351	BECAUSE THE AXIS IS MOVING, THE SYNC CONTROL IS CAN'T BE USED.	**T** While the axis being subject to synchronous control was moving, an attempt was made to start or cancel the synchronous control by a synchronous control axis selection signal.
0352	SYNCHRONOUS CONTROL AXIS COMPOSITION ERROR.	**T** This error occurred when: 1) An attempt was made to perform synchronous control for the axis during a synchronization, composite, or superimposed control. 2) An attempt was made to synchronize a further great-grandchild for a parent-child-grandchild relation. 3) An attempt was made to operate synchronous control although a parent-child-grandchild relation was not set.

Number	Message	Description
0353	THE INSTRUCTION WAS DONE FOR THE AXIS WHICH WAS NOT ABLE TO MOVE.	**T** This error occurred when: 1) A move command was executed for an axis for which bit 7 (NUMx) of parameter No. 8163 was 1. 2) A move command was executed for a slave axis in synchronous control. 3) A move command was executed for an axis for which bit 7 (MUMx) of parameter No. 8162 was 1 in composite control.
0354	THE G28 WAS INSTRUCTED IN WITH THE REF POS NOT FIXED IN SYNC MODE	**T** This error occurred when G28 was specified to the master axis being parking during synchronous control, but an axis reference position is not set for the slave axis.
0355	PARAMETER OF THE INDEX OF THE COMPOSITE CONTROL AXIS SET ERROR.	**T** An illegal composite control axis number (parameter No. 8183) is specified.
0356	BECAUSE THE AXIS IS MOVING, THE COMP CONTROL IS CAN'T BE USED.	**T** While the axis being subject to composite control was moving, an attempt was made to start or cancel the composite control by a composite control axis selection signal.
0357	COMPOSITE CONTROL AXIS COMPOSITION ERROR.	**T** This error occurred when an attempt was made to perform composite control for the axis during a synchronous, composite, or superimposed control.
0359	THE G28 WAS INSTRUCTED IN WITH THE REF POS NOT FIXED IN COMP MODE	**T** This error occurred when G28 was specified to the composite axis during composite control, but a reference position is not set to the other part of the composition.
0360	PARAMETER OF THE INDEX OF THE SUPERPOS CONTROL AXIS SET ERROR.	**T** An illegal superimposed control axis number (parameter No. 8186) is specified.
0361	BECAUSE THE AXIS IS MOVING, THE SUPERPOS CONTROL IS CAN'T BE USED.	**T** While the axis being subject to superimposed control was moving, an attempt was made to start or cancel the superimposed control by a superimposed control axis selection signal.
0362	SUPERPOSITION CONTROL AXIS COMPOSITION ERROR.	**T** This error occurred when: 1) An attempt was made to perform superimposed control for the axis during a synchronous, composite, or superimposed control. 2) An attempt was made to synchronize a further great-grandchild for a parent-child-grandchild relation.
0363	THE G28 WAS INSTRUCTED IN TO THE SUPERPOS CONTROL SLAVE AXIS.	**T** This error occurred when G28 was specified to the superimposed control slave axis during superimposed control.
0364	THE G53 WAS INSTRUCTED IN TO THE SUPERPOS CONTROL SLAVE AXIS.	**T** This error occurred when G53 was specified to the slave axis being moved during superimposed control.
0365	TOO MANY MAXIMUM SV/SP AXIS NUMBER PER PATH	The number of controlled axes or spindles to be used in one path is not set correctly. Check parameters No. 981 and No. 982. If this alarm is generated, the emergency stop state cannot be released.
0369	G31 FORMAT ERROR	1) No axis is specified or two or more axes are specified in the torque limit switch instruction (G31P98/P99). 2) G31P90 cannot be specified.

Number	Message	Description
0370	G31P/G04Q ERROR	1) The specified address P value for G31 is out of range. The address P range is 1 to 4 in a multistage skip function. 2) The specified address Q value for G04 is out of range. The address Q range is 1 to 4 in a multistage skip function. 3) P1-4 for G31, or Q1-4 for G04 was commanded without a multistage skip function option. ![T] 4) In G72 or G74 in grinding canned cycles, the specified address P value is out of range. Address P ranges from 1 to 4 in the multistage skip function. P1-4 was specified in G72 or G74 even though the multistage skip function option is not present.
0372	REFERENCE RETURN INCOMPLETE	An attempt was made to perform an automatic return to the reference position on the orthogonal axis before the completion of a return to the reference position on the angular axis. However, this attempt failed because a manual return to the reference position during angular axis control or an automatic return to the reference position after power-up was not commanded. First, return to the reference position on the angular axis, then return to the reference position on the orthogonal axis.
0373	ILLEGAL HIGH-SPEED SKIP SIGNAL	In the skip commands (G31, G31P1 to G31P4) and dwell commands (G04, G04Q1 to G04Q4), the same high-speed signal is selected in different paths.
0375	CAN NOT ANGULAR CONTROL(SYNC:MIX:OVL)	Angular axis control is disabled for this axis configuration. 1) All related axes in angular axis control are not in synchronous control mode. Alternatively, settings must be made to provide synchronous control between angular axes, and also between orthogonal axes. 2) All related axes in angular axis control are not in composite control mode. Alternatively, settings must be made to provide composite control between angular axes, and also between orthogonal axes. 3) The related axes in angular axis control are in superimposed control mode.
0376	SERIAL DCL: ILLEGAL PARAMETER	1) When bit 1 of parameter No. 1815 is set to "1", bit 3 of parameter No. 2002 is set to "0" 2) The absolute-position detection function is enabled. (Bit 5 (APCx) of parameter No.1815 is set to "1".)
0412	ILLEGAL G CODE	An unusable G code was used.
0445	ILLEGAL AXIS OPERATION	![T] The positioning command was issued in the speed control mode. Check the SV speed control mode signal (Fn521).
0446	ILLEGAL COMMAND IN G96.1/G96.2/G96.3/G96.4	![T] G96.1, G96.2, G96.3, and G96.4 are specified in the block that includes other commands. Modify the program.
0447	ILLEGAL SETTING DATA	The spindle controlled with the servo motor is not set correctly. Check the parameters for the function of spindle control with the servo motor.
0455	ILLEGAL COMMAND IN GRINDING	In grinding canned cycles: ![M] 1) The signs of the I, J, and K commands do not match. 2) The amount of travel of the grinding axis is not specified.

Number	Message	Description
0456	ILLEGAL PARAMETER IN GRINDING	Parameters related to grinding canned cycles are incorrectly set. Probable causes are given below. 1) The axis number of the grinding axis is incorrectly set (parameters Nos. 5176 to 5179). **M** 2) The axis number of the dressing axis is incorrectly set (parameters Nos. 5180 to 5183). 3) The axis numbers of the cut axis, grinding axis, and dressing axis (only for the M series) overlap.
0601	ILLEGAL AXIS OPERATION FOR SERVO MOTOR SPINDLE	A move command is executer for the spindle controlled with the servomotor. Modify the program.
0602	ILLEGAL AXIS OPERATION FOR LIVE TOOL AXIS	The spindle controlled with the serve motor is not selected correctly.
1001	AXIS CONTROL MODE ILLEGAL	The axis control mode is illegal.
1013	ILLEGAL POS. OF PROGRAM NO.	Address O or N is specified where it must not (After the macro statement etc.).
1014	ILLEGAL FORMAT OF PROGRAM NO.	Address O or N is not followed by a number.
1016	EOB NOT FOUND	EOB (End of Block) code is missing at the end of a program input in the MDI mode.
1077	PROGRAM IN USE	An attempt was made in the foreground to execute a program being edited in the background. The currently edited program cannot be executed, so end editing and restart program execution.
1079	PROGRAM FILE NOT FOUND	The program of the specified file No. is not registered in an external device. (external device subprogram call)
1080	DUPLICATE DEVICE SUB PROGRAM CALL	Another external device subprogram call was made from a subprogram after the subprogram called by the external device subprogram call.
1081	EXT DEVICE SUB PROGRAM CALL MODE ERROR	The external device subprogram call is not possible in this mode.
1091	DUPLICATE SUB-CALL WORD	More than one subprogram call instruction was specified in the same block.
1092	DUPLICATE MACRO-CALL WORD	More than one macro call instruction was specified in the same block.
1093	DUPLICATE NC-WORD & M99	An address other than O, N, P or L was specified in the same block as M99 during the macro modal call state.
1095	TOO MANY TYPE-2 ARGUMENT	More than ten sets of I, J and K arguments were specified in the type–II arguments (A, B, C, I, J, K, I, J, K, ...) for custom macros.
1096	ILLEGAL VARIABLE NAME	An illegal variable name was specified. A code that cannot be specified as a variable name was specified. The command of [#_OFSxx] does not match the type (A or C) of tool compensation memory in current use.
1097	TOO LONG VARIABLE NAME	The specified variable name is too long.
1098	NO VARIABLE NAME	The specified variable name cannot be used as it is not registered.
1099	ILLLEGAL SUFFIX [ ]	A suffix was not specified to a variable name that required a suffix enclosed by [ ]. A suffix was specified to a variable name that did not require a suffix enclosed by [ ]. The value enclosed by the specified [ ] was out of range.
1100	CANCEL WITHOUT MODAL CALL	Call mode cancel (G67) was specified even though macro continuous–state call mode (G66) was not in effect.

Number	Message	Description
1101	ILLEGAL CNC STATEMENT IRT.	An interrupt was made in a state where a custom macro interrupt containing a move instruction could not be executed.
1115	READ PROTECTED VARIABLE	An attempt was made in a custom macro to use on the right side of an expression a variable that can only be used on the left side of an expression.
1120	ILLEGAL ARGUMENT FORMAT	The specified argument in the argument function (ATAN, POW) is in error.
1124	MISSING DO STATEMENT	The DO instruction corresponding to the END instruction was missing in a custom macro.
1125	ILLEGAL EXPRESSION FORMAT	The description of the expression in a custom macro statement contains an error. A parameter program format error. The screen displayed to enter periodic maintenance data or item selection menu (machine) data does not match the data type.
1128	SEQUENCE NUMBER OUT OF RANGE	The jump destination sequence No. in a custom macro statement GOTO instruction was out of range (valid range: 1 to 99999).
1131	MISSING OPEN BRACKET	The number of left brackets ([) is less than the number of right brackets (]) in a custom macro statement.
1132	MISSING CLOSE BRACKET	The number of right brackets (]) is less than the number of left brackets ([) in a custom macro statement.
1133	MISSING '='	An equal sign (=) is missing in the arithmetic calculation instruction in a custom macro statement.
1134	MISSING ','	A delimiter (,) is missing in a custom macro statement.
1137	IF STATEMENT FORMAT ERROR	The format used in the IF statement in a custom macro is in error.
1138	WHILE STATEMENT FORMAT ERROR	The format used in the WHILE statement in a custom macro is in error.
1139	SETVN STATEMENT FORMAT ERROR	The format used in the SETVN statement in a custom macro is in error.
1141	ILLEGAL CHARACTER IN VAR. NAME	The SETVN statement in a custom macro contacts a character that cannot be used in a variable name.
1142	TOO LONG V-NAME (SETVN)	The variable name used in a SETVN statement in a custom macro exceeds 8 characters.
1143	BPRNT/DPRNT STATEMENT FORMAT ERROR	The format used in the BPRINT statement or DPRINT statement is in error.
1144	G10 FORMAT ERROR	Data input for the L No. of G10 or the corresponding function is not enabled. Data setting address P or R is not specified. An address not relating to the data setting is specified. Which address to specify varies according to the L No. The sign, decimal point or range of the specified address are in error.
1160	COMMAND DATA OVERFLOW	An overflow occurred in the position data within the CNC. This alarm is also generated if the target position of a command exceeds the maximum stroke as a result of calculation such as coordinate conversion, offset, or introduction of a manual intervention amount.
1180	ALL PARALLEL AXES IN PARKING	⊤ All of the axis specified for automatic operation are parked.
1196	ILLEGAL DRILLING AXIS SELECTED	An illegal axis was specified for drilling in a canned cycle for drilling. In the G code command block in a canned cycle, a Z point is not specified for the drilling axis.

Number	Message	Description
1200	PULSCODER INVALID ZERO RETURN	The grid position could not be calculated during grid reference position return using the grid system as the one–revolution signal was not received before leaving the deceleration dog. This alarm is also generated when the tool does not reach a feedrate that exceeds the servo error amount preset to parameter No. 1836 before the deceleration limit switch is left (deceleration signal *DEC returns to "1").
1202	NO F COMMAND AT G93	**M** F codes in the inverse time specification mode (G93) are not handled as modal, and must be specified in individual blocks.
1223	ILLEGAL SPINDLE SELECT	An attempt was made to execute an instruction that uses the spindle although the spindle to be controlled has not been set correctly.
1298	ILLEGAL INCH/METRIC CONVERSION	An error occurred during inch/metric switching.
1300	ILLEGAL ADDRESS	The axis No. address was specified even though the parameter is not an axis–type while loading parameters or pitch error compensation data from a tape or by entry of the G10 parameter. Axis No. cannot be specified in pitch error compensation data.
1301	MISSING ADDRESS	The axis No. was not specified even though the parameter is an axis–type while loading parameters or pitch error compensation data from a tape or by entry of the G10 parameter. Or, data No. address N, or setting data address P or R are not specified.
1302	ILLEGAL DATA NUMBER	A non–existent data No. was found while loading parameters or pitch error compensation data from a tape or by entry of the G10 parameter. This alarm is also generated when illegal word values are found.
1303	ILLEGAL AXIS NUMBER	An axis No. address exceeding the maximum number of controlled axes was found while loading parameters from a tape or by entry of the G10 parameter.
1304	TOO MANY DIGIT	Data with too many digits was found while loading parameters or pitch error compensation data from a tape.
1305	DATA OUT OF RANGE	Out–of–range data was found while loading parameters or pitch error compensation data from a tape. The values of the data setting addresses corresponding to L Nos. during data input by G10 was out of range. This alarm is also generated when NC programming words contain out–of–range values.
1306	MISSING AXIS NUMBER	A parameter which requires an axis to be specified was found without an axis No. (address A) while loading parameters from a tape.
1307	ILLEGAL USE OF MINUS SIGN	Data with an illegal sign was found while loading parameters or pitch error compensation data from a tape, or by entry of the G10 parameter. A sign was specified to an address that does not support the use of signs.
1308	MISSING DATA	An address not followed by a numeric value was found while loading parameters or pitch error compensation data from a tape.
1329	ILLEGAL MACHINE GROUP NUMBER	An machine group No. address exceeding the maximum number of controlled machine groups was found while loading parameters from a tape or by entry of the G10 parameter.

Number	Message	Description
1330	ILLEGAL SPINDLE NUMBER	An spindle No. address exceeding the maximum number of controlled spindles was found while loading parameters from a tape or by entry of the G10 parameter.
1331	ILLEGAL PATH NUMBER	An path No. address exceeding the maximum number of controlled path was found while loading parameters from a tape or by entry of the G10 parameter.
1332	DATA WRITE LOCK ERROR	Could not load data while loading parameters, pitch error compensation data and work coordinate data from tape.
1333	DATA WRITE ERROR	Could not write data while loading data from tape.
1470	G40.1 –G42.1 PARAMETER MISS	**M** A parameter setting related to normal direction control is illegal. The axis number of a normal direction controlled axis is set in parameter No. 5480, but that axis number is in the range of the number of controlled axes. The axis set as a normal direction controlled axis is not set as a rotation axis (ROTx, bit 0 of parameter No. 1006) = 1 and No.1022=0). Set the feedrate at which to insert rotation about a normal direction controlled axis in parameter No. 5481, in the range of 1 to 15000 mm/min.
1508	DUPLICATE M-CODE (INDEX TABLE REVERSING)	**M** A function to which the same code as this M code is set exists. (index table indexing)
1509	DUPLICATE M-CODE (SPOS AXIS ORIENTATION)	**T** A function to which the same code as this M code is set exists. (spindle positioning, orientation)
1510	DUPLICATE M-CODE (SPOS AXIS POSITIONING)	**T** A function to which the same code as this M code is set exists. (spindle positioning, positioning)
1511	DUPLICATE M-CODE (SPOS AXIS RELEASE)	**T** A function to which the same code as this M code is set exists. (spindle positioning, mode cancel)
1533	ADDRESS F UNDERFLOW (G95)	The feedrate for the hole drilling axis calculated from the F and S codes is too slow in the feed per single rotation mode.
1534	ADDRESS F OVERFLOW (G95)	The feedrate for the hole drilling axis calculated from the F and S codes is too fast in the feed per single rotation mode.
1537	ADDRESS F UNDERFLOW (OVERRIDE)	The speed obtained by applying override to the F instruction is too slow.
1538	ADDRESS F OVERFLOW (OVERRIDE)	The speed obtained by applying override to the F instruction is too fast.
1541	S-CODE ZERO	"0" has been instructed as the S code.
1543	ILLEGAL GEAR SETTING	**T** The gear ratio between the spindle and position coder, or the set position coder number of pulses is illegal in the spindle positioning function.
1544	S-CODE OVER MAX	The S command exceeds the maximum spindle rotation number.
1548	ILLGAL AXIS MODE	The spindle positioning (T series) axis/Cs contour control axis was specified during switching of the controlled axis mode.
1561	ILLEGAL INDEXING ANGLE	**M** The specified angle of rotation is not an integer multiple of the minimum indexing angle.
1564	INDEX TABLE AXIS – OTHER AXIS SAME TIME	**M** The index table indexing axis and another axis have been specified in the same block.

Number	Message	Description
1567	INDEX TABLE AXIS DUPLICATE AXIS COMMAND	**M** Index table indexing was specified during axis movement or on an axis for which the index table indexing sequence was not completed.
1590	TH ERROR	A TH error was detected during reading from an input device. The read code that caused the TH error and how many statements it is from the block can be verified in the diagnostics screen.
1591	TV ERROR	An error was detected during the single–block TV error. The TV check can be suppressed by setting bit 0 (TVC) of parameter No. 0000 to "0".
1592	END OF RECORD	The EOR (End of Record) code is specified in the middle of a block. This alarm is also generated when the percentage at the end of the NC program is read. For the program restart function, this alarm is generated if a specified block is not found.
1593	EGB PARAMETER SETTING ERROR	**M** Error in setting a parameter related to the EGB 1) The setting of SYN, bit 0 of parameter No. 2011, is not correct. 2) The slave axis specified with G81 is not set as a rotation axis. (ROT, bit 0 of parameter No. 1006) 3) Number of pulses per rotation (Parameter (No. 7772 or No. 7773) is not set.)
1594	EGB FORMAT ERROR	**M** Error in the format of the block of an EGB command 1) T (number of teeth) is not specified in the G81 block. 2) In the G81 block, the data specified for one of T, L, P, and Q is out of its valid range. 3) n the G81 block, only one of P and Q is specified.
1595	ILL-COMMAND IN EGB MODE	**M** During synchronization with the EGB, a command that must not be issued is issued. 1) Slave axis command using G27, G28, G29, G30, G33, G53, etc. 2) Inch/metric conversion command using G20, G21, etc.
1596	EGB OVERFLOW	**M** An overflow occurred in the calculation of the synchronization coefficient.
1805	ILLEGAL COMMAND	[I/O Device] An attempt was made to specify an illegal command during I/O processing on an I/O device. [G30 Reference Position Return] The address P numbers for specifying the 2nd, 3rd, and 4th reference position returns are not 2, 3, and 4. [Single Rotation Dwell] The specified spindle rotation is "0" when single rotation dwell is specified.
1806	DEVICE TYPE MISS MATCH	An operation not possible on the I/O device that is currently selected in the setting was specified. This alarm is also generated when file rewind is instructed even though the I/O device is not a FANUC Cassette.
1807	PARAMETER SETTING ERROR	An illegal I/O interface is specified. The external I/O device and baud rate, stop bit and protocol selection settings are erroneous.

Number	Message	Description
1808	DEVICE DOUBLE OPENED	An attempt was made to open a device that is being accessed.
1820	ILLEGAL DI SIGNAL STATE	1) An each axis workpiece coordinate system preset signal was turned "1" in the state in which all axes on the path including the axis on which to perform preset with the each axis workpiece coordinate system were not stopped or in which a command was in execution. 2) When the M code for performing preset with an each axis workpiece coordinate system preset signal is specified, the each axis workpiece coordinate system preset signal is not input. 3) The auxiliary function lock is enabled.
1823	FRAMING ERROR(1)	The stop bit of the character received from the I/O device connected to reader/punch interface 1 was not detected.
1830	DR OFF(2)	The data set ready input signal DR of the I/O device connected to reader/punch interface 2 turned OFF.
1832	OVERRUN ERROR(2)	The next character was received from the I/O device connected to reader/punch interface 2 before it could read a previously received character.
1833	FRAMING ERROR(2)	The stop bit of the character received from the I/O device connected to reader/punch interface 2 was not detected.
1834	BUFFER OVERFLOW(2)	The NC received more than 10 characters of data from the I/O device connected to reader/punch interface 2 even though the NC sent a stop code (DC3) during data reception.
1912	V-DEVICE DRIVER ERROR (OPEN)	An error occurred during device driver control.
1960	ACCESS ERROR (MEMORY CARD)	Illegal memory card accessing This alarm is also generated during reading when reading is executed up to the end of the file without detection of the EOR code.
1961	NOT READY (MEMORY CARD)	The memory card is not ready.
1962	CARD FULL (MEMORY CARD)	The memory card has run out of space.
1963	CARD PROTECTED (MEMORY CARD)	The memory card is write–protected.
1964	NOT MOUNTED (MEMORY CARD)	The memory card could not be mounted.
1965	DIRECTORY FULL (MEMORY CARD)	The file could not be generated in the root directory for the memory card.
1966	FILE NOT FOUND (MEMORY CARD)	The specified file could not be found on the memory card.
1967	FILE PROTECTED (MEMORY CARD)	The memory card is write–protected.
1968	ILLEGAL FILE NAME (MEMORY CARD)	Illegal memory card file name
1969	ILLEGAL FORMAT (MEMORY CARD)	Check the file name.
1970	ILLEGAL CARD (MEMORY CARD)	This memory card cannot be handled.
1971	ERASE ERROR (MEMORY CARD)	An error occurred during memory card erase.
1972	BATTERY LOW (MEMORY CARD)	The memory card battery is low.
1973	FILE ALREADY EXIST	A file having the same name already exists on the memory card.
2032	EMBEDDED ETHERNET/DATA SERVER ERROR	An error was returned in the built-in Ethernet/data server function. For details, see the error message screen of the built-in Ethernet or data server.
2051	#200-#499ILLEGAL P-CODE MACRO COMMON INPUT(NO OPTION)	An attempt was made to enter a custom macro common variable not existing in the system.

Number	Message	Description
2052	#500-#549P-CODE MACRO COMMON SELECT(CANNOT USE SETVN)	The variable name cannot be entered. The SETVN command cannot be used with the P-CODE macro common variables #500 to #549.
2053	P-CODE VARIABLE NUMBER IS OUTSIDE OF RANGE	An attempt was made to enter a P-CODE-only variable not existing in the system.
2054	EXTENDED P-CODE VARIABLE NUMBER IS OUTSIDE OF RANGE	An attempt was made to enter an extended P-CODE-only variable not existing in the system.
4010	ILLEGAL REAL VALUE OF OBUF :	The real value for a output buffer is in error.
5006	TOO MANY WORD IN ONE BLOCK	The number of words in a block exceeds the maximum. The maximum is 26 words. However, this figure varies according to NC options. Divide the instruction word into two blocks.
5007	TOO LARGE DISTANCE	Due to compensation, point of intersection calculation, interpolation or similar reasons, a movement distance that exceeds the maximum permissible distance was specified. Check the programmed coordinates or compensation amounts.
5009	PARAMETER ZERO (DRY RUN)	The dry run feedrate parameter No. 1410 or maximum cutting feedrate parameter No. 1430 for each axis has been set to 0.
5010	END OF RECORD	The EOR (End of Record) code is specified in the middle of a block. This alarm is also generated when the percentage at the end of the NC program is read.
5011	PARAMETER ZERO (CUT MAX)	The maximum cutting feedrate parameter No. 1430 has been set to 0.
5014	TRACE DATA NOT FOUND	A transfer could not be made because of no trace data.
5016	ILLEGAL COMBINATION OF M CODES	M codes which belonged to the same group were specified in a block. Alternatively, an M code which must be specified without other M codes in the block was specified in a block with other M codes.
5018	POLYGON SPINDLE SPEED ERROR	**T** In G51.2 mode, the speed of the spindle or polygon synchronous axis either exceeds the clamp value or is too small. The specified rotation speed ratio thus cannot be maintained. For polygon turning between spindles: More information as to why this alarm occurred is indicated in DGN No. 471.
5020	PARAMETER OF RESTART ERROR	An invalid value is set in parameter No. 7310, which specifies the axis order in which the tool is moved along axes to the machining restart position in dry run. A value ranging from 1 to the number of controlled axes may be set in this parameter.
5046	ILLEGAL PARAMETER (S-COMP)	**M** The setting of a parameter related to simple straightness compensation contains an error. Possible causes include: 1) A non-existent axis number is set in a moving or compensation axis parameter. 2) The simple straightness compensation point numbers do not have correct magnitude relationships. 3) No simple straightness compensation point is found between the furthest pitch error compensation point in the negative region and that in the positive region. 4) The compensation per compensation point is either too large or too small.
5064	DIFFERRENT AXIS UNIT	Circular interpolation has been specified on a plane consisting of axes having different increment systems.

Number	Message	Description
5065	DIFFERRENT AXIS UNIT(PMC AXIS)	Axes having different increment systems have been specified in the same DI/DO group for PMC axis control. Modify the setting of parameter No. 8010.
5073	NO DECIMAL POINT	No decimal point has been specified for an address requiring a decimal point.
5074	ADDRESS DUPLICATION ERROR	The same address has been specified two or more times in a single block. Alternatively, two or more G codes in the same group have been specified in a single block.
5110	IMPROPER G-CODE (AICC MODE)	An unspecifiable G code was specified in the advanced preview control, AI advanced preview control, or AI contour control mode.
5131	NC COMMAND IS NOT COMPATIBLE	$\boxed{T}$ The PMC axis control and polar coordinate interpolation were specified simultaneously.
5195	DIRECTION CAN NOT BE JUDGED	$\boxed{T}$ Measurement is invalid in the tool compensation measurement value direct input B function. [For 1-contact input] 1) The recorded pulse direction is not constant. For example, the stopped state may be set during offset write mode, the servo off state may be entered, or the direction may vary. 2) The tool is moving along the two axes (X-axis and Y-axis). [For movement direction judgment in 4-contact input] 1) The recorded pulse direction is not constant. For example, the stopped state may be set during offset write mode, the servo off state may be entered, or the direction may vary. 2) The tool is moving along the two axes (X-axis and Z-axis). 3) The direction indicated by the tool compensation write signal does not match the movement direction of the axis.
5220	REFERENCE POINT ADJUSTMENT MODE	In case of distance coded linear scale I/F, the reference point auto setting bit 2 of parameter No.1819 is set to "1". Move the machine to reference position by manual operation and execute manual reference return.
5257	G41/G42 NOT ALLOWED IN MDI MODE	Tool radius/tool nose radius compensation was specified in MDI mode. (Depending on the setting of the bit 4 (MCR) of parameter No. 5008)
5303	TOUCH PANEL ERROR	The touch panel is not connected correctly, or the touch panel cannot be initialized when the power is turned on. Correct the cause then turn on the power again.

Number	Message	Description
5305	ILLEGAL SPINDLE NUMBER	In a spindle select function by address P for a multiple spindle control, 1) Address P is not specified. 2) A P code for selecting a spindle is not set in parameter No. 3781. 3) An illegal G code which cannot be commanded with an S_P_; command is specified. 4) Multi-spindle control is not enabled because bit 1 (EMS) of parameter No. 3702 is 1. 5) The spindle amplifier number of each spindle is not set in parameter No. 3717. 6) A spindle command is executed from a path in which this command is prohibited (parameter No. 11090). 7) The setting of parameter No. 11090 is incorrect.
5306	MODE CHANGE ERROR	A mode switchover failed at the time of activation. An attempt to activate a one-touch macro was made while not in the reset state or during a reset or emergency stop.
5329	M98 AND NC COMMAND IN SAME BLOCK	A subprogram call which is not a single block was commanded during canned cycle mode.
5339	ILLEGAL FORMAT COMMAND IS EXECUTED IN SYNC/MIX/OVL CONTROL.	$\boxed{T}$ 1. The value of P, Q, or L specified by G51.4/G50.4/G51.5/G50.5/G51.6/G50.6 is invalid. 2. A duplicate value is specified by parameter No. 12600.
5346	RETURN TO REFERENCE POINT	The coordinate establishment of the Cs contour control axis is not made. Perform a manual reference position return. 1) When Cs coordinate establishment is made for the Cs-axis for which the Cs-axis reference position status signal CSPENx is 0 2) When positional information is not sent from the spindle amplifier 3) When the servo off state is entered during the start of Cs-axis coordinate establishment 4) When the emergency stop state is entered during Cs-axis coordinate establishment $\boxed{T}$ 5) When the Cs-axis is under synchronous or superimposed control 6) When an attempt is made to release composite control for the Cs-axis during Cs-axis coordinate establishment 7) When an attempt is made to start synchronous, composite, or superimposed control for the Cs-axis during Cs-axis coordinate establishment
5362	CONVERT INCH/MM AT REF-POS	An inch/metric conversion was performed at a position other than the reference position. Perform an inch/metric conversion after returning to the reference position.
5391	CAN NOT USE G92	$\boxed{M}$ Workpiece coordinate system setting G92 cannot be specified. 1) After tool length compensation was changed by tool length compensation shift type, G92 was specified when no absolute command is present. 2) G92 was specified in the block in which G49 is present.

Number	Message	Description
5395	CS AXIS NUMBER OVER	The number of axes to be set for Cs-axis contour control exceeds the maximum number allowed in the system. Check parameter No. 1023. If this alarm is generated, the emergency stop state cannot be released.
5445	CAN NOT COMMAND MOTION IN G39	Corner circular interpolation (G39) of tool radius/tool nose radius compensation is not specified alone but is specified with a move command.
5446	NO AVOIDANCE AT G41/G42	Because there is no interference avoidance vector, the interference check avoidance function of tool radius/tool nose radius compensation does not work.
5447	DANGEROUS AVOIDANCE AT G41/G42	The interference check avoidance function of tool radius/tool nose radius compensation operation will lead to danger.
5448	INTERFERENCE TO AVD. AT G41/G42	In the interference check avoidance function of tool radius/tool nose radius compensation, a further interference occurs for an already created interference avoidance vector.

(4) Parameter writing alarm (SW alarm)

Number	Message	Description
SW0100	PARAMETER ENABLE SWITCH ON	The parameter setting is enabled (bit 0 (PWE) of parameter No. 8900 is set to "1"). To set the parameter, turn this parameter ON. Otherwise, set to OFF.

(5) Servo alarms (SV alarm)

Number	Message	Description
SV0001	SYNC ALIGNMENT ERROR	In feed axis control , the amount of compensation for synchronization exceeded the parameter (No. 8325) setting value. This alarm occurs only for a slave axis.
SV0002	SYNC EXCESS ERROR ALARM 2	In feed axis control , the amount of synchronization error exceeded the parameter (No. 8332) setting value. When the synchronization is not completed after power-up, the determination is made by the parameter value (No. 8332) multiplied by the parameter (No. 8330) multiplier. This alarm occurs only for a slave axis only.
SV0003	SYNCHRONOUS/COMPOSITE/SUPER IMPOSED CONTROL MODE CAN'T BE CONTINUED	$\boxed{\text{T}}$ Since as axis in synchronization, composite, or superimposed mode caused a servo alarm, the mode could not be continued, If one of the axes in a mode causes a servo alarm, all axes relating to the axis enter the servo-off state. This alarm is generated to enable the cause of the servo-off state to be checked.
SV0004	EXCESS ERROR (G31)	The amount of positional deviation during torque limit skip command operation exceeded the limit value of the parameter No.6287.
SV0005	SYNC EXCESS ERROR (MCN)	In feed axis control , for synchronization, the difference value of the machine coordinate between a master and slave axes exceeded the parameter (No. 8314) setting value. This alarm occurs for a master or slave axis.
SV0006	ILLEGAL TANDEM AXIS	For the slave axis under tandem control, absolute position detection is set (parameter bit 5 (APC) of parameter No. 1815 = 1).

Number	Message	Description
SV0007	SV ALM ANOTHER PATH(MULTI AMP.)	☐ **T** When a multiaxis amplifier was used in a 2-path system across paths, a servo alarm occurred on an axis belonging to another path. When a 2-path system and multiple servo axes between paths are controlled by a multiaxis amplifier, if a servo alarm occurs on an axis belonging to another path of the same amplifier, the MCC of the amplifier goes down and SV0401 V-READY OFF occurs on an axis belonging to the local path in the same amplifier. Since SV0401 is caused by a servo alarm occurred on an axis in another path, SV0007 is caused together to clearly indicate the fact. The axis belonging to another path in the same amplifier resolves the cause of the servo alarm.
SV0301	APC ALARM: COMMUNICATION ERROR	Since the absolute-position detector caused a communication error, the correct machine position could not be obtained. (data transfer error) The absolute-position detector, cable, or servo interface module is thought to be defective.
SV0302	APC ALARM: OVER TIME ERROR	Since the absolute-position detector caused an overtime error, the correct machine position could not be obtained. (data transfer error) The absolute-position detector, cable, or servo interface module is thought to be defective.
SV0303	APC ALARM: FRAMING ERROR	Since the absolute-position detector caused a framing error, the correct machine position could not be obtained. (data transfer error) The absolute-position detector, cable, or servo interface module is thought to be defective.
SV0304	APC ALARM: PARITY ERROR	Since the absolute-position detector caused a parity error, the correct machine position could not be obtained. (data transfer error) The absolute-position detector, cable, or servo interface module is thought to be defective.
SV0305	APC ALARM: PULSE ERROR	Since the absolute-position detector caused a pulse error, the correct machine position could not be obtained. The absolute-position detector, or cable is thought to be defective.
SV0306	APC ALARM: OVER FLOW ERROR	Since the amount of positional deviation overflowed, the correct machine position could not be obtained. Check to see the parameter No. 2084 or No. 2085.
SV0307	APC ALARM: MOVEMENT EXCESS ERROR	Since the machine moved excessively, the correct machine position could not be obtained.
SV0360	ABNORMAL CHECKSUM(INT)	The checksum alarm occurred on the built–in Pulsecoder.
SV0361	ABNORMAL PHASE DATA(INT)	The phase data abnormal alarm occurred on the built–in Pulsecoder.
SV0362	ABNORMAL REV. DATA(INT)	The speed count abnormal alarm occurred on the built-in Pulsecoder.
SV0363	ABNORMAL CLOCK(INT)	The clock alarm occurred on the built–in Pulsecoder.
SV0364	SOFT PHASE ALARM(INT)	A digital servo soft detected an abnormality on the built in Pulsecoder.
SV0365	BROKEN LED(INT)	The digital servo software detected abnormal data on the built–in Pulsecoder.
SV0366	PULSE MISS(INT)	A pulse error occurred on the built–in Pulsecoder.
SV0367	COUNT MISS(INT)	A count error occurred on the built–in Pulsecoder.

Number	Message	Description
SV0368	SERIAL DATA ERROR(INT)	The communications data could not be received from the built–in Pulsecoder.
SV0369	DATA TRANS. ERROR(INT)	A CRC error or stop bit error occurred in the communications data from the built–in Pulsecoder.
SV0380	BROKEN LED(EXT)	Separate detector error
SV0381	ABNORMAL PHASE (EXT)	An abnormal alarm in the position data occurred on the separate detector.
SV0382	COUNT MISS(EXT)	A count error occurred on the separate detector.
SV0383	PULSE MISS(EXT)	A pulse error occurred on the separate detector.
SV0384	SOFT PHASE ALARM(EXT)	The digital servo software detected abnormal data on the separate detector.
SV0385	SERIAL DATA ERROR(EXT)	The communications data could not be received from the separate detector.
SV0386	DATA TRANS. ERROR(EXT)	A CRC error or stop bit error occurred in the communications data from the standalone detector.
SV0387	ABNORMAL ENCODER(EXT)	An abnormality occurred on a separate detector. For more information, contact the scale manufacturer.
SV0401	IMPROPER V_READY OFF	Although the ready signal (PRDY) of the position control was ON, the ready signal (VRDY) of the velocity control was OFF.
SV0403	CARD/SOFT MISMATCH	The combination of the axis card and the servo software is incorrect. Probable causes are given below. 1) The correct axis card is not attached. 2) The correct servo software is not installed in flash memory.
SV0404	IMPROPER V_READY ON	Although the ready signal (PRDY) of the position control was OFF, the ready signal (VRDY) of the velocity control was ON.
SV0407	EXCESS ERROR	$\boxed{\text{T}}$ The difference value of the amount of positional deviation for the synchronization axis exceeded the setting value. (during synchronous control only)
SV0409	DETECT ABNORMAL TORQUE	An abnormal load was detected on the servo motor, during Cs axis, or spindle positioning (T series) axis. The alarm can be canceled by RESET.
SV0410	EXCESS ERROR (STOP)	The amount of positional deviation during stopping exceeded the parameter (No. 1829) setting value.
SV0411	EXCESS ERROR (MOVING)	The amount of positional deviation during traveling became excessive than the parameter (No.1828) setting value.
SV0413	LSI OVERFLOW	The counter for the amount of positional deviation overflowed
SV0415	MOTION VALUE OVERFLOW	The velocity exceeding the travel velocity limit was commanded.

Number	Message	Description
SV0417	ILL DGTL SERVO PARAMETER	A digital serve parameter setting is incorrect. [When bit 4 of diagnosis information No. 203 is 1.] An illegal parameter was detected by the servo software. Identify the cause with reference to diagnosis information No. 352. [When bit 4 of diagnosis information No. 203 is 0.] The CNC software detected an illegal parameter. Probable causes are given below (see diagnosis information No. 280). 1) The value specified in parameter No. 2020 as the motor model falls outside the specified range. 2) The motor rotation direction in parameter No. 2022 is not set to a correct value (111 or -111). 3) The speed feedback pulse count per motor rotation in parameter No. 2023 is set to a negative or other incorrect value. 4) The position feedback pulse count per motor rotation in parameter No. 2024 is set to a negative or other incorrect value.
SV0420	SYNC TORQUE EXCESS	In feed axis control , for synchronization, the difference value of torque between a master and slave axes exceeded the parameter (No. 2031) setting value. This alarm occurs for a master axis.
SV0421	EXCESS ERROR(SEMI-FULL)	The difference between the feedback from the semi and full sides exceeded the setting of parameter No.2118.
SV0422	EXCESS VELOCITY IN TORQUE	In torque control, the commanded permissible velocity was exceeded.
SV0423	EXCESS ERROR IN TORQUE	In torque control, the total permissible move value specified as a parameter was exceeded.
SV0430	SV MOTOR OVERHEAT	The servo motor has overheated.
SV0431	CNV. OVERLOAD	Power Supply (PS) : Overheat Servo Amplifier : Overheat
SV0432	CNV. LOW VOLT CONTROL	Power Supply (PS) : The control power supply voltage has dropped. Servo Amplifier : The control power supply voltage has dropped.
SV0433	CNV. LOW VOLT DC LINK	Power Supply (PS) : Low DC link voltage Servo Amplifier : Low DC link voltage
SV0434	INV. LOW VOLT CONTROL	Servo Amplifier : Low control power voltage
SV0435	INV. LOW VOLT DC LINK	Servo Amplifier : Low DC link voltage
SV0436	SOFTTHERMAL(OVC)	The digital servo software detected a software thermal (OVC).
SV0437	CNV. OVERCURRENT POWER	Power Supply (PS) : Overcurrent on input circuit section.
SV0438	INV. ABNORMAL CURRENT	Servo Amplifier : Motor overcurrent
SV0439	CNV. OVER VOLT DC LINK	Power Supply (PS) : The DC link voltage is too high. Servo Amplifier : The DC link voltage is too high.
SV0440	CNV. EX DECELERATION POW.	Power Supply (PS) : Excessive generative discharge Servo Amplifier : Excessive generative discharge, or abnormal error in generative power circuit
SV0441	ABNORMAL CURRENT OFFSET	The digital servo software detected an abnormality in the motor current detection circuit.
SV0442	CNV. CHARGE FAILURE	Power Supply (PS) : The spare charge circuit for the DC link is abnormal.
SV0443	CNV. COOLING FAN FAILURE	Power Supply (PS) : Internal cooling fan failure. Servo Amplifier : Internal cooling fan failure.

Number	Message	Description
SV0444	INV. COOLING FAN FAILURE	Servo Amplifier : Internal cooling fan failure.
SV0445	SOFT DISCONNECT ALARM	The digital servo software detected a disconnected Pulsecoder.
SV0446	HARD DISCONNECT ALARM	The hardware detected a disconnected built–in Pulsecoder.
SV0447	HARD DISCONNECT(EXT)	The hardware detected a disconnected separate detector.
SV0448	UNMATCHED FEEDBACK ALARM	The sign of the feedback signal from the standalone detector is opposite to that from the feedback signal from the built–on Pulsecoder.
SV0449	INV. IPM ALARM	Servo Amplifier : The IPM (Intelligent Power Module) detected an alarm.
SV0453	SPC SOFT DISCONNECT ALARM	Software disconnection alarm of the α Pulsecoder. Turn off the power to the CNC, then remove and insert the Pulsecoder cable. If this alarm is issued again, replace the Pulsecoder.
SV0454	ILLEGAL ROTOR POS DETECT	The magnetic pole detection function terminated abnormally. The magnetic pole could not be detected because the motor did not run.
SV0456	ILLEGAL CURRENT LOOP	An attempt was made to set the current loop that could not be set. The amplifier pulse module in use does not comply with HIGH SPEED HRV. Or, requirements to control are not satisfied in the system.
SV0458	CURRENT LOOP ERROR	The specified current loop differs from the actual current loop.
SV0459	HI HRV SETTING ERROR	For two axes whose servo axis numbers (parameter No. 1023) are consecutively even and odd numbers, HIGH SPEED HRV control is possible for one axis and impossible for the other.
SV0460	FSSB DISCONNECT	The FSSB connection was discontinued. Probable causes are: 1) The FSSB connection cable was disconnected or broken. 2) The amplifier was turned off . 3) In the amplifier, the low-voltage alarm occurred.
SV0462	SEND CNC DATA FAILED	The correct data could not be received on a slave side because of the FSSB communication error.
SV0463	SEND SLAVE DATA FAILED	The correct data could not be received in the servo software side because of the FSSB communication error.
SV0465	READ ID DATA FAILED	A read of the ID information for the amplifier has failed at power-on.
SV0466	MOTOR/AMP. COMBINATION	The maximum current of an amplifier is different to that of a motor. Probable causes are: 1) The connection command for an amplifier is incorrect. 2) The parameter (No.2165) setting is incorrect
SV0468	HI HRV SETTING ERROR(AMP)	An attempt was made to set up HIGH SPEED HRV control for use when the controlled axis of an amplifier for which HIGH SPEED HRV control could not be used.
SV0600	INV. DC LINK OVER CURRENT	DC link overcurrent.
SV0601	INV. RADIATOR FAN FAILURE	External radiator cooling fan failure.
SV0602	INV. OVERHEAT	The servo motor has overheated.
SV0603	INV. IPM ALARM(OH)	The IPM (Intelligent Power Module) detected an overheat alarm.
SV0604	AMP. COMMUNICATION ERROR	The communication between Servo amplifier and Power Supply (PS) is in error.

Number	Message	Description
SV0605	CNV. EX. DISCHARGE POW.	Power Supply (PS) : The motor regenerative power is too much.
SV0606	CNV. RADIATOR FAN FAILURE	Power Supply (PS) : External radiator cooling fan failure.
SV0607	CNV. SINGLE PHASE FAILURE	Power Supply (PS) : The input power supply has a missing phase.
SV0646	ABNORMAL ANALOG SIGNAL(EXT)	An error occurred in the analog 1Vp-p output of the separate detector. The separate detector, cable, or separate detector interface unit may be failed.
SV1025	V_READY ON (INITIALIZING)	The ready signal (VRDY) of the velocity control which should be OFF is ON while the servo control is ON.
SV1026	ILLEGAL AXIS ARRANGE	The parameter for servo axis arrange is not set correctly. A negative value, duplicate value, or greater value than the number of control axes was set to the parameter No. 1023 "The servo axis number of each axis."
SV1055	ILLEGAL TANDEM AXIS	In tandem control, the setting of the parameter No. 1023 is incorrect.
SV1056	ILLEGAL TANDEM PAIR	In tandem control, the setting of the bit 6 (TDM) of parameter No.1817 is incorrect.
SV1067	FSSB:CONFIGURATION ERROR(SOFT)	An FSSB configuration error occurred (detected by software). The connected amplifier type is incompatible with the FSSB setting value.
SV1100	S-COMP. VALUE OVERFLOW	**M** The amount of compensation for the simple straightness exceeded a maximum value of 32767.
SV5134	FSSB:OPEN READY TIME OUT	In the initialization, the FSSB could not be in an open ready sate. The axis card is thought to be defective.
SV5136	FSSB:NUMBER OF AMP. IS INSUFFICIENT	The number of amplifier identified by the FSSB is insufficient than the number of control axes. Or, the setting of the number of axes or the amplifier connection is in error.
SV5137	FSSB:CONFIGURATION ERROR	An FSSB configuration error occurred. The connecting amplifier type is incompatible with the FSSB setting value.
SV5139	FSSB:ERROR	Servo initialization has not completed successfully. It is probable that an optical cable failed or a connection between the amplifier and another module failed.
SV5197	FSSB:OPEN TIME OUT	The initialization of the FSSB was completed, but it could not be opened. Or, the connection between the CNC and the amplifier in is incorrect.

(6) Overtravel alarms (OT alarm)

Number	Message	Description
OT0500	+ OVERTRAVEL (SOFT 1)	Exceeded the positive side stored stroke check 1.
OT0501	- OVERTRAVEL (SOFT 1)	Exceeded the negative side stored stroke check 1.
OT0502	+ OVERTRAVEL (SOFT 2)	Exceeded the positive side stored stroke check 2. **T** Or, in the chuck tail stock barrier, an entry to the inhibited area was made during movement in the positive direction.
OT0503	- OVERTRAVEL (SOFT 2)	Exceeded the negative side stored stroke check 2. **T** Or, in the chuck tail stock barrier, an entry to the inhibited area was made during movement in the negative direction.
OT0504	+ OVERTRAVEL (SOFT 3)	Exceeded the positive side stored stroke check 3.
OT0505	- OVERTRAVEL (SOFT 3)	Exceeded the - side stored stroke check 3.

Number	Message	Description
OT0506	+ OVERTRAVEL (HARD)	The stroke limit switch in the positive direction was triggered. This alarm is generated when the machine reaches the stroke end. When this alarm is not generated, feed of all axes is stopped during automatic operation. During manual operation, only the feed of the axis on which the alarm occurred is stopped.
OT0507	- OVERTRAVEL (HARD)	The stroke limit switch in the negative direction was triggered. This alarm is generated when the machine reaches the stroke end. When this alarm is not generated, feed of all axes is stopped during automatic operation. During manual operation, only the feed of the axis on which the alarm occurred is stopped.
OT0508	INTERFERENCE:+	<kbd>T</kbd> A tool moving in the positive direction along the n axis has fouled another tool post.
OT0509	INTERFERENCE:-	<kbd>T</kbd> A tool moving in the negative direction along the n axis has fouled another tool post.
OT0510	+ OVERTRAVEL (PRE-CHECK)	The tool exceeded the limit in the negative direction during the stroke check before movement.
OT0511	- OVERTRAVEL (PRE-CHECK)	The tool exceeded the limit in the positive direction during the stroke check before movement.

(7) Memory file alarms (IO alarm)

Number	Message	Description
IO1001	FILE ACCESS ERROR	The resident–type file system could not be accessed as an error occurred in the resident–type file system.
IO1002	FILE SYSTEM ERROR	The file could not be accessed as an error occurred in the CNC file system.
IO1030	CHECK SUM ERROR	The checksum of the CNC part program storage memory is incorrect.
IO1032	MEMORY ACCESS OVER RANGE	Accessing of data occurred outside the CNC part program storage memory range.
IO1104	OVER MAXIMUM TOOL LIFE PAIRS	The maximum number of tool life management pairs is exceeded. Modify the setting of the maximum number of tool life management pairs in parameter No. 6813.

(8) Alarms requiring power to be turned off (PW alarm)

Number	Message	Description
PW0000	POWER MUST BE OFF	A parameter was set for which the power must be turned OFF then ON again.
PW0001	X-ADDRESS(*DEC) IS NOT ASSIGNED.	The X address of the PMC could not be assigned correctly. This alarm may occur in the following case: 1) During the setting of parameter No. 3013, the X address could not be assigned correctly for the deceleration dog (*DEC) for a return to the reference position.
PW0002	PMC address is not correct(AXIS).	The address to assign the axis signal is incorrect. This alarm may occur in the following case: 1) The parameter No.3021 setting is incorrect.

Number	Message	Description
PW0003	PMC address is not correct(SPINDLE).	The address to assign the spindle signal is incorrect. This alarm may occur in the following case: 1) The parameter No.3022 setting is incorrect.
PW0006	POWER MUST BE OFF (ILL-EXEC-CHK)	The malfunction prevention function detected an alarm to require the power off.
PW0007	X-ADDRESS(SKIP) IS NOT ASSIGNED	The X address of PMC could not be assigned correctly. Possible causes are: 1) During the set of parameter No. 3012, the skip signal of the X address was not assigned correctly. 2) During the set of parameter No. 3019, the address other than the skip signal of the X address was not assigned correctly.
PW1102	ILLEGAL PARAMETER (I-COMP.)	The parameter for setting slope compensation is incorrect. This alarm occurs in the following cases: 1) When the size relationship between the slope compensation point Nos. is incorrect 2) When the slope compensation point is not located between the most negative side and most positive side of pitch error compensation 3) When the compensation per compensation point is too small or too great.
PW1110	ILLEGAL PARAMETER (SERVO MOTOR SPINDLE)	The parameter for the spindle controlled with the servo motor is not set correctly.
PW1111	ILLEGAL SPINDLE NUMBER (SERVO MOTOR SPINDLE)	The spindle number (parameter No. 11010) or spindle amplifier number (parameter No. 3717) for the spindle controlled with the servo motor is not set correctly.
PW5046	ILLEGAL PARAMETER (S-COMP.)	**M** The parameter for setting simple straightness compensation is incorrect.

(9) Spindle alarms (SP alarm)

Number	Message	Description
SP0740	RIGID TAP ALARM : EXCESS ERROR	The positional deviation of the stopped spindle has exceeded the set value during rigid tapping.
SP0741	RIGID TAP ALARM : EXCESS ERROR	The positional deviation of the moving spindle has exceeded the set value during rigid tapping.
SP0742	RIGID TAP ALARM : LSI OVERFLOW	An LSI overflow has occurred for the spindle during rigid tapping.
SP0752	SPINDLE MODE CHANGE ERROR	This alarm is generated if the system does not properly terminate a mode change. The modes include the Cs contour control, spindle positioning (T series), rigid tapping, and spindle control modes. The alarm is activated if the spindle control unit does not respond correctly to the mode change command issued by the NC.
SP0754	ABNORMAL TORQUE	An abnormal load was detected in a spindle motor. The alarm can be canceled by RESET.
SP1202	SPINDLE SELECT ERROR	In a multi spindle control, the spindle number other than the valid spindle number was selected by a position coder select signal. An attempt was made to select the spindle number of the system having no valid spindle.
SP1220	NO SPINDLE AMP.	Either the cable connected to a serial spindle amplifier is broken, or the serial spindle amplifier is not connected.
SP1221	ILLEGAL MOTOR NUMBER	The spindle No. and the motor No. are incorrectly matched.
SP1224	ILLEGAL SPINDLE-POSITION CODER GEAR RATIO	The spindle–position coder gear ratio was incorrect.

Number	Message	Description
SP1225	CRC ERROR (SERIAL SPINDLE)	A CRC error (communications error) occurred in communications between the CNC and the serial spindle amplifier.
SP1226	FRAMING ERROR (SERIAL SPINDLE)	A framing error occurred in communications between the CNC and the serial spindle amplifier.
SP1227	RECEIVING ERROR (SERIAL SPINDLE)	A receive error occurred in communications between the CNC and the serial spindle amplifier.
SP1228	COMMUNICATION ERROR (SERIAL SPINDLE)	A communications error occurred between the CNC and the serial spindle amplifier.
SP1229	COMMUNICATION ERROR SERIAL SPINDLE AMP.	A communications error occurred between serial spindle amplifiers (motor Nos. 1 and 2, or motor Nos. 3–4).
SP1231	SPINDLE EXCESS ERROR (MOVING)	The position deviation during spindle rotation was greater than the value set in parameters.
SP1232	SPINDLE EXCESS ERROR (STOP)	The position deviation during spindle stop was greater than the value set in parameters.
SP1233	POSITION CODER OVERFLOW	The error counter/speed instruction value of the position coder overflowed.
SP1234	GRID SHIFT OVERFLOW	Grid shift overflowed.
SP1240	DISCONNECT POSITION CODER	The analog spindle position coder is broken.
SP1241	D/A CONVERTER ERROR	The D/A converter for controlling analog spindles is erroneous.
SP1243	ILLEGAL SPINDLE PARAMETER SETTING(GAIN)	The setting for the spindle position gain is incorrect.
SP1244	MOTION VALUE OVERFLOW	The amount of distribution to a spindle is too much
SP1245	COMMUNICATION DATA ERROR	A communication data error was detected on the CNC.
SP1246	COMMUNICATION DATA ERROR	A communication data error was detected on the CNC.
SP1247	COMMUNICATION DATA ERROR	A communication data error was detected on the CNC.
SP1969	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1970	SPINDLE CONTROL ERROR	Initialization of spindle control ended in error.
SP1971	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1972	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1974	ANALOG SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1975	ANALOG SPINDLE CONTROL ERROR	An position coder error was detected on the analog spindle.
SP1976	SERIAL SPINDLE COMMUNICATION ERROR	The amplifier No. could not be set to the serial spindle amplifier.
SP1977	SERIAL SPINDLE COMMUNICATION ERROR	An error occurred in the spindle control software.
SP1978	SERIAL SPINDLE COMMUNICATION ERROR	A time–out was detected during communications with the serial spindle amplifier.
SP1979	SERIAL SPINDLE COMMUNICATION ERROR	The communications sequence was no longer correct during communications with the serial spindle amplifier.
SP1980	SERIAL SPINDLE AMP. ERROR	Defective SIC–LSI on serial spindle amplifier
SP1981	SERIAL SPINDLE AMP. ERROR	An error occurred during reading of the data from SIC–LSI on the analog spindle amplifier side.
SP1982	SERIAL SPINDLE AMP. ERROR	An error occurred during reading of the data from SIC–LSI on the serial spindle amplifier side.
SP1983	SERIAL SPINDLE AMP. ERROR	Could not clear on the spindle amplifier side.
SP1984	SERIAL SPINDLE AMP. ERROR	An error occurred during re–initialization of the spindle amplifier.
SP1985	SERIAL SPINDLE CONTROL ERROR	Failed to automatically set parameters
SP1986	SERIAL SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1987	SERIAL SPINDLE CONTROL ERROR	Defective SIC–LSI on the CNC
SP1988	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1989	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.

Number	Message	Description
SP1996	ILLEGAL SPINDLE PARAMETER SETTING	The spindle was assigned incorrectly. Alternatively, the number of spindles exceeded the maximum number allowed in the system. Check to see the following parameter. (No.3701#1,#4, 3716, 3717)
SP1998	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.
SP1999	SPINDLE CONTROL ERROR	An error occurred in the spindle control software.

Refer to A.3 for SP9001 or later.

(10) Overheat alarms (OH alarm)

Number	Message	Description
OH0700	LOCKER OVERHEAT	CNC cabinet overheat
OH0701	FAN MOTOR STOP	PCB cooling fan motor abnormality
OH0704	OVERHEAT	**T** Spindle overheat due to detection of changes in the spindle speed 1) When the cutting load is large, offload the cutting conditions. 2) Check if the cutting tool became dull. 3) Check if the spindle amplifier malfunctions.

(11) Other alarms (DS alarm)

Number	Message	Description
DS0001	SYNC EXCESS ERROR (POS DEV)	In feed axis control , the difference in the amount of positional deviation between the master and slave axes exceeded the parameter (No. 8323) setting value. This alarm occurs only for the slave axis.
DS0003	SYNCHRONIZE ADJUST MODE	The system is in the synchronize adjust mode.
DS0004	EXCESS MAXIMUM FEEDRATE	The malfunction prevention function detected the command in which a value exceeding the maximum speed was specified.
DS0005	EXCESS MAXIMUM ACCELERATION	The malfunction prevention function detected the command in which a value exceeding the maximum acceleration was specified.
DS0006	ILLEGAL EXECUTION SEQUENCE	The malfunction prevention function detected an illegal execution sequence.
DS0007	ILLEGAL EXECUTION SEQUENCE	The malfunction prevention function detected an illegal execution sequence.
DS0008	ILLEGAL EXECUTION SEQUENCE	The malfunction prevention function detected an illegal execution sequence.
DS0009	ILLEGAL EXECUTION SEQUENCE	The malfunction prevention function detected an illegal execution sequence.
DS0010	ILLEGAL REFERENCE AREA	The malfunction prevention function detected an invalid reference area.
DS0011	ILLEGAL REFERENCE AREA	The malfunction prevention function detected an invalid reference area.
DS0012	ILLEGAL REFERENCE AREA	The malfunction prevention function detected an invalid reference area.
DS0013	ILLEGAL REFERENCE AREA	The malfunction prevention function detected an invalid reference area.
DS0014	TOOL CHANGE DETECT MACHINE LOCK	A machine lock is turned on for the Z axis for which the tool is being changed.
DS0015	TOOL CHANGE DETECT MIRROR IMAGE	A mirror image is turned on for the Z axis for which the tool is being changed.

Number	Message	Description
DS0016	SERIAL DCL:FOLLOW-UP ERROR	1) The settings of parameters No.1883 and No.1884 fall outside the range. 2) The current position at establishment of the reference position subtracted by the distance between the reference positions (detection unit) exceeded ±2147483647. Change the current position or reference position to prevent this situation.
DS0017	SERIAL DCL:REF-POS ESTABLISH ERR	The travel amount at the FL speed at establishment of the reference position exceeded the setting of parameter No. 14010.
DS0018	SERIAL DCL:MISMATCH(SSYNC CTRL)	Of the master and slave axes for feed axis control, one axis is a linear scale with the origin and the other is not a linear scale with the reference position. In such a configuration, the feed axis control selection signal (SYNC<Gn138> or SYNCJ <Gn140>) needs to be set to 0 to establish the origin.
DS0020	REFERENCE RETURN INCOMPLETE	An attempt was made to perform an automatic return to the reference position on the perpendicular axis before the completion of a return to the reference position on the angular axis. However, this attempt failed because a manual return to the reference position during angular axis control or an automatic return to the reference position after power-up was not commanded. First, return to the reference position on the angular axis, then return to the reference position on the perpendicular axis.
DS0021	START ERROR(ONE TOUCH MACRO)	A macro program start operation cannot be accepted. 1) The feed hold signal *SP is 0. 2) An alarm is generated. 3) The SRN signal is 1.
DS0023	ILLEGAL PARAMETER (I-COMP VAL)	The setting of the inclination compensation parameter is incorrect. The compensation per compensation point is too large or too small.
DS0024	UINT SIGNAL WAS ILLEGALLY INPUT	An interruption custom macro was started during movement to the machining restart position at the dry run speed.
DS0025	G60 CANNOT BE EXECUTED	**M** The state of a mirror image is different between the time when look-ahead of a block for unidirectional positioning was performed and the time when execution of the block was started, so unidirectional positioning cannot be performed. Modify the program.
DS0026	MISMATCH OF ANGULAR AXIS(D.C.S)	On angular axis control, one of the angular/perpendicular axes is the scale with ref-pos, and the other of them is not the scale with ref-pos. Such system is not admired.
DS0027	MISMATCH OF SYNCHRONOUS AXIS(D.C.S)	Master/slave axes of axis synchronous control, one of them is the linear scale with distance-coded reference marks, and the other of them is not the linear scale with distance-coded reference marks. Please establish reference position with the input signal SYNCn<G138>, SYNCJn<G140> or parameter setting to 0.

Number	Message	Description
DS0059	SPECIFIED NUMBER NOT FOUND	[External data I/O] 　The No. specified for a program No. or sequence No. search could not be found. 　There was an I/O request issued for offset (tool data), but either no tool numbers have been input since power ON or there is no data for the entered tool No. [External workpiece No. search] 　The program corresponding to the specified workpiece No. could not be found.
DS0131	TOO MANY MESSAGE	An attempt was made to display an external operator message or external alarm message, but five or more displays were required simultaneously.
DS0132	MESSAGE NUMBER NOT FOUND	An attempt to cancel an external operator message or external alarm message failed because the specified message number was not found.
DS0133	TOO LARGE NUMBER	A value other than 0 to 4095 was specified as the external operator message or the external alarm message number.
DS0300	APC ALARM: NEED REF RETURN	A setting to zero position for the absolute position detector (association with reference position and the counter value of the absolute position detector) is required. Perform the return to the reference position. This alarm may occur with other alarms simultaneously. In this case, other alarms must be handled first.
DS0306	APC ALARM: BATTERY VOLTAGE 0	The battery voltage of the absolute position detector has dropped to a level at which data can no longer be held. Or, the power was supplied to the Pulsecoder for the first time. If this problem recurs after the power is turned off and then back on, the battery or cable may be defective. Replace the battery with the machine turned on.
DS0307	APC ALARM: BATTERY LOW 1	The battery voltage of the absolute position detector has dropped to a level at which a replacement is required. Replace the battery with the machine turned on.
DS0308	APC ALARM: BATTERY LOW 2	The battery voltage of the absolute position detector dropped to a level at which a replacement was required in the past. (including during power off) Replace the battery with the machine turned on.
DS0309	APC ALARM: REF RETURN IMPOSSIBLE	An attempt was made to set the zero point for the absolute position detector by MDI operation when it was impossible to set the zero point. Rotate the motor manually at least one turn, and set the zero position of the absolute position detector after turning the CNC and servo amplifier off and then on again.
DS0405	ZERO RETURN END NOT ON REF	The axis specified in automatic zero return was not at the correct zero point when positioning was completed. Perform zero return from a point whose distance from the zero return start position to the zero point is 2 or more revolutions of the motor. Other probable causes are: - The positional deviation after triggering the deceleration dog is less than 128. - Insufficient voltage or malfunctioning Pulsecoder.
DS1120	UNASSIGNED ADDRESS (HIGH)	The upper 4 bits (EIA4 to EIA7) of an external data I/O interface address signal are set to an undefined address (high bits).

Number	Message	Description
DS1121	UNASSIGNED ADDRESS (LOW)	The lower 4 bits (EIA0 to EIA3) of an external data I/O interface address signal are set to an undefined address (low bits).
DS1124	OUTPUT REQUEST ERROR	OUTPUT REQUEST ERROR An output request was issued during external data output, or an output request was issued for an address that has no output data.
DS1128	DI.EIDLL OUT OF RANGE	The numerical value input by external data input signals ED0 to ED31 has exceeded the permissible range.
DS1130	SEARCH REQUEST NOT ACCEPTED	No requests can be accepted for a program No. or a sequence No. search as the system is not in the memory mode or the reset state.
DS1131	EXT-DATA ERROR (OTHER)	[External Data I/O] An attempt was made to input tool data for tool offset by a tool No. during loading by the G10 code.
DS1150	A/D CONVERT ALARM	A/D converter malfunction
DS1184	PARAMETER ERROR IN TORQUE	An invalid parameter was set for torque control. The torque constant parameter is set to "0".
DS1448	ILLEGAL PARAMETER (D.C.S.)	The setting value of parameter for reference marks is satisfied the following any conditions. 1) A setting is made to use the absolute position detector (bit 5 (APC) of parameter No. 1815 is 1). 2) Either parameter 1821 (mark-1 interval) or parameter 1882 (mark-2 interval) is set to 0. 3) Parameters 1821 and 1882 have identical settings. 4) The difference between the settings made for parameters 1821 and 1882 is greater than or equal to twice either setting. 5) The setting value of parameters 1883 and 1884 are over the valid data range.
DS1449	REFERENCE MARK ARE DIFFERENT FROM PARAMETER	In case of distance coded linear scale I/F, the actual interval of reference marks is different from parameter (No.1821,1882) setting value.
DS1450	ZERO RETURN NOT FINISHED	When bit 0 (ZRN) of parameter No. 1005 is 0, if a manual reference position return has never been performed after power-up, the 1st reference position return (07h) is specified.
DS1451	IMPROPER PMC AXIS COMMAND	The PMC axes cannot be controlled in this state.
DS1512	EXCESS VELOCITY	$\boxed{\text{T}}$ The feedrate of the linear axis during polar coordinate interpolation exceeded the maximum cutting feedrate.
DS1933	NEED REF RETURN(SYNC:MIX:OVL)	$\boxed{\text{T}}$ The relation between a machine coordinate of an axis in synchronization, composite, or superimposed control, and the absolute, or relative coordinate was displaced. Perform the manual return to the reference position.
DS2003	ILLEGAL PARAMETER SETTING FOR LIVE TOOL AXIS (PMC AX-CTRL)	The spindle controlled with the servo motor is set as a PMC-controlled axis.
DS2005	NOW GAIN TUNING	Automatic operation cannot be started during automatic speed gain adjustment. Start automatic operation after confirming the completion of automatic adjustment.
DS5340	PARAMETER CHECK SUM ERROR	The parameter check sum does not match the reference check sum because of a change in the parameters. Restore the parameters or set the reference check sum again.

(12) Malfunction prevention function alarms (IE alarm)

Number	Message	Description
IE0001	+ OVERTRAVEL (SOFT 1)	The malfunction prevention function detected that stored stroke check 1 on the positive side was exceeded.
IE0002	- OVERTRAVEL (SOFT 1)	The malfunction prevention function detected that stored stroke check 1 on the negative side was exceeded.
IE0003	+ OVERTRAVEL (SOFT 2)	The malfunction prevention function detected that stored stroke check 2 on the positive side was exceeded.
IE0004	- OVERTRAVEL (SOFT 2)	The malfunction prevention function detected that stored stroke check 2 on the negative side was exceeded.
IE0005	+ OVERTRAVEL (SOFT 3)	The malfunction prevention function detected that stored stroke check 3 on the positive side was exceeded.
IE0006	- OVERTRAVEL (SOFT 3)	The malfunction prevention function detected that stored stroke check 3 on the negative side was exceeded.
IE0007	EXCESS MAXIMUM REV. DATA	The malfunction prevention function detected the command in which a value exceeding the maximum speed was specified.
IE0008	ILLEGAL ACC/DEC	The malfunction prevention function detected the acceleration/deceleration error.
IE0009	ILLEGAL MCN COODINATE	The malfunction prevention function detected the displacement of a machine coordinate in the check point.

A.2   ALARM LIST (PMC)

A.2.1   Messages That May Be Displayed on the PMC Alarm Screen

The following table lists the PMC alarm messages that may be displayed on the PMC alarm screen.

Alarm number	Faulty location/corrective action	Contents
ER01 PROGRAM DATA ERROR	<1> Enter the sequence program again. <2> If this error recurs even after you have entered the sequence program again, the error may be due to a hardware fault. In that case, contact us.	The sequence program is invalid.
ER02 PROGRAM SIZE OVER	<1> Reduce the size of the sequence program. <2> Contact us, and specify a ladder step count option that allows you to set a larger program size.	The sequence program is too large. The sequence program is invalid.
ER03 PROGRAM SIZE ERROR(OPTION)	<1> Reduce the size of the sequence program. <2> Contact us, and specify a ladder step count option that allows you to set a larger program size.	The sequence program exceeds the size specified by the ladder step count option.
ER04 PMC TYPE UNMATCH	Change the sequence program so that it specifies the adequate PMC type, by using the programmer.	The PMC type specified in the sequence program does not match the type of the PMC actually in use.
ER07 NO OPTION(LADDER STEP)	<1> Restore the backup CNC parameter data. <2> Contact us, and specify a ladder step count option that allows you to set a larger program size.	No ladder step count option is found.
ER08 OBJECT UNMATCH	Contact us.	An unsupported function is used in the sequence program.

Alarm number	Faulty location/corrective action	Contents
ER09 PMC LABEL CHECK ERROR. PLEASE TURN ON POWER AGAIN WITH PRESSING 'O'&'Z'. (CLEAR PMC SRAM)	<1> Turn on the power of the CNC again, by holding down the 'O' and 'Z' keys at the same time. <2> Replace the backup batteries.	The nonvolatile memory of the PMC system needs to be initialized in such cases as when you have changed the PMC model.
ER17 PROGRAM PARITY	<1> Enter the sequence program again. <2> If this error recurs even after you have entered the sequence program again, the error may be due to a hardware fault. In that case, contact us.	The parity of the sequence program is invalid.
ER18 PROGRAM DATA ERROR BY I/O	Enter the sequence program again.	An interrupt was specified while the sequence program was being read.
ER19 LADDER DATA ERROR	Display the LADDER DIAGRAM EDITOR screen again, and terminate the editing operation by pressing the [EXIT] soft key.	A function key was pressed during the editing of the ladder program, causing a switch to the CNC screen.
ER22 NO PROGRAM	Enter the sequence program again.	The sequence program is empty.
ER27 LADDER FUNC. PRM IS OUT OF RANGE	Correct the sequence program; change the parameter number specified in a functional instruction to a value that is within the allowable range.	An out-of-range parameter number is specified in the TMR, TMRB, CTR, CTRB, DIFU, or DIFD functional instruction.
ER28 NO OPTION(I/O LINK CHx)	Contact us; specify the I/O Link point count expansion option for the indicated channel.	The I/O Link point count expansion option is not specified for CHx.
ER31 NO OPTION (EXTENDED PMC LADDER INSTRUCTION FUNCTION)	Change the sequence program so that it specifies the adequate PMC model by using the programmer.	An attempt was made to execute a ladder program including an extended ladder diagram. Alternatively, the model set in the sequence program does not match the actual model.
ER32 NO I/O DEVICE	<1> Check whether the power of each I/O device is on. <2> Check whether the power of each I/O device has been turned on before the CNC. <3> Check cable connections.	None of the I/O devices, such as the I/O Link, connection unit, and Power Mate, is connected.
ER33 I/O LINK ERROR or ER33 I/O LINK ERROR(CHn)	Contact us; replace the faulty hardware.	The LSI for the I/O Link is faulty.
ER34 I/O LINK ERROR(xx) or ER34 I/O LINK ERROR(CHn xx)	<1> Check the cable connections to the devices of group xx. <2> Check whether the power of each I/O device has been turned on before the CNC. <3> Replace any device of group xx in which the PMC control module is embedded.	An I/O device communication error occurred on the slave side of group xx.
ER35 TOO MUCH OUTPUT DATA IN GROUP(xx) or ER35 TOO MUCH OUTPUT DATA IN GROUP(CHn xx)	Reduce the output data count of group xx.	The output data count of I/O Link group xx exceeds the upper limit (33 bytes). The superfluous data is regarded as invalid.
ER36 TOO MUCH INPUT DATA IN GROUP(xx) or ER36 TOO MUCH INPUT DATA IN GROUP(CHn xx)	Reduce the input data count of group xx.	The input data count of I/O Link group xx exceeds the upper limit (33 bytes). The superfluous data is regarded as invalid.

Alarm number	Faulty location/corrective action	Contents
ER37 TOO MUCH SLOT IN BASE or ER37 TOO MUCH SLOT IN BASE(CHn)	Correct the slot number to a value of 10 or less.	The slot number for the I/O Link exceed the upper limit (10). The slot number larger than 11 is regarded as invalid.
ER38 MAX SETTING OUTPUT DATA OVER(xx) or ER38 MAX SETTING OUTPUT DATA OVER(CHn xx)	Reduce the total amount of output data of all groups to 128 bytes or less.	The I/O area for the I/O Link is insufficient. (The area allocated to the group xx and later on the output side is regarded as invalid.)
ER39 MAX SETTING INPUT DATA OVER(xx) or ER39 MAX SETTING INPUT DATA OVER(CHn xx)	Reduce the total amount of input data of all groups to 128 bytes or less.	The I/O area for the I/O Link is insufficient. (The area allocated to the group xx and later on the input side is regarded as invalid.)
ER43 PROGRAM DATA ERROR(PT/NT)	<1> Input the sequence program recompiled by FANUC LADDER-III. <2> If the error persists even after inputting the sequence program again, contact FANUC.	The sequence program is invalid.
ER56 TOTAL PROGRAM SIZE OVER (OPTION)	<1> Contact FANUC and set the ladder number option again.	The total ladder step option is too large for a multipath PMC.
ER97 IO LINK FAILURE(CHx yyGROUP)	If this alarm is issued on a machine that once operated normally, possible causes are given below. (1) When communication with an I/O unit in the yy group or later is disabled - The communication cable between the (yy-1) group and the yy group is broken or in poor contact. - An I/O unit in the yy group or later is powered off or is not powered on yet. - An I/O unit in the yy group is defective or an I/O unit in the (yy-1) group is defective. (2) When the CNC is powered off and back on again, an I/O unit remains powered on. - When the CNC is powered off and back on again, all I/O units must be powered off once. If this alarm is issued when the sequence program is debugged, any of the following settings may be incorrect in addition to the above causes. (1) I/O module allocation setting (2) Setting of the parameter of the I/O Link allocation data select function I/O Link channel 2-path allocation setting	This alarm is issued when the number of I/O units is insufficient. This alarm is issued when the number of I/O units set by the I/O module allocation and I/O Link allocation select function parameters does not match the number of I/O units actually connected to the CNC. None of the I/O units connected to the channel on which this alarm was issued is linked. The ladder program runs regardless of this alarm.
WN02 OPERATE PANEL ADDRESS ERROR	Correct the Series 0 operator's panel address that is set in the PMC system parameter.	The Series 0 operator's panel address that is set in the PMC system parameter is invalid.

Alarm number	Faulty location/corrective action	Contents
WN03 ABORT NC-WINDOW/EXIN	<1> Check the ladder program to verify that it is free from errors, and then restart the ladder program (press the RUN key). <2> Turn on the power of the CNC again.	The ladder program was stopped while communication was in progress between CNC and PMC. This alarm may cause the WINDR, WINDW, EXIN, and DISPB functional instructions to malfunction.
WN07 LADDER SP ERROR(STACK)	Correct the sequence program so that the subprogram has eight or fewer levels of nesting.	There are too many levels of nesting (levels more than 8) for the CALL or CALLU functional instruction to call the subprogram.
WN09 SEQUENCE PROGRAM IS NOT WRITTEN TO FLASH ROM	If you want to use a changed sequence program again next time you power on the system, write the sequence program to flash ROM. If you have made any unwanted change to the sequence program by mistake, read the original sequence program from flash ROM.	You have changed the sequence program using the LADDER DIAGRAM EDITOR screen or DATA I/O screen, but you have not yet written the changed sequence program to flash ROM. If you shut down the system without writing the changed sequence program to flash ROM, the changes you have made will be nowhere next time you turn on the power.
WN10 NO OPTION(STEP SEQUENCE)	<1> Add the step sequence option. <2> Arrange so that the step sequence subprogram will not be called.	No step sequence option was found when the system attempted to execute a step sequence.
WN11 INCOMPATIBLE FUNCTION	Recompile the program using FANUC LADDER-III or ladder editing package.	A function command does not comply with this PMC.
WN57 OVERRIDE FUNCTION IS ACTIVE	Disable the override function before shipment because it is used to debug a ladder program.	The override function is enabled.
WN58 UNSUPPORTED FUNCTION	Correct the program using the internal ladder editing function.	There is an unsupported function command. The command was not processed.
WN59 MESSAGE FILE SYMBOL UNDEFINED	Correct the error in the multi-language display message file.	The multi-language display message file has a symbol not present in the ladder program.
WN60 MESSAGE FILE SYMBOL INVALID	Correct the error in the multi-language display message file.	A symbol other than the A address is defined in the multi-language display message file.
WN61 MESSAGE FILE ADDRESS DUPLICATE	Correct the error in the multi-language display message file.	An A address is redundantly defined between symbols and addresses or between symbols.
WN62 MESSAGE FILE NUMBER ERROR	Correct the error in the multi-language display message file.	Different message numbers are used for the same A address between the ladder program and the multi-language display message file.
WN63 MESSAGE FILE IS NOT WRITTEN TO FLASH ROM	When using the modified multi-language display message file, write the message file into a flash ROM.	Multi-language display message data was modified on the data input/output screen, but the modified multi-language display message data is not written to the flash ROM. The modified multi-language display message data is lost during power-on unless it is written to the flash ROM.

Alarm number	Faulty location/corrective action	Contents
WN64 MESSAGE FILE SIZE OVER	Reduce the size of the multi-language display message file. Contact FANUC and specify an option for a lager size.	The size of the multi-language display message file is larger than the program storage area. The multi-language display message file is invalid.
WN65 MESSAGE FILE MISMATCH	Contact FANUC.	An unsupported function is used in the multi-language display message file.
WN66 MESSAGE FILE PARITY	Enter the multi-language display message file again. If the error persists even after entering the message file, contact FANUC because a hardware failure is suspected.	The parity of the multi-language display message file is invalid.
WN67 MESSAGE FILE ERROR BY I/O	Enter the multi-language display message file again.	Interruption was specified during reading of the multi-language display message file.

> **NOTE**
> The group number displayed in message of ER34, ER35, ER36, ER38, ER39, or ER97 is a group number for wiring I/O units.

A.2.2   PMC System Alarm Messages

Alarm number	Faulty location/corrective action	Contents
PC004 CPU ERR xxxxxxxx:yyyyyyyy PC006 CPU ERR xxxxxxxx:yyyyyyyy PC009 CPU ERR xxxxxxxx:yyyyyyyy PC010 CPU ERR xxxxxxxx:yyyyyyyy PC012 CPU ERR xxxxxxxx:yyyyyyyy	This alarm may be due to a hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.	A CPU error occurred in the PMC system. xxxxxxxx and yyyyyyyy are internal error codes.
PC030 RAM PARI xxxxxxxx:yyyyyyyy	This alarm may be due to a hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.	A RAM parity error occurred in the PMC system. xxxxxxxx and yyyyyyyy are internal error codes.

Alarm number	Faulty location/corrective action	Contents
PC050 IOLINK ER1 CHz:GRyy:xx	(1) Check whether instantaneous power interruption or changes in voltage occurred in the slave unit of group number yy (0 to 15) connected to the I/O link line of channel number z (1 to 3). (2) Check whether there is no failure or no poor contact on the cable between JD1A of group number yy-1 (0 to 15) and JD1B of group number yy (0 to 15), which are connected to the I/O link line of channel number z (1 to 3). (3) Check whether the slave unit of group number yy (0 to 15) connected to the I/O Link line of channel number z (1 to 3) is not defective.	A communication error occurred in I/O Link. The symbol z indicates a channel number (1 to 3). The symbol yy indicates the group number (0 to 15) of the slave unit in which a problem may be caused. The symbol xx indicates an internal error code. This alarm is issued if communication with the slave unit of channel number z and group number yy is interrupted. The interruption may be caused by: (1) Instantaneous power interruption, a change in voltage, or a defective power cable in the slave unit (2) Defective communication cable or poor contact (3) Failure in the slave unit Group number yy indicated in this alarm may be incorrect depending on the state in which the alarm occurred, so the defective position may not always be identified.

Alarm number	Faulty location/corrective action	Contents
PC051 IOLINK ER2 CHz:yy:xx:ww:vv	(1) When using the I/O Unit-MODEL A, even though the base expansion has been allocated, the base is not connected. Check whether the units actually connected follow the I/O Link allocation. (2) When the Power Mate or Servo Motor β series I/O Link option was connected as an I/O slave unit, check whether a system alarm occurred first in any of these units. (3) Check whether noise is generated on the communication line. Check the grounding state of I/O Link slave units and the shielding state of connected cables. (4) Check whether the DO output of I/O units is not short-circuited. (5) Check whether instantaneous power interruption or changes in voltage occurred in the power for I/O Link master and slave units. (6) Check that there is no failure in cable connection. (7) Check that there is no failure in cables. (8) Check that the ground terminals of I/O units and the shield wires of communication cables are properly grounded. (9) Check that the I/O Link slave units are not defective. (10) Check that the PMC modules are not defective.	A communication error occurred in I/O Link. The symbol z indicates a channel number (1 to 3). The symbols yy, xx, ww, and vv indicate internal error codes. A communication error occurred on channel z of I/O Link. This alarm is issued by various factors related to I/O Link.
PC060 FBUS xxxxxxxx:yyyyyyyy PC061 FL-R xxxxxxxx:yyyyyyyy	This alarm may be due to a hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.	A bus error occurred in the PMC system.
PC070 LADDER SPE (PMCn)	Check the correspondence between the CALL or CALLU instruction and the SPE instruction.	A stack error occurred in function command SPE in the ladder program of the n-th path PMC.

Alarm number	Faulty location/corrective action	Contents
PC097 LADDER PARITY ERR (PMCn) PC098 CODE PARITY ERR	This alarm may be due to a hardware fault; contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.) as well as the displayed internal error codes.	A RAM check error occurred.
PC501 NC/PMC INTERFACE ERR PATH_	Contact us with information on the circumstances under which the alarm occurred (displayed message, system configuration, operation suspected of causing the alarm, timing of alarm occurrence, frequency of occurrence, etc.).	The read or write operation between CNC and PMC failed.
PC502 LADDER SUBaaa (PMCn)	Correct the sequence program so that the SUBaaa functional instruction will not be used.	Command SUBaaa used in the n-th path PMC is unsupported.

NOTE
The group number displayed in message of PC050 is a group number for wiring I/O units.

A.2.3 Operation Errors

Error messages that may be displayed on the PMC LADDER DIAGRAM VIEWER screen

Alarm number	Faulty location/corrective action	Contents
INPUT INVALID	Input a valid address or numeric value.	The input address or numeric value is invalid.
PROGRAM IS PROTECTED BY PASSWORD	Enter the password.	The screen cannot be displayed because the program is protected by the password.
ILLEGAL SUBPROGRAM NAME	Input a existent subprogram number or symbol.	A nonexistent subprogram number or symbol is specified.
SYMBOL UNDEFINED	Input a defined symbol or bit address.	An undefined symbol character string is specified.
THE NET IS NOT FOUND		The specified net is not found.
THE ADDRESS IS NOT FOUND		The specified address is not found.
THE FUNCTIONAL INSTRUCTION IS NOT FOUND		The specified functional instruction is not found.
WRITE COIL NEEDS BIT ADDRESS	Specify a bit address for the write coil search.	You entered a byte address when specifying an address used for the write coil search.
SOME NETS ARE DISCARDED	The system cannot pick up all the nets. Choose the nets to pick up, by using the LADDER DIAGRAM VIEWER display screen, and then perform the net pickup operation manually.	The system failed to pick up all the nets because there were 128 nets or more to be picked up.

Alarm number	Faulty location/corrective action	Contents
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the ladder data.	The ladder data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the ladder data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the PMC LADDER DIAGRAM EDITOR screen

Alarm number	Faulty location/corrective action	Contents
THIS NET IS PROTECTED		When you are editing data on a per-subprogram basis, you cannot edit the subprogram frame nets (END1, END2, END3, SP, and SPE).
TOO LARGE DATA TO COPY	Reduce the range of data to copy. Perform the copy operation several times, copying a smaller range of data at a time.	The selected range of data exceeds the size of the copy buffer.
TOO LARGE DATA TO PASTE	Reduce the size of data to paste.	An attempt was made to paste data whose size exceeded the free space of the sequence program.
BIT ADDRESS IS REQUIRED	Make sure that the address types match for the alteration operation.	An attempt was made to alter a bit address to a byte address.
BYTE ADDRESS IS REQUIRED	Make sure that the address types match for the alteration operation.	An attempt was made to alter a byte address to a bit address.
ILLEGAL PMC ADDRESS	Check the address to be input, and then enter it correctly.	• A character string was entered that was unacceptable as a PMC address. • A wildcard (*) was specified in an inappropriate manner. • Ether "OLD ADDRESS" or "NEW ADDRESS" was not entered.
THE ADDRESS IS READ-ONLY	Enter a write-permitted address.	• An attempt was made to alter a write coil address to a write-prohibited bit address. • An attempt was made to alter an address set in an output parameter of a functional instruction to a write-prohibited bit address.
THE ADDRESS TYPE ARE MISMATCHED	Check the types of the address in "OLD ADDRESS" and "NEW ADDRESS" and, if necessary, enter the correct address or addresses.	The type of the addresses in "OLD ADDRESS" does not match that in "NEW ADDRESS".
***** DOSE NOT HAVE SYMBOL	Define symbol data in "OLD ADDRESS".	No symbol data is defined in "OLD ADDRESS".
***** ALREADY HAS SYMBOL	Make sure that the address types match for the alteration operation.	Symbol data is already defined in "NEW ADDRESS".

Error messages that may be displayed on the PMC LADDER DIAGRAM EDITOR screen (when updating)

Alarm number	Faulty location/corrective action	Contents
OVERLAPPED COM	If COME is missing, add it in proper position. If the COM is unnecessary, remove it.	There is no COME that corresponds to this COM.
END IN COM END1 IN COM END2 IN COM	If COME is missing, add it in proper position. If COM is unnecessary, remove it.	END,END1,END2, or END3 is found between COM and COME.
JMPE IN COM	JMPE and corresponding JMP must have same COM/COME status. Review JMP range and COM range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	JMPE is found between COM and COME, and JMP and corresponding JMPE have different COM/COME status.
SP/SPE IN COM	If COME is missing, add it in proper position. If the COM is unnecessary, remove it.	SP or SPE is found between COM and COME.
COME WITHOUT COM	If COM is missing, add it in proper position. If the COME is unnecessary, remove it.	There is no COM that corresponds to this COME.
DUPLICATE CTR NUMBER (WARNING)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural CTRs have the same number as their parameter. (This is warning.)
ILLEGAL CTR NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	CTR has parameter number that is out of range.
DUPLICATE DIFU/DIFD NUMBER (WARNING)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural DIFUs or DIFDs have the same number as their parameter. (This is warning.)
ILLEGAL DIFU/DIFD NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	DIFU or DIFD has parameter number that is out of range.

Alarm number	Faulty location/corrective action	Contents
NO END NO END1 NO END2 NO END3	Add END, END1, END2 or END3 in proper position.	END, END1, END2 or END3 is not found.
DUPLICATE END1 DUPLICATE END2 DUPLICATE END3	Remove extra END1, END2 or END3.	Multiple END1, END2 or END3 are found.
GARBAGE AFTER END GARBAGE AFTER END2 GARBAGE AFTER END3	Remove unnecessary nets, and move necessary nets to proper position so that they will be executed.	There are some nets after END, END2 or END3, which will not be executed.
OVERLAPPED JMP	If JMPE is missing, add it in proper position. If the JMP is unnecessary, remove it.	There is no JMPE that corresponds to this JMP.
JMP/JMPE TO BAD COM LEVEL	JMP and corresponding JMPE must have same COM/COME status. Review JMP range and COM range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	JMP and corresponding JMPE have different COM/COME status.
COME IN JMP	COME and corresponding COM must have same JMP/JMPE status. Review COM range and JMP range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	COME is found between JMP and JMPE, and COM and corresponding COME have different JMP/JMPE status.
END IN JMP END1 IN JMP END2 IN JMP END3 IN JMP	If JMPE is missing, add it in proper position. If JMP is unnecessary, remove it.	END,END1,END2, or END3 is found between JMP and JMPE.
SP/SPE IN JMP	If JMPE is missing, add it in proper position. If the JMP is unnecessary, remove it.	SP or SPE is found between JMP and JMPE.
JMPB OVER COM BORDER	JMPB and its destination must have same COM/COME status. Review range of JMPB and COM range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	JMPB and its destination differ in COM/COME status.
JMPB OVER LEVEL	JMPB can only jump to the same program level, or within a subprogram. If the JMPB is unnecessary, remove it. If LBL for the JMPB is missing, add it in proper position. If it should be JMPC, correct it.	JMPB jumps to different program level.
LBL FOR JMPB NOT FOUND	If JMPB is unnecessary, remove it. If LBL is missing, add it in proper position.	Can not find proper LBL for JMPB.
JMPC IN BAD LEVEL	JMPC is used to jump from a subprogram to level 2. If the JMPC is unnecessary, remove it. If it should be JMPB or JMP, correct it.	JMPC is used in other than subprogram.
LBL FOR JMPC NOT FOUND	If JMPC is unnecessary, remove it. If LBL is missing, add it in proper position: JMPC jumps into level 2.	Can not find proper LBL for JMPC.

Alarm number	Faulty location/corrective action	Contents
LBL FOR JMPC IN BAD LEVEL	JMPC is used to jump from a subprogram to level 2. If the JMPC is unnecessary, remove it. If another LBL of same L-address that the JMPC is intended to jump exists in the subprogram, assign different L-address to these two LBLs. If it should be JMPB or JMP, correct it.	Destination of JMPC is not level 2.
JMPC INTO COM	LBL for JMPC must be located out of any COM and COME pair. If the JMPC is unnecessary, remove it. If the LBL is located wrong, move it to correct position. If the L-address of JMPC is wrong, correct it.	JMPC jumps to LBL between COM and COME.
JMPE WITHOUT JMP	If JMP is missing, add it in proper position. If the JMPE is unnecessary, remove it.	There is no JMP that corresponds to this JMPE.
TOO MANY LBL	Remove unnecessary LBLs. If this error still occurs, adjust the construction of program to use less LBLs.	There are too many LBLs.
DUPLICATE LBL	If some of these LBLs are unnecessary, remove them. If all of these LBLs is necessary, assign other L-addresses to them to make all LBLs unique.	Same L-address is used in plural LBLs.
OVERLAPPED SP	If SPE is missing, add it in proper position. If the SP is unnecessary, remove it.	There is no SPE that corresponds to this SP.
SPE WITHOUT SP	If SP is missing, add it in proper position. If the SPE is unnecessary, remove it.	There is no SP that corresponds to this SPE.
END IN SP	If SPE is missing, add it in proper position. If END is in wrong place, move it to proper position.	END is found between SP and SPE.
DUPLICATE P ADDRESS	If some of these SPs are unnecessary, remove them. If all of these SPs is necessary, assign other P-addresses to them to make all SPs unique.	Same P-address is used in plural SPs.
DUPLICATE TMRB NUMBER (WARNING)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural TMRBs have the same number as their parameter. (This is warning.)
ILLEGAL TMRB NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	TMRB has parameter number that is out of range.

Alarm number	Faulty location/corrective action	Contents
DUPLICATE TMR NUMBER (WARNING)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural TMRs have the same number as their parameter. (This is warning.)
ILLEGAL TMR NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	TMR has parameter number that is out of range.
NO SUCH SUBPROGRAM	If it calls wrong subprogram, correct it. If the subprogram is missing, create it.	Subprogram that is called by CALL/CALLU is not found.
UNAVAILABLE INSTRUCTION	Confirm that this ladder program is correct one. If this program is correct one, all these unsupported instructions have to be removed.	Unsupported instruction for this PMC model is found.
SP IN BAD LEVEL	SP can be used at top of a subprogram. Correct it so that no SP exists in other place.	SP is found in wrong place.
LADDER PROGRAM IS BROKEN	This ladder program must be all cleared once, and remake ladder program.	Ladder program may be broken by some reason.
NO WRITE COIL	Add proper write coil.	Write coil is necessary, but is not found.
CALL/CALLU IN BAD LEVEL	CALL/CALLU must be used in Level 2 or in subprograms. Do not use any other places.	CALL/CALLU is used in wrong place.
SP IN LEVEL3	If END3 is located wrong, move it to correct position. If the SP is unnecessary, remove it.	SP is found in level 3.

Error messages that may be displayed on the PMC NET EDITOR screen

Alarm number	Faulty location/corrective action	Contents
ILLEGAL FUNCTIONAL INSTRUCTION NAME	Specify the name of an available functional instruction.	The entered name of functional instruction is invalid.
TOO MANY FUNCTIONAL INSTRUCTIONS IN ONE NET	Only one functional instruction is allowed to constitute a net. If necessary, divide the net into plural nets.	Too many functional instructions are in one net.
TOO LARGE NET	Divide the net into plural nets so that step number in a net may become small.	Net is too large. When a net is converted into the object, the net exceeds 256 steps.
NO INPUT FOR OPERATION	Coil without input, or coil connected to output of functional instruction that has no output, causes this error. If coil is not necessary, remove it. If necessary, connect it to meaningful input.	No signal is provided for logical operation.

OPERATION AFTER FUNCTION IS FORBIDDEN	Output of functional instruction can not be connected to a contact, nor to conjunction with other signal that will be implemented by logical-or operation.	No logical operation with functional instruction output is permitted, except write coils.
WRITE COIL IS EXPECTED	Write coil is not found even if it is expected. Add proper write coil to the net.	Write coil is expected, but not found.
BAD COIL LOCATION	Coil can be located only at rightmost column. Any coil located at other place must be erased once, and place necessary coils in correct place.	Coil is located in bad position.
SHORT CIRCUIT	Find contact with terminals connected by short circuit, and correct connections.	Some contacts are connected with short circuit. CTR has a parameter number that is out of the range.
FUNCTION AFTER DIVERGENCE IS FORBIDDEN	Functional instruction can not be used in output section of net. If necessary, divide the net into plural nets.	Functional instruction is used in output section of net.
ALL COIL MUST HAVE SAME INPUT	Left terminals of all coils in a net must be connected to same input point.	When a net contains more than one coil, the coils should not have any contact beside them affects only of the coils.
BAD CONDITION INPUT	Check the connection of all condition inputs of the functional instruction. Especially for functional instruction that has more than one condition input, check if connections to condition inputs interfere with each other.	Some condition input of functional instruction is not connected correctly.
NO CONNECTION	Find gap that is expected to be connected, and correct the connection.	There is signal connected to nowhere.
NET IS TOO COMPLICATED	Examine every connection, and find unnecessarily bending connection, or coils that are connected to different point.	Net is too complicated to analyze.
PARAMETER IS NOT SUPPLIED	Enter all of the relay addresses, and parameters of functional instructions.	Relay with blank address, or blank parameter of functional instruction, is found.

Error messages that may be displayed on the TITLE DATA EDITOR screen

Alarm number	Faulty location/corrective action	Contents
TOO MANY CHARACTERS	Make sure that the entered character string is within the allowable input length.	The number of characters in the entered character string exceeds the allowable input length. Some of the characters are discarded.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the title data.	The title data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the title data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SYMBOL & COMMENT DATA EDITOR screen

Alarm number	Faulty location/corrective action	Contents
TOO MANY CHARACTERS	Make sure that the entered address is within the allowable input length.	The number of characters in the entered address exceeds the allowable address input length.
ADDRESS IS REQUIRED	Enter an address correctly.	No address was entered during the batch input of address, symbol, and comment data using the SYMBOL & COMMENT EDITOR screen.
ILLEGAL PMC ADDRESS	Enter an address correctly.	The specified address is invalid, or the entered address character string contains a space or spaces.
THE ADDRESS ALREADY HAS AN ENTRY	Specify another address.	An already registered address was entered.
THE SYMBOL NAME IS ALREADY USED	Specify another symbol.	An already registered symbol was entered.
PMC ADDRESS MUST BE ENTERED	Enter a PMC address in the ADDRESS field.	No PMC address was entered when new symbol/comment data is registered.
TOO LONG SYMBOL NAME	Make sure that the symbol consists of 16 characters or less.	The entered symbol exceeds the specified number of characters.
TOO LONG COMMENT STRING	Make sure that the comment consists of 30 characters or less.	The entered comment exceeds the specified number of characters.
BAD SYMBOL NAME	Define a symbol that contains no space.	The entered symbol contains a space or spaces.
THE STRING IS NOT FOUND	Specify another character string for the search.	The search was done for the specified character string but did not find it.
OUT OF SPACE	Create free space for the sequence program, by deleting unnecessary ladder or message data.	The symbol/comment editing area has no free space.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the symbol/comment data.	The symbol/comment data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the symbol/comment data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.
BAD SYMBOL NAME	Change the symbol name.	The symbol name is invalid.
CANNOT EDIT ADDRESS AUTO ASSIGNED SYMBOL	Use FANUC LADDER-III to change the symbol.	The symbol whose PMC address is assigned automatically by compiling FANUC LADDER-III, can not edit.
ILLEGAL DATA TYPE	Enter a correct data type.	The specified data type is invalid.
ILLEGAL PROGRAM NAME	Enter a correct program name.	The specified program is invalid.
LINE FEED IS NOT AVAILABLE IN THIS DATA	Line feed code can be entered in comment data only. Do not enter it in other data.	Line feed code can not be entered in this data.
LINE FEED IS NOT AVAILABLE IN THIS MODE	Enter Line feed code in the insert or overwrite mode.	Line feed code can not be entered in this mode.
NO SYMBOL. PROGRAM SETTING IS IGNORED	Symbol name is required for local symbol.	The specified program is ignored because no symbol is specified.
NOTHING TO PASTE	You need to copy or cut character strings before you paste them.	You try to paste character strings without copying or cutting ones.

Alarm number	Faulty location/corrective action	Contents
TOO LARGE DATA TO PASTE	Shorten the character string to copy or cut.	The character strings is too long to copy or cut.
UNAVAILABLE CHARACTERS WAS OMITTED.	Do not copy or cut characters which can not be used at pasted position.	The characters which can not be used at pasted position, were omitted.

Error messages that may be displayed on the MESSAGE DATA EDITOR screen

Alarm number	Faulty location/corrective action	Contents
INPUT INVALID	Enter ";" in the 5th digit position in the batch message input process.	The delimiter code - semicolon (;) - was not entered in the batch message input process.
ILLEGAL NUMBER	Enter a four-digit number as the message number.	The entered message number contains any nonnumeric character, or a number shorter than four digits was entered.
THE NUMBER IS OUT OF RANGE	Make sure that the entered message number is in the range between 1000 and 9999.	The entered message number is out of the 1000-9999 range.
CLOSING "@" IS NOT FOUND	When entering kana or other Japanese characters, make sure that they are enclosed within a pair of @ signs.	One of the @ sign pair is missing.
BAD NUMBER OF CHARACTERS IN "@-@"	Enter a character string correctly between a pair of @ signs.	The number of characters entered between the pair of @ signs is not even.
ILLEGAL CHARACTER IN "@-@"	Enter a character string correctly between a pair of @ signs.	One or more invalid character codes exist between the pair of @ signs.
BAD NUMBER OF CHARACTERS FOR 2-BYTE CODE	Enter a two-byte code correctly between @02 and 01@.	The number of characters in the two-byte code (characters entered between @02 and 01@) is not a multiple of four.
ILLEGAL 2-BYTE CODE	Enter a two-byte code correctly between @02 and 01@.	The two-byte code (characters entered between @02 and 01@) contains one or more characters other than the JIS codes.
CLOSING CONTROL CODE "01" IS NOT FOUND	Enter the closing control code.	The two-byte code (characters entered between @02 and 01@) lacks the closing control code (01).
CONTROL CODE "XX" IS REPEATED	Remove any repeated control code.	The starting control code (02), closing control code (01), and/or umlaut code (0D) is repeated.
CLOSING "]" IS NOT FOUND	Make sure that the "[" and "]" codes are entered in pairs.	The delimiter codes for numerical data are not entered in pairs.
BAD NUMERICAL DATA FORMAT	Specify the numerical data correctly.	The format of the numerical data is invalid.
BAD PMC ADDRESS FOR NUMERIAL DATA	Enter an available address.	The address section of the numerical data is invalid.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the message data.	The message data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the message data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the I/O MODULE EDITOR screen

Alarm number	Faulty location/corrective action	Contents
GROUP NUMBER IS TOO LARGE	Specify 15 or a smaller value as the group number.	The entered group number is too large.
BASE NUMBER IS TOO LARGE	Specify base number 0 for I/O Unit-B (##, #1 - #10).	The entered base number is too large.
SLOT NUMBER IS TOO LARGE	Specify 30 or a smaller value as the slot number for I/O Unit-B (##, #1 - #10). For other I/O units, specify 10 or a smaller value.	The entered slot number is too large.
SLOT NUMBER IS TOO SMALL	Specify 0 or a large value as the slot number for I/O Unit-B (##, #1 - #10). For other I/O units, specify 1 or a larger value.	The entered slot number is too small.
I/O UNIT NAME MISMATCH	Check the I/O unit name or address.	The input I/O unit is assigned to the Y address, or the output I/O unit is assigned to the X address.
ILLEGAL I/O UNIT NAME	Enter a correct I/O unit name.	The entered I/O unit name is invalid.
NOT ENOUGH SPACE	Enter the data again after creating free space by deleting the data allocated behind the current cursor position or by other adequate means.	There is not enough free address space for the size of the I/O unit you are going to assign. This error also occurs if you attempt to assign the I/O unit to an already allocated address space.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the I/O module data.	The I/O module data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the I/O module data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SYSTEM PARAMETER screen

Alarm number	Faulty location/corrective action	Contents
INPUT INVALID	Enter a correct numerical value.	The entered numerical value or its input format is invalid.
SYMBOL UNDEFINED	Enter a defined symbol or bit address.	An undefined symbol character string was entered.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the system parameter data.	The system parameter data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the system parameter data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SIGNAL STATUS screen

Alarm number	Faulty location/corrective action	Contents
INPUT INVALID	Enter a correct numerical value.	The entered numerical value or its input format is invalid.
SYMBOL UNDEFINED	Enter a defined symbol or bit address.	An undefined symbol character string was entered.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the PMC PARAM screen

Alarm number	Faulty location/corrective action	Contents
INPUT INVALID	Enter a correct numerical value.	The entered numerical value or its input format is invalid.
MUST BE IN EMERGENCY STOP OR IN MDI MODE	Change to MDI mode or emergency stop mode.	There is not in MDI mode or emergency stop mode.
PWE MUST BE ON	Set "PWD" to 1 in NC setting screen.	"PWD" is 0 in NC setting screen.
EITHER PWE OR KEY4 MUST BE ON	Set "PWD" to 1 in NC setting screen or set the program protect signal "KEY4" to 1	"PWD" is 0 in NC setting screen and the program protect signal "KEY4" is 0.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SIGNAL TRACE screen

Alarm number	Faulty location/corrective action	Contents
TRACE FUNCTION IS ALREADY IN USE	Wait until FANUC LADDER-III or some other application finishes using the trace function before executing it.	FANUC LADDER-III or some other application is currently using the trace function.
NO SAMPLING ADDRESS	Specify a bit address as a sampling address in the trace parameter.	No sampling address is specified in the trace parameter.
NO STOP TRIGGER ADDRESS	Specify a bit address as the stop trigger address in the trace parameter.	The stop trigger address is not specified in the trace parameter.
NO SAMPLING TRIGGER ADDRESS	Specify a bit address as the sampling trigger address in the trace parameter.	The sampling trigger address is not specified in the trace parameter.

Error messages that may be displayed on the trace setting screen

Alarm number	Faulty location/corrective action	Contents
INPUT INVALID	Enter a numerical value that is within the specified data range of the relevant trace parameter.	A nonnumeric value or an out-of-range parameter value was entered.
SYMBOL UNDEFINED	Enter a defined symbol or bit address.	An undefined symbol character string was entered.
BIT ADDRESS IS REQUIRED	Specify a bit address as the stop or sampling trigger address.	A byte address was specified as the stop or sampling trigger address.
INVALID STOP TRIGGER ADDRESS	Enter a PMC signal address that can be used as the stop trigger address.	The bit address entered as the stop trigger address is invalid.

Alarm number	Faulty location/corrective action	Contents
INVALID SAMPLING TRIGGER ADDRESS	Enter a PMC signal address that can be used as the sampling trigger address.	The bit address entered as the sampling trigger address is invalid.

Error messages that may be displayed on the I/O diagnosis screen

Alarm number	Faulty location/corrective action	Contents
ENTER STRING TO SEARCH.	Enter a string before starting a search.	No search string is specified.
I/O DIAGNOSIS FUNCTION IS NOT SUPPORTED	To use the I/O diagnosis function, update the PMC system software.	The I/O diagnosis function cannot be used because the PMC system software is an older version.
INPUT INVALID	Check the entered string.	The entered string is invalid.
LADDER PROGRAM IS BROKEN	Check the information displayed on the PMC alarm screen and reload the program.	The program is corrupted.
NO GROUP FORMAT.	Use [GROUP] on the I/O diagnosis (setting) screen.	No group display is set.
PROGRAM IS BEING MODIFIED.	Retry after completing the function that is using the program.	The program cannot be referenced because it is being used by another function.
REACHED TO THE END OF SYMBOL DATA.	To make another search, specify a string again.	The search has been completed until the end of the data has been reached.
SYMBOL ORDER IS NOT AVAILABLE.	Use the FANUC LADDER-III to convert the program to one with an expanded function.	The format of this program does not allow sorting and display in symbol order.
THE GROUP IS NOT FOUND	Check the specified group.	The specified group is not found.
FORCING IS PROTECTED ON THIS PATH.	Disable the programmer protection function.	The forced input/output function is currently protected on the selected PMC path.
THE STRING IS NOT FOUND	Check the specified string.	The specified string is not found.

A.2.4   I/O Communication Error Messages

The error messages that may appear on the I/O screen and their meanings and actions are listed below.

Error messages displayed during memory card I/O operation

Alarm number	Faulty location/corrective action	Contents
MEMORY CARD IS NOT READY	Check whether a memory card is installed.	No memory card is installed.
MEMORYCARD IS FULL	Delete files to create available space.	There is no available space in the memory card.
MEMORYCARD IS WRITE PROTECTED	Release the write protection of the memory card.	The memory card is write-protected.
MEMORYCARD IS NOT FORMATTED	Format the memory card in FAT16. (It cannot be recognized if formatted in FAT32.)	The memory card cannot be recognized.
TOO MANY FILES IN MEMORYCARD	Delete unnecessary files to reduce the number of files.	There are too many files.
FILE NOT FOUND	On the list screen, check the file name or file number.	The specified file cannot be found.
FILE IS READ-ONLY	Check the attributes of the file.	Write to the specified file is not permitted.
FILE NAME IS INVALID	Specify the file name in MS-DOS form.	The file name is illegal.

Alarm number	Faulty location/corrective action	Contents
COULD NOT FORMAT MEMORY CARD	The NC cannot format this memory card. Format the memory card in FAT16 using another PC. (It cannot be recognized if formatted in FAT32.)	The memory card cannot be formatted.
UNSUPPORTED MEMORYCARD	Replace the memory card with another one.	This memory card is not supported.
CAN NOT DELETE FILE	Check the attributes of the file.	An error occurred when a file was deleted from the memory card.
MEMORYCARD BATTERY ALARM	Replace the battery of the memory card.	The battery of the memory card has become weak.
THIS FILE NAME IS ALREADY USED	Change the file name to another one.	The file name is already used.
MEMORYCARD ACCESS ERROR	Replace the memory card with another one.	The memory card cannot be accessed.
DIFFERENCE FOUND		File comparison detected a mismatch.
MEMORY CARD IS LOCKED BY OTHER FUNCTION	Wait until the PMC user completes processing, then retry.	Another PMC user is using the memory card.
MEMORY CARD HEADER ROM DATA ID IS ILLEGAL	This file cannot be read. Check the type of the file.	An attempt was made to read a file, but its ROM data ID was illegal.
FILE NUMBER CAN NOT SELECTED	If the file does not exist, the key entry is invalid. If this error occurs even when the cursor is placed at a file name, contact the FANUC service center.	The file number cannot be selected.
THE FILE NUMBER DOES NOT EXIST	Check the total number of files on the list screen.	The entered file number is not present. The entered number exceeds the total number of files.
FILE NUMBER IS RESTRICTED TO "128"	Enter a numeric value not exceeding 128.	A value up to 128 can be entered as the file number.
MEMORY CARD IS USED BY OTHER FUNCTION	Retry after terminating the other function that is currently using the memory card.	Some other function is currently using the memory card.
MEMORY CARD IS WRITE PROTECTED	Cancel the write protection of the memory card, or use another memory card that is not write protected.	The memory card is write protected.
UNSUPPORTED MEMORY CARD	Use another memory card.	This is an unsupported type of memory card.
COULD NOT DELETE FILE	Check the read/write permission attribute of the file.	The file cannot be deleted.
TRACE FILE NUMBER IS OVER	Delete unnecessary old trace result file or files.	No more trace result file can be created because the maximum trace result file number (file extension) has been reached.
INTERNAL ERROR (xxxxxxxxxx)	Contact the FANUC service center, and report the displayed message correctly.	An error due to an internal factor occurred. Details on the error are displayed in parentheses.

Error messages displayed during flash ROM I/O operation

Alarm number	Faulty location/corrective action	Contents
NOT IN EMG STOP MODE	Place the system in the emergency stop state.	The system is not in the emergency stop state.
INVALID LADDER PROGRAM	Check the program.	The transfer program is illegal.
DIFFERENCE FOUND		A file comparison detected a mismatch.

Alarm number	Faulty location/corrective action	Contents
FLASH ROM IS LOCKED BY OTHER FUNCTION	Wait until the PMC user completes processing, then retry.	Another PMC user is using the flash ROM.
FLASH ROM HEADER ROM DATA ID IS ILLEGAL	This file cannot be read.　Check the type of the file.	An attempt was made to read a file, but its ROM data ID was illegal.
FLASH ROM IS USED BY OTHER FUNCTION	This file cannot be read.　Check the type of the file.	The ROM data ID of the file you attempted to read is invalid.
INTERNAL ERROR (xxxxxxxxxx)	Contact the FANUC service center, and report the displayed message correctly.	An error due to an internal factor occurred.　Details on the error are displayed in parentheses.

Error messages displayed during FLOPPY or other input/output device I/O operation

Alarm number	Faulty location/corrective action	Contents
ILLEGAL PMC PARAMETER FORMAT	Specify a file of the PMC parameter format.　Also, check the specified file to see whether its content is not disrupted.	The specified file is not of the PMC parameter format.
ILLEGAL HANDY FILE FORMAT	Specify a file of the handy file format. Also, check the specified file to see whether its content is not disrupted.	The specified file is not of the handy file format.
UNKNOWN FILE FORMAT	Specify file of recognizable format such as PMC parameter format, or check the contents of the file.	Can not recognize the format of specified file.
FILE NAME OR FILE NUMBER IS REQUIRED	Specify file name or file number for the operation.	Need file name or file number to identify file to read, compare, or delete.
COMMUNICATION TIMEOUT	Check the communication parameters such as baud rate, and retry to communicate.	Communication with the I/O device has been timeout.
I/O DEVICE IS NOT ATTACHED OR IN ERROR STATUS	Check the power of I/O device is ON. Check the I/O device is connected. Check the cable that connects I/O device with PMC is correct one. If some error has occurred in I/O device, solve it.	Any I/O device is not connected, or some error has occurred in it.
RECEIVED BAD DATA: CHECK THE COMMUNICATION PARAMETERS	Check the PMC's communication parameters such as baud rate match the ones of I/O device.	Invalid data has been received.
RECEIVED DATA HAS OVERRUN	Check the communication parameters about flow control.	Too many data have received at once.
OTHERS FUNCTION IS USING THIS CHANNEL	Use the other channel, or stop the function.	Others function is using this channel.
BAD COMMUNICATION PARAMETER	Check the communication parameters such as baud rate.	Setting parameters of communication are not correct.
OTHER FUNCTION IS USING I/O FUNCTION	Wait until function that using I/O function do finish, or stop the function.	Another function such as FANUC LADDER-III is using I/O function.
UNKNOWN HANDY FILE FORMAT DATA	Check the file.	The received data is not a program of the PMC system or is a program of some other incompatible type.
ILLEGAL BAUD RATE SETTING	Set a valid baud rate.	The set baud rate is invalid.
ILLEGAL CHANNEL NUMBER	Set a valid channel number.	The set channel number is invalid.
ILLEGAL PARITY BIT SETTING	Set a valid parity bit.	The set parity bit is invalid.
ILLEGAL STOP BIT SETTING	Set a valid stop bit.	The set stop bit is invalid.

Alarm number	Faulty location/corrective action	Contents
ILLEGAL WRITE CODE SETTING	Set a valid output code.	The set output code is invalid.
SEQUENCE PROGRAM IS IN USE BY ONLINE FUNCTION	Wait until On-line function, do finish the using I/O function. In general, both of I/O function and On-line function should not be used at the same time.	Can not input/output of sequence program, because On-line function is using sequence program.

Common error messages that may be displayed on individual devices during the I/O operations

Alarm number	Faulty location/corrective action	Contents
ERROR OCCURS IN LADDER PROGRAM	Check the PMC alarm screen and correct the indicated program error accordingly.	Data cannot be output because there is an error in the ladder program.
UNKNOWN DATA TYPE	Check the file.	The PMC type of the input data is unknown.
MUST BE IN EMERGENCY STOP	Set the NC to the emergency stop state.	The NC is not in the emergency stop state when the PMC parameter is read.
PWE MUST BE ON	Set PWE to 1 on the NC setting screen.	PWE on the NC setting screen is 0 during reading from the PMC parameter.
MUST BE IN EDIT MODE	Set the NC to the EDIT mode.	The NC is not in the EDIT mode during writing to the PMC parameter.
THIS FUNCTION IS NOT ALLOWED	Release the protection by the programmer protection function or 8-level protection function.	Protection is made by the programmer protection function or 8-level protection function.
PMC PARAMETER IS LOCKED BY OTHER FUNCTION	Retry after terminating the other function that is currently using the PMC parameter.	The PMC parameter is currently used by some other function and cannot be referenced by this function.
THIS DEVICE IS USED BY OTHER FUNCTION	Retry after terminating the other function that is currently using the specified device.	The specified device is currently used by some other function and cannot be used by this function.
PMC PARAMETER IS PROTECTED BY OTHER FUNCTION	Retry after terminating the other function that is currently using the PMC parameter.	The PMC parameter is currently used by some other function and cannot be changed by this function.
LADDER TYPE UNMATCH	Specify a program of a valid type.	The specified program is of a different type and cannot be read.
TOO LARGE LADDER PROGRAM	Check the file. Or, change to a step number option that allows you to set a larger program size.	The ladder program is too large to read.
LADDER PROGRAM IS USED BY OTHER FUNCTION	Retry after terminating the other function that is currently displaying the ladder program.	The ladder program is currently used by some other function and cannot be referenced by this function.

A.3   ALARM LIST (SERIAL SPINDLE)

When a serial spindle alarm occurs, the following number is displayed on the CNC.

NOTE
*1 Note that the meanings of the Spindle Amplifier indications differ depending on which LED, the red or yellow LED, is on. When the red LED is on, the Spindle Amplifier indicates a 2-digit alarm number. When the yellow LED is on, the Spindle Amplifier indicates an error number that designates a sequence problem (for example, when a rotation command is entered with the emergency stop state not released).
See "Error Codes (Serial Spindle)."
*2 For serial spindle alarms with a number not listed, refer to the following documents depending on the spindle motor to which a connection is actually made.
-    FANUC AC SPINDLE MOTOR αi series Maintenance Manual (B-65285EN)
-    Technical Report etc.

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9001	SSPA:01 MOTOR OVERHEAT	01	1 Check and correct the peripheral temperature and load status. 2 If the cooling fan stops, replace it.	The internal temperature of the motor exceeds the specified level. The motor is used in excess of the continuous rating, or the cooling component is abnormal.
SP9002	SSPA:02 EX DEVIATION SPEED	02	1 Check and correct the cutting conditions to decrease the load. 2 Correct parameter No. 4082.	The motor speed cannot follow a specified speed. An excessive motor load torque is detected. The acceleration/deceleration time in parameter No. 4082 is insufficient.
SP9003	SSPA:03 DC-LINK FUSE IS BROKEN	03	1 Replace the Spindle Amplifier. 2 Check the motor insulation status.	The Power Supply (PS) becomes ready ("00" is indicated), but the DC link voltage is too low in the Spindle Amplifier. The fuse in the DC link section in the Spindle Amplifier is blown. (The power device is damaged or the motor is ground-fault.)
SP9004	SSPA:04 POWER SUPPLY ERROR	04	Check the voltage of the power input to the Power Supply (PS) and the connection status.	The Power Supply (PS) found a missing power supply phase. (Power Supply (PS) alarm E)
SP9006	THERMAL SENSOR DISCONNECT	06	1 Check and correct the parameter. 2 Replace the feedback cable.	The temperature sensor of the motor is disconnected.

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9007	SSPA:07 OVER SPEED	07	Check for a sequence error. (For example, check whether spindle synchronization was specified when the spindle could not be turned.)	The motor speed has exceeded 115% of its rated speed. When the spindle axis was in position control mode, positional deviations were accumulated excessively (SFR and SRV were turned off during spindle synchronization.)
SP9009	SSPA:09 OVERHEAT MAIN CIRCUIT	09	1 Improve the heat sink cooling status. 2 If the external radiator cooling fan stops, replace the Spindle Amplifier.	The temperature in the power semiconductor cooling radiator is abnormally high.
SP9010	SSPA:10 LOW VOLT INPUT POWER	10	1 The input power voltage in the Power Supply (PS) is too low. 2 The power cable between amplifiers is abnormal. 3 The spindle amplifier is abnormal.	A drop in the input power voltage in the spindle amplifier is detected.
SP9011	SSPA:11 OVERVOLT POWER CIRCUIT	11	1 Check the selected Power Supply (PS). 2 Check the input power voltage and change in power during motor deceleration. If the voltage exceeds 253 VAC (for the 200-V system) or 530 VAC (for the 400-V system), improve the power supply impedance.	Overvoltage of the DC link section of the Power Supply (PS) was detected. (Power Supply (PS) alarm indication: 7) Power Supply (PS) selection error. (The maximum output specification of the Power Supply (PS) is exceeded.)
SP9012	SSPA:12 OVERCURRENT POWER CIRCUIT	12	1 Check the motor insulation status. 2 Check the spindle parameters. 3 Replace the Spindle Amplifier.	The motor current is abnormally high. A motor-specific parameter does not match the motor model. Poor motor insulation
SP9013	SSPA:13 CPU DATA MEMORY FAULT	13	Replace the Spindle Amplifier control printed circuit board.	Abnormality in an Spindle Amplifier control circuit component is detected. (Internal RAM is abnormal.)
SP9014	SERIAL SPINDLE ALARM	14	Upgrade the spindle software program.	A spindle amplifier that is not registered in the spindle software program is used.
SP9015	SSPA:15 SPINDLE SWITCHING FAULT	15	1 Check and correct the ladder sequence. 2 Replace the switching MC.	The switch sequence in spindle switch/output switch operation is abnormal. The switching MC contact status check signal and command do not match.
SP9016	SSPA:16 RAM ERROR	16	Replace the Spindle Amplifier control printed circuit board.	Abnormality in an Spindle Amplifier control circuit component is detected. (RAM for external data is abnormal.)

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9017	SERIAL SPINDLE ALARM	17	Replace the Spindle Amplifier.	Abnormality in spindle amplifier ID data is detected.
SP9018	SSPA:18 SUMCHECK ERROR PROGRAM ROM	18	Replace the Spindle Amplifier control printed circuit board.	Abnormality in an Spindle Amplifier control circuit component is detected. (Program ROM data is abnormal.)
SP9019	SSPA:19 EXCESS OFFSET CURRENT U	19	Replace the Spindle Amplifier.	Abnormality in an Spindle Amplifier component is detected. (The initial value for the U phase current detection circuit is abnormal.)
SP9020	SSPA:20 EXCESS OFFSET CURRENT V	20	Replace the Spindle Amplifier.	Abnormality in an Spindle Amplifier component is detected. (The initial value of the V phase current detection circuit is abnormal.)
SP9021	POS SENSOR POLARITY ERROR	21	Check and correct the parameters. (Parameter No. 4000#0, 4001#4)	The polarity parameter setting of the position sensor is wrong.
SP9022	SERIAL SPINDLE ALARM	22	1 Review operation conditions (acceleration/ deceleration and cutting) to reduce the load. 2 Check and correct the parameters.	A spindle amplifier overload current was detected.
SP9024	SSPA:24 SERIAL TRANSFER ERROR	24	1 Place the CNC-to-spindle cable away from the power cable. 2 Replace the cable.	The CNC power is turned off (normal power-off or broken cable). An error is detected in communication data transferred to the CNC.
SP9027	SSPA:27 DISCONNECT POSITION CODER	27	Replace the cable.	The spindle position coder (connector JYA3) signal is abnormal.
SP9029	SSPA:29 OVERLOAD	29	Check and correct the load status.	Excessive load has been applied continuously for a certain period of time. (This alarm is issued also when the motor shaft has been locked in the excitation state.)
SP9030	SSPA:30 OVERCURRENT INPUT CIRCUIT	30	Check and correct the power supply voltage.	Overcurrent is detected in Power Supply (PS) main circuit input. (Power Supply (PS) alarm indication: 1) Unbalanced power supply. Power Supply (PS) selection error (The maximum Power Supply (PS) output specification is exceeded.)
SP9031	SSPA:31 MOTOR LOCK OR DISCONNECT DETECTOR	31	1 Check and correct the load status. 2 Replace the motor sensor cable (connector JYA2).	The motor cannot rotate at a specified speed. (A level not exceeding the SST level for the rotation command has existed continuously.)
SP9032	SSPA:32 SIC-LSI RAM FAULT	32	Replace the Spindle Amplifier control printed circuit board.	Abnormality in an Spindle Amplifier control circuit component is detected. (The LSI device for serial transfer is abnormal.)

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9033	SSPA:33 SHORTAGE POWER CHARGE	33	1 Check and correct the power supply voltage. 2 Replace the Power Supply (PS).	The DC power voltage in the power circuit is insufficient when the magnetic contactor is turned on. (Power Supply (PS) alarm indication: 5) (Such as open phase and defective charging resistor).
SP9034	SSPA:34 ILLEGAL PARAMETER	34	Correct a parameter value according to the FANUC AC SPINDLE MOTOR αi series PARAMETER MANUAL (B-65280EN). If the parameter number is unknown, connect the spindle check board, and check the indicated parameter.	Parameter data exceeding the allowable limit is set.
SP9036	SSPA:36 OVERFLOW ERROR COUNTER	36	Check whether the position gain value is too large, and correct the value.	An error counter overflow occurred.
SP9037	SSPA:37 ILLEGAL SETTING VELOCITY DETECTOR	37	Correct the value according to the FANUC AC SPINDLE MOTOR αi series PARAMETER MANUAL (B-65280EN).	The setting of the parameter for the number of pulses in the speed detector is incorrect.
SP9041	SSPA:41 ILLEGAL 1REV SIGN OF POSITION CODER	41	1 Check and correct the parameter. 2 Replace the cable.	1 The 1-rotation signal of the spindle position coder (connector JYA3) is abnormal. 2 Parameter setting error
SP9042	SSPA:42 NO 1REV SIGN OF POSITION CODER	42	Replace the cable.	The 1-rotation signal of the spindle position coder (connector JYA3) is disconnected.
SP9043	SSPA:43 DISCONNECT POSITION CODER DEF. SPEED	43	Replace the cable.	The differential speed position coder signal (connector JYA3S) in the submodule SW is abnormal.
SP9046	SSPA:46 ILLEGAL 1REV SIGN OF SCREW CUT	46	1 Check and correct the parameter. 2 Replace the cable. 3 Readjust the BZ sensor signal.	The 1-rotation signal in threading is abnormal.
SP9047	SSPA:47 ILLEGAL SIGNAL OF POSITION CODER	47	1 Replace the cable. 2 Correct the cable layout (vicinity of the power line).	The A/B phase signal of the spindle position coder (connector JYA3) is abnormal. The relationship between the A/B phase and 1-rotation signal is incorrect (Pulse interval mismatch).
SP9049	SSPA:49 DEF. SPEED IS OVER VALUE	49	Check whether the calculated differential speed value exceeds the maximum motor speed.	In differential speed mode, the speed of the other spindle converted to the speed of the local spindle has exceeded the allowable limit (the differential speed is calculated by multiplying the speed of the other spindle by the gear ratio).

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9050	SSPA:50 SYNCRONOUS VALUE IS OVER SPEED	50	Check whether the calculated value exceeds the maximum motor speed.	In spindle synchronization, the speed command calculation value exceeded the allowable limit (the motor speed is calculated by multiplying the specified spindle speed by the gear ratio).
SP9051	SSPA:51 LOW VOLT POWER CIRCUIT	51	1 Check and correct the power supply voltage. 2 Replace the MC.	Input voltage drop was detected. (Power Supply (PS) alarm indication: 4) (Momentary power failure or poor MC contact)
SP9052	SSPA:52 ITP FAULT 1	52	1 Replace the Spindle Amplifier control printed circuit board. 2 Replace the main board or sub CPU board in the CNC.	An abnormality is detected in the interface between the CNC and spindle amplifier (the ITP signal stopped).
SP9053	SSPA:53 ITP FAULT 2	53	1 Replace the Spindle Amplifier control printed circuit board. 2 Replace the main board or sub CPU board in the CNC.	An abnormality is detected in the interface between the CNC and spindle amplifier the ITP signal stopped).
SP9054	SSPA:54 OVERCURRENT	54	Review the load state.	An overload current was detected.
SP9055	SSPA:55 ILLEGAL POWER LINE	55	1 Replace the magnetic contactor. 2 Check and correct the sequence.	The power line state signal of the magnetic contactor for selecting a spindle or output is abnormal.
SP9056	COOLING FAN FAILURE	56	Replace the internal cooling fan.	The internal cooling fan stopped.
SP9057	CONV. EX. DECELERATION POW.	57	1 Decrease the acceleration/deceleration duty. 2 Check the cooling condition (peripheral temperature). 3 If the cooling fan stops, replace the resistor. 4 If the resistance is abnormal, replace the resistor.	An overload was detected in the regenerative resistance. (Power Supply (PS) alarm indication: H) Thermostat operation or short-time overload was detected. The regenerative resistor was disconnected, or an abnormal resistance was detected.
SP9058	CNV. OVERLOAD	58	1 Check the Power Supply (PS) cooling status. 2 Replace the Power Supply (PS).	The temperature of the radiator of the Power Supply (PS) has increased abnormally. (Power Supply (PS) alarm indication: 3)
SP9059	CNV. COOLING FAN FAILURE	59	Replace the Power Supply (PS).	The internal cooling fan for the Power Supply (PS) stopped. (Power Supply (PS) alarm indication: 2)
SP9061	SERIAL SPINDLE ALARM	61	Check parameter settings.	The error between the semi-closed and full-closed sides when the dual position feedback function is used is too large.

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9065	SERIAL SPINDLE ALARM	65	1 Check parameter settings. 2 Check sensor connections and signals. 3 Check power line connections.	The move distance is too long when the magnetic pole is confirmed (synchronization spindle)
SP9066	COM. ERROR BETWEEN SP AMPS	66	1 Replace the cable. 2 Check and correct the connection.	An error was found in communication between spindle amplifiers (connector JX4).
SP9069	SAFETY SPEED OVER	69	1 Check federate. 2 Check parameter settings. 3 Check sequence.	In the state in which safety speed monitoring was enabled, the system detected that the motor speed exceeded the safety speed or detected an error during a free-run stop.
SP9070	ILLEGAL AXIS DATA	70	Setting the spindle amplifier side to conform the connection state.	The axis data is abnormal. An error was detected in an axis number check.
SP9071	SAFETY PARAMETER ERROR	71	1 Inputting the safety parameter again. 2 Replace the spindle amplifier control printed-circuit board.	The safety parameter is abnormal. An abnormality is detected in the safety parameter.
SP9072	MISMATCH RESULT OF MOTOR SPEED CHECK	72	1 Replace the spindle amplifier control printed-circuit board. 2 Replace the spindle interface printed circuit board in the CNC.	A mismatch was detected between the safety speed check results of the spindle amplifier and those of the CNC.
SP9073	MOTOR SENSOR DISCONNECTED	73	1 Replace the feedback cable. 2 Check the shield processing. 3 Check and correct the connection. 4 Adjust the sensor.	The motor sensor feedback signal is not present (connector JYA2).
SP9074	CPU TEST ERROR	74	Replace the spindle amplifier control printed-circuit board.	An error was detected in a CPU test.
SP9075	CRC ERROR	75	Replace the spindle amplifier control printed-circuit board.	An error occurred in a spindle amplifier CRC test.
SP9076	INEXECUTION OF SAFETY FUNCTIONS	76	Replace the spindle amplifier control printed-circuit board.	The spindle amplifier detected that safety functions were not executed.
SP9077	MISMATCH RESULT OF AXIS NUMBER CHECK	77	1 Replace the spindle amplifier control printed-circuit board. 2 Replace the spindle interface printed circuit board in the CNC.	A mismatch was detected between the axis number check results of the spindle amplifier and those of the CNC.
SP9078	MISMATCH RESULT OF SAFETY PARAMETER CHECK	78	1 Replace the spindle amplifier control printed-circuit board. 2 Replace the spindle interface printed circuit board in the CNC.	A mismatch was detected between the safety parameter check results of the spindle amplifier and those of CNC.

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9079	INITIAL TEST ERROR	79	Replace the spindle amplifier control printed-circuit board.	An error was detected in a spindle amplifier initial test.
SP9080	ALARM AT THE OTHER SP AMP.	80	Remove the cause of the alarm of the remote Spindle Amplifier.	During inter-Spindle Amplifier communication, an alarm was generated on the remote Spindle Amplifier.
SP9081	1-ROT MOTOR SENSOR ERROR	81	1 Check and correct the parameter. 2 Replace the feedback cable. 3 Adjust the sensor.	The one-rotation signal of the motor sensor cannot be correctly detected(connector JYA2).
SP9082	NO 1-ROT MOTOR SENSOR	82	1 Replace the feedback cable. 2 Adjust the sensor.	The one-rotation signal of the motor sensor is not generated(connector JYA2).
SP9083	MOTOR SENSOR SIGNAL ERROR	83	1 Replace the feedback cable. 2 Adjust the sensor.	An irregularity was detected in a motor sensor feedback signal(connector JYA2).
SP9084	SPNDL SENSOR DISCONNECTED	84	1 Replace the feedback cable. 2 Check the shield processing. 3 Check and correct the connection. 4 Check and correct the parameter. 5 Adjust the sensor.	The spindle sensor feedback signal is not present(connector JYA4).
SP9085	1-ROT SPNDL SENSOR ERROR	85	1 Check and correct the parameter. 2 Replace the feedback cable. 3 Adjust the sensor.	The one-rotation signal of the spindle sensor cannot be correctly detected(connector JYA4).
SP9086	NO 1-ROT SPNDL SENSOR	86	1 Replace the feedback cable. 2 Adjust the sensor.	The one-rotation signal of the spindle sensor is not generated(connector JYA4).
SP9087	SPNDL SENSOR SIGNAL ERROR	87	1 Replace the feedback cable. 2 Adjust the sensor.	An irregularity was detected in a spindle sensor feedback signal(connector JYA4).
SP9088	COOLING RADI FAN FAILURE	88	Replace the Spindle Amplifier external radiator cooling fan.	The external radiator cooling fan stopped.
SP9089	SERIAL SPINDLE ALARM	89	1 Check the connection between the Spindle Amplifier and the submodule SM (SSM). 2 Replace the submodule SM(SSM). 3 Replace the Spindle Amplifier control printed-circuit board.	Submodule SM (SSM) error (synchronous spindle)
SP9090	SERIAL SPINDLE ALARM	90	1 Check magnetic pole detection operation. 2 Check whether the rotor and sensor are aligned correctly.	Abnormal rotation of the synchronous spindle motor was detected.

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9091	SERIAL SPINDLE ALARM	91	Replace the motor sensor cable.	Count error of the magnetic pole position of the synchronous spindle motor
SP9092	SERIAL SPINDLE ALARM	92	Check the sequence (whether SFR or SRV is turned on and off in the position control mode).	The motor speed exceeds the acceleration level corresponding to the velocity command.
SP9110	AMP COMMUNICATION ERROR	b0	1 Replace the communication cable between Spindle Amplifier and Power Supply (PS). 2 Replace the Spindle Amplifier or Power Supply (PS) control printed circuit board.	Communication error between Spindle Amplifier and Power Supply (PS).
SP9111	CONV. LOW VOLT CONTROL	b1	Replace the Power Supply (PS) control printed circuit board.	Low Power Supply (PS) control power supply voltage (Power Supply (PS) indication = 6)
SP9112	CONV. EX. DISCHARGE POW.	b2	1 Check the regenerative resistance. 2 Check the motor selection. 3 Replace the Power Supply (PS)	Excessive Power Supply (PS) regenerative power (Power Supply (PS) indication = 8)
SP9113	CONV. COOLING FAN FAILURE	b3	Replace the external radiator cooling fan for Power Supply (PS).	Stopped the external radiator cooling fan for Power Supply (PS) (Power Supply (PS) indication = A)
SP9120	COMMUNICATION DATA ERROR	C0	1 Replace the communication cable between CNC and Spindle Amplifier. 2 Replace the Spindle Amplifier control printed circuit board. 3 Replace the CNC side main board or sub CPU board.	Communication data alarm
SP9121	COMMUNICATION DATA ERROR	C1	1 Replace the communication cable between CNC and Spindle Amplifier. 2 Replace the Spindle Amplifier control printed circuit board. 3 Replace the CNC side main board or sub CPU board.	Communication data alarm
SP9122	COMMUNICATION DATA ERROR	C2	1 Replace the communication cable between CNC and Spindle Amplifier. 2 Replace the Spindle Amplifier control printed circuit board. 3 Replace the CNC side main board or sub CPU board.	Communication data alarm
SP9123	SERIAL SPINDLE ALARM	C3	Replace the submodule SW(SSW).	Submodule SW (SSW) error (spindle switching)
SP9131	SERIAL SPINDLE ALARM	d1	Check the message displayed by SERVO GUIDE.	Spindle adjustment function alarm

Number	Message	Amplifier indication (*1)	Faulty location and remedy	Description
SP9132	SERIAL SPINDLE ALARM	d2	Replace the sensor.	Serial data error
SP9133	SERIAL SPINDLE ALARM	d3	Replace the sensor.	Data transfer error
SP9134	SERIAL SPINDLE ALARM	d4	1 Check and correct the sensor parameter setting. 2 Take action against noise. 3 Replace the sensor.	Soft phase
SP9135	SAFETY SPEED ZERO ERROR(SP)	d5	Perform operation within the safety speed zero range.	The motor position exceeded the safety speed zero monitoring width.
SP9136	MISMATCH RESULT OF SAFETY SPEED ZERO CHECK(SP)	d6	Replace the spindle amplifier control printed circuit board.	The spindle amplifier speed zero determination result did not match the CNC speed zero determination result.
SP9137	SERIAL SPINDLE ALARM	d7	Replace the spindle amplifier control printed circuit board.	Device communication error
SP9139	SERIAL SPINDLE ALARM	d9	Replace the sensor.	Pulse error
SP9140	SERIAL SPINDLE ALARM	E0	1 Take action against noise. 2 Replace the sensor.	Count error
SP9141	SERIAL SPINDLE ALARM	E1	1 Check and correct the sensor parameter setting. 2 Replace the sensor.	Serial sensor one-rotation signal undetected

A.4　ERROR CODES (SERIAL SPINDLE)

> **NOTE**
> *1 Note that the meanings of the Spindle Amplifier indications differ depending on which LED, the red or yellow LED, is on. When the yellow LED is on, an error code is indicated with a 2-digit number. When the red LED is on, the Spindle Amplifier indicates the number of an alarm generated in the serial spindle.
> → See Appendix A.3, "ALARM LIST (SERIAL SPINDLE)."

Diagnosis indication (*1)	Description	Remedy
01	Although neither *ESP (emergency stop signal; there are two types of signals including the input signal and contact signal of Power Supply (PS)) nor MRDY (machine ready signal) is input, SFR (forward rotation signal)/SRF (reverse rotation signal)/ORCM (orientation command) is input.	Check the *ESP and MRDY sequence. For MRDY, pay attention to the parameter setting regarding the use of the MRDY signal (parameter No. 4001#0).
03	The parameter settings are such that a position sensor is not used (position control not performed) (bits 3, 2, 1, 0 of parameter No. 4002 = 0, 0, 0, 0), but a Cs contour control command is input. In this case, the motor is not excited.	Check the parameter settings.

Diagnosis indication (*1)	Description	Remedy
04	The parameter settings are such that a position sensor is not used (position control not performed) (bits 3, 2, 1, 0 of parameter No.4002 = 0, 0, 0,), but a servo mode (rigid tapping, spindle positioning, etc.) or spindle synchronization command is input. In this case, the motor is not excited.	Check the parameter settings.
05	The orientation function option parameter is not specified, but ORCM (orientation command) is input.	Check the orientation function parameter settings.
06	The output switching control function option parameter is not specified, but low-speed characteristic winding is selected (RCH = 1).	Check the output switching control function parameter settings and the power line state check signal (RCH).
07	A Cs contour control command is input, but SFR (clockwise rotation command)/SRV (counterclockwise rotation command) is not input.	Check the sequence.
08	A servo mode (rigid tapping, spindle positioning, etc.) control command is input, but SFR (clockwise rotation command)/SRV (counterclockwise rotation command) is not input.	Check the sequence.
09	A spindle synchronization command is input, but SFR (clockwise rotation command)/SRV (counterclockwise rotation command) is not input.	Check the sequence.
10	A Cs contour control command is input, but another mode (servo mode, spindle synchronization, or orientation) is specified.	Do not switch to another mode during a Cs contour control command. Before moving to another mode, cancel the Cs contour control command.
11	A servo mode (rigid tapping, spindle positioning, etc.) command is input, but another mode (Cs contour control, spindle synchronization, or orientation) is specified.	Do not switch to another mode during a servo mode command. Before moving to another mode, cancel the servo mode command.
12	A spindle synchronization command is input, but another mode (Cs contour control, servo mode, or orientation) is specified.	Do not switch to another mode during a spindle synchronization command. Before moving to another mode, cancel the spindle synchronization command.
13	An orientation command is input, but another mode (Cs contour control, servo mode, or spindle synchronization control) is specified.	Do not switch to another mode during an orientation command. Before moving to another mode, cancel the orientation command.
14	Both SFR (clockwise rotation command) and SRV (counterclockwise rotation command) are input at the same time.	Issue either of them.
16	The parameter settings are such that the differential speed control function is not used (bit 5 of parameter No. 4000 = 0), but DEFMD (differential speed mode command) is input.	Check the parameter settings and differential speed mode command.
17	The speed detector parameter settings (bits 2, 1, and 0 of parameter No. 4011) are not valid. There is no corresponding speed detector.	Check the parameter settings.

Diagnosis indication (*1)	Description	Remedy
18	The parameter settings are such that a position sensor is not used (position control not performed (bits 3, 2, 1, and 0 of parameter No. 4002), but position coder system orientation is issued.	Check the parameter settings and the input signal.
19	The magnetic sensor orientation command is input, but another mode (Cs contour control, servo mode, or spindle synchronization control) is specified.	Do not switch to another mode during an orientation command. Before moving to another mode, cancel the orientation command.
21	The tandem operation command was input in the spindle synchronization control enable state.	Input the tandem operation command when spindle synchronization control is canceled.
22	Spindle synchronization control was specified in the tandem operation enable state.	Specify spindle synchronization control when torque tandem operation is canceled.
23	The tandem operation command is input without the required option.	Torque tandem control requires a CNC software option. Check the option.
24	If index is performed continuously in position coder system orientation, an incremental operation is performed first (INCMD = 1), then an absolute position command (INCMD = 0) is input.	Check INCMD (incremental command). If an absolute position command is to follow, be sure to perform absolute position command orientation first.
26	The parameter settings are such that both spindle switch and three-stage output switch are used.	Check the parameter settings and the input signal.
29	The parameter settings are such that the shortest-time orientation function is used (bit 6 of parameter No. 4018 = 0, Nos. 4320 to 4323 ≠0).	In the αi series spindle amplifier, the shortest-time orientation function cannot be used. The use of the optimum orientation function is recommended.
30	The magnetic pole has not been detected, but a command is input.	In the magnetic pole undetected state (EPFIXA = 0), the motor cannot be driven even when a command is input. Input a command in the magnetic pole detected state (EPFIXA = 1). When EPFSTR is set to 1, any command is ignored and this error is displayed even in the magnetic pole detected state. After the completion of magnetic pole detection, set EPFSTR to 0.
32	S0 is not specified as the velocity mode, but the disturbance input function is enabled (bit 7 of parameter No. 4395 is set to 1).	Specify S0 as the velocity mode before enabling the disturbance input function (bit 7 of parameter No. 4395 to 1).
34	Both the spindle FAD function and spindle EGB function are enabled. In this case, the motor is not excited.	These functions cannot be used simultaneously. Enable only either of these functions.
35	Spindle amplifier ID information cannot be obtained.	Replace the spindle amplifier with one with correct ID information.
36	The submodule SM (SSM) is abnormal. 1) The interface signal between the spindle amplifier and the SSM is disconnected. 2) SSM failure	For action to be taken for this status error, refer to Section 1.4, "SUBMODULE SM," in Part IV in the FANUC AC SPINDLE MOTOR $\alpha i/\beta i$ series Parameter Manual (B-65280EN).
37	The current loop setting (No. 4012) has been changed.	Check the setting of parameter No. 4012, and turn the power off, then on again.

Diagnosis indication (*1)	Description	Remedy
38	A parameter related to communication between spindle amplifiers is specified incorrectly. Alternatively, a function unavailable with the torque tandem function is set.	Check the parameters.
39	Although SFR (forward rotation command), SRV (reverse rotation command), or ORCM (orientation command) is input, DSCN (disconnection detection disable signal) is input.	Check the sequence. Do not input DSCN (disconnection detection disable signal) during the input of a command which excites the motor.
43	A setting which does not support the αiCZ sensor (serial) is used.	Check the parameter settings.
44	The spindle amplifier does not support the control period setting.	Check the setting of parameter No. 4012.

B   LIST OF MAINTENANCE PARTS

Fuse and fan

Item			Ordering information	Remarks
Fuse	LCD-mounted type	Control unit	A02B-0236-K100	
	Stand-alone type	Control unit	A02B-0319-K100	
	Others	For operator's panel I/O module For standard machine operator's panel I/O Unit for 0i	A03B-0815-K001	
		For connector panel I/O module	A03B-0815-K002	
		For I/O Link-AS-i converter	A03B-0815-K001	
		For terminal type I/O module	A03B-0823-K001	
		For separate detector interface	A60L-0001-0290#LM20	
Fan motor	LCD-mounted type	Fan unit: 40-mm square	A02B-0309-K120	
		Fan unit: 60-mm square	A02B-0309-K121	
	Stand-alone type	For 2-slot basic unit	A02B-0303-K120	

Others

Item			Ordering information	Remarks
Battery	LCD-mounted type	For control unit memory backup	A02B-0309-K102	
	Stand-alone type	For control unit memory backup	A02B-0200-K102	
		For separate absolute Pulsecoder	A06B-6050-K061	
MDI key sheet		Horizontal type for T series	A02B-0319-K710#T	
		Horizontal type for M series	A02B-0319-K710#M	
		Vertical type for T series	A02B-0319-K711#T	
		Vertical type for M series	A02B-0319-K711#M	
Touch panel protection sheet		For 8.4" LCD	A02B-0309-K132	
		For 10.4" LCD	A02B-0309-K133	
Pen for touch panel			A02B-0236-K111	

NOTE
For maintenance parts for the PANEL i used for the stand-alone type, refer to the FANUC PANEL i Connection and Maintenance Manual (B-64223EN).

C   BOOT SYSTEM

Appendix C, "BOOT SYSTEM", consists of the following sections:

C.1   OVERVIEW

The boot system load the CNC system software (Flash ROM $\rightarrow$ DRAM), then starts it so that software can be executed.
The boot system provides the following maintenance functions for the CNC:

(1) Registering a file in Flash ROM
     A file is read from the FAT16-formatted memory card and written to the flash memory.
     (A FAT32-formatted memory card cannot be recognized.)
(2) Checking a file (series and edition) in Flash ROM
(3) Checking a file (series and edition) in Memory card
(4) Deleting a file from Flash ROM
(5) Deleting a file from Memory card
(6) Saving a file in Flash ROM to a Memory card
(7) Batch saving and restoration of files of parameters and programs backed up by battery (SRAM area), to and from a Memory card
(8) Formatting of a Memory card

This manual describes the activation of the boot system, as well as the screen displays and operation for the functions listed above.

⚠ **CAUTION**
1   This control unit supports the use of a Memory card as an input/output device.
    The Flash ATA card is available:
    See the order list for details of the supported Memory card types.
2   On a Memory card, only those files that are in the root directory can be accessed
    for display, reading, and writing. Those in subdirectories cannot be used.
3   The time required to read or write each data item varies depending on the
    Memory card type, the status of use, and other factors.
4   For flash ATA cards, only those recommended by FANUC are available.
5   When formatting a flash ATA card, use the quick formatting method, which
    clears the file allocation table and the directory information on the root directory.
    An unformatted flash ATA card needs to be formatted in FAT16 with a PC or the
    like.   (A FAT32-formatted ATA card cannot be recognized.)

C.1.1   Displaying the Power ON Sequence

```
(1)  RAM TEST :END
(2)  ROM TEST :END [60W3A]
(3)  DRAM ID  :xxxxxxxx
(4)  SRAM ID  :xxxxxxxx
(5)  FROM ID  :xxxxxxxx



     *** MESSAGE ***
(7)  LOADING CNC DATA-1      xxxxxx/xxxxxx
     END
```

```
     RAM TEST :END
(2)  ROM TEST :ERROR
```
Processing is stopped in the event of an error

```
     *** MESSAGE ***
(6)  ROM PARITY ERROR:NC BASIC. HIT SELECT.

     [SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```
SELECT key → SYSTEM MONITOR

Details of display items
(1) WORK RAM test results are displayed. In the event of an error, however, the sequence is not displayable, and LED indication is conducted without error display.
(2) BOOT ROM parity test results are displayed. During normal operation, the series and edition are displayed. In the event of an error, processing is stopped.
(3) The ID of the DRAM MODULE installed in the CNC is displayed.
(4) The ID of the SRAM MODULE installed in the CNC is displayed.
(5) The ID of the FROM MODULE installed in the CNC is displayed.
(6) The CNC BASIC software in flash memory is checked for validity and, in the event of an error, an error is displayed. In the event of an error, clicking the [SELECT] soft key allows you to select the SYSTEM MONITOR screen.
(7) This message indicates that the CNC BASIC software is being transferred to flash memory to DRAM.

C.1.2   Starting the Boot System

In ordinary system activation, the boot system automatically transfers files from Flash ROM to DRAM in the background.
The user is not aware of this operation. However, the boot system must be operated manually, from menu screen, when maintenance is to be carried out or when the Flash ROM does not contain a required file.

Operating procedure
(1) In system maintenance, for example, to replace a file in ROM operation

-   When soft keys or MDI keys are present
Turn on the power while pressing the rightmost soft key and the soft key to the right at the same time. Numerical keys 6 and 7 on the MDI keyboard can also be used.
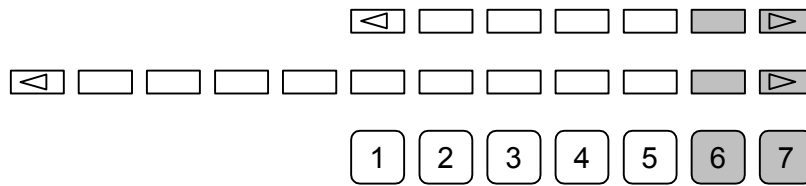
After an FROM ID and other items are displayed on the CNC screen, releasing the key brings you to the SYSTEM MONITOR screen.

- When soft keys or MDI keys are not present (touch panel)

In the CNC power-off state, turn on the power while pressing [ ] at the upper-left corner of the touch panel screen.
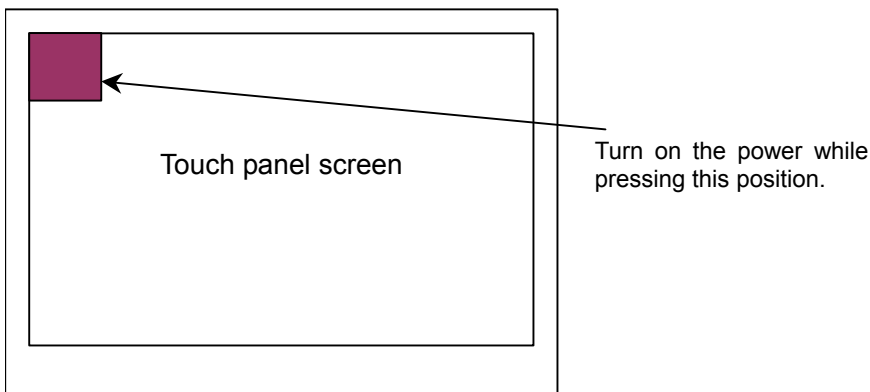
The maintenance operation screen below appears after a while.
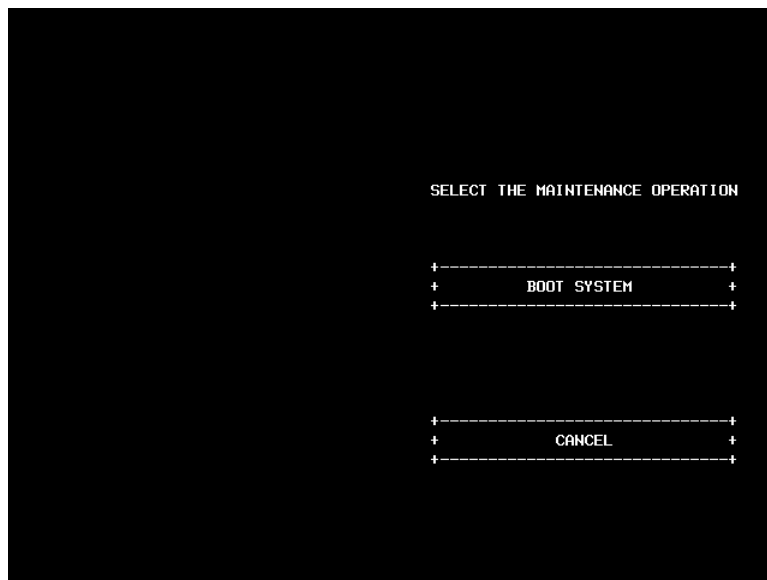
When the rectangle enclosing "BOOT SYSTEM" is pressed on the maintenance operation screen, the SYSTEM MONITOR screen appears.
When the rectangle enclosing "CANCEL" is pressed on the maintenance operation screen, the CNC system starts up.

> **NOTE**
> 1 If the area to be pressed on a touch panel is large, the response is reduced. Please use a special stylus or the like.
> 2 This function is enabled only when the 10.4-inch LCD with a touch panel is used as the display unit.

(2)   When the flash memory does not contain a file required to start the CNC

Immediately after the CNC is turned on, the boot system starts transferring files from Flash ROM to DRAM. If, for some reason, a file required to start the CNC (NC BASIC) is not in Flash ROM or has been destroyed, the boot system is automatically started.

C.1.3   System Files and User Files

The boot system organizes files in Flash ROM into two main groups : system files and user files. These two file types have the following characteristics :

System files
Control software for the CNC or servo provided by FANUC

User files
PMC sequence program (ladder), P-CODE macro program, and other user-created files

Naming convention for user files
Each of the files in flash ROM has a specific name based on its type.   These file names are used by the following items described later.
- SYSTEM DATA CHECK
- SYSTEM DATA DELETE
- SYSTEM DATA SAVE

The correspondence between the file names and their types is shown below.

File name	Type
PMC□	Ladder
PMCS	Ladder (for dual check safety)
M□PMCMSG	PMC message multi-language data
CEX □.□M	C language executor user application
CEX□○○○○	C language executor user data
PC0Δ○○○○ or PC0Δ○.○○	Macro executor user application

□: One numeric

Δ: Numeric 1 to 6

○: One numeric or one alphanumeric

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C.2   SCREEN CONFIGURATION AND OPERATING PROCEDURE

When the boot system is first started, the MAIN MENU screen is displayed. This screen is described below :

MAIN MENU screen

(1)	SYSTEM MONITOR MAIN MENU 60W3 - 01
(2)	1.END
(3)	2.USER DATA LOADING
(4)	3.SYSTEM DATA LOADING
(5)	4.SYSTEM DATA CHECK
(6)	5.SYSTEM DATA DELETE
(7)	6.SYSTEM DATA SAVE
(8)	7.SRAM DATA BACKUP
(9)	8.MEMORY CARD FORMAT
	*** MESSAGE ***
(10)	SELECT MENU AND HIT SELECT KEY.
	[SELECT][YES][NO][UP][DOWN]

(1) Screen title. The series and edition of the BOOT SYSTEM are displayed at the right end.
(2) Function for terminating the boot system and starting the CNC.
(3) Function for writing data to Flash ROM.
(4) Function for writing data to Flash ROM.
(5) Function for checking the edition of a file in ROM.
(6) Function for deleting a file from Flash ROM or Memory card.
(7) Function for making a backup copy of the data stored on the Memory card.
(8) Function for backing up and restoring the SRAM area
(9) Function for formatting a Memory card.
(10) Simple operating instructions and error messages are displayed.

Operating procedure
-   For other than the touch panel
Press the [UP] or [DOWN] soft key to select the desired function. After positioning the cursor to the desired function, press the [SELECT] soft key. Before executing a function, for a confirmation, it maybe need to press the [YES] or [NO] soft key.

-   For the touch panel
This procedure directly presses [SELECT], [YES], [NO], [UP], and [DOWN] on the screen. For the touch panel, [PREV] equivalent to soft key $\boxed{\triangleleft}$ and [NEXT] equivalent to soft key $\boxed{\triangleright}$ are displayed, so press these keys for operation.

Basic operation

```
┌──────────────────┐    ┌──────────────────┐    ┌──────────────────┐
│ Position the     │    │ Select a function│    │ Check the        │
│ cursor.          │ →  │ [SELECT]         │ →  │ selection        │
│ [ UP ]           │    │                  │    │ [ YES ]          │
│ [ DOWN ]         │    │                  │    │ [ NO ]           │
└──────────────────┘    └──────────────────┘    └──────────────────┘
        ┌──────────────────┐    ┌──────────────────┐    ┌──────────────────┐
        │ Execute the      │    │                  │    │ Return to        │
     →  │ function         │ →  │ Select END       │ →  │ original state   │
        └──────────────────┘    └──────────────────┘    └──────────────────┘
```
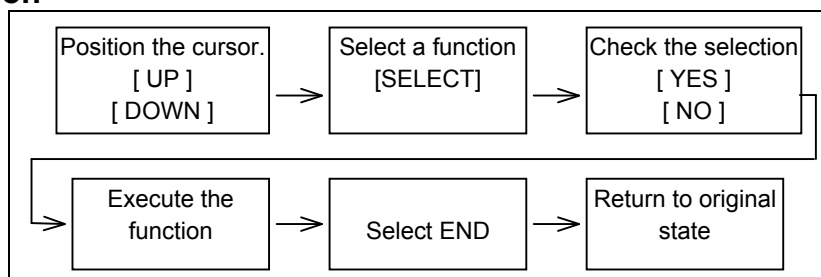
C.2.1   USER DATA LOADING/SYSTEM DATA LOADING Screen

Description

This screen is used to read a system or user file from a Memory card into Flash ROM.

The USER DATA LOADING screen is used to load ROM data from a Memory card to flash memory.

The SYSTEM DATA LOADING screen is used to check the contents of the ROM card installed in a Memory card and then load ROM data from the Memory card to flash memory.

Screen configuration

```
(1)  SYSTEM DATA LOADING
(2)  MEMORY CARD DIRECTORY  (FREE[KB]:  5123)
(3)   1 D4F1_B1.MEM 1048704 2003-01-01 12:00
      2 D4F1_B2.MEM 1048704 2003-01-01 12:00
(4)   3 END


     *** MESSAGE ***
(5)  SELECT MENU AND HIT SELECT KEY.

     [SELECT][ YES ][  NO ][  UP ][ DOWN ]
```

(1) Screen title.
(2) The size of the free space of the Memory card is displayed.
(3) A list of files in the Memory card is displayed.

(4) Returning to the MAIN MENU.

(5) Message

Operating procedure

(1) Position the cursor to the file to be read from the Memory card and written to Flash ROM. Then, press the [SELECT] soft key.
   -   A single page can list up to ten file names.
   -   If the Memory card contains ten or more files, the remaining files are displayed on another page.
       To display the next page, press the ▷ soft key.
       To display the previous page, press the ◁ soft key. The END option is displayed on the last page.

(2) When you select a file from the USER DATA LOADING screen, you are prompted for confirmation.

```
USER DATA LOADING
MEMORY CARD DIRECTORY  (FREE[KB]:  5123)
 1 D4F1_B1.MEM 1048704 2003-01-01 12:00
 2 D4F1_B2.MEM 1048704 2003-01-01 12:00
 3 END


*** MESSAGE ***
LOADING OK ? HIT YES OR NO.

[SELECT][ YES ][  NO ][  UP ][ DOWN ]
```

(3)   When you select a file from the SYSTEM DATA LOADING screen, a ROM data confirmation
      screen is displayed for confirmation.

```
SYSTEM DATA CHECK & DATA LOADING
D4F1_B1.MEM
 1 D4F1 001A
 2 D4F1 021A
 3 D4F1 041A
 4 D4F1 061A
 5 D4F1 081A
 6 D4F1 0A1A
 7 D4F1 0C1A
 8 D4F1 0E1A


*** MESSAGE ***
LOADING OK ? HIT YES OR NO.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(4)   To start loading, press the [YES] soft key. To cancel, press the [NO] key.

```
*** MESSAGE ***
LOADING FROM MEMORY CARD xxxxxx/xxxxxx

[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(5)   When loading terminates normally, the system displays the following message. Press the [SELECT]
      soft key. If an error occurs, see C.3

```
*** MESSAGE ***
LOADING COMPLETE.
HIT SELECT KEY.
[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

> **NOTE**
> 1 The option parameters of the CNC are saved in the option information file
>   (OPRM INF).   If this file is modified, the option parameters need to be certified
>   because the settings of the option parameter are assumed to be changed.
> 2 Since the option information file (OPRM INF) may be necessary when the
>   printed circuit board is replaced, it is recommended that this file be backed up in
>   advance as in SRAM data.

C.2.2 SYSTEM DATA CHECK Screen

Description

This screen is used to list files in Flash ROM or Memory card, together with the corresponding numbers of management units in each file and the series and edition of the software.

Screen configuration

```
(1)   SYSTEM DATA CHECK                        (1) Screen title.

(2)   1.FROM SYSTEM                            (2) Select the FROM SYSTEM screen.
(3)   2.MEMORY CARD SYSTEM                      (3) Select the MEMORY CARD SYSTEM
(4)   3.END                                         screen.
                                               (4) Returning to the MAIN MENU.


      *** MESSAGE ***
(5)   SELECT MENU AND HIT SELECT KEY.          (5) Message

      [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Screen configuration (FROM SYSTEM screen)

```
(1)   SYSTEM DATA CHECK                        (1) Screen title.
      FROM DIRECTORY
(2)   1 NC BAS-1(0008)                         (2) Names of files in Flash ROM The
      2 NC BAS-2(0008)                             number of management units
      3 NC BAS-3(0008)                             constituting each file appears in
      4 NC BAS-4(0008)                             parentheses to the right of the
      5 DGD0SRVO(0003)                             filename.
      6 PS0B   (0006)
(3)   7 END                                    (3) Returning to the MAIN MENU.

      *** MESSAGE ***
(4)   SELECT FILE AND HIT SELECT KEY.          (4) Message

      [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Screen configuration (MEMORY CARD SYSTEM screen)

```
(1)  SYSTEM DATA CHECK                          (1) Screen title.
(2)  MEMORY CARD DIRECTORY  (FREE[KB]:  5123)   (2) The size of the free space of the
(3)   1 D4F1_B1.MEM 1048704 2003-01-01 12:00        Memory card is displayed.
      2 D4F1_B2.MEM 1048704 2003-01-01 12:00    (3) A list of files in the Memory card is
(4)   3 END                                         displayed.
                                                (4) Returning to the MAIN MENU.


     *** MESSAGE ***
(5)  SELECT FILE AND HIT SELECT KEY.            (5) Message

     [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Operating procedure

(1) Select either the FROM SYSTEM or MEMORY CARD SYSTEM screen.
(2) Select the file that you want to confirm (for example, "NC BAS-1 (0008)").
(3) For the selected file, the management unit numbers are listed, together with the series and editions of the management units. After checking the listed data, select the [SELECT] soft key to return to the file selection screen.

```
(1)  SYSTEM DATA CHECK                          (1) Screen title.
     NC BAS-1(0008)
(2)   1 D4F1 001A 0000                          (2) The following items are displayed for
      2 D4F1 021A 0001                              each management unit:
      3 D4F1 041A 0002                              - Series
      4 D4F1 061A 0003                              - ROM number and edition
      5 D4F1 081A 0004                              - Internal management-unit number
      6 D4F1 0A1A 0005                              If a check result cannot be displayed, a
      7 D4F1 0C1A 0006                              "@" is displayed.
      8 D4F1 0E1A 0007


     *** MESSAGE ***

     HIT SELECT KEY.
     [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Others (Parity information for the system file and user file)

The NC BAS-1, DGD0SRVO, and other system files in Flash ROM contain parity information in each management unit. If the file name field or parity field on the check screen contains a non-ASC II character or an "@", the Flash ROM may have been destroyed or a damaged file may have been read. Re-read the data from the Memory card.

The PMC1, and other user files do not contain parity information in each management unit. A non-ASCII character or an "@" may appear in the series/edition information. In this case, it does not indicate that the file has been damaged.

C.2.3 SYSTEM DATA DELETE Screen

Description

This screen is used to delete a user file from Flash ROM or Memory card.

Screen configuration

```
(1)   SYSTEM DATA DELETE                    (1) Screen title.

(2)    1.FROM SYSTEM                         (2) Select the FROM SYSTEM screen.
(3)    2.MEMORY CARD SYSTEM                  (3) Select the MEMORY CARD SYSTEM
(4)    3.END                                     screen.
                                             (4) Returning to the MAIN MENU.


      *** MESSAGE ***
(5)   SELECT MENU AND HIT SELECT KEY.        (5) Message


      [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Screen configuration (FROM SYSTEM screen)

```
(1)   SYSTEM DATA DELETE                    (1) Screen title.
      FROM DIRECTORY
(2)    1 NC BAS-1(0008)                      (2) Names of files in Flash ROM
       2 NC BAS-2(0008)                          The number of management units
       3 NC BAS-3(0008)                          constituting each file appears in
       4 NC BAS-4(0008)                          parentheses to the right of the filename.
       5 DGD0SRVO(0003)
       6 PS0B    (0006)
       7 PMC1    (0001)
(3)    8 END                                 (3) Returning to the MAIN MENU.


      *** MESSAGE ***
(4)   SELECT FILE AND HIT SELECT KEY.        (4) Message


      [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Screen configuration (MEMORY CARD SYSTEM screen)

```
(1)   SYSTEM DATA DELETE                          (1) Screen title.
(2)   MEMORY CARD DIRECTORY  (FREE[KB]: 5123)     (2) The size of the free space of the
(3)    1 D4F1_B1.MEM 1048704 2003-01-01 12:00         Memory card is displayed.
       2 D4F1_B2.MEM 1048704 2003-01-01 12:00     (3) A list of files in the Memory card is
(4)    3 END                                          displayed.
                                                  (4) Returning to the MAIN MENU.


      *** MESSAGE ***
(5)   SELECT FILE AND HIT SELECT KEY.

                                                  (5) Message
      [SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Operating procedure

(1)   Select either the FROM SYSTEM or MEMORY CARD SYSTEM screen.

(2)   Select the file you want to delete.

(3)   The following message is displayed for confirmation.

```
*** MESSAGE ***
DELETE OK ? HIT YES OR NO.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(4)   To start deleting, press the [YES] soft key. To cancel, press the [NO] key.

```
*** MESSAGE ***
EXECUTING
ADDRESS xxxx:
[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(5)   When deleting terminates normally, the system displays the following message. Press the [SELECT] soft key. If an error occurs, see C.3

```
*** MESSAGE ***
DELETE COMPLETE. HIT SELECT KEY.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

Others (System files and user files on SYSTEM DATA DELETE screen)

The system files are protected from accidental deletion. User files, however, are not protected. Protected system files can be overwritten from the USER DATA LOADING / SYSTEM DATA LOADING screen.

C.2.4   SYSTEM DATA SAVE Screen

Description

This screen is used to write a user file in Flash ROM to a Memory card. Only user files can be saved from Flash ROM to a Memory card.   System files cannot be saved.

Screen configuration

(1) `SYSTEM DATA SAVE` `FROM DIRECTORY`	(1) Screen title.

(2) `1 NC BAS-1(0008)`
`2 NC BAS-2(0008)`
`3 NC BAS-3(0008)`
`4 NC BAS-4(0008)`
`5 DGD0SRVO(0003)`
`6 PS0B    (0006)`
`7 PMC1    (0001)`
	(2) Names of files in Flash ROM
	The number of management units constituting each file appears in parentheses to the right of the filename.

(3) `8 END`	(3) Returning to the MAIN MENU.

(4) `*** MESSAGE ***`
`SELECT FILE AND HIT SELECT KEY.`
 	
`[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]`
	(4) Message

Operating procedure

(1) Select the file you want to save.

(2) The system displays the following confirmation message :

```
*** MESSAGE ***
SYSTEM DATA SAVE OK ? HIT YES OR NO.

[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

(3) To start saving, press the [YES] key. To cancel, press [NO].

```
*** MESSAGE ***
STORE TO MEMORY CARD

[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

(4) When saving terminates normally, the system displays the following message. Press the [SELECT] key. The names of files written to the Memory card are listed. Check the file names by, for example, making a note of the list.

```
*** MESSAGE ***
FILE SAVE COMPLETE. HIT SELECT KEY.
SAVE FILE NAME : PMC1.000
[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

Saving ATA PROG

A file whose file name is ATA PROG contains an NC program.   Even if you want to save this file, you cannot save it on this SYSTEM DATA SAVE screen, because it is saved together with SRAM data on the SRAM DATA UTILITY screen.

Others (System files and user files on SYSTEM DATA SAVE screen)

The SYSTEM DATA SAVE function provides a safeguard against free copying of the system files.
User files, however, are not protected.
Files saved from Flash ROM to a Memory card have the following names :

Header ID in Flash ROM		File name in Memory card
PMC1	→	PMC1.xxx
PC010.5M	→	PC0105M.xxx
PC011.0M	→	PC0110M.xxx

"xxx" is replaced by one of 32 numbers "000", "001", …, and "031".
For example, if you attempt to save the file "PMC1   " from Flash ROM to a Memory card, it will be saved with a name of "PMC1.000" if no file with a name of "PMC1.000" is found on the Memory card. If, however, that file is saved to a Memory card that already contains a file named PMC1.000, the saved file is named PMC1.001. As files are added, the extension is incremented up to a maximum of PMC1.031. Any no-longer used numbers in the sequence of the extension numbers are used in as sending order. If two or more files having identical names but different extension numbers are normally saved to the Memory card, check the file names displayed subsequently.

C.2.5   SRAM DATA UTILITY Screen

Description
This screen is used to collectively save and restore parameters, tool compensation memories, and other data, retained after the CNC power in SRAM is turned off, to and from a Memory card.
Automatic data backup (optional function) is available to restore data backed up in the FROM in the CNC.

Screen configuration

| (1) | ```
SRAM DATA UTILITY
``` |
| | |
| (2) | ```
1.SRAM BACKUP  ( CNC -> MEMORY CARD )
2.SRAM RESTORE ( MEMORY CARD -> CNC )
3.AUTO BKUP RESTORE ( FROM -> CNC )
``` |
| (3) | ```
4.END
``` |
| (4) | ```
 SRAM + ATA PROG FILE : (4MB)
``` |
| (5) | ```
  SRAM_BAK.001

*** MESSAGE ***
SET MEMORY CARD NO.001
ARE YOU SURE ? HIT YES OR NO.
[SELECT][ YES ][ NO ][ UP ][ DOWN ]
``` |
| (6) | ```
*** MESSAGE ***
SELECT MENU AND HIT SELECT KEY.

[SELECT][ YES ][ NO ][ UP ][ DOWN ]
``` |

(1) Screen title.

(2) Menu

(3) Returning to the MAIN MENU.
(4) The SRAM file size is displayed. (Displayed after a processing option is selected.)
(5) The name of the file currently being saved or loaded is displayed. (Displayed after a processing option is selected.)

(6) Message

Operating procedure (Backing up data)
(1) Select "1.SRAM BACKUP" The following confirmation message is displayed. To start backup, press the [YES] soft key.

(2) If the data cannot be saved entirely onto a single Memory card, a message such as that shown below is displayed. With the power still on, insert the second Memory card and press the [YES] key. Press the [NO] key to cancel saving.

```
*** MESSAGE ***
SET MEMORY CARD NO.002
ARE YOU SURE ? HIT YES OR NO.
[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

(3) In this way, you can divide SRAM data onto a maximum of 999 Memory card for backup.

(4) Upon the termination of backup, the system displays the following message. Press the [SELECT] soft key.

```
*** MESSAGE ***
SRAM BACKUP COMPLETE. HIT SELECT KEY.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

Operating procedure (Restoring the data)

(1) Select "2.RESTORE SRAM" The following confirmation message is displayed. To start restoration, press the [YES] soft key.

(2) A message such as that shown below is displayed. Insert the first Memory card containing SRAMBACK.001 and press the [YES] key. Press the [NO] key to cancel restoration.

```
*** MESSAGE ***
SET MEMORY CARD INCLUDING SRAM_BAK.001
ARE YOU SURE ? HIT YES OR NO.
[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(3) If another Memory card is required, a message such as that shown below is displayed. With the power still on, insert the second Memory card and press the [YES] key. Press the [NO] key to cancel restoration.

```
*** MESSAGE ***
SET MEMORY CARD INCLUDING SRAM_BAK.002
ARE YOU SURE ? HIT YES OR NO.
[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(4) Replace the second card with another, if required. Repeat this step until backing up all data.

(5) Upon the termination of restoration, the system displays the following message. Press the [SELECT] soft key.

```
*** MESSAGE ***
SRAM RESTORE COMPLETE. HIT SELECT KEY.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

⚠ **CAUTION**
1 Backup files will be created with a file name of SRAMBAK.xxx, where xxx is
   replaced with a number between 001 and 999 sequentially.
   On the first Memory card, a backup file is created with a name of SRAMBAK.001.
   If all data is not contained on the single card, a backup file containing the excess
   data is created with a name of SRAMBAK.002 on the second Memory card.
   In this way, you can divide data onto a maximum of 999 Memory card for saving.
2 Check that the Memory card used for backup does not contain a file with a name
   of SRAMBAK.xxx before performing a BACKUP operation. You can check a list
   of file names on a Memory card by using the SYSTEM DATA LOADING function.
3 The Memory card used for backup needs to be formatted in FAT16.

Operating procedure (Restoring backup data using automatic data backup (option))

(1) Select "3.AUTO BKUP RESTORE."   The following menu is displayed.
     (When the FROM contains no backup data, "1. END" is displayed.)

```
AUTO BACKUP DATA RESTORE

 1. BACKUP DATA1 yyyy/mm/dd **:**:**
 2. BACKUP DATA2 yyyy/mm/dd **:**:**
 3. BACKUP DATA3 yyyy/mm/dd **:**:**
 4. END
```

(2) Select data from the above menu and execute restoration.
     Selecting END displays the SRAM DATA UTILITY screen again.

(3) Upon the termination of restoration, the system displays the following message.
     Press the [SELECT] key to terminate operation.   (The MAIN MENU screen of the boot system is
     displayed again.)

```
*** MESSAGE ***
RESTORE COMPLETE. HIT SELECT KEY.


[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

C.2.6   MEMORY CARD FORMAT Screen

Description

This function is used to format a Memory card. Memory cards must be formatted before they can be used
for the first time or before they can be re-used after their data has been destroyed or lost because of, for
example, battery failure.

Operating procedure

(1) From the MAIN MENU screen, select "8.MEMORY CARD FORMAT."

(2) The system displays the following confirmation message. Press the [YES] key.

```
*** MESSAGE ***
MEMORY CARD FORMAT OK ? HIT YES OR NO.


[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

(3) The system displays the following message asking whether to delete all data on the Memory card.
     To format the Memory card, press the [YES] key.

```
*** MESSAGE ***
MEMORY CARD FORMAT OK ? HIT YES OR NO.
ALL DATA IN THE MEMORY CARD IS LOST.
[SELECT][ YES ][ NO ][ UP ][ DOWN ]
```

(4) The system displays the following message during formatting :

```
*** MESSAGE ***
FORMATTING MEMORY CARD.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

(5) When a card has been formatted normally, the system display the following message. Press the [SELECT] soft key.

```
*** MESSAGE ***
FORMAT COMPLETE. HIT SELECT KEY.


[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

C.2.7   LOAD BASIC SYSTEM

Description
The function is used to terminate the boot system and activate the CNC.

Operating procedure
From the MAIN MENU screen, select "1. END." The system displays the "ARE YOU SURE? HIT YES OR NO" message. To terminate the boot system and activate the CNC, press the [YES] soft key. Press the [NO] soft key, and you will be brought back to the MAIN MENU.

```
*** MESSAGE ***

ARE YOU SURE ? HIT YES OR NO.
[SELECT][ YES  ][  NO  ][  UP  ][ DOWN ]
```

C.3   ERROR MESSAGES AND REQUIRED ACTIONS

The following table lists and explains error messages in alphabetical order.

	Message	Description and required action
D	DEVICE ERROR (xxxx)	An attempt to write data to Flash ROM was unsuccessful. Turn the power off and back on again. If the second attempt also fails, the Flash ROM may have been damaged or destroyed. Replace the Flash ROM module.
F	FILE CLOSE ERROR. HIT SELECT KEY.	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
	FILE DELETE ERROR. HIT SELECT KEY.	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
	FILE OPEN ERROR. HIT SELECT KEY.	Access to a Memory card failed. Confirm that the Memory card is FAT16-formatted. (If the Memory card is formatted in FAT32, it cannot be recognized.)

		Message	Description and required action
F		FILE READ ERROR. HIT SELECT KEY.	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
		FILE SAVE ERROR. HIT SELECT KEY.	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
		FLASH MEMORY NO SPACE. HIT SELECT KEY.	There is insufficient free Flash ROM to store the selected file. Delete any unnecessary files from Flash ROM.
I		ILLEGAL FORMAT FILE. HIT SELECT KEY.	The selected file cannot be read into Flash ROM. The selected file or the header information for Flash ROM may have been damaged or destroyed.
		ILLEGAL SRAM MODULE. HIT SELECT KEY.	The SRAM module ID is illegal. Check the drawing No. of the SRAM module.
M		MAX EXTENSION OVER. HIT SELECT KEY.	The extension number added to a file name exceeds 031. Either replace the Memory card or delete any unnecessary backup files.
		MEMORY CARD BATTERY ALARM. HIT SELECT KEY.	The Memory card's battery is exhausted. Replace the battery.
		MEMORY CARD DISMOUNT ERROR. HIT SELECT KEY.	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
		MEMORY CARD FORMAT ERROR	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
		MEMORY CARD FULL. HIT SELECT KEY.	The Memory card is full. Delete any unnecessary files from the Memory card. Alternatively, replace the Memory card with another card having sufficient free space.
		MEMORY CARD MOUNT ERROR. HIT SELECT KEY.	Access to a Memory card failed. Check that the Memory card has been FAT16-formatted. (When the Memory card has been FAT32-formatted, it is not recognized.)
		MEMORY CARD NOT EXIST. HIT SELECT KEY.	The Memory card is not inserted into its slot. Check that the Memory card is pushed fully home.
		MEMORY CARD PROTECTED. HIT SELECT KEY.	Although writing to the Memory card was selected, the write inhibit switch is set. Disable the write inhibit switch.
		MEMORY CARD RESET ERROR. HIT SELECT KEY.	Access to a Memory card failed. The Memory card's battery may have gone dead, the Memory card may have been damaged electrically, or the Memory card may not be inserted in the slot securely.
R		ROM PARITY ERROR:NC BASIC. HIT SELECT.	NC BASIC data is not correct. Use SYSTEM DATA CHECK to check that CNC system software is installed.
S		SRAM TEST ERROR (ECC)	An error was detected in the SRAM module. You can start up the system because data has been automatically restored. Replace the SRAM module, however, just in case that the data may be disarranged in the future.

D MEMORY CARD SLOT

Appendix D, "MEMORY CARD SLOT", consists of the following sections:

D.1 OVERVIEW

Whether a memory card slot is provided or not depends on the hardware configuration. See the following table:

Hardware configuration	Card slot on LCD unit	Card slot on control unit
Type 1	Provided	No card slot
Type 3	Provided (when PANEL *i* is used) (See NOTE given below.)	Provided

(Supplementary)
- Types 1 and 3 indicate hardware configuration. See Section D.3.

> **NOTE**
> When the hardware configuration is type 3, software write operation and other operations are implemented by open CNC functions.

D.2 TYPES OF AVAILABLE MEMORY CARDS

Flash ATA card (Data I/O)
Compact flash card (Data I/O)

> **NOTE**
> Use memory cards that are recommended by or purchased from FANUC.

Use of the compact flash card adapter in the card slot

When a compact flash card is inserted into a compact flash card adapter (A02B-0303-K150) (referred to below as the CF adapter) purchased from FANUC, and then the CF adapter is inserted into the card slot on the display unit side, the compact flash card lock function is available, the memory card interface cover can be closed with the CF adapter inserted.
1. Insertion
    - Set a compact flash card in the CF adapter (A02B-0303-K150).
    - Check that lock lever A is lifted, then insert the CF adapter into the memory card interface.
    - Lower lock lever A.
    - Close the memory card interface cover.

NOTE
1 This adapter is available only with the LCD-mounted type.   It is unavailable with the stand-alone type.
2 For continuous operation with a CF adapter inserted, be sure to lower lock lever A and close the memory card interface cover.
3 The lock function is enabled only when a CF adapter (A02B-0303-K150) is used.
4 Insert a CF adapter so that the plane bearing the label faces the screen.

2. Extraction
- Open the cover of the memory card interface.
- Push up lock lever A.
- Push eject button B once. The button protrudes.
- Push eject button B again. The CF adapter is ejected.
- Hold the CF adapter with fingers and pull it out.
- Close the memory card interface cover.

NOTE
When the lock lever is lowered (locked), the eject button cannot be pushed.

Lock lever A

Eject button B

Compact flash card

Compact flash card adapter

D.3 HARDWARE CONFIGURATION

Type 1

LCD-mounted type

Card slot on display unit side

Control unit (LCD-mounted type)

Type 3

Stand-alone type
When the HSSB interface on the main board is used to connect the PANEL *i* or personal computer

Card slot on control unit side

(Whe PANEL *i* is used)
Card slot on display unit side

Optical cable

HSSB interface

Control unit (stand-alone type)

PANEL *i* or personal Computer

E LED DISPLAY

Appendix E, "LED DISPLAY", consists of the following sections:

E.1 OVERVIEW

On the CNC, a 7-segment LED is installed.
The 7-segment LED indication changes according to the operating status of the CNC.
The 7-segment LED indications provided after the power is turned on until the CNC is ready for operation and when system errors occur are described below.

E.2 7-SEGMENT LED INDICATIONS (TURNED ON)

Table E.2 (a)   LED display from power-on to the operable state

LED Display	Meaning
	Power not turned on (power-off state)
0	Initialization completed and ready for operation
1	CPU started up (BOOT system)
2	Initialization of G/A (BOOT system)
3	Initialization of various functions
4	Task initialization
5	System configuration parameter check Additional board waiting 2
6	Installation of various drivers All files cleared
7	Title display System ROM test
8	State where the CPU is not started after the power is turned on (BOOT system)
9	BOOT system ended, NC system started (BOOT system)
A	FROM initialization

LED Display	Meaning
b	Loading of embedded software
C	Loading of software for optional boards
c	IPL monitoring in progress
d	DRAM test error (BOOT system, NC system)
E	BOOT system error (BOOT system)
F	File cleared Optional board waiting 1
H	Loading of basic system software (BOOT system)
J	Optional board waiting 3 Optional board waiting 4
L	Final system operation check
P	Display unit initialization (BOOT system)
U	FROM initialization (BOOT system)
u	BOOT monitoring in progress (BOOT system)

If processing stops during startup due to a CNC error, and the system alarm screen is not displayed, take corrective action referring to Table E.2 (b).

Table E.2 (b)   Faulty Regions and Check Items If Processing Stops during Startup

LED display	Faulty region and check item
□	The power supply (24V) or the power module may be faulty.
2	The main board or the display unit may be faulty.
8	The main board may be faulty.
9	The main board may be faulty.
E	The main board (CPU circuit) may be faulty.
H	The SRAM/FROM module or the main board may be faulty.

LED display	Faulty region and check item
P	The main board or the display unit may be faulty.
L	The main board (CPU circuit) may be faulty.

E.3　7-SEGMENT LED INDICATIONS (BLINKING)

Table E.3 (a)　LED display during occurrence of a system error

LED Display	Meaning
	Faulty region and check item
0	ROM PARITY error
	The SRAM/FROM module may be faulty.
2	An FROM file for program memory cannot be created.
	The state of the file for program memory on the FROM is checked with the BOOT system. Rearrange the FROM. Check the FROM size.
3	Software-detected system alarm
	If it is generated during startup:　Use BOOT to check the state of the built-in software in FROM, and check the size of DRAM. In other cases:　Check the error on the alarm screen and take corrective action.
4	The DRAM/SRAM/FROM ID is invalid. (BOOT system, NC system)
	The main board or the SRAM/FROM module may be faulty.
5	A servo CPU timeout occurred.
	Check the state of servo software on the FROM with the BOOT system. The servo card may be faulty.
6	An error occurred when embedded software is incorporated.
	Check the state of embedded software on the FROM with the BOOT system.
7	The display unit cannot be recognized.
	The display unit may be faulty.
8	Hardware-detected system alarm
	Check the error on the alarm screen and take corrective action.
9	Software for optional boards could not be loaded.
	Check the state of software for optional boards on the FROM with the BOOT system.
A	An error occurred in waiting for an optional board.
	The option board or the PMC module may be faulty.
b	The BOOT FROM was updated. (BOOT system)
	Turn on the power again.
d	DRAM test error
	The main board may be faulty.
C	The ID of the display unit is invalid.
	Check the display unit.
u	The ID of the BASIC system software does not math that of the hardware.
	Check the combination of the BASIC system software and the hardware

F MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)

Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)", consists of the following sections:

F.1 OVERVIEW

When the stand-alone type CNC is connected to the PANEL *i* or personal computer via HSSB, you can perform maintenance of the CNC using Ncboot32.exe.

> **NOTE**
> When the LCD-mounted type CNC is connected to the PC over Ethernet, use the standard LCD/MDI for the maintenance of the CNC.

Ncboot32.exe is installed simultaneously when the HSSB driver is installed on the personal computer. It automatically starts up at the start-up of Windows and resides in the system tray.

Ncboot32.exe provides the following functions:
- BOOT screen (for CNC system data maintenance, SRAM backup, and so forth)
- IPL screen (for clearing SRAM, and so forth)
- Display of the CNC power-on screen
- Display of CNC alarm screen
- Re-connection in case of the occurrence of a communication error
- Start of a registered application program
- Automatic call of the BOOT/IPL screen at the next start-up of the CNC

Supplementary 1: Multi-connection
Ncboot32.exe supports HSSB multi-connection. The CNCs connected by HSSB are managed as nodes. The BOOT, IPL, and system alarm screens are displayed in windows that are opened independently for each node.

Supplementary 2: Termination method
Normally, Ncboot32.exe need not be terminated. If you need to terminate it, however, see the "System tray" explanation, below:　Display the popup menu and select "End".
When the Ncboot32.exe window is open, End cannot be selected.

System tray

Right-click the icon in the system tray, and the popup menu, shown below, appears.

Selecting [Open] causes the status screen to open.
Selecting [About] causes the version information dialog box to appear.
Selecting [End] causes Ncboot32.exe to terminate.

Double-clicking the icon in the system tray causes Open in the menu to be automatically selected.

F.2   CHANGING START SEQUENCES

By setting the rotary switch provided on the main board of the CNC main unit to the F position, you can perform maintenance work using the BOOT and IPL screens.

Start-up sequence for the maintenance work (rotary switch position: F)
1.   Wait until communication with the CNC is established.
2.   Display the BOOT screen.
3.   Display the IPL screen.
4.   Display the CNC power-on screen.
5.   Start FOCAS2.
6.   Start a registered application program (such as CNC screen display function).
7.   Perform monitoring for communication errors and CNC system alarms.

Start-up sequence for normal operation (rotary switch position: 0)
1.   Wait until communication with the CNC is established.
2.   Start FOCAS2.
3.   Start a registered application program (such as CNC screen display function).
4.   Perform monitoring for communication errors and CNC system alarms.

Asynchronous start-up sequence (rotary switch position: E)
1.   The CNC starts without waiting for communication to be established.
2.   After communication is established, the personal computer performs initialization described below.
3.   Start FOCAS2.
4.   Start a registered application program (such as CNC screen display function).
5.   Perform monitoring for communication errors and CNC system alarms.

- **Location of rotary switch**

- Stand-alone type Series 0*i*-D

Rotary switch

F.3   EXPLANATION OF SCREENS

> **NOTE**
> To open each screen of Ncboot32.exe, you are recommended to use either the mouse or touch panel.

F.3.1   BOOT Screen

The area where the file is to be placed can be changed by using the [Setting...] button.

Select the memory card on the CNC or a personal computer folder. The file location may be changed at any time.

"Memory Card on CNC":   Specify the memory card slot of the CNC.
"Folder":   Specify a folder on the PC.
To use the memory card slot beside PANEL *i*, select "Folder" and specify the drive name given to the memory card by Windows.

F.3.1.1   System data manipulation

The following screen is used for manipulating system data (including control software and ladder programs) on the CNC.

[Load...] opens the file selection screen. Specify a file to be loaded.
[Save] saves the selected system data on the CNC in a file.
[Check] checks the selected system data on the CNC.
[Delete] deletes the selected system data on the CNC.

F.3.1.2   SRAM operation

This screen is used to store and restore CNC SRAM data.

[Backup]:   Saves SRAM data to a file.
[Restore]:   Restore SRAM data from a file.
The progress of the operation is indicated in the lower part of the screen.   The name of the backup file is automatically determined according to the SRAM size and cannot be changed.

The CNC has the automatic data backup (option) of automatically saving the data of SRAM in FROM. The personal computer can restore the data that was saved automatically to SRAM.   Press the **[AutoBackup...]** button to display the following screen.

Select a saved image under **"Name"** and press the **[Restore]** button to restore the SRAM data of the CNC.

F.3.1.3   File operation

The following screen is used for operating files on a memory card in the CNC or in a folder of the personal computer.

[Delete]   deletes a selected file.
[Format]   formats the memory card. This button is valid when the memory card is selected by [Setting...]
[Refresh]   updates the file list to the latest state. After changing memory cards or floppy disks, click this button.

F.3.2   IPL Screen

> **NOTE**
> The contents of the IPL screen vary depending on the CNC model. Follow the instructions displayed in the menu.

The CNC allows functions to be performed according to the key status set at power-on.
The open CNC does not allow this operation. On the IPL screen, however, equivalent functions can be executed.
For details of the menu on the IPL screen and supported functions, see the table given in Section F.3.2.1.

F.3.2.1   Functions on the IPL screen

Title on IPL screen	Corresponding MDI key operation at power-on (Operation with a standard CNC)
0. EXIT	
1. IPL MONITOR	<-> + <.> (Start-up of the IPL monitor)
2. BACK-UP CNC DATA ALL CLEAR	<DELETE> + <RESET> (Memory all clear)
3. LOCKED PROGRAM ALL CLEAR	<M> + <0> (The C language executor is not temporarily started.)

F.4   OTHER SCREENS

F.4.1   CNC Alarm Screen

This screen appears when a system alarm is issued in the CNC. (The above screen is an example. The displayed information varies depending on the system alarm issued in the CNC.)

F.4.2   Status Screen

To open the status screen, double-click the icon in the system tray.   Alternatively, in the menu popped up by right-clicking, click Open.

Node: Node number
Name: Node name. (Define the node name in advance by using the HSSB applet on the control panel.)
Bus: Hardware communication status (0: Communication error, 1:   Communication established)
Status: Status (in hexadecimal)
Bit 2:   End of BOOT processing
Bit 3:   End of IPL processing
Bit 4:   Rotary switch position 0
Bit 5:   Display of 30 lines on IPL/system alarm screen
Bit 8:   CNC system alarm
Pop up this window on communication error: By checking this item, this screen is opened automatically when a communication error occurs.

Clicking the [Close] button closes the screen.
Clicking the [Setting...] button opens the option setting screen.
Clicking the [About...] button opens the version information screen.

F.4.3   Option Setting Screen

On the option setting screen, application programs can be registered.
Any programs for use with FOCAS2 will not run unless they are started after communication establishment with CNC. By registering these programs in Ncboot32.exe, they can be executed in synchronization with the start of FOCAS2. (Such as CNC screen display function)

Clicking the [Settings...] button on the status screen causes the option setting screen to open. On the option setting screen, an application must be registered with each node that requires it. In addition, it is possible to set the display of the BOOT/IPL screen during the next startup of the CNC.

[Node]   selects a node.   In the list box in the center of the screen, the programs registered for the
                 selected node are displayed.
[New...]   registers a new program. When a blank character is included in the path, it is enclosed
                 with double quotation marks.
[Remove]   deletes a selected line.
[Edit]   allows editing of a selected line. This button is used to edit arguments. The character
                 string %d in the command line is replaced by a node number. To represent % itself,
                 describe %%.

Example: To start the CNC screen display function after FOCAS2 starts at that node, code the following:
         "C:\Program Files\CNCScreen\CNCScrn.exe" /Node=%d

To set the display of the BOOT/IPL screen during the next startup of the CNC, select the **"Boot Option"**
tab on the option setting screen.

If a CNC that is not grayed out is checked, the BOOT/IPL screen appears during the next startup of the
CNC, regardless of the setting of the rotary switch on the CNC side.   This display setting is enabled only
once and automatically cleared by Ncboot32.exe.

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G   IPL MONITOR

Appendix G, "IPL MONITOR", consists of the following sections:

G.1   OVERVIEW

With the IPL monitor, the following operations can be performed:
1)   Clearing of individual files
      CNC parameters, tool compensation data, and so forth can be cleared.
2)   Output of system alarm information
      System alarm information that is stored in history information can be output to the memory card.

> ⚠ **WARNING**
> 1 From the IPL monitor menu, do not select an item other than the items listed
>   below.
>   The other items represent functions for FANUC service.
>   0. END IPL
>   3. CLEAR FILE
>   5. SYSTEM ALARM UTILITY
> 2 When an individual file is cleared, all data stored in the file is cleared and
>   initialized.   So, before clearing an individual file, back up the data of the file as
>   needed.
> 3 If a system label error has occurred, perform a clear operation according to
>   Appendix H, "MEMORY CLEAR", instead of clearing of an individual file.

G.2   STARTING OF THE IPL MONITOR

The IPL monitor can be started according to the procedure below.

LCD-mounted type
<1> Turn on the power by pressing the MDI keys [.] and [-] simultaneously.
<2> The IPL monitor screen is displayed.

Stand-alone type
<1> Start NCBOOT32.
<2> Select "1. IPL MONITOR" on the IPL screen.
<3> The IPL monitor screen is displayed.
For details, see Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)".

G.3   IPL MENU

When the IPL monitor is started, the following screen is displayed.


```
                    D4F1-01.0
                 COPYRIGHT FANUC LTD 2008
RAM TEST : END
ROM TEST : END (D4F1A)
SERVO RAM TEST : END
LOAD SYSTEM LABEL : END
IPL MENU
  0. END IPL
  1. DUMP MEMORY
  2. DUMP FILE
  3. CLEAR FILE
  4. MEMORY CARD UTILITY
  5. SYSTEM ALARM UTILITY
  6. FILE SRAM CHECK UTILITY
  7. MACRO COMPILER UTILITY
  8. SYSTEM SETTING UTILITY
  9. CERTIFICATION UTILITY
 11. OPTION RESTORE
?
```

Enter a menu item number by using the corresponding MDI key.
One of the following menu items can be selected:
0 :   END IPL
3 :   CLEAR FILE
5 :   SYSTEM ALARM UTILITY

END IPL

This menu item ends the IPL monitor and starts the CNC.

CLEAR FILE

This menu item clears and initializes displayed individual files.
1 :   All files except option parameter files
2 :   CNC parameter files
3 :   Tool compensation data
      Tool compensation memory A and C, tool nose radius compensation data (including virtual tool tip direction),
      Y-axis offset data, and so forth
4 :   Program storage files
5 :   PMC parameter files
7 :   Custom macro files
      Macro variables, macro variable names
8 :   Macro executor files
      P code variables
9 :   Touch panel data files

> **NOTE**
> The displayed individual file items vary, depending on the system configuration.

```
D4F1-01.0
COPYRIGHT FANUC LTD 2008
CHECK SYSTEM LABEL : END

   1 : CNC-PARA.DAT
   2 : PITCH.DAT
   5 : PMC-PARA.DAT
   6 : PROG-DIR.DAT
   7 : PROG.DAT
   9 : PROG-MNG.DAT
CLEAR FILE NUMBER ?
```

A file can be cleared according to the following procedure:

<1> Enter the number of a file to be cleared.

<2> The IPL monitor displays "CLEAR FILE OK ? (NO=0,YES=1)".   Enter "1" to clear the file.   To cancel the clearing of the file, enter "0".

<3> When "1" is entered, the specified file is cleared then the menu above is displayed again.

<4> To clear an additional file, repeat steps <1> through <3>.
    To quit, enter "0".

SYSTEM ALARM UTILITY

System alarm information can be output to the memory card.

For details, see Section 10.25, "SYSTEM ALARMS" in Chapter 10, "TROUBLESHOOTING PROCEDURE".

H   MEMORY CLEAR

Appendix H, "MEMORY CLEAR", consists of the following sections:

H.1   OVERVIEW

If an unexpected error occurs, such as the "SYSTEM LABEL CHECK ERROR" at system startup or the "SYSTEM ALARM", which may be generated suddenly, this function can start up the CNC system in its initial state to return the system to the state in which restoration work can be performed, by clearing all data stored in CNC memory.

H.2   OPERATION METHOD

1. Starting method
    <1> For LCD-mounted type
        When turning the power ON to the CNC, turn the power ON while pressing the MID keys
        ⌈RESET⌉ and ⌈DELETE⌉ at the same time and holding them down.   Keep holding them down until
        the memory all clear approval screen is displayed.

    <2> For stand-alone type
        Use the NC BOOT32 function to display the IPL menu.
        From the IPL menu, select "2. BACK-UP CNC DATA ALL CLEAR".
        For details, see Appendix F, "MAINTENANCE OF OPEN CNC (BOOT-UP AND IPL)".

```
NCBOOT32 - Node0 : CNC-1                              [_][□][X]
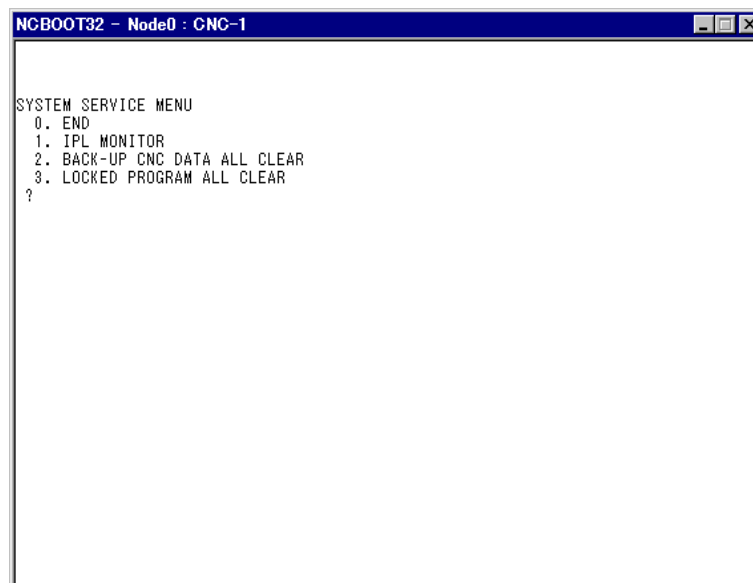

SYSTEM SERVICE MENU
  0. END
  1. IPL MONITOR
  2. BACK-UP CNC DATA ALL CLEAR
  3. LOCKED PROGRAM ALL CLEAR
?
```

2. Memory all clear approval screen
    Performing the operation in 1. causes the following screen to be displayed, asking you whether to execute all clear.

Memory All Clear Approval Screen

From the screen shown above, select between the following operation and execute it:
- If you do not want to execute memory all clear, press the numeric key "0".   All clear will be canceled.
- To execute memory all clear, press the numeric key "1".   All clear will be executed.

⚠ **WARNING**
1 When this operation is performed, the CNC system enters a state (initial state) in which it can start up by itself.   To restore various function operations, therefore, you must reconfigure cleared data.
2 This operation can be performed only by personnel who have been trained in maintenance and safety.

H.3   DATA TYPES TO BE CLEARED

The various data types to be cleared by this operation are as follows:

Data type	Data area
System label	SRAM
Data related to C language executor (such as SRAM disk data)	SRAM
Data related to macro executor (such as P code variables, extended P code variables, user file data)	SRAM
NC parameters	SRAM
Pitch error compensation data	SRAM
Custom macro variables, variable name	SRAM
Data related to PMC (such as parameters, KEEP relay value)	SRAM
Data related to part program (such as program main body)	SRAM/ FROM
Tool offset data	SRAM
Workpiece coordinate system addition data (M series) (Workpiece coordinate system data is included in NC parameters.)	SRAM
Tool life management data	SRAM
System alarm history data	SRAM
Software operator's panel data	SRAM

Data type	Data area
Periodic maintenance data	SRAM
Data related to Fast Data Server / Fast Ethernet (such as parameters)	SRAM
Operation history data	SRAM
Bi-directional pitch error compensation data	SRAM
Touch panel data	SRAM
PRFIBUS master/slave function data	SRAM
Rigid tapping retraction data (M series)	SRAM
Y-axis offset data (T series)	SRAM
Tool nose radius compensation value data (T series)	SRAM
Cutter compensation value data (M series)	SRAM
Data of interference check for each path (T series)	SRAM
Workpiece shift value data (T series)	SRAM
Embedded Ethernet data	SRAM
DeviceNet master/slave function data	SRAM
FL-net function data	SRAM
Data of protection of Data at Eight Levels	SRAM
FSSB data	SRAM
MNUAL GUIDE i data	SRAM
MNUAL GUIDE 0i data	SRAM
TURN MATE i data (T series)	SRAM

⚠ **CAUTION**
The types of data stored in SRAM/FROM differ depending on the system configuration.

INDEX

Revision Record

FANUC Series 0*i*/0*i* Mate-MODEL D MAINTENANCE MANUAL (B-64305EN)

Edition	Date	Contents
03	Jul., 2009	• Deletion of Series 00*i*-D • Modification of "Measures Against Surges due to Lightning" • Modification of "REPLACING BATTERY FOR ABSOLUTE PULSECODERS" • Addition of "MOTOR/DETECTOR/AMPLIFIER PREVENTIVE MAINTENANCE" • Correction of errors
02	May, 2009	• Addition of Series 00*i*-D • Addition of stand-alone type • Addition of options • Correction of errors
01	Jun., 2008	———————
Edition	Date	Contents

B-64305EN/03

Date: 23 Mar., 2010
General Manager of
CNC Laboratory

FANUC Series 0i/0i Mate-MODEL D MAINTENANCE MANUAL
An amendment of the option information file

1. Communicate this report to:

	Your information
✓	~~FANUC CNC America,~~ FANUC CNC Europe S.A.
	FANUC Robotics America, FANUC Robotics Europe
✓	Machine tool builder
	Sales agency
	End user

2. Summary for Sales Documents

3. Notice

4. Attached Document:

Export Control:

☐ Controlled (Related item No. of Foreign Exchange Order Attachment List of Japan:_____)

☑ Non-controlled for item No. 2 to 15 of Foreign Exchange Order Attachment List of Japan

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Acceptance (Technical Administration Dept.)			
Manager	Section Manager	Person in Charge	Person in Charge
技術管理部 22.3.23 藤田	技術管理課 22.3.26 課長 佐藤	技術管理課 22.3.25 主任担当員 北嶋	滝 口 22.3.25

Order section of issuer of issue		
Department Manager	Section Manager	Person in Charge
	CNC研究所 一部二課 22.3.23 課長 伊藤	坂 本 22.3.23

FANUC Series 0i/0i Mate-MODEL D MAINTENANCE MANUAL
An amendment of the option information file

1. Type of applied technical documents

Name	FANUC Series 0i/0i Mate-MODEL D MAINTENANCE MANUAL
Spec. No. / Version	B-64305EN/03

2. Summary of change

Group	Name / Outline	New, Add., Correct, Del.	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice	The section 4.11 is modified. NOTE in APPENDIX C.2.1 is modified.		
Correction			
Another			

				TITLE FANUC Series 0i/0i Mate-MODEL D MAINTENANCE MANUAL An amendment of the option information file			
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Edit.	DATE	Design	Description	**FANUC LTD**		SHEET	1 / 3

4.11   The option information file

This CNC supports the "FANUC Remote Option System."

The note in the restoration of the option information file

1) Optional parameters are stored in an option information file (with file name "OPRM INF") in the FROM module.
Please also back up the option information file (file name: "OPRM INF") in the FROM, when you back up the SRAM memory and the user files. This is for easy recovery in case of data loss.

2) If once the option information file is restored, P/S alarm No.5523 (WAITING THE OPTION CERTIFICATION) occurs when the power is turned on. Then, the certification of the option parameters by FANUC Service is required within the expiration date (30 days (720 hour) after Alarm occures.).
(The P/S alarm No.5523 can be canceled by reset within the expiration date.)
Request FANUC Service to certify the option parameters.

Edit.	DATE	Design	Description		
				TITLE	
				DRAW. NO. B-64305EN/03-01	CUST.
Edit.	DATE	Design	Description	**FANUC LTD**	SHEET 2 / 3

C2.1 USER DATA LOADING/SYSTEM DATA LOADING Screen

> **NOTE**
> 1 The option parameters of the CNC are saved in the option information file (OPRM INF). If this file is modified, the option parameters need to be certified because the settings of the option parameter are assumed to be changed by FANUC Service. Request FANUC Service to certify the option parameters.
> 2 Since the option information file (OPRM INF) may be necessary when the printed circuit board is replaced, it is recommended that this file be backed up in advance as in SRAM data.

Edit.	DATE	Design	Description	TITLE		
				DRAW. NO. B-64305EN/03-01	CUST.	
				FANUC LTD	SHEET	3 / 3

FANUC Series 0i-MODEL D
FANUC Series 0i Mate-MODEL D
MAINTENANCE MANUAL
Addition of the specification of the FROM/SRAM module

1. Type of applied technical documents

Name	FANUC Series 0i-MODEL D FANUC Series 0i Mate-MODEL D MAINTENANCE MANUAL
Spec. No. / Version	B-64305EN/03

2. Summary of change

Group	Name / Outline	New, Add., Correct, Del.	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts	Addition of the specification of the FROM/SRAM module	Add	At once
Notice			
Correction			
Another			

				Title		
				Addition of the specidication of the FROM/SRAM module		
				Drawing No.	B-64305EN/03-03	CUST.
01	2011/3/15	Otsuki	New issue			
Edit.	Date	Designer	Description	**FANUC CORPORATION**	SHEET	1 / 3

We add the specification of the FROM/SRAM module in the P.C.B. list at the following paragraph.

2.4.1 Main Board

- FROM/SRAM module mounting location (P.75)

No.	Name	Specification	Function	Remarks
①	FROM/SRAM module A1	A20B-3900-0242 A20B-3900-0286	FROM 64MB SRAM 1MB	The FROM stores various control software programs, user software programs, and so forth. The SRAM is a battery-backed memory module.
	FROM/SRAM module B1	A20B-3900-0240 A20B-3900-0280	FROM 128MB SRAM 1MB	
	FROM/SRAM module B2	A20B-3900-0241 A20B-3900-0281	FROM 128MB SRAM 2MB	

2.5.4 Printed Circuit Boards (P.80)

Name	Drawing No.	ID	Remarks
FROM/SRAM module A1 (FROM 64MB, SRAM 1MB)	A20B-3900-0242	FROM: E3 SRAM: 03	A20B-3900-024x: Old specification A20B-3900-028x: New specification
	A20B-3900-0286	FROM: C3 SRAM: 03	The new specification is not compatible with the old one.
FROM/SRAM module B1 (FROM 128MB, SRAM 1MB)	A20B-3900-0240	FROM: E4 SRAM: 03	
	A20B-3900-0280	FROM: C4 SRAM: 03	
FROM/SRAM module B2 (FROM 128MB, SRAM 2MB)	A20B-3900-0241	FROM: E4 SRAM: 04	
	A20B-3900-0281	FROM: C4 SRAM: 04	

3.4 CONFIGURATION OF PRINTED CIRCUIT BOARD CONNECTORS AND CARDS
- Mounting positions of cards and DIMM modules (P.101)

No.	Item	Ordering code	Function	Remarks
(3)	FROM/SRAM module A1	A20B-3900-0242 A20B-3900-0286	FROM 64MB SRAM 1MB	The FROM stores various control software programs, user software programs, and so forth. The SRAM is a battery-backed memory module.
	FROM/SRAM module B1	A20B-3900-0240 A20B-3900-0280	FROM 128MB SRAM 1MB	
	FROM/SRAM module B2	A20B-3900-0241 A20B-3900-0281	FROM 128MB SRAM 2MB	

				Title		
				Drawing No. B-64305EN/03-03		CUST.
Edit.	Date	Designer	Description	**FANUC CORPORATION**	SHEET	2 / 3

3.5.2 List of Printed Circuit Boards (P.106)

Item	Ordering code	ID	Remarks
FROM/SRAM module A1 (FROM 64MB, SRAM 1MB)	A20B-3900-0242	FROM: E3 SRAM: 03	A20B-3900-024x: Old specification A20B-3900-028x: New specification
	A20B-3900-0286	FROM: C3 SRAM: 03	
FROM/SRAM module B1 (FROM 128MB, SRAM 1MB)	A20B-3900-0240	FROM: E4 SRAM: 03	The new specification is not compatible with the old one.
	A20B-3900-0280	FROM: C4 SRAM: 03	
FROM/SRAM module B2 (FROM 128MB, SRAM 2MB)	A20B-3900-0241	FROM: E4 SRAM: 04	
	A20B-3900-0281	FROM: C4 SRAM: 04	

About Modified Section of FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual

1. Type of applied technical documents

Name	FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual
Spec.No.／ Version	B-64305EN/03

2. Summary of changes

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function			
Unit	Mainbords and display units with USB interface	Add	2011.8
	Mainbords	Add	2011.7
Maintenance			
Notice	Section 2.4.1, 2.5.2, 2.5.4, 2.6<3> and 2.7 are modified.		01
	Section 2.4.1, 2.5.4, 2.6<3> and 2.7 are modified.		02
Correction			
Another			

Ed	Date	Design	Description	TITLE About Modified Section of FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual		
02	June.27, 2011	Osa	Pages 2,6,8 and 10 are modified.			
01	May.31, 2011	Osa	K.Ito	DRAW. NO B-64305EN/03-04		CUST
Ed	Date	Design	Description	**FANUC CORPORATION**	SHEET 1/ 10	

Following description of "Configuration of printed circuit board connectors and cards" is modified as section 2.4.1.

2.4 CONFIGURATION OF PRINTED CIRCUIT BOARD CONNECTORS AND CARDS
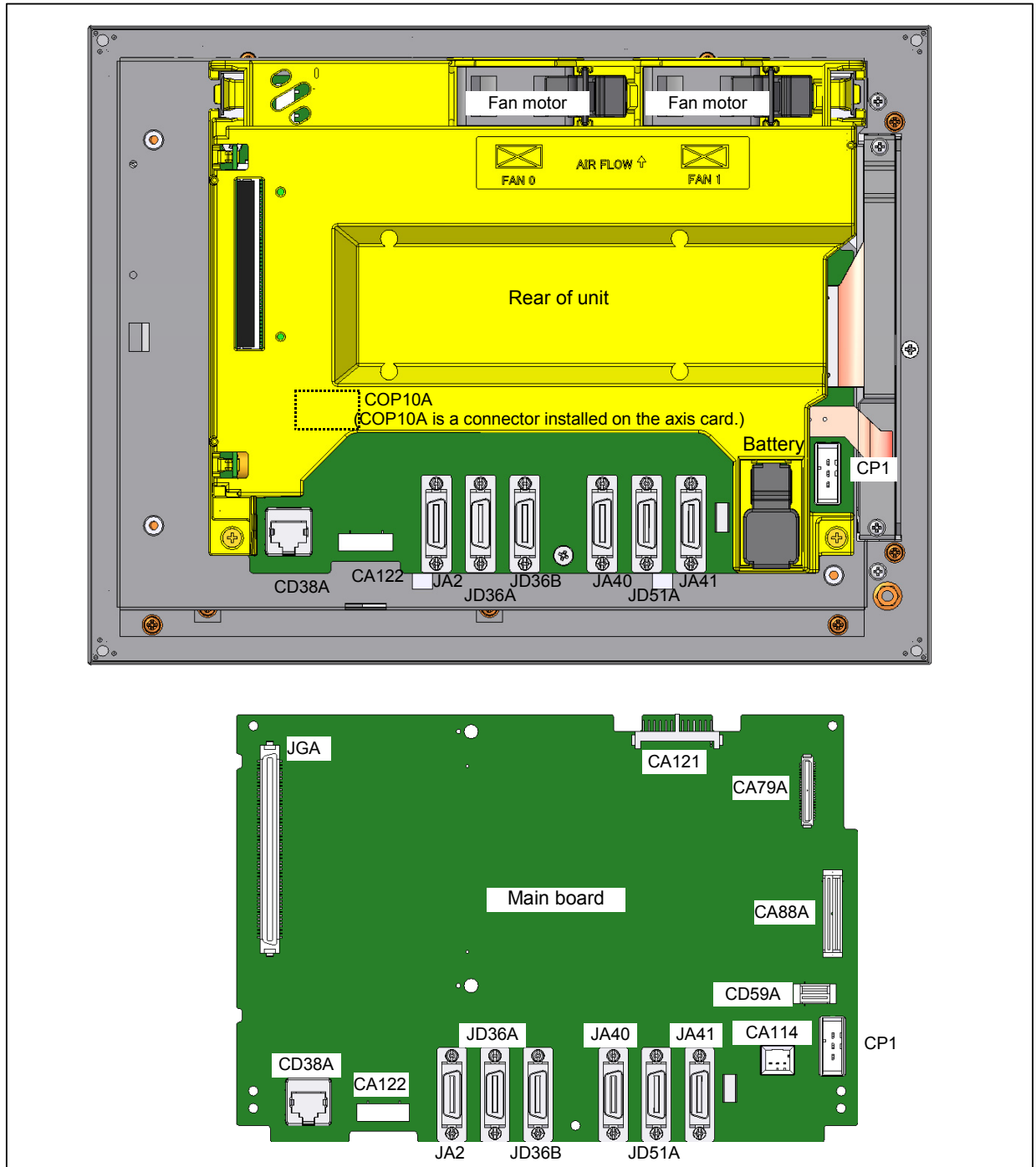
2.4.1 Main Board

- Main board specification

Name	CNC model	Specification	Compatibility	PMC series	Remarks
Main board A0	0*i*	A20B-8200-0540	with	40B0	
		A20B-8200-0844			
Main board A1	0*i*	A20B-8200-0541	with	40B0	(NOTE 1)
		A20B-8200-0845			
		A20B-8200-0925	without	40B1	
Main board A2	0*i*	A20B-8200-0542	with	40B0	
		A20B-8200-0846			
Main board A3	0*i*	A20B-8200-0543	with	40B0	(NOTE 1)
		A20B-8200-0847			
		A20B-8200-0927	without	40B1	
Main board A5	0*i* Mate	A20B-8200-0545	with	40B0	
		A20B-8200-0849			
Main board A0U	0*i*	A20B-8200-0840	-	40B0	with USB
Main board A1U	0*i*	A20B-8200-0841	without	40B0	with USB
		A20B-8200-0921	without	40B1	(NOTE 1)
Main board A2U	0*i*	A20B-8200-0842	-	40B0	with USB
Main board A3U	0*i*	A20B-8200-0843	without	40B0	with USB
		A20B-8200-0923	without	40B1	(NOTE 1)
Main board A5U	0*i* Mate	A20B-8200-0848	-	40B0	with USB

NOTE
1. Main board with compatibility can be replaced by main board with the same name. But main board without compatibility can only be replaced by main board with the same specification number.

- Connector mounting location

Connector number	Application
COP10A	Servo amplifier (FSSB)
JA2	MDI
JD36A	RS-232-C serial port 1
JD36B	RS-232-C serial port 2 (NOTE)
JA40	Analog spindle / high-speed DI
JD51A	I/O Link
JA41	Serial spindle / position coder

Ed	Date	Design	Description		
02	June.27, 2011	Osa		TITLE	About Modified Section of FANUC Series 0i/0i Mate-MODEL D Maintenance Manual
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CP1	DC24V-IN
JGA	Back panel interface
CA79A	Video signal interface
CA88A	PCMCIA interface
CD59A	USB interface
CA122	Soft key
CA121	Inverter
CD38A	Ethernet

NOTE
RS-232-C serial port 2 is also used as a touch panel interface.
CD59A is unmount on Main board A0～A5.
CD38A is unmount on Main board A5.

Following description of "Display Unit" is modified as section 2.5.2.

2.5.2   Display Unit

CNC model	Name	Drawing number	LCD ID	MDI ID	USB	MDI-type	Remarks
0*i*	10.4" LCD unit	A02B-0319-D510	1010		without USB		
		A02B-0319-D530			with USB		
	10.4" LCD unit (with touch panel)	A02B-0319-D511			without USB		
		A02B-0319-D531			with USB		
	10.4" LCD unit (with touch panel and soft key)	A02B-0319-D512			without USB		
		A02B-0319-D532			with USB		
0*i* 0*i* Mate	8.4" color LCD/MDI unit	A02B-0319-D514#T	1011	14	without USB	Horizontal	for T series
		A02B-0319-D514#M		14	without USB	Horizontal	for M series
		A02B-0319-D534#T		14	with USB	Horizontal	for T series
		A02B-0319-D534#M		14	with USB	Horizontal	for M series
		A02B-0319-D515#T		18	without USB	Vertical	for T series
		A02B-0319-D515#M		18	without USB	Vertical	for M series
		A02B-0319-D535#T		18	with USB	Vertical	for T series
		A02B-0319-D535#M		18	with USB	Vertical	for M series
	8.4" color LCD/MDI unit (with touch panel)	A02B-0319-D518#T	1011	14	without USB	Horizontal	for T series
		A02B-0319-D538#T		14	with USB	Horizontal	for T series
		A02B-0319-D519#T		18	without USB	Vertical	for T series
		A02B-0319-D539#T		18	with USB	Vertical	for T series

NOTE
   0*i* –PD belongs to M series.

Ed	Date	Design	Description		
				TITLE About Modified Section of FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual	
02	June.27, 2011	Osa			
01	May.31, 2011	Osa		DRAW. NO B-64305EN/03-04	CUST
Ed	Date	Design	Description	**FANUC CORPORATION**	SHEET 5/ 10

Following description of "Printed Circuit Boards" is modified as section 2.5.4.

2.5.4   Printed Circuit Boards

Name	Drawing number	Compatibility	ID	Remarks
Main board A0	A20B-8200-0540	with	00428	
	A20B-8200-0844			
Main board A1	A20B-8200-0541	with	00429	(NOTE 1)
	A20B-8200-0845			
	A20B-8200-0925	without		
Main board A2	A20B-8200-0542	with	0042A	
	A20B-8200-0846			
Main board A3	A20B-8200-0543	with	0042B	(NOTE 1)
	A20B-8200-0847			
	A20B-8200-0927	without		
Main board A5	A20B-8200-0545	with	0042C	
	A20B-8200-0849			
Main board A0U	A20B-8200-0840	-	00438	with USB
Main board A1U	A20B-8200-0841	without	00439	with USB
	A20B-8200-0921	without		(NOTE 1)
Main board A2U	A20B-8200-0842	-	0043A	with USB
Main board A3U	A20B-8200-0843	without	0043B	with USB
	A20B-8200-0923	without		(NOTE 1)
Main board A5U	A20B-8200-0848	-	0043C	with USB

NOTE
1. Main board with compatibility can be replaced by main board with the same name. But main board without compatibility can only be replaced by main board with the same specification number.

Ed	Date	Design	Description		
02	June.27, 2011	Osa	This page is modified.	TITLE About Modified Section of FANUC Series 0i/0i Mate-MODEL D Maintenance Manual	
01	May.31, 2011	Osa		DRAW. NO B-64305EN/03-04	CUST
Ed	Date	Design	Description	FANUC CORPORATION	SHEET 6/ 10

Following description of "Replacing the main board" is modified as section 2.6<3>.

<3> Connectors on the main board
First, detach the cables from the following connectors:
CA88A (PCMCIA interface connector)
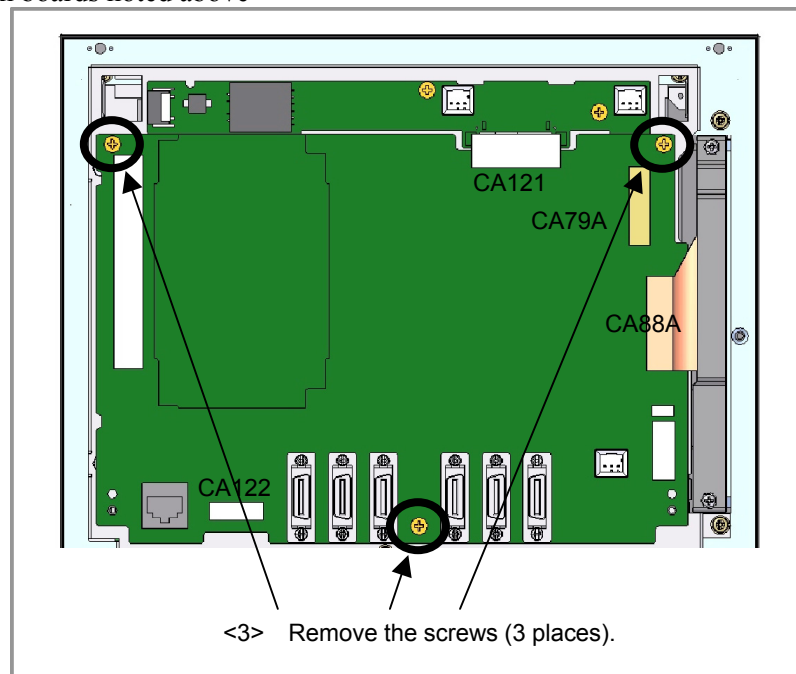CD59A (USB interface connector)   CD59A is unmounted on some main boards.
CA79A (video signal interface connector)
CA122 (connector for soft keys)
Next, remove the screws fastening the main board.   The main board is connected directly to
the inverter PCB with connector CA121.   So, slide down the main board when detaching it.

Name	CNC model	Specification
Main board A0	0*i*	A20B-8200-0540
Main board A1	0*i*	A20B-8200-0541
Main board A2	0*i*	A20B-8200-0542
Main board A3	0*i*	A20B-8200-0543
Main board A5	0*i* Mate	A20B-8200-0545

Main boards noted above

CA121

CA79A

CA88A

CA122

<3>   Remove the screws (3 places).

Name	CNC model	Specification
Main board A0U	0*i*	A20B-8200-0840
Main board A1U	0*i*	A20B-8200-0841
		A20B-8200-0921 ②
Main board A2U	0*i*	A20B-8200-0842
Main board A3U	0*i*	A20B-8200-0843
		A20B-8200-0923 ②
Main board A0	0*i*	A20B-8200-0844
Main board A1	0*i*	A20B-8200-0845
		A20B-8200-0925 ②
Main board A2	0*i*	A20B-8200-0846
Main board A3	0*i*	A20B-8200-0847
		A20B-8200-0927 ②
Main board A5U	0*i* Mate	A20B-8200-0848
Main board A5	0*i* Mate	A20B-8200-0849

Main boards noted above

CA121
CA79A
CA88A
CD59A
CA122

<3>   Remove the screws (3 places).

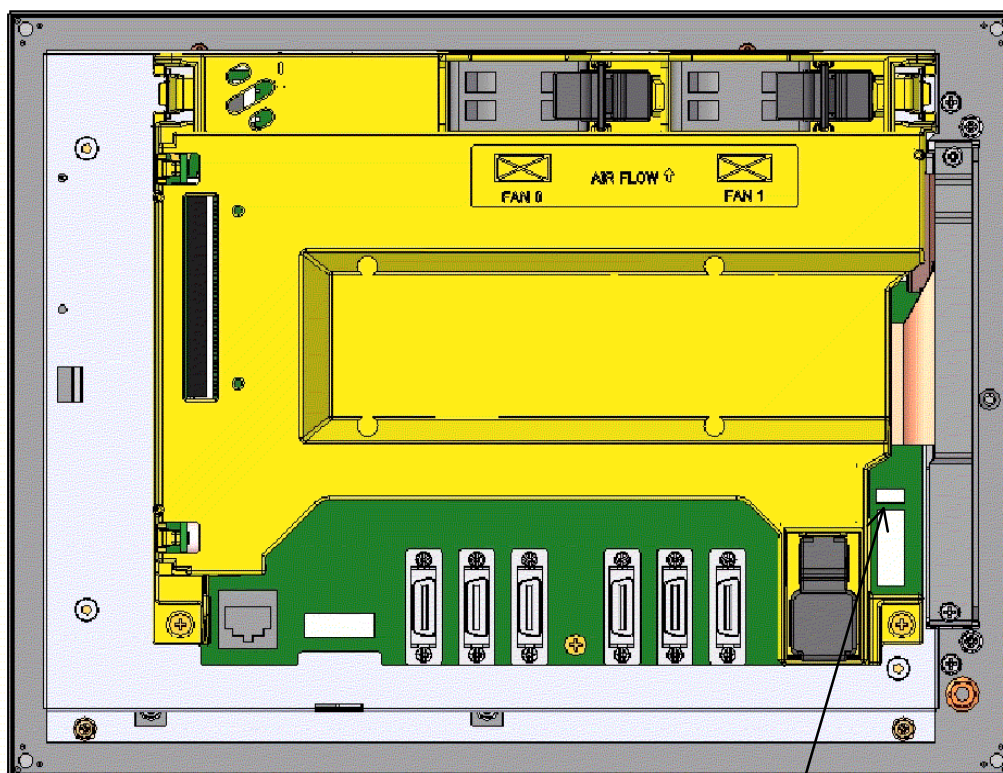|				TITLE	About Modified Section of FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual		
02	June.27, 2011	Osa	② are modified.				
01	May.31, 2011	Osa		DRAW. NO	B-64305EN/03-04		CUST
Ed	Date	Design	Description	**FANUC CORPORATION**		SHEET 8/ 10	

2.7   REPLACING FUSE ON CONTROL UNIT

> ⚠ **WARNING**
> Before replacing a blown fuse, locate and remove the cause of the blown fuse.
> For this reason, only those personnel who have received approved safety and maintenance training may perform this replacement work.
> When opening the cabinet and replacing a fuse, be careful not to touch the high-voltage circuits (marked ⚠ and fitted with an insulating cover).
> Touching the uncovered high-voltage circuits presents an extremely dangerous electric shock hazard.

Fuse mounting location

Name	CNC model	Specification
Main board A0	0*i*	A20B-8200-0540
Main board A1	0*i*	A20B-8200-0541
Main board A2	0*i*	A20B-8200-0542
Main board A3	0*i*	A20B-8200-0543
Main board A5	0*i* Mate	A20B-8200-0545

Main boards noted above

FUSE1 (transparent)
for 24 VDC input

Ed	Date	Design	Description		
02	June.27, 2011	Osa		TITLE About Modified Section of FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual	
01	May.31, 2011	Osa		DRAW. NO B-64305EN/03-04	CUST
Ed	Date	Design	Description	**FANUC CORPORATION**	SHEET 9/ 10

Name	CNC model	Specification
Main board A0U	0*i*	A20B-8200-0840
Main board A1U	0*i*	A20B-8200-0841
		A20B-8200-0921 ②
Main board A2U	0*i*	A20B-8200-0842
Main board A3U	0*i*	A20B-8200-0843
		A20B-8200-0923 ②
Main board A0	0*i*	A20B-8200-0844
Main board A1	0*i*	A20B-8200-0845
		A20B-8200-0925 ②
Main board A2	0*i*	A20B-8200-0846
Main board A3	0*i*	A20B-8200-0847
		A20B-8200-0927 ②
Main board A5U	0*i* Mate	A20B-8200-0848
Main board A5	0*i* Mate	A20B-8200-0849

Main boards noted above

FUSE1 (transparent)
for 24 VDC input

Fuse ordering information

Marking	Application	Ordering information	Rating	Individual specification
FUSE1	For 24 VDC power input	A02B-0236-K100	5A	A60L-0001-0290#LM50C

Ed	Date	Design	Description		
02	June.27, 2011	Osa	② are modified.	TITLE About Modified Section of FANUC Series 0*i*/0*i* Mate-MODEL D Maintenance Manual	
01	May.31, 2011	Osa		DRAW. NO B-64305EN/03-04	CUST
Ed	Date	Design	Description	**FANUC CORPORATION**	SHEET 10/ 10