GE Fanuc Automation

PowerMotion™ Products

Power Mate D and F Motion Controllers

Maintenance Manual

GFZ-62835EN/01

October 1996

Warnings, Cautions, and Notes as Used in this Publication

Warning

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

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

Caution

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

Note

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

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

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DEFINITION OF WARNING, CAUTION, AND NOTE

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

WARNING

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

CAUTION

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

NOTE

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

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

PREFACE

Description of this manual

1. Display and operation

This chapter covers those items, displayed on the CRT, that are related to maintenance. A list of all supported operations (CRT or DPL) is also provided at the end of this chapter.

2. Hardware

This chapter covers hardware–related items, including the hardware configuration, connection, and Power Mate status indicated on printed circuit boards. A list of all units is also provided as well as an explanation of how to replace each unit.

3. Data input/output

This chapter describes the input/output of data, including programs, parameters, lodder program, and tool compensation data, as well as the input/output procedures.

4. Interface between the Power Mate and PMC

This chapter describes the PMC specifications, the system configuration, and the signals used by the PMC.

5. Digital servo

This chapter describes the servo tuning screen and how to adjust the reference position return position.

6. and 7. AC spindles

These chapters describe the spindle amplifier checkpoints, as well as the spindle tuning screen.

8. Trouble shooting

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 automatic operation cannot be performed. Countermeasures to be applied in the event of alarms being output are also described.

9. and 10. Spindle trouble shooting

These chapters explain the alarms related to spindles, as well as the corresponding countermeasures to be applied.

APPENDIX

The appendix consists of a list of all alarms, as well as a list of maintenance parts. The I/O Unit–MODEL A is also described.
This manual does not provide a parameter list. If necessary, refer to the Connection Manual (B–62833EN).
This manual describes all optional functions. Refer to the manual provided by the machine tool builder for details of any options with which the installed machine tool is provided.

Applicable models

This manual describes following function.

The models covered by this manual, and their abbreviations, are :

Product Name	Abbreviations	
FANUC Power Mate–MODEL D	Power Mate–D	Power Mate
FANUC Power Mate–MODEL F	Power Mate–F	

Related manuals

The table below lists manuals related to the Power Mate–D/F.
In the table, this manual is marked with an asterisk(*).

Table 1 Manuals related to the Power Mate–D/F

Manual name	Specification Number	
FANUC Power Mate–MODEL D/F DESCRIPTIONS	B–62092E	
FANUC Power Mate–MODEL D/F CONNECTION MANUAL	B–62833EN	
FANUC Power Mate–MODEL D/F OPERATOR'S MANUAL	B–62094E	
FANUC Power Mate–MODEL D/F MAINTENANCE MANUAL	B–62835EN	*
FANUC Power Mate–MODEL D/F OPERATION AND MAINTENANCE HAND BOOK	B–62097EN	
FANUC Power Mate–MODEL D/F PROGRAMMING MANUAL (Macro Compiler/Macro executor)	B–62093E–1	

For specifications and maintenance of FUNUC CONTROL MOTOR α /β series, refer to the following manuals:

Document name	Document number	Major contents	Major usage
FANUC AC SERVO MOTOR α series DESCRIPTIONS	B–65142E	• Specification • Characteristics • External dimensions • Connections	• Selection of motor • Connection of motor
FANUC CONTROL MOTOR AMPLIFIER α series DESCRIPTIONS	B–65162E	• Specifications and functions • Installation • External dimensions and maintenance area • Connections	• Selection of amplifier • Connection of amplifier
FANUC CONTROL MOTOR α series MAINTENANCE MANUAL	B–65165E	• Start up procedure • Troubleshooting • Maintenance of motor	• Start up the system (Hardware) • Troubleshooting • Maintenance of motor
FANUC AC SERVO MOTOR α series PARAMETER MANUAL	B–65150E	• Initial setting • Setting parameters • Description of parameters	• Start up the system (Software) • Turning the system (Parameters)
FANUC CONTROL MOTOR β series DESCRIPTIONS	B–65232EN	• Specification • Characteristics • External dimensions • Connections	• Selection of motor • Connection of motor

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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.

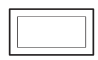
1.1 FUNCTION KEYS AND SOFT KEYS

Operations and soft key display staturs for each function key are described below.

1.1.1 Soft Keys

To display a more detailed screen of CRT, PDP, LCD, handy operator’s panel, press a function key followed by a soft key. Soft keys are also used for actual operations.
The following illustrates how soft key displays are changed by pressing each function key.

The symbols in the following figures mean as shown below :

	:	Indicates screens
	:	Indicates a screen that can be displayed by pressing a function key(*1)
[ ]	:	Indicates a soft key(*2)
( )	:	Indicates input from the MDI panel.
	:	Indicates the continuous menu key (rightmost soft key).

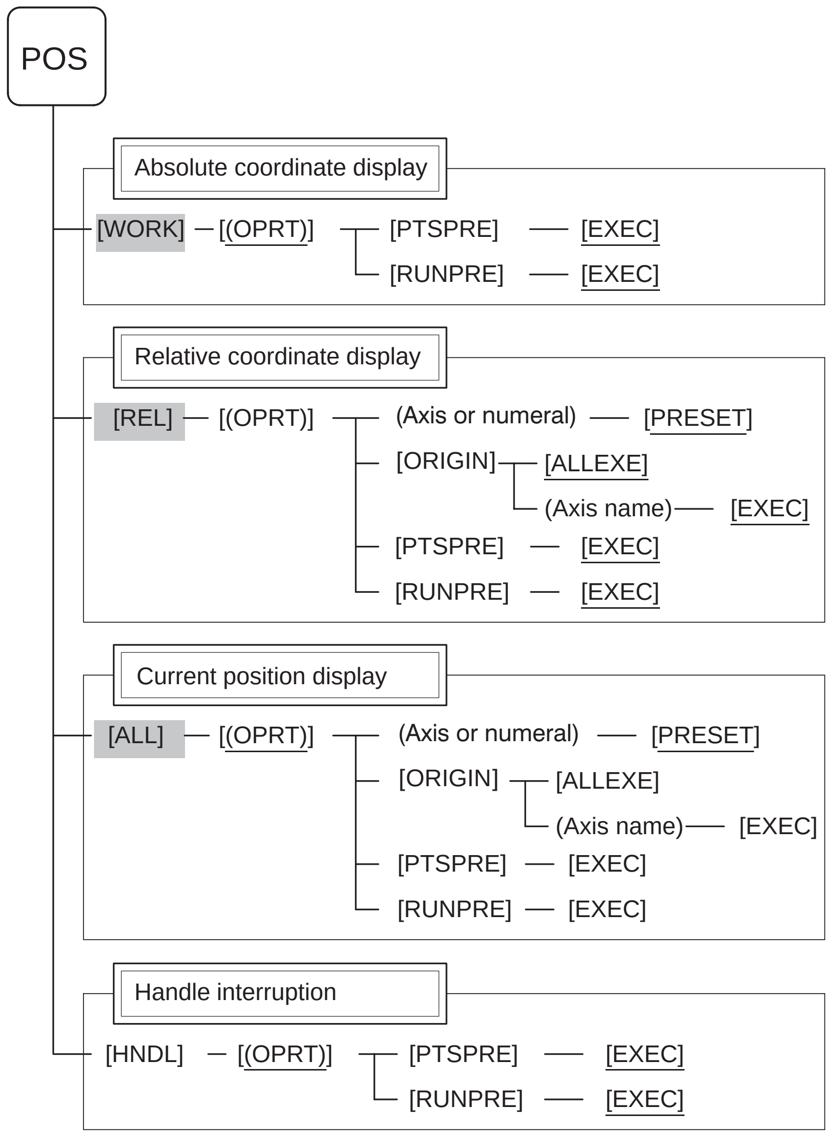
*1 Press function keys to switch between screens that are used frequently.

*2 Some soft keys are not displayed depending on the option configuration.

NOTE
1. The CRT, PDP, LCD, and handy operator’s panel cannot be used with the Power Mate–F.
2. If the DPL/MDI is connected, the CRT, PDP, LCD, and handy operator’s panel are disabled, and the functions of these screens are restricted to position display.

POSITION SCREEN

Soft key transition triggered by the function key POS



PROGRAM SCREEN

Soft key transition triggered by the function key PROG in the AUTO mode

PROG

Program display screen

[PRGRM] (1) — [(OPRT)] —
- [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
- (O number) — [O SRH]
- (N number) — [N SRH]
- [REWIND]

Program check display screen

[CHECK] — [WORK] / [REL] — [(OPRT)] —
- [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
- (O number) — [O SRH]
- (N number) — [N SRH]
- [REWIND]

Current block display screen

[CURRNT] — [(OPRT)] — [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”

Next block display screen

[NEXT] — [(OPRT)] — [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”

▷

[FL.SDL] —
- [PRGRM] ⇒ Return to (1) (Program display)
- **File directory display screen**
  [DIR] — [(OPRT)] — [SELECT] —
  - (File No.) — [F SET]
  - [EXEC]

PROGRAM SCREEN

Soft key transition triggered by the function key PROG in the EDIT mode

1/2

PROG

Program display

- [PRGRM] — [(OPRT)]
  - [BG–EDT] ⇒ See "When the soft key [BG–EDT] is pressed"
  - (O number) — [O SRH]
  - (Address) — [SRH↓]
  - (Address) — [SRH↑]
  - [REWIND]
  - ▷
  - [F SRH]
    - [CAN]
    - (N number) — [EXEC]
  - [READ]
    - [CHAIN] (The cursor moves to the end of a program.)
    - [STOP]
    - [CAN]
    - (O number) — [EXEC]
  - [PUNCH]
    - [STOP]
    - [CAN]
    - (O number) — [EXEC]
  - [DELETE]
    - [CAN]
    - (N number) — [EXEC]
  - [EX–EDT]
    - [COPY]
      - [CRSR~] / [~CRSR] / [~BTTM] / [ALL] — (O number) — [EXEC]
    - [MOVE]
      - [CRSR~] / [~CRSR] / [~BTTM] / [ALL] — (O number) — [EXEC]
    - [MERGE]
      - [~CRSR] / [~BTTM] — (O number) — [EXEC]
    - [CHANGE] — (Address) — [BEFORE] — (Address) — [AFTER]
      - [SKIP]
      - [1–EXEC]
      - [EXEC]

(1)(Continued on the next page)

2/2

(1)

Program directory display

- [LIB] — [(OPRT)]
  - [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
  - (O number) — [O SRH] ⇒ Return to the program
  - ▷
  - [READ]
    - [CHAIN]
    - [STOP]
    - [CAN]
    - (O number) — [EXEC]
  - [PUNCH]
    - [STOP]
    - [CAN]
    - (O number) — [EXEC]

▷

Floppy directory display

- [FLOPPY]
  - [PRGRM] ⇒ Return to the program
  - [DIR] — [(OPRT)]
    - [F SRH]
      - (Numeral) — [F SET]
      - [CAN]
      - [EXEC]
    - [READ]
      - (Numeral) — [F SET]
      - (Numeral) — [O SET]
      - [STOP]
      - [CAN]
      - [EXEC]
    - [PUNCH]
      - (Numeral) — [F SET]
      - (Numeral) — [O SET]
      - [STOP]
      - [CAN]
      - [EXEC]
    - [DELETE]
      - (Numeral) — [F SET]
      - [CAN]
      - [EXEC]

PROGRAM SCREEN

Soft key transition triggered by the function key PROG in the MDI mode

PROG

Program display

- [PRGRM] — [(OPRT)] — [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”

Program input screen

- [MDI] — [(OPRT)]
  - [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
  - [START]
    - [CAN]
    - [EXEC]
  - (Address) — [SRH↓]
  - (Address) — [SRH↑]
  - [REWIND]

Current block display screen

- [CURRNT] — [(OPRT)] — [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”

Next block display screen

- [NEXT] — [(OPRT)] — [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”

PROGRAM SCREEN

Soft key transition triggered by the function key PROG in the STEP, JOG or ZRN mode

PROG

Program display

[PRGRM] —— [(OPRT)] —— [BG–EDT] ⇒ See "When the soft key [BG–EDT] is pressed"

Current block display screen

[CURRNT] —— [(OPRT)] —— [BG–EDT] ⇒ See "When the soft key [BG–EDT] is pressed"

Next block display screen

[NEXT] —— [(OPRT)] —— [BG–EDT] ⇒ See "When the soft key [BG–EDT] is pressed"

PROGRAM SCREEN

Soft key transition triggered by the function key PROG in the TJOG or THDL mode

PROG

- **Program display**
  - [PRGRM] — [(OPRT)] — [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
- **Program input screen**
  - [MDI] — [(OPRT)]
    - [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
    - (O number) — [O SRH] ⇒ Return to the program
    - (Address) — [SRH↓]
    - (Address) — [SRH↑]
    - [REWIND]
- **Program directory display**
  - [LIB] — [(OPRT)]
    - [BG–EDT] ⇒ See “When the soft key [BG–EDT] is pressed”
    - (O number) — [O SRH] ⇒ Return to the program

PROGRAM SCREEN

Soft key transition triggered by the function key PROG
(When the soft key [BG–EDT] is pressed in all modes)

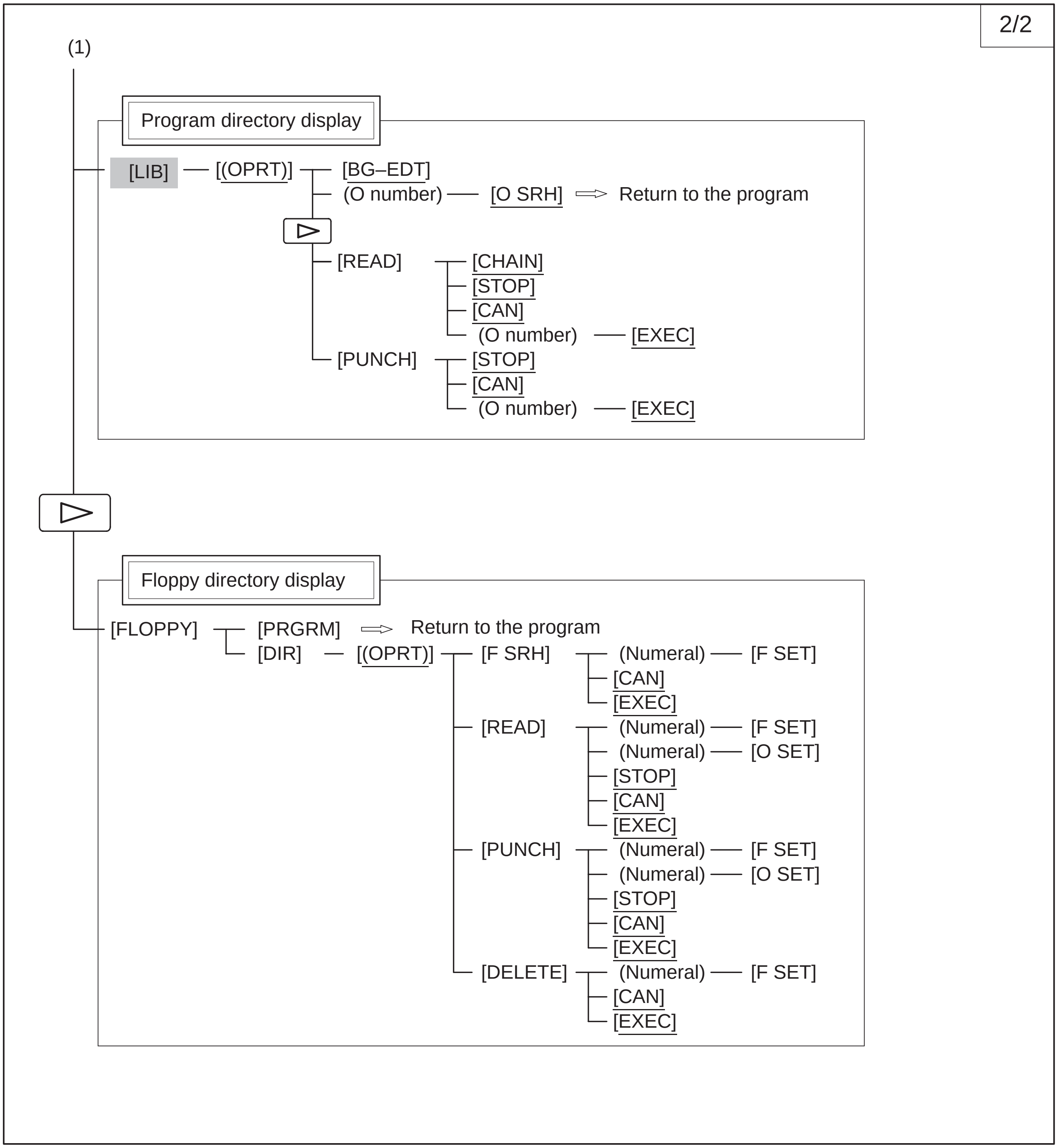
1/2

PROG

Program display

- [PRGRM] — [(OPRT)]
  - [BG–END]
  - (O number) — [O SRH]
  - (Address) — [SRH↓]
  - (Address) — [SRH↑]
  - [REWIND]
  - ▷
  - [F SRH]
    - [CAN]
    - (N number) — [EXEC]
  - [READ]
    - [CHAIN] (The cursor moves to the end of a program.)
    - [STOP]
    - [CAN]
    - (O number) — [EXEC]
  - [PUNCH]
    - [STOP]
    - [CAN]
    - (O number) — [EXEC]
  - [DELETE]
    - [CAN]
    - (N number) — [EXEC]
  - [EX–EDT]
    - [COPY]
      - [CRSR~] / [~CRSR] / [~BTTM] / [ALL] — (O number) — [EXEC]
    - [MOVE]
      - [CRSR~] / [~CRSR] / [~BTTM] / [ALL] — (O number) — [EXEC]
    - [MERGE]
      - [~CRSR] / [~BTTM] — (O number) — [EXEC]
    - [CHANGE] — (Address) — [BEFORE] — (Address) — [AFTER]
      - [SKIP]
      - [1–EXEC]
      - [EXEC]

(1)(Continued on the next page)


2/2
(1)
Program directory display
[LIB]
[(OPRT)]
[BG–EDT]
(O number)
[O SRH]
Return to the program
[READ]
[CHAIN]
[STOP]
[CAN]
(O number)
[EXEC]
[PUNCH]
[STOP]
[CAN]
(O number)
[EXEC]
Floppy directory display
[FLOPPY]
[PRGRM]
Return to the program
[DIR]
[(OPRT)]
[F SRH]
(Numeral)
[F SET]
[CAN]
[EXEC]
[READ]
(Numeral)
[F SET]
(Numeral)
[O SET]
[STOP]
[CAN]
[EXEC]
[PUNCH]
(Numeral)
[F SET]
(Numeral)
[O SET]
[STOP]
[CAN]
[EXEC]
[DELETE]
(Numeral)
[F SET]
[CAN]
[EXEC]

OFFSET/SETTING SCREEN

Soft key transition triggered by the function key OFFSET SETTING

OFFSET SETTING

- Tool offset screen
  - [OFFSET] — [(OPRT)]
    - (Number) — [NO SRH]
    - (Axis name) — [INP.C.]
    - (Numeral) — [+INPUT]
    - (Numeral) — [INPUT]
- Setting screen
  - [SETING] — [(OPRT)]
    - (Number) — [NO SRH]
    - [ON:1]
    - [OFF:0]
    - (Numeral) — [+INPUT]
    - (Numeral) — [INPUT]

▷

- Macro variables display screen
  - [MACRO] — [(OPRT)]
    - (Number) — [NO SRH]
    - (Axis name) — [INP.C.]
    - (Numeral) — [INPUT]
    - ▷
      - [PUNCH]
- Menu programming screen
  - [MENU] — [(OPRT)] — (Number) — [SELECT]
- Software operator’s panel screen
  - [OPR]

SYSTEM SCREEN Soft key transition triggered by the function key SYSTEM

1/3

SYSTEM

Parameter screen

- [PARAM] — [(OPRT)]
  - (Number) — [NO SRH]
  - [ON:1]
  - [OFF:0]
  - (Numeral) — [+INPUT]
  - (Numeral) — [INPUT]
  - ▷
  - [READ]
    - [CAN]
    - [EXEC]
    - To enter a file number: Press N, enter a file number, then press ▷, [F–SRCH], and [EXEC] on the PRGRM screen
  - [PUNCH]
    - [CAN]
    - [EXEC]
    - To enter a file number: Press N, enter a file number, then press ▷, [F–SRCH], and [EXEC] on the PRGRM screen

Diagnosis screen

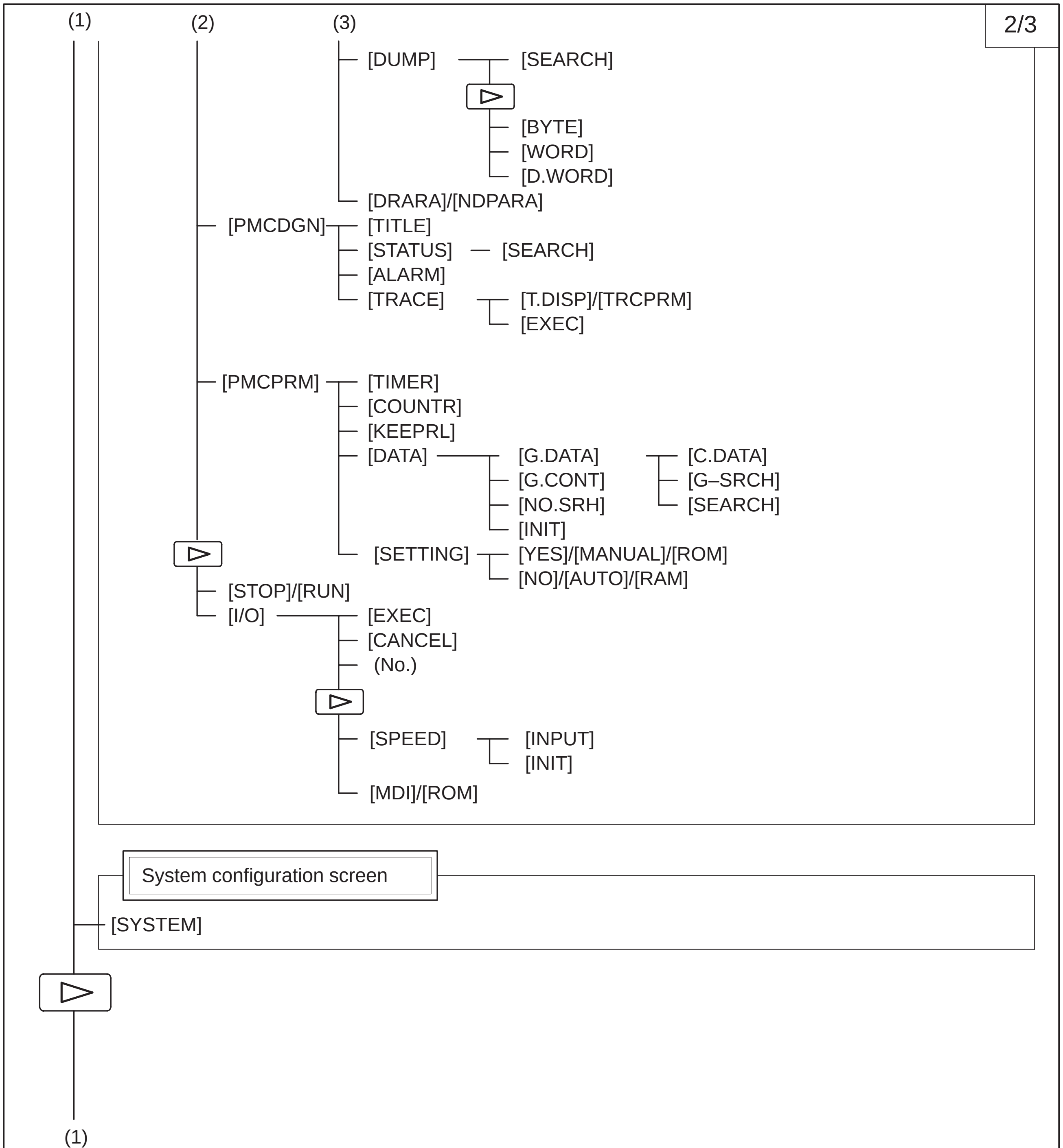
- [DGNOS] — [(OPRT)] — (Number) — [NO SRH]

PMC screen

- [PMC] (1)
  - [PMCLAD] (2)
    - [SEARCH] (3)
      - [TOP]
      - [BOTTOM]
      - [SRCH]
      - [W–SRCH]
      - [N–SRCH]
      - ▷
      - [F–SRCH]
    - [ADRESS]/[SYMBOL]
    - [TRIGER]
      - [TRGON]
      - [TRGOFF]
      - [START]
      - ▷
      - [DUMP]
        - [SEARCH]
        - ▷
        - [BYTE]
        - [WORD]
        - [D.WORD]
      - [DPARA]/[NDPARA]
      - [TRGSRC]
      - [INIT]
    - [WINDOW]
      - [DIVIDE]
      - [CANCEL]
      - [DELETE]
      - [SELECT]
      - [WIDTH]
    - ▷

(1) (2) (3)

(Continued on the next page)



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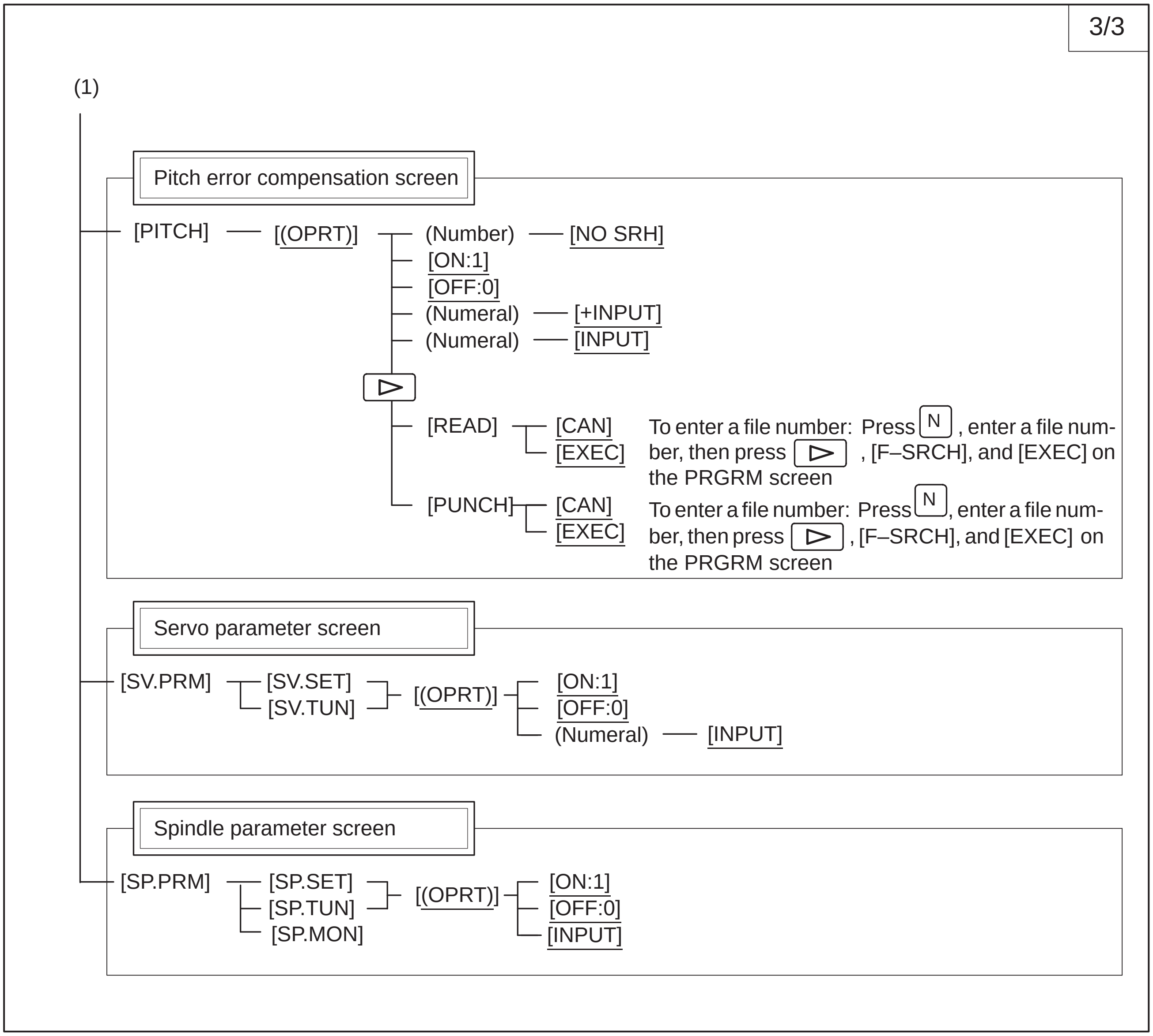

3/3
(1)
Pitch error compensation screen
[PITCH]
[(OPRT)]
(Number)
[NO SRH]
[ON:1]
[OFF:0]
(Numeral)
[+INPUT]
(Numeral)
[INPUT]
[READ]
[CAN]
[EXEC]
To enter a file number: Press N, enter a file number, then press ▷, [F–SRCH], and [EXEC] on the PRGRM screen
[PUNCH]
[CAN]
[EXEC]
To enter a file number: Press N, enter a file number, then press ▷, [F–SRCH], and [EXEC] on the PRGRM screen
Servo parameter screen
[SV.PRM]
[SV.SET]
[SV.TUN]
[(OPRT)]
[ON:1]
[OFF:0]
(Numeral)
[INPUT]
Spindle parameter screen
[SP.PRM]
[SP.SET]
[SP.TUN]
[SP.MON]
[(OPRT)]
[ON:1]
[OFF:0]
[INPUT]

MESSAGE SCREEN

Soft key transition triggered by the function key MESSAGE

MESSAGE

Alarm display screen

[ALARM]

Message display screen

[MSG]

Alarm history screen

[HISTRY] —— [(OPRT)] —— [CLEAR]

HELP SCREEN

Soft key transition triggered by the function key HELP

HELP

Alarm detail screen

[1 ALAM] —— [(OPRT)] —— [SELECT]

Operation method screen

[2 OPR] —— [(OPRT)] —— [SELECT]

Parameter table screen

[3 PARA]

1.1.2 DPL/MDI

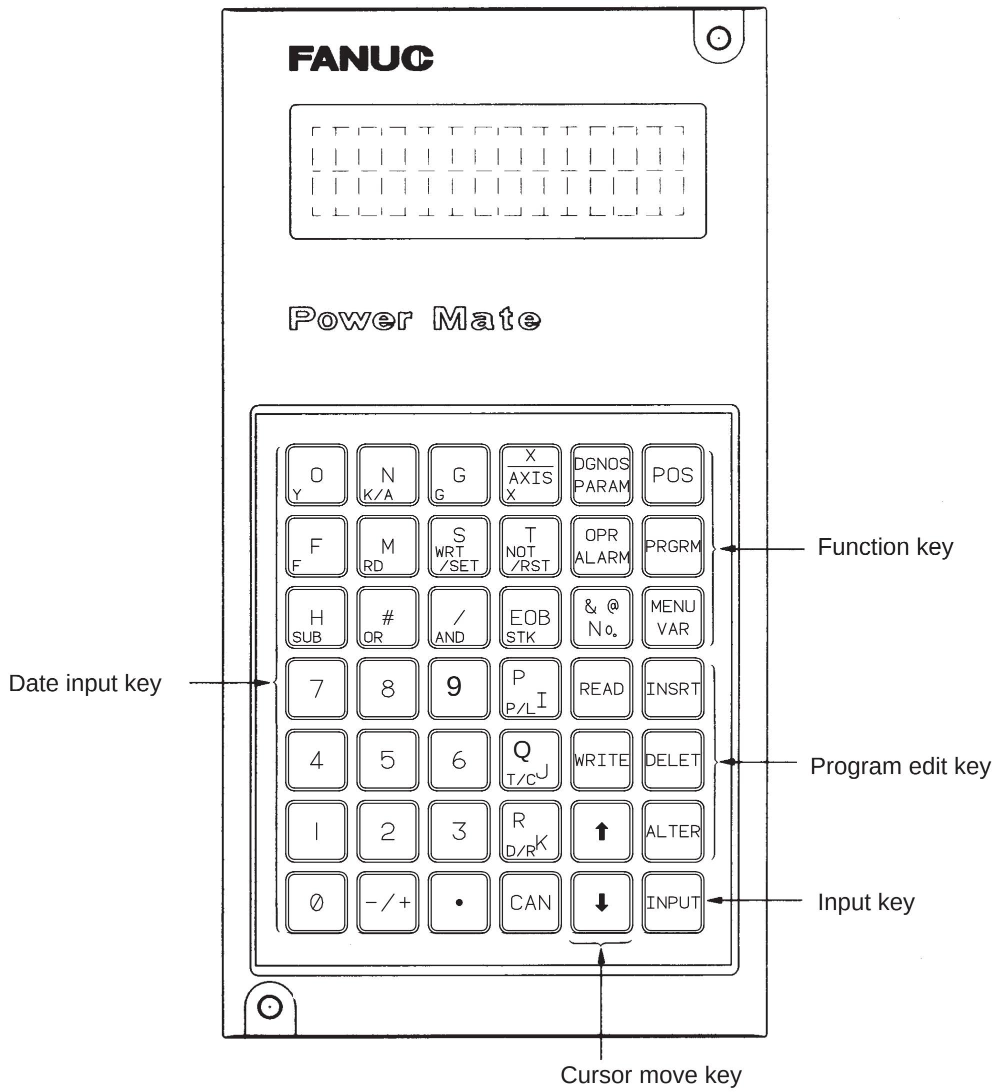


Fig.1.1.2 DPL/MDI Panel

(1) Function keys
Function keys indicate large items like chapters in a document.

Indicates the current position.

Conducts the following:
In EDIT mode ...edits and displays the program in the memory
In automatic operation ...displays command value.

Used to display offset settings and to set and display macro variables.

Used to set and display parameter, diagnostic, and PMC parameter.

[OPR ALARM]

Display of Alarm number and external message.

(2) Keyboard functions

Table 1.1.2 MDI Keyboard functions

Key	Functions
Address /numerical key	Press these keys to input alphabetic, numeric, and other characters.
INPUT ([INPUT]) key	When an address or a numerical key is pressed, the letter or the numeral is input once to the key input buffer, and it is displayed on the DPL. To input the data, press the INPUT key.
Cancel ([CAN]) key	Press this key to cancel character or sign input to the key input buffer. **(Example)** When the key input buffer displays N0001, N0001 is cancelled with this key. When an alarm is displayed, depressing CAN will reset the alarm message.
Cursor shift keys	There are two kinds of cursor shift key described below. [⬆] : This key is used to shift the cursor a short distance in the forward direction. [⬇] : This key is used to shift the cursor a short distance in the reverse direction.
READ ([READ]) key WRITE ([WRITE]) key	Press this key to actuate I/O device. Pressing a key activates the corresponding I/O device. Be careful not to press the wrong key.

(3) Caution on using the DPL/MDI

If the DPL/MDI, CRT (PDP, LCD)/MDI, and handy operator’s panel are connected at the same time, the DPL/MDI takes precedence. The CRT (PDP, LCD)/MDI and handy operator’s panel are disabled, and their functions are restricted to position display.

1.2 CONFIGURATION DISPLAY OF SOFTWARE

Both the CRT/MDI (PDP, LCD) and DPL/MDI can be used with the Power Mate–D. Only the DPL/MDI can be used with the Power Mate–F.

1.2.1 CRT/MDI

1) Upon normal start

```
8834–01                 ← Power Mate control software

      SERVO : 9060–01   ← Digital servo software
      PMC : zzzz–zz     ← PMC
```

2) When the CRT/MDI has started normally, but cannot communicate with the controller

```
*** INTELLIGENT CRT/MDI 8813/03 ***

  ROM PARITY CHECK OK
  WAITING FOR CRT DATA
```

> **NOTE**
> If nothing appears on the screen, it indicates that the CRT/MDI has failed to start.

1.2.2 DPL/MDI

1) Upon normal start

```
Power Mate–D
8834–01
```

Power Mate control software

2) When the DPL/MDI has started normally, but cannot communicate with the controller

```
ROM PARI. OK
RAM CHECK OK
```

NOTE
If nothing appears on the screen, it indicates that the DPL/MDI has failed to start.

1.3 SYSTEM CONFIGURATION SCREEN

After the system has been installed correctly, you can not display the system configuration screen. However, you can find the PCBs installed and the softwares integrated on the system configuration screen.
The Power Mate–F cannot display its system configuration.

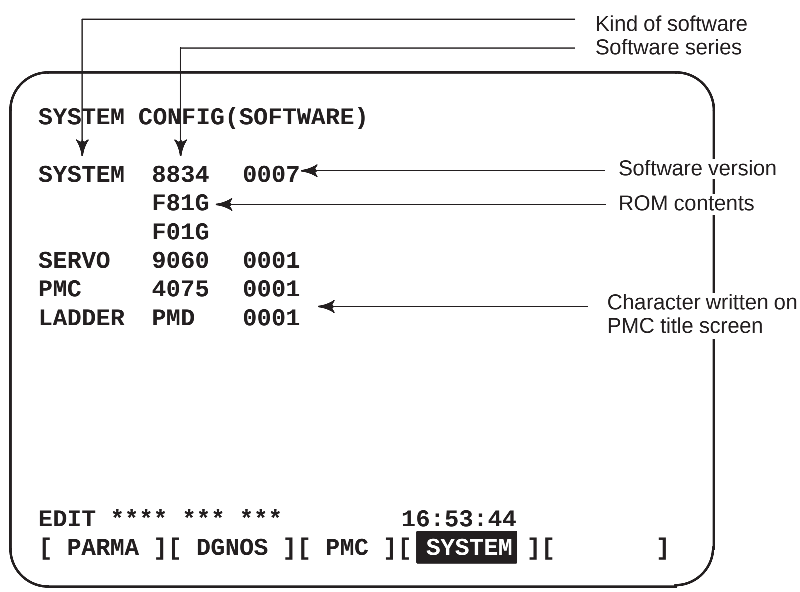
1.3.1 Display Method

(1) Press SYSTEM key.

(2) Press soft key **[system]**,then the system configuration screen is displayed.

(3) The system configuration screen is composed of two screens and each of them can be selected by the page key PAGE↑ PAGE↓.

1.3.2 Software Configuration Screen



1.3.3 Module Configuration Screen

Configuration of the modules displayed on PCB.

```
SYSTEM CONFIG(MODULE)

MODULE                    TYPE
 RAM                      256KB
                          2.5MB
                          ___
 PMC                      BIT
 SCA (CRT)                9”CRT
 SERVO  1/2               MOUNTED           (2)
 POS LSI                  MOUNTED
 (SUB BOARD               BUILT IN I/O)     Information of
                                            sub PCB
                                (1)
EDIT **** *** ***         16:53:44
[ PARMA ][ DGNOS ][ PMC ][ SYSTEM ][        ]
```

Contents of display

(1) Type of mounted module, unit, or hardware

(2) Mounted or not, or type of module or unit
Pressing the PAGE key displays the system configuration screen of other PCBs.
*Refer to ”2.4.8 Location of Modules and Internal Printed Boards” for correspondence with each module and display.

1.4 ALARM HISTORY SCREEN

1.4.1 General

Alarms generated in the Power Mate are recorded. The latest 25 alarms generated are recorded. The 26th and former alarms are deleted.

DPL/MDI can not display the alarm history screen.

The Power Mate–F is not provided with an alarm history function.

1.4.2 Screen Display

(1) Press MESSAGE key .

(2) Press soft key **[HISTRY]** and an alarm history screen is displayed.

(3) Other pages are displayed by ↑PAGE or PAGE↓ key.

```
ALARM HISTORY                          O0100 N00001

1  90. 02. 14 16:43:48
   2  010 3  IMPROPER G–CODE
   90. 02. 13 8:22:21
     500 OVER TRAVEL   : + X
   90. 02. 12 20:15:43
     417 SERVO ALARM : X AXIS DGTL PARAM




   AUTO **** *** ***                   19:47:45

[ ALARM ][ MSG ][ HISTORY ][       ][ (OPRT) ]
```

1 The date the alarm was issued
2 Alarm No.
3 Alarm message (some contains no message)

1.4.3 Clearing Alarm History

(1) Press soft key **[(OPE)]**.

(2) Press soft key **[(CLEAR]**, then the alarm history is cleared.

1.4.4 Display of Special Alarms

- **Alarms generated by custom macro**

Alarm numbers are 3000s and the messages are all ”MACRO ALARM”.
(Ex) #3000=1(ERROR)⇒”3001 MACRO ALARM”.

- **Alarms generated by DISP or DISPB instruction of PMC.**

Alarms of 1000s and the message is all ”EXTERNAL ALARM”.
(Ex) DISP instruction A000.0 1000 ERROR1⇒”1000 EXTERNAL ALARM”

1.5 HELP FUNCTION

1.5.1 General

The help function displays alarm information, operation method and a table of contents for parameters. This function is used as a handbook.

DPL/MDI can not use the help function.

The Power Mate–F is not provided with a help function.

1.5.2 Display Method

- **Display of help screen**

Press HELP key on any screen other than PMC screen, then a help screen appears.

```
HELP (INITIAL MENU)              O1234 N12345

             *****   HELP   *****
           1. ALARM DETAIL
           2. OPERATION METHOD
           3. PARAMETER TABLE









EDIT * * * *   * * *   * * *      00:00:00
[1 ALAM]  [2 OPE]  [3 PARA]  [     ]  [     ]
```

(However, it is not available when PMC screen or CUSTOM screen is displaying)

- **Help for alarm**

(1) When an alarm is generated, press soft key **[1 ALAM]**, then a help message of the alarm is displayed.

```
HELP (INITIAL MENU)              O1234 N12345

NUMBER     : 010
M'SAGE  : IMPROPER G CODE
FUNCTION  :
ALARM  :
  A G CODE NOT LISTED IN G-CODE TABLE
  IS BEING COMMANDED
  ALSO G-CODE FOR FUNCTION NOT ADDED
  IS BEING COMMANDED



>_
EDIT * * * *   * * *   * * *      00:00:00
[1  ALAM]  [2 OPE]  [3 PARA] [     ] [ OPRT ]
```

(2) Pressing soft key **[OPRT]**,(alarm No.), and soft key **[SELECT]** in this order, a help message corresponding to the input alarm number is displayed.

- **Help for operation**

(1) Press **[2 OPR]**, then a menu for operation method is displayed.

```
HELP (OPERATION METHOD)          O1234 N12345

1. PROGRAM EDIT
2. SEARCH
3. RESET
4. DATA INPUT WITH MDI
5. DATA INPUT WITH TAPE
6. OUTPUT
7. INPUT WITH FANUC CASSETTE
8. OUTPUT WITH FANUC CASSETTE
9. MEMORY CLEAR



>_
EDIT * * * *  * * *  * * *      00:00:00
[1 ALARM]  [2 OPR]  [3 PARA]  [ OPRT ]
```

(2) Press **[OPRT]**, (an item number) and soft key **[SELECT]**, then an operation method of the item is displayed.

Pressing PAGE key  or  displays another pages.

```
HELP (OPERATION METHOD)          O1234 N12345
<<1.PROGRAM EDIT>>                   1/4
DELETE ALL PROGRAMS
  MODE :EDIT
  SCREEN:PROGRAM
  OPR  :(0–9999) – (DELETE)

DELETE ONE PROGRAM
  MODE : EDIT
  SCREEN: PROGRAM
  OPR  :(0+PROGRAM NUMBER) – <DELETE>


>_
EDIT * * * *  * * *  * * *      00:00:00
[    ]  [    ]  [    ]  [    ]  [SELECT]
```

Current page/ Total page

- **Parameter table**

Press soft key **[3 PARA]**, then a parameter table is displayed.

```
HELP (PARAMETER TABLE)               O1234 N12345
                                              1/3
·SETTING                             (NO.0000~ )
·READER/PUNCHER INTERFACE            (NO.0100~ )
·AXIS CONTROL/SETTING UNIT           (NO.1000~ )
·COORDINATE SYSTEM                   (NO.1200~ )
·STROKE LIMIT                        (NO.1300~ )
·FEED RATE                           (NO.1400~ )
·ACCEL/DECELERATION CTRL             (NO.1600~ )
·SERVO RELATED                       (NO.1800~ )
·DI/DO                               (NO.3000~ )



EDIT **** *** ***                 00:00:00
[1 ALAM ][2 OPR ][ 3 PARA ] [      ][SELECT]
```

Current page/ Total page

Another screen can be selected by the PAGE key PAGE or PAGE.

1.6 DISPLAYING DIAGNOSTIC PAGE

1.6.1 Displaying of CRT/MDI

The Power Mate–D uses the CRT/MDI for diagnosis display, while the Power Mate–F uses the DPL/MDI.

(1) Press SYSTEM key on the CRT/MDI.

(2) Press soft key **[DGN]**, then a diagnostic screen is displayed.

1.6.2 Displaying of DPL/MDI

(1) Press the DGNOS PARAM key to select the diagnosis screen.

When PMC data is displayed, operate & @ No. → Number → INPUT in turn.

```
>  @0001        0
   @0002        1
```

Following are display methods in the diagnostic screen of PMC data.

(2) Press the key of the PMC address to be displayed.
(Use the bottom left address of the key.)

```
>  @0001        0
   D_           0
```

Example: Display the address data for D0100

(3) Enter the number of the PMC address to be displayed.

```
>  @0001        0
   D0100
```

(4) Press the INPUT key.

```
>  D0100        000000000
   D0100        000001010
```

By pressing the ⬆ and ⬇ keys, the cursor can be moved within the PMC address being displayed.

1.6.3 Contents Displayed (Common)

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

000 WAITING FOR FIN SIGNAL	An M/S/T function is being executed.
001 MOTION	Travel command of cycle operation is being executed.
002 DWELL	Dwell is being executed.
003 IN–POSITION CHECK	In–position check is being done.
004 FEEDRATE OVERRIDE 0%	Feedrate override is 0%.
005 INTERLOCK/START LOCK	Interlock is input.
006 SPINDLE SPEED ARRIVAL CHECK	The unit is waiting for spindle speed signal SAR (G029#4) to become ”1”.
007 WAITING FOR CHASER OPEN OR CLOSE	The unit is waiting for the chaser tool to be opened or closed.
010 PUNCHING	Data is being output through reader/puncher interface.
011 READING	Data is being input through reader/puncher interface.
013 JOG FEEDRATE OVERRIDE 0%	Jog override is 0%.
014 WAITING FOR RESET, ESP,RRW OFF	Power Mate is in reset state.
015 EXTERNAL PROGRAM NUMBER SEARCH	External Program Number Search

- **Cause of the cycle start LED turned off**

020 CUT SPEED UP/DOWN	1	0	0	0	1	0	0
021 RESET BUTTON ON	0	0	1	0	0	0	0
022 RESET AND REWIND ON	0	0	0	1	0	0	0
023 EMERGENCY STOP ON	1	0	0	0	0	0	0
024 RESET ON	1	1	1	1	0	0	0
025 STOP MOTION OR DWELL	1	1	1	1	1	1	0

Input of emergency stop signal
Input of external reset signal
Reset button On of MDI
Input of reset & rewind
Servo alarm generation
Switching to other mode, Feed hold
Single block stop

- **State of TH alarm**

030 CHARACTER NUMBER TH ALARM	Position of the character that caused TH alarm. The position is counted from the head.
031 TH DATA	Data of the character that caused TH alarm.

- **Detail of Alarm 350 of serial pulse coder**

	Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN	0202		CSA	BLA	PHA	RCA	BZA	CKA	SPH

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

- **Detail of Alarm 351 of serial pulse coder**

	Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN	0203	DTE	CRC	STB					

#7(DTE): Communication failure of serial pulse coder.
There is no response for communication.
#6(CRC): Communication failure of serial pulse coder.
Transferred data is erroneous.
#5(STB): Communication failure of serial pulse coder.
Transferred data is erroneous.

- **Details of digital servo alarm 414**

	Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN	0200	OVL	LV	OVC	HCA	HVA	DCA	FBA	OFA

#7(OVL): Overload alarm (Refer to DGN 201)
#6(LV) : Insufficient voltage alarm
#5(OVC): Over current alarm
#4(HCA): Abnormal current alarm
#3(HVA): Overvoltage alarm
#2(DCA): Discharge alarm
#1(FBA): Disconnection alarm (Refer to DGN 201)
#0(OFA): Overflow alarm

	Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN	0201	ALD			EXP				

Overload alarm	0	–	–	–	Motor overheat
	1	–	–	–	Amplifier overheat
Disconnection alarm	1	–	–	0	Built–in pulse coder (hard)
	1	–	–	1	Disconnection of separated type pulse coder (hard)
	0	–	–	0	Disconnection of pulse coder (software)

Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN 0204		OFS	MCC	LDA	PMS			

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

- **Position error amount**

Address	
DGN 0300	Position error of an axis in detection unit

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

- **Machine position**

Address	
DGN 0301	Distance from reference position of an axis in detection unit

- **Serial spindle**

Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN 0400				SAI		SSR	POS	SIC

This data indicates the offset data received by the CNC while it is calculating the machine coordinates.

#4(SAI) 0 : Spindle analog control is not used.
1 : Spindle analog control is used.

#2(SSR) 0 : Spindle serial control is not used.
1 : Spindle serial control is used.

#1 (POS) A module required for spindle analog control is
0 : not mounted
1 : mounted

#0 (SIC) A module required for spindle serial control is
0 : not mounted
1 : mounted

Address	
DGN 0401	Serial spindle alarm state of 1st spindle

Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN 0408	SSA		SCA	CME	CER	SNE	FRE	CRE

#0 (CRE): A CRC error occurred. (Warning)
#1 (FRE): A framing error occurred. (Warning)
#2 (SNE): The transmission/reception target is invalid.
#3 (CER): An error occurred during reception.
#4 (CME): No response was returned during automatic scanning.
#5 (SCA): A communication alarm occurred on the spindle amplifier side.
#7 (SSA): A system alarm occurred on the spindle amplifier side.
(These problems cause spindle alarm 749. Such problems are mainly caused by noise, disconnection, or instantaneous power–off).

	Address	#7	#6	#5	#4	#3	#2	#1	#0
DGN	0409					SPE		S1E	SHE

Refer to this diagnosis when alarm 750 has generated.

#3 (SPE) In spindle serial control serial spindle parameters

0 : Satisfy start condition of spindle unit
1 : Do not satisfy start condition of spindle unit

#1 (S1E) 0 : 1st spindle started normally in spindle serial control.

1 : 1st spindle did not start normally in spindle serial control.

#0 (SHE) 0 : The module needed for spindle serial control on the CNC side is normal.

1 : An abnormal condition occurred in the module needed for spindle serial control on the CNC side.

DGN	0410	Load meter of 1st spindle [%]
DGN	0411	Speed meter of 1st spindle [%]
DGN	0417	Feedback information of 1st spindle position coder
DGN	0418	Position error of 1st spindle position loop mode

- **Diagnostic data related to rigid tapping**

DGN	450	Spindle position error during rigid tapping

[Data type] Word
[Unit of data] Detection units

DGN	451	Spindle distribution during rigid tapping

[Data type] Word
[Unit of data] Detection units

DGN	454	Accumulated spindle distribution during rigid tapping

[Data type] Two–word
[Unit of data] Detection units

1.6.4 Contens Displayed (DPL/MDI)

The system configuration screen and the state display etc. are not prepared on the DPL/MDI.

With the CRT/MDI, the following numbers cannot be used for reference.

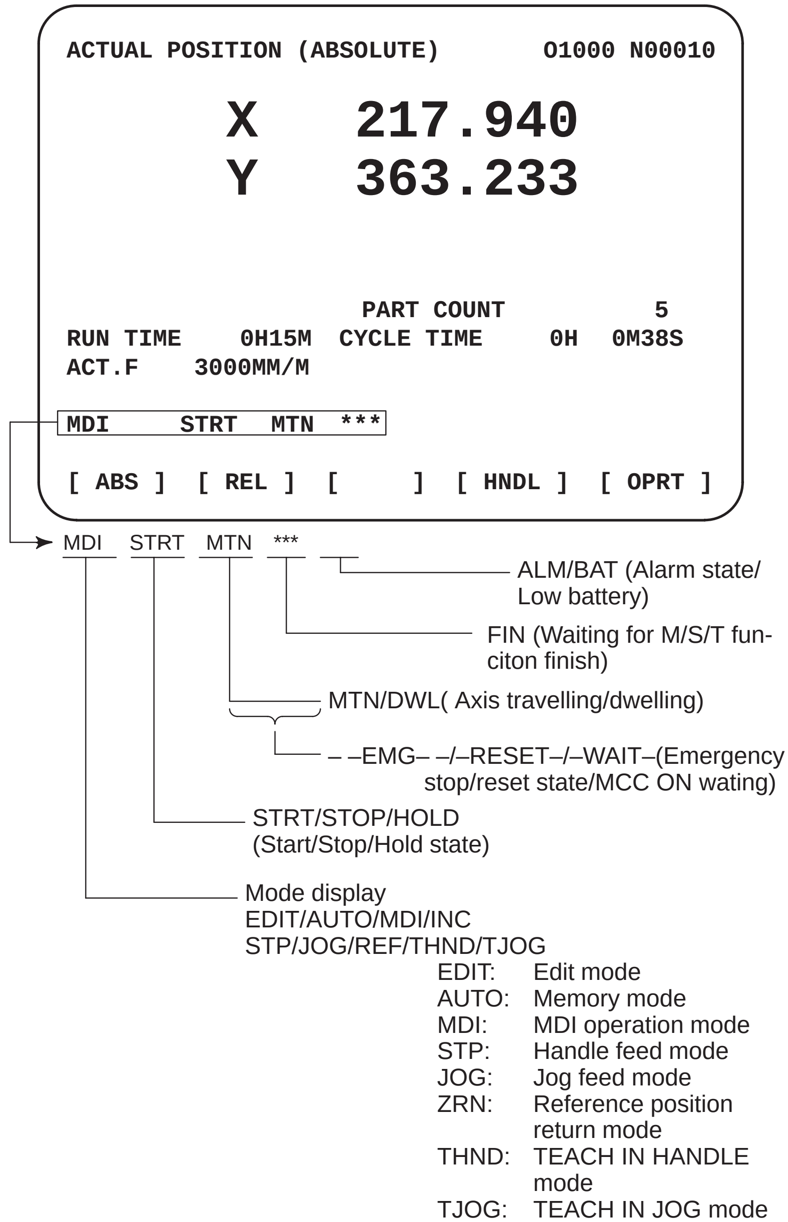
Therefor, see the following diagnostic number.

Diagnostic No.		Unit
800	Relative coordinates	Least input increment
801	Skip position	Least input increment
802	Remaining travel	(Least input increment)/2
803	Acceleration/deceleration accumulation	Detection unit
804	Ending position of previous block	(Least input increment)/2
810	Number of program being executed	
811	Number of sequence being executed	
820	Group 01 G–code	
821	Group 02 G–code	
822	Group 03 G–code	
823	Group 05 G–code	
824	Group 06 G–code	
825	Group 08 G–code	
826	Group 09 G–code	
827	Group 10 G–code	
830	F–code being executed	Unit: 0.001 mm/min or 0.00001 inch/m (When no decimal point is entered, units are 1 mm/min or 0.01 inch/min.)
831	Actual feedrate	Unit: mm/min, deg/min, or 0.01 inch/min
832	Actual spindle speed	Unit: rpm
833	Corrected version of a value input using the analog input function	Unit: 10mV
840	Number of registered blocks	Unit: Blocks
841	Amount of memory used by program	Unit: Characters
850	ROM series No. of NC system (Example) 8834	
851	ROM version No. of NC system (Example) 01, 02, etc.	
852	Operation mode (Example) AUTO, JOG, STEP, EDIT, etc.	
853	Servo system series No. (Example) 9060	
854	Servo system version No. (Example) 09, 10, etc.	
855	PMC system series No. (Example) 4075	

856 PMC system version No. (Example) 01, 02, etc.
857 Ladder program No.
(Example) FL01
858 Ladder program version No.
(Example) 01, 02, etc.
859 System RAM size
(Example) 256K, 512K
860 PMC module
(Example) BIT (PMC–PA1 compatible),
PMP (PMC–PA3 compatible)
861 Sub PCB
(Example) BIN (built–in I/O card)

1.7 POWER MATE STATE DISPLAY

See the diagnostic screen for the DPL/MDI of the Power Mate–D or Power Mate–F.



1.8 OPERATION HISTORY

This function displays the key and signal operations performed by the NC operator upon the occurrence of a fault or the output of an NC alarm, together with the corresponding NC alarms.
Operation history information cannot be displayed on the DPL/MDI. The Power Mate–F is not provided with an operation history function.

This function records the following data:

(1) MDI key operations performed by the NC operator

(2) Status changes (ON/OFF) of input and output signals (selected signals only)

(3) Details of NC alarms

(4) Time stamp (date and time)

1.8.1 Screen Display

- **Displaying the operation history**

(1) Press the SYSTEM function key.

(2) Press the continue menu key [▷]. The **[OPEHIS]** (operation history) soft key are displayed.

(3) Press the **[OPEHIS]** soft key twice. The operation history screen is displayed.

```
OPERATION HISTORY                      O1234 N12345
                                         Page : 123
  No.DATA         No.DATA         No.DATA
  01 92/06/03     11 F0000.7↑     21 F0001.0↓
  02 08:40:00     12 F0000.5↑     22 <POS>
  03 <DELETE>     13 F0001.0↑     23 <PROG>
  04 F0000.6↑     14 F0000.5↓     24 <RESET>
  05 MEM          15 P/S0010      25 EDIT
  06 G0009.0↑     16 92/06/03     26 O
  07 G0009.1↑     17 09:27:49     27 1
  08 G0009.2↑     18 <PROG>       28 2
  09 ST↑          19 <RESET>      29 3
  10 ST↓          20 F0000.7↓     30 4

EDIT ****   ***  ***              08:20:52
[  TOP  ][ BOTTOM ][       ][       ][PG.SRH]
```

On the operation history screen, the soft keys are configured as shown below:

⇒ [▷] [PARAM] [DGNOS] [PMC] [SYSTEM] [(OPRT)][▷]
⇓push
[◁] [W.DGNS] [ ] [ ] [OPEHIS] [(OPRT)][▷]
⇓ push
[◁] [OPEHIS] [SG–SEL] [ ] [ ] [(OPRT)][▷]
⇓push
[◁] [TOP] [BOTTOM] [ ] [ ] [PG.SRH] [▷]

(4) To display the next part of the operation history, press the page down key PAGE ↓ . The next page is displayed.

To display the interface between two pages, press cursor key → or ← . The screen is scrolled by one row.

These soft keys can also be used:

1) Pressing the **[TOP]** soft key displays the first page (oldest data).
2) Pressing the **[BOTTOM]** soft key displays the last page (latest data).
3) Pressing the **[PG.SRH]** soft key displays a specified page.

Example) By entering 50 then pressing the **[PG.SRH]** key, page 50 is displayed.

Data displayed on the operation history screen

(1) MDI keys

Address and numeric keys are displayed after a single space.
Soft keys are displayed in square brackets ([]).
Other keys (RESET/INPUT, for example) are displayed in angle brackets (<>).
A key pressed at power–on is displayed in reverse video.

1) Function key: <POS>, <PROG>, <OFFSET>, etc.
2) Address/numeric key: A to Z, 0 to 9, ; (EOB), +, –, (, etc.
3) Page/cursor key: <PAGE ↑>, <CUR↓>, <CUR←>
4) Soft key: [SF1], [SF2], etc.
5) Other key: <RESET>, <CAN>, etc.
6) Key pressed at power–on: **<RESET>**

(2) Input and output signals

General signals are displayed in the following format:

G 0 0 0 0 . 7 ↑

The ↑ mark indicates that the signal is turned on.
The ↓ mark indicates that the signal is turned off.
Indicates the bit.
Indicates the address.

Some signals are indicated by their symbol names.

SBK ↑ (Indicates that the single block switch is turned on.)

Mode selection signals and rapid traverse override signals are displayed as indicated below:

Input signal					Name displayed
MD1	ND2	MD4	ZRN	DNCI	
0	0	0	0	0	MDI
1	0	0	0	0	MEM
1	0	0	0	1	RMT
0	1	0	0	0	NOMODE
1	1	0	0	0	EDT
0	0	1	0	0	H/INC
1	0	1	0	0	JOG
1	0	1	1	0	ZRN
0	1	1	0	0	TJOG
1	1	1	0	0	THND

Input signal		Name displayed
RV1	RV2	
0	0	R 100%
1	0	R 50%
0	1	R 25%
1	1	R F0%

(3) NC alarms

NC alarms are displayed in reverse video.

P/S alarms, system alarms, and external alarms are displayed together with their numbers.

For other types of alarms, only the alarm type is displayed. (No details are displayed.)

Example) **P/S0050, SV_ALM**

(4) Time stamp (date and time)

The following time data (date and time) is recorded:

1) Date and time of power–on

2) Date and time of power–off

3) Date and time when an NC alarm occurs

(a) The power–on time is displayed as shown below:
92/01/20 ==== Year/Month/Day
09:15:30 ==== Hour:Minute:Second

(b) The power–off time and the time when an NC alarm occurred are displayed in reverse video.
92/01/20 ==== Year/Month/Day
09:15:30 ==== Hour:Minute:Second
If a system alarm occurs, the date and time are not recorded.

- **Input signal or output signal to be recorded in the operation history**

(1) P ress the SYSTEM function key.

(2) Press the continue menu key ▷. The **[OPEHIS]** (operation history) soft key is displayed.

(3) Press the **[OPEHIS]** soft key, then press the **[SG–SEL]** soft key. The operation history signal selection screen is displayed.

```
OP_HIS SIGNAL SELECT              O1000 N02000

  No.  ADDRES  SIGNAL    No.  ADDRES  SIGNAL
  01   X0000   00001000  11   G0000   00000001
  02   X0004   10000000  12   G0004   00000011
  03   X0008   00001100  13   G0008   00000111
  04   X0009   00111000  14   G0003   00001111
  05   X0012   00001111  15   G0043   01100000
  06   Y0000   01000000  16           ********
  07   Y0004   00110000  17           ********
  08   Y0007   00011100  18           ********
  09   Y0008   00011100  19           ********
  10   Y0010   00011100  20           ********
  >
    EDIT  **** *** * * *  00:00:00
[OPEHIS] [SG–SEL] [       ] [       ] [ (OPRT) ]
```

1.8.2 Setting the Input Signal or Output Signal to be Recorded in the Operation History

(1) On the operation history signal selection screen, press the **[(OPRT)]** soft key.

```
OP_HIS SIGNAL SELECT            O1000 N02000

  No.  ADDRES SIGNAL    No.  ADDRES SIGNAL
  01   G0004  00000010  11          ********
  02          ********  12          ********
  03          ********  13          ********
  04          ********  14          ********
  05          ********  15          ********
  06          ********  16          ********
  07          ********  17          ********
  08          ********  18          ********
  09          ********  19          ********
  10          ********  20          ********
  >
    EDIT **** *** *** *** 00:00:00
[ ALLDEL ][ DELETE ][ ON:1 ][ OFF:0 ][        ]
```

(2) Press the cursor key ↑ or ↓ to position the cursor to a desired position.

(3) Key in a signal type (X, G, F, or Y) and an address, then press the INPUT key.

Example) G0004 INPUT

Signal address G0004 is set in the ADDRES column. The corresponding position in the SIGNAL column is initialized to 000000000.

(4) Select the bit to be recorded.

To select all bits of the specified signal address, press the **[ON:1]** soft key while the cursor is positioned to 00000000 .

To select a particular bit, position the cursor to that bit by pressing the cursor key ← or →, then press the **[ON:1]** soft key. To cancel a selection made by pressing the **[ON:1]** soft key or to cancel a previously selected signal, press the **[OFF:0]** soft key.

(5) Up to 20 addresses can be specified by means of this signal selection. These addresses need not always be specified at consecutive positions, starting from No.1.

(6) Pressing the **[ALLDEL]** and **[EXEC]** soft keys deletes all data. If the **[ALLDEL]** key is pressed by mistake, it can be cancelled by pressing the **[CAN]** key.

(7) To delete a selected signal address, position the cursor to the corresponding position then press the **[DELETE]** and **[EXEC]** soft keys. In the SIGNAL column, asterisks ******** are displayed in place of the deleted data. In the ADDRES column, the corresponding position is cleared.
If the **[DELET]** key is pressed by mistake, it can be cancelled by pressing the **[CAN]** key.

(8) Pressing the return menu key [◁] causes the **[OPEHIS]** (operation history) soft key to be displayed again.

- **Input signals and output signals to be recorded in the history**

> **NOTE**
> 1 A cross (×) indicates that a signal will not be recorded. Also, any signal for which an address is not specified will not be recorded, either.
> 2 A circle (○) indicates that a signal can be recorded.
> 3 A signal indicated by its symbol name will also be displayed by its symbol name.

1. M/T addresses

MT→PMC

	#7	#6	#5	#4	#3	#2	#1	#0
X000	○	○	○	○	○	○	○	○
~								
X127	○	○	○	○	○	○	○	○

PMC→CNC

	#7	#6	#5	#4	#3	#2	#1	#0
G000	○	○	○	○	○	○	○	○
~								
G003	○	○	○	○	○	○	○	○
G004	○	○	○	○	FIN	○	○	○
G005	○	○	○	○	TFIN	SFIN	○	MFIN
G006	○	○	○	○	○	*ABS	○	○
G007	RLSOT	○	*FLUP	○	○	ST	○	○
G008	ERS	RRW	*SP	*ESP	○	○	○	*IT
G009	○	○	○	○	○	○	○	○
~								
G018	○	○	○	○	○	○	○	○
G019	RT	○	○	○	○	○	○	○
G020	○	○	○	○	○	○	○	○
~								
G042	○	○	○	○	○	○	○	○
G043	○	×	○	×	×	○	○	○
G044	○	○	○	○	○	○	MLK	BDT1
G045	BDT9	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
G046	DRN	KEY4	KEY3	KEY2	KEY1	○	SBK	○
G047	○	○	○	○	○	○	○	○
~								
G060	○	○	○	○	○	○	○	○
G061	○	○	○	○	○	○	○	RGTA
G062	○	○	○	○	○	○	○	○
~								
G099	○	○	○	○	○	○	○	○
G100	○	○	○	○	○	○	+J2	+J1

	#7	#6	#5	#4	#3	#2	#1	#0
G101	○	○	○	○	○	○	○	○
G102	○	○	○	○	○	○	–J2	–J1
G103	○	○	○	○	○	○	○	○
≀								
G105	○	○	○	○	○	○	○	○
G106	○	○	○	○	○	○	MI2	MI1
G107	○	○	○	○	○	○	○	○
G108	○	○	○	○	○	○	MLK2	MLK1
G109	○	○	○	○	○	○	○	○
G110	○	○	○	○	○	○	+LM2	+LM1
G111	○	○	○	○	○	○	○	○
G112	○	○	○	○	○	○	–LM2	–LM1
G113	○	○	○	○	○	○	○	○
≀								
G125	○	○	○	○	○	○	○	○
G126	○	○	○	○	○	○	SVF2	SVF1
G127	○	○	○	○	○	○	○	○
≀								
G129	○	○	○	○	○	○	○	○
G130	○	○	○	○	○	○	*IT2	*IT1
G131	○	○	○	○	○	○	○	○
G132	○	○	○	○	○	○	+MIT2	+MIT1
G133	○	○	○	○	○	○	○	○
G134	○	○	○	○	○	○	–MIT2	–MIT1
G135	○	○	○	○	○	○	○	○
≀								
G255	○	○	○	○	○	○	○	○

PMC→MT

	#7	#6	#5	#4	#3	#2	#1	#0
Y000	○	○	○	○	○	○	○	○
~								
Y127	○	○	○	○	○	○	○	○

CNC→PMC

	#7	#6	#5	#4	#3	#2	#1	#0
F000	○	○	○	○	○	○	○	○
~								
F255	○	○	○	○	○	○	○	○

1.8.3 Notes

(1) While the operation history screen is displayed, no information can be recorded to the history.

(2) An input signal having an on/off width of up to 16 msec is not recorded in the history. Some signals are not recorded in the history.

(3) Once the storage becomes full, old data is deleted, starting from the oldest record. Up to about 8000 key information items can be recorded.

(4) The recorded data is retained even after the power is turned off. A memory all clear operation, however, erases the recorded data.

(5) Set the date and time on the setting screen.

1.9 LIST OF OPERATIONS (CRT/MDI)

Classification	Function	KEY SW	SETTING PWE = 1	Mode	Function key	Operation
Reset	Resetting the operating time			–	POS	[(OPRT)] [TIME: 0] → [EXEC]
	Resetting the number of machined parts			–	POS	[(OPRT)] [TIME: 0] → [EXEC]
	Resetting the OT alarm			When the power is on	–	O P and CAN
	Resetting alarm 100			–	–	CAN and RESET
Data input from the MDI	Inputting parameters		○	MDI or emergency stop	SYSTEM (PARAM)	Parameter No. → [NO.SRH] → Data → INPUT → PWE = 0 → RESET
	Inputting offset data	○		–	OFFSET	Offset No. → [NO.SRH] → Offset value → INPUT
	Inputting setting data	○		MDI	SETTING	Setting No. → [NO.SRH] → Data → INPUT
	Inputting PMC parameters (for the counter and data table)	○		MDI or emergency stop	SYSTEM (PMC)	[PMCPRM] → [COUNTR] [DATA] → Data → INPUT
	Inputting PMC parameters (for the timer and keep relay)		○			[PMCPRM] → [TIMER] [KEEPRL] → Data → INPUT
Data input from external I/O units	Inputting parameters		○	EDIT or emergency stop	SYSTEM (PARAM)	[(OPRT)] → [▷] → [READ] → [EXEC]
	Inputting PMC parameters or ladder program		○	Emergency stop	SYSTEM (PMC)	[▷] → [I/O]→ (CANNEL NO) INPUT → (DEVICE NAME) [FDCAS] → (KIND OF DATA) [PARAM] → [READ] → (FILE NO) File No . INPUT → [EXEC]
	Inputting offset data	○		EDIT	OFFSET	[(OPRT)] → [▷] → [READ] → [EXEC]
	Inputting programs	○		EDIT	PROG	[(OPRT)] → [▷] → [READ] → [EXEC]
Data output to I/O units	Outputting parameters			EDIT	SYSTEM (PARAM)	[(OPRT)] → [▷] → [PUNCH] → [EXEC]
	Outputting PMC parameters			EDIT	SYSTEM (PMC)	[Continuous menu key] → [I/O]→ (CANNEL NO) INPUT → (DEVICE NAME) [FDCAS] → (KIND OF DATA) [PARAM] → [WRITE] → (FILE NO) INPUT [EXEC]
	Outputting ladder program			EDIT	SYSTEM (PMC)	[Continuous menu key] → [I/O]→ (CANNEL NO) INPUT → (DEVICE NAME) [FDCAS] → (KIND OF DATA) [LADDER] → [WRITE] → (FILE NO) INPUT [EXEC]
	Outputting offset data			EDIT	OFFSET	[(OPRT)] → [▷] → [PUNCH] → [EXEC]

Classifi-cation	Function	KEY SW	SETTING PWE = 1	Mode	Function key	Operation
Data output to I/O units	Outputting all the programs			EDIT	PROG	O P → –9999 → [▷] → [PUNCH] → [EXEC]
	Outputting one program			EDIT	PROG	O P → Program No. → [▷] → [PUNCH] → [EXEC]
Search	Searching for a program number			AUTO or EDIT	PROG	O P → Program No. → [O SRH]
	Searching for a sequence number			AUTO	PROG	Program No. search → N Q → Sequence No. → [N SRH]
	Searching for an address word			EDIT	PROG	Data to be searched for → [SRH↑] or [SRH ↓]
	Searching for an address only			EDIT	PROG	Address to be searched for → [SRH↑] or [SRH ↓]
	Searching for an offset number			–	OFFSET	Offset No. → [NO.SRH]
	Searching for a diagnosis number			–	SYSTEM (DGNOS)	Diagnosis No. → [NO.SRH]
	Searching for a parameter number			–	SYSTEM (PARAM)	Parameter No. → [NO.SRH]
Edit	Displaying the amount of memory used			EDIT	PROG	[LIBRARY]
	Deleting all the programs	○		EDIT	PROG	O P → –9999 → DELETE
	Deleting one program	○		EDIT	PROG	O P → Program No. → DELETE
	Deleting some blocks	○		EDIT	PROG	N Q → Sequence No. → DELETE
	Deleting one block	○		EDIT	PROG	EOB → DELETE
	Deleting a word	○		EDIT	PROG	Searching for the word to be deleted → DELETE
	Changing a word	○		EDIT	PROG	Searching for the word to be changed → New data → ALTER
	Inserting a word	○		EDIT	PROG	Searching for the word immediately before the word to be inserted → New data → INSERT
Verify	Verifying the memory			EDIT	PROG	[(OPRT)] → [▷] → [READ] → [EXEC]
Input/output with the PMC off–line programmer (P–G, P–G Mate, personal computer FAPT LADDER)	Ladder program input/output			–	SYSTEM (PMC)	[▷] → [I/O] →(CHANEL NO) I INPUT → (DEVICE NAME) [HOST] → [EXEC] →Manipulation on the HOST side Input/output is discriminated automatically by manipulation on the HOST side.
Input/output to/from the FANUC Cassette	Searching a file for its beginning			EDIT	PROG	N Q → FILE No. → [▷] → [F SRH] → [EXEC]
	Deleting a file	○		EDIT	PROG	N Q → FILE No. → [▷] → [F DELETE] → [EXEC]
	Inputting a program	○		EDIT	PROG	N Q → FILE No. → [▷] → [READ] → [EXEC]

Classifi- cation	Function	KEY SW	SETTING PWE = 1	Mode	Function key	Operation
Input/ output to/ from the FANUC Cassette	Outputting all the programs			EDIT	PROG	O P → –9999 → [▷] → [PUNCH] → [EXEC]
	Outputting one program			EDIT	PROG	O P → Program No. → [▷] → [PUNCH] → [EXEC]
	Verifying a program			EDIT	PROG	Searching a file for its beginning → O P → Program No. → [(OPRT)] → [▷] → [READ] → [EXEC]
Playback	Creating NC program			TEACH-IN JOG/ HANDLE	PROG	Move the machine. → X U , Y V → INSERT → NC data → INSERT → EOB INSERT
Input/out- put with the memory card	Output to the memory card			EDIT	PRGRM	Emergency stop→ M I →[▷]→ [PUNCH] →[EXEC]
	Input of all data		○	EDIT or MDI	PRGRM	Emergency stop→ M I →[▷]→ [READ] →[EXEC]
	Input of all data (for a 2–path Power Mate–D)		○	EDIT or MDI for both Power Mate–D units	PRGRM	Emergency stop→ M I → SHIFT → 2 → [▷]→[READ]→[EXEC]
	Input of individual data items		○	EDIT	PRGRM	Emergency stop→ M I → [Data type] → [▷]→[READ]→[EXEC]
Clear	Memory all clear			When the power is on	–	RESET AND DELETE
	Parameters/offset clear		○	When the power is on	–	RESET
	Program clear		○	When the power is on		DELETE
	Alarm P/S 101 clear			–	–	PROG AND RESET
	Ladder program end PMC parameter clear			When the power is on	–	X U AND O P
	Memory all clear (for 1st path)			When the power is on	–	1 AND CAN
	Memory all clear (for 2nd path)			When the power is on	–	2 AND CAN
	Parameters/offset clear (for 1st path)		○	When the power is on	–	1 AND RESET
	Parameter/offset clear (for 2nd path)		○	When the power is on	–	2 AND RESET
	Program clear (for 1st path)			When the power is on	–	1 AND DELET
	Program clear (for 2nd path)			When the power is on	–	2 AND DELET

NOTE

1 After completion of ladder program input the power must be turned on again because the Ladder program is in halt state.

2 The above operating procedure also applies to the LCD, PDP, detachable LCD/MDI, and handy operator's panel. Note, however, that the handy operator's panel does not support some functions.

1.10 LIST OF OPERATION (DPL/MDI)

Classification	Function	KEY SW	SETTING PWE = 1	Mode	Function key	Operation
Clear	All memory clear			Power ON	—	[7] AND [9]
	Parameter/offset clear		○	Power ON	—	[DGNOS PARAM]
	Program clear		○	Power ON	—	[DELET]
	Alarm clear			—	—	[CAN] or Power OFF/ON
	Alarm P/S101 clear			—	—	[CAN] AND [OPR ALARM]
	Ladder program and PMC parameter clear			Power ON	—	[0] AND [X AXIS]
	Memory all clear (for 1st path)			When the power is on	–	[1] AND [CAN]
	Memory all clear (for 2nd path)			When the power is on	–	[2] AND [CAN]
	Parameter/offset clear (for 1st path)		○	When the power is on	–	[1] AND [PARAM]
	Parameter/offset clear (for 2nd path)		○	When the power is on	–	[2] AND [PARAM]
	Program clear (for 1st path)			When the power is on	–	[1] AND [DELET]
	Program clear (for 2nd path)			When the power is on	–	[2] AND [DELET]
Reset	OT alarm reset			Power ON	—	[P I] AND [CAN]
Registration from MDI	Parameter input		○	—	[DGNOS PARAM]	PARAM screen → [No.] → Number → [INPUT] → Data → [INPUT] →PWE=0 → [CAN]
	PMC parameter input		SETTING DWE=1	—	[DGNOS PARAM]	DGNOS screen → PMC address → Number →[INPUT] → Data → [INPUT]
	Pitch error compensation data input		○	—	[DGNOS PARAM]	Pitch error correction data screen → [No.] → Data number → [INPUT] →Data→ [INPUT]
	Setting data input			—	[MENU VAR]	Setting data screen → Cursor movement → Data → [INPUT]
	Offset data input	○		—	[MENU VAR]	Offset data screen → [No.] → Data number →[INPUT] → Data→ [INPUT]
	Macro variable data input	○		—	[MENU VAR]	Macro variable screen → [No.]→ Data number → [INPUT] → Data → [INPUT]
Search	Program number search			EDIT/AUTO	[PRGRM]	[O] → Program number →[↓]
	Sequence number search			AUTO	[PRGRM]	After program number search; [N] → Sequence number →[↓]
	Address word search			EDIT	[PRGRM]	Word to be searched for → [↓]
	Search address only			EDIT	[PRGRM]	Address to be searched for →[↓]
	Parameter search			—	[DGNOS PARAM]	PARAM screen → [No.] → Number → [INPUT]

Classifi-cation	Function	KEY SW	SETTING PWE = 1	Mode	Function key	Operation
Search	PMC parameter search			—	[DGNOS PARAM]	DGNOS screen → $\boxed{\text{PMC address}}$ → Number → [INPUT]
	Pitch error compensation data search			—	[DGNOS PARAM]	Pitch error correction data screen → [# No.] → Data number → [INPUT]
	Offset data search			—	[MENU VAR]	Offset screen → [# No.] → Data number → [INPUT]
	Macro variable data search			—	[MENU VAR]	Macro variable screen → [# No.] → Data number → [INPUT]
	Diagnosis search			—	[DGNOS PARAM]	DGNOS screen → [# No.] → Number→ [INPUT]
Editing	All program delete	○		EDIT	[PRGRM]	[O] → –9999 → [DELET]
	One program delete	○		EDIT	[PRGRM]	[O] → Program number → [DELET]
	Multiple block delete	○		EDIT	[PRGRM]	[N] → Sequence number → [DELET]
	One block delete	○		EDIT	[PRGRM]	[EOB] → [DELET]
	Word delete	○		EDIT	[PRGRM]	Search for word to be deleted → [DELET]
	Word change	○		EDIT	[PRGRM]	After searching for word to be deleted; New data → [ALTER]
	Word insertion	○		EDIT	[PRGRM]	After searching for word after which word is to be inserted; New data → [INSRT]
Collation	Program collation			EDIT	[PRGRM]	[READ]
Registra-tion from external I/O	Parameter input		○	EDIT or emergency stop	[DGNOS PARAM]	PARAM screen → [READ]
	Program input	○		EDIT	[PRGRM]	[READ]
	Pitch error compensation data input		○	EDIT	[DGNOS PARAM]	Pitch error correction data screen → [READ]
	Offset data input	○		EDIT	[MENU VAR]	Offset data screen → [READ]
	Macro variable data input	○		EDIT	[PRGRM]	[READ] → Mode AUTO → Execute the loaded program.
Output to external I/O	Parameter output			EDIT	[DGNOS PARAM]	PARAM screen → [WRITE]
	All program output			EDIT	[PRGRM]	[O] → –9999 → [WRITE]
	One program output			EDIT	[PRGRM]	[O] → Program number → [WRITE]
	Pitch error compensation data output			EDIT	[DGNOS PARAM]	Pitch error correction data screen → [WRITE]
	Offset data output			EDIT	[MENU VAR]	Offset screen → [WRITE]
	Macro variable data output			EDIT	[MENU VAR]	Macro variable screen → [WRITE]
Input/out-put to and from memory card	Output to memory card			EDIT	[PRGRM]	Emergency stop → [M RD] → [WRITE]
	All data item input		○	EDIT or MDI	[PRGRM]	Emergency stop → [M RD] → [READ]
	One data item input		○	EDIT	[PRGRM]	Emergency stop → [M RD] → Data type → [READ]
	All data item input (when 2–path Power Mate–D)		○	EDIT or MDI (Path 1 and path 2)	[PRGRM]	Emergency stop → [M RD] → [# OR] → [READ]

Classification	Function	KEY SW	SETTING PWE = 1	Mode	Function key	Operation
Input/output with the PMC off–line programmer (P–G, P–G Mate, personal computer FAPT LADDER)	Ladder program input/output			—	DGNOS PARAM	DGNOS screen → READ or WRITE → Operation on host Input/output is automatically identified with operation on host. (The baud rate is fixed to 9600 bps.)
Input/output to and from FANUC cassette	Program registration	○		EDIT	PRGRM	N K/A → File number → READ → READ
	All program output			EDIT	PRGRM	O Y → –9999 → WRITE
	One program output			EDIT	PRGRM	O Y → Program number → WRITE
	Search for beginning of file			EDIT	PRGRM	N K/A → Program number, –9999, or –9998 → READ
	File delete	○		EDIT	PRGRM	N K/A → File number → WRITE
	Program collation			EDIT	PRGRM	N K/A → File number → READ → READ
	PMC parameter Ladder program input		○ (Only when PMC parameter is input)	Emergency stop	DGNOS PARAM	DGNOS screen → & @ No. → File number → READ → Data type is automatically identified. (The baud rate is fixed to 4800 bps.)
	PMC parameter output			EDIT	DGNOS PARAM	PMC parameter display → & @ No. → File number → WRITE
	Ladder program output			—	DGNOS PARAM	DGNOS screen → & @ No. → File number → WRITE

NOTE

After completion of ladder program input, the power must be turned on again because the ladder program is in halt state.

1.11 WARNING SCREEN DISPLAYED WHEN AN OPTION IS CHANGED

This warning message is not displayed on either the DPL/MDI or the Power Mate–F.

● **Warning screen**

This CNC displays a warning screen when the configuration of the options using the SRAM area is changed. The data for the function indicated on the screen is cleared the next time the system is turned on.

```
WARNING



   YOU SET THE PARAMETER No. □□□□ # □

   ALL FILES WILL BE CLEARED IN THE PART
   PROGRAM STORAGE AREA.
                                              *1


   PLEASE PRESS ”DELETE” OR ”CAN” KEY.
   ”DELETE”: CLEAR ALL FILES
   ”CAN”   : CANCEL
```

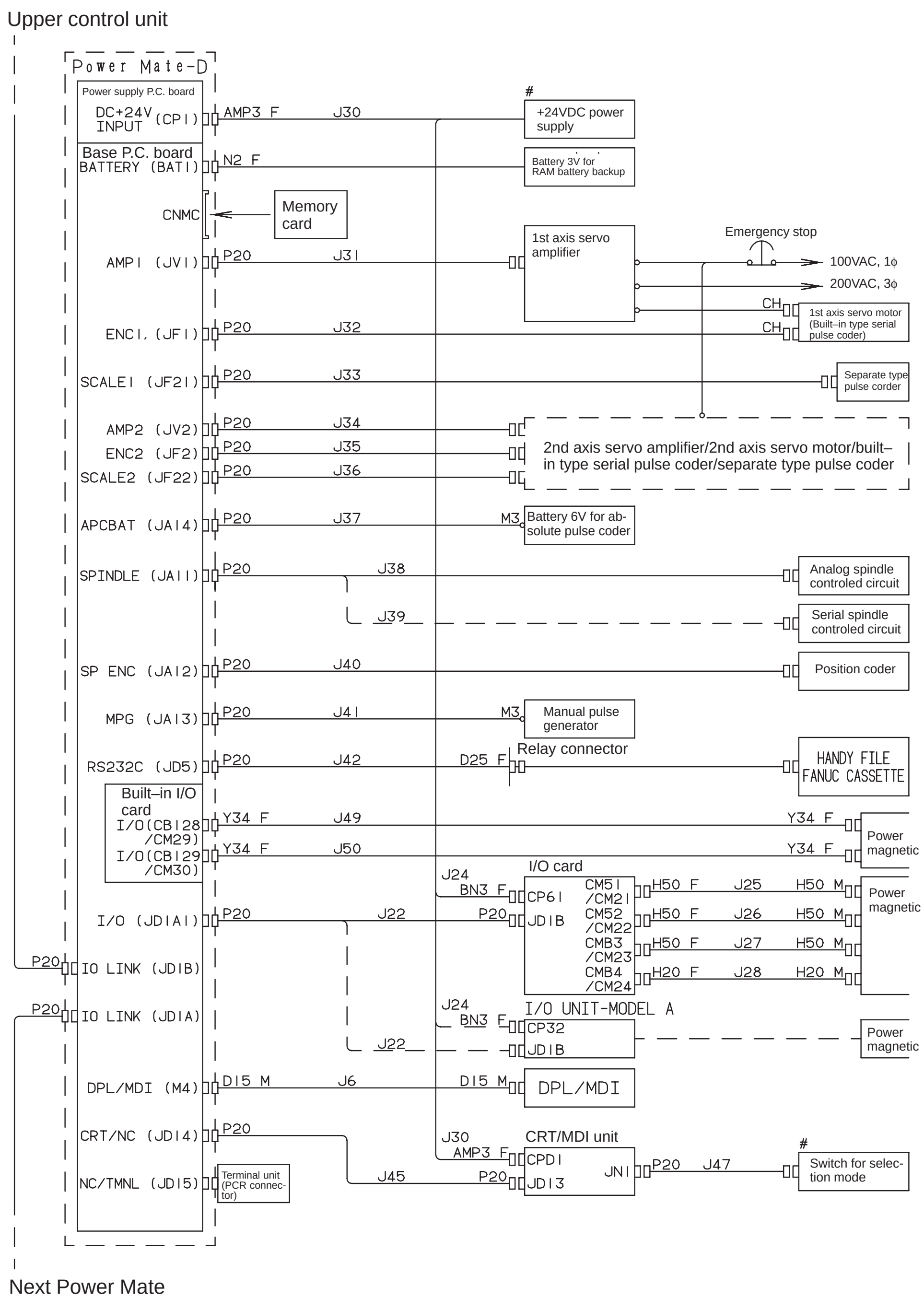
> **NOTE (*1)**
> This line varies with the parameter settings. Two or more function names may be displayed.

2 HARDWARE

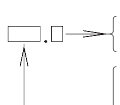
This chapter describes structure of CNC control section, connection of units and the functions of PCBs and modules mounted on PCBs.

2.1 TOTAL CONNECTION DIAGRAM

a) 1–path Power Mate–D (servo interface type A)



Note 1 : Connector and terminal symbols



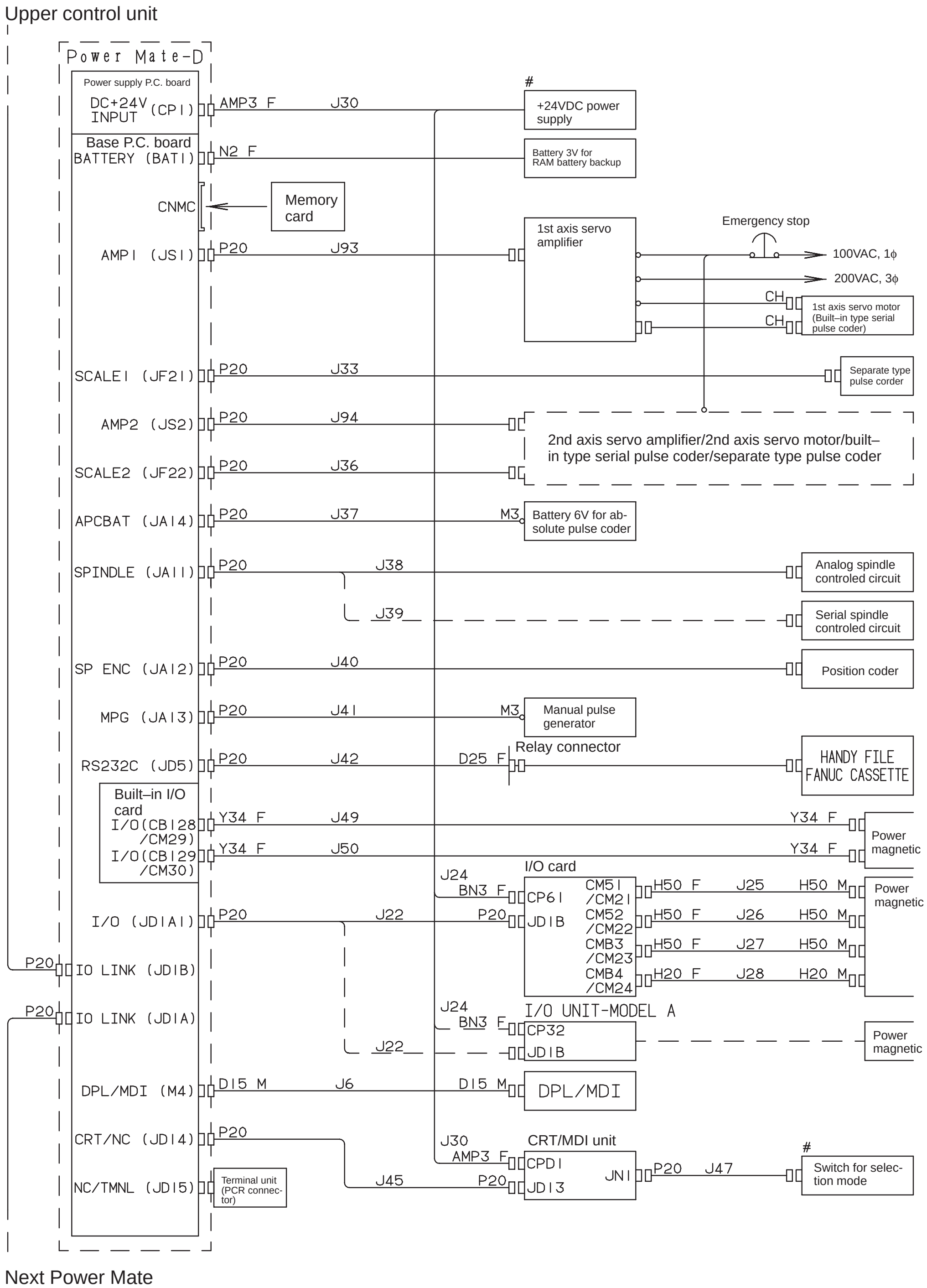
M : Male connector
F : Female connector

H50 : Honda Tsushin MR connector (50 pins)
H20 : Honda Tsushin MR connector (20 pins)
AMP3 : AMP Japan connector (3 pins)
D15 : D–sub connector (15 pins)
D25 : D–sub connector (25 pins)
P20 : Honda Tsushin PCR connector (20 pins)
BN3 : Burndy, brown (3 pins)
N2 : Japan Aviation Electronics (2 pins)
Y34 : Yamaichi (34 pins)
M3 : M3 screw terminal
CH : Varies with the AC motor

Note 2 : The +24 VDC power supply (marked #) and mode selection switch (marked #) should be prepared by the customer.

Note 3 : All cables except the RAM battery back–up battery cable should be prepared by the customer.

b) 1–path Power Mate–D (servo interface type B)



Note 1 : Connector and terminal symbols

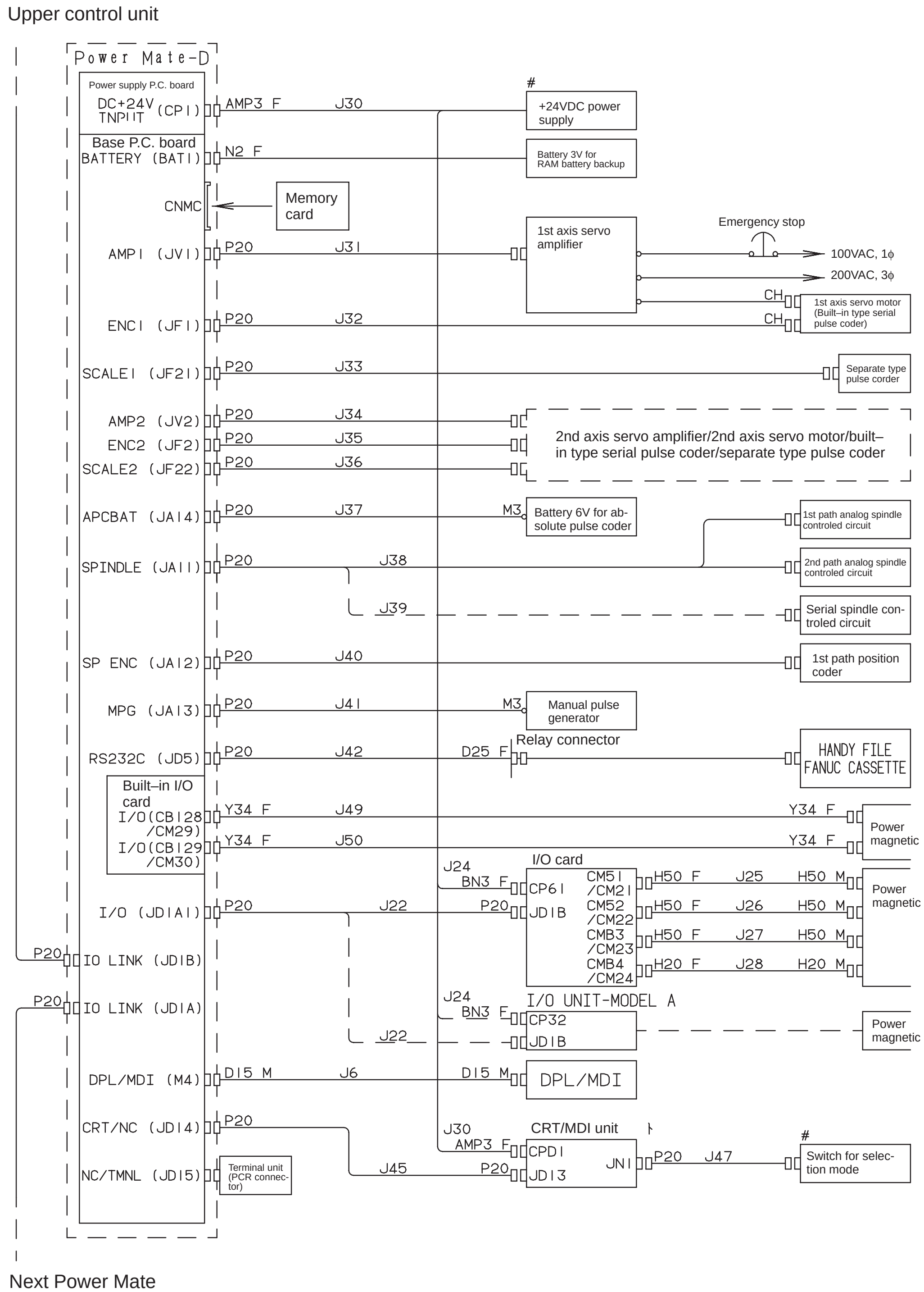
M : Male connector
F : Female connector

H50 : Honda Tsushin MR connector (50 pins)
H20 : Honda Tsushin MR connector (20 pins)
AMP3 : AMP Japan connector (3 pins)
D15 : D–sub connector (15 pins)
D25 : D–sub connector (25 pins)
P20 : Honda Tsushin PCR connector (20 pins)
BN3 : Burndy, brown (3 pins)
N2 : Japan Aviation Electronics (2 pins)
Y34 : Yamaichi (34 pins)
M3 : M3 screw terminal
CH : Varies with the AC motor

Note 2 : The +24 VDC power supply (marked #) and mode selection switch (marked #) should be prepared by the customer.

Note 3 : All cables except the RAM battery back–up battery cable should be prepared by the customer.

c) 2–path Power Mate–D (servo interface type A)



Note 1 : Connector and terminal symbols

M : Male connector
F : Female connector

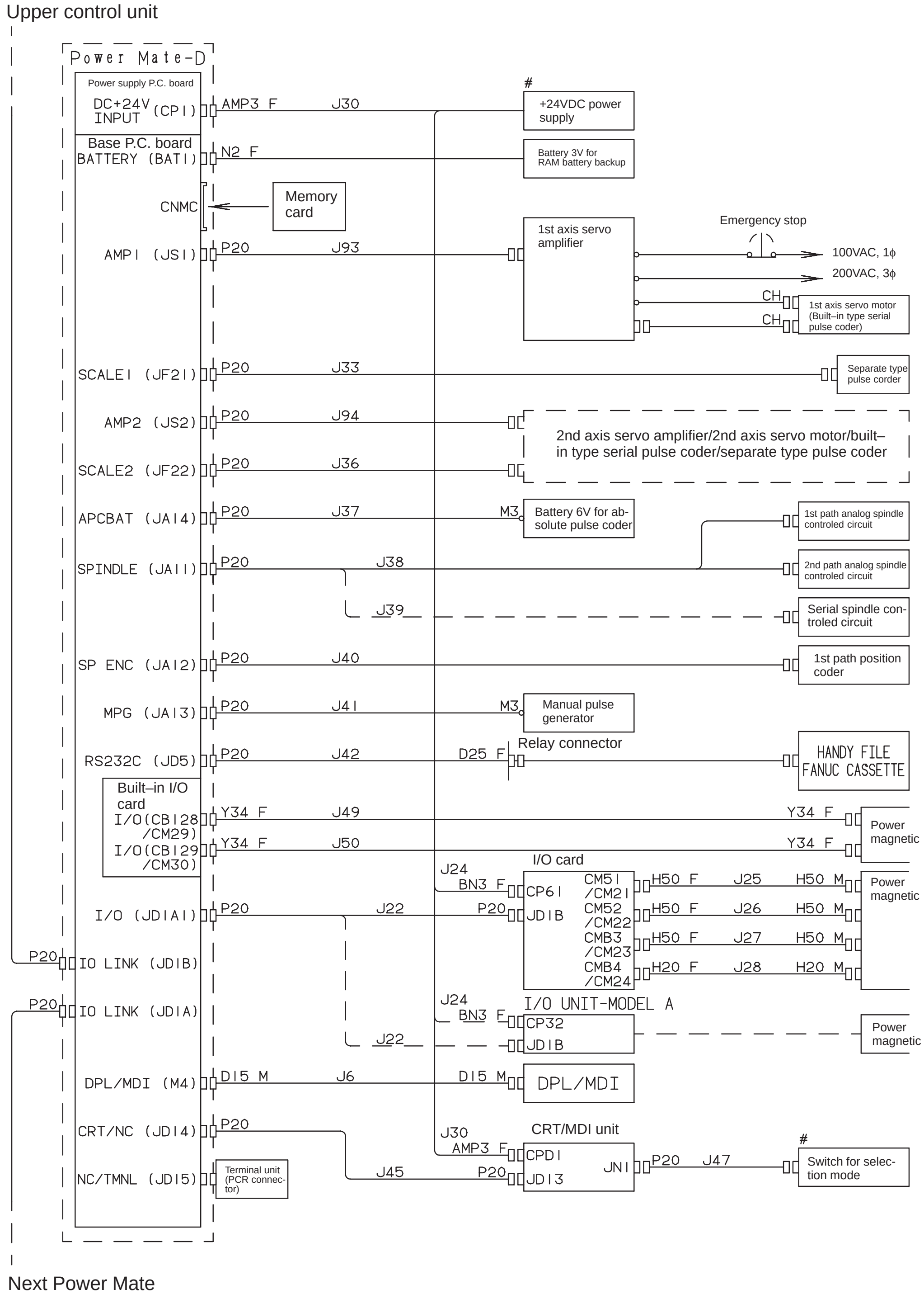
H50 : Honda Tsushin MR connector (50 pins)
H20 : Honda Tsushin MR connector (20 pins)
AMP3 : AMP Japan connector (3 pins)
D15 : D–sub connector (15 pins)
D25 : D–sub connector (25 pins)
P20 : Honda Tsushin PCR connector (20 pins)

BN3 : Burndy, brown (3 pins)
N2 : Japan Aviation Electronics (2 pins)
Y34 : Yamaichi (34 pins)
M3 : M3 screw terminal
CH : Varies with the AC motor

Note 2 : The +24 VDC power supply (marked #) and mode selection switch (marked #) should be prepared by the customer.

Note 3 : All cables except the RAM battery back–up battery cable should be prepared by the customer.

d) Power Mate–F (servo interface type B)



Note 1 : Connector and terminal symbols

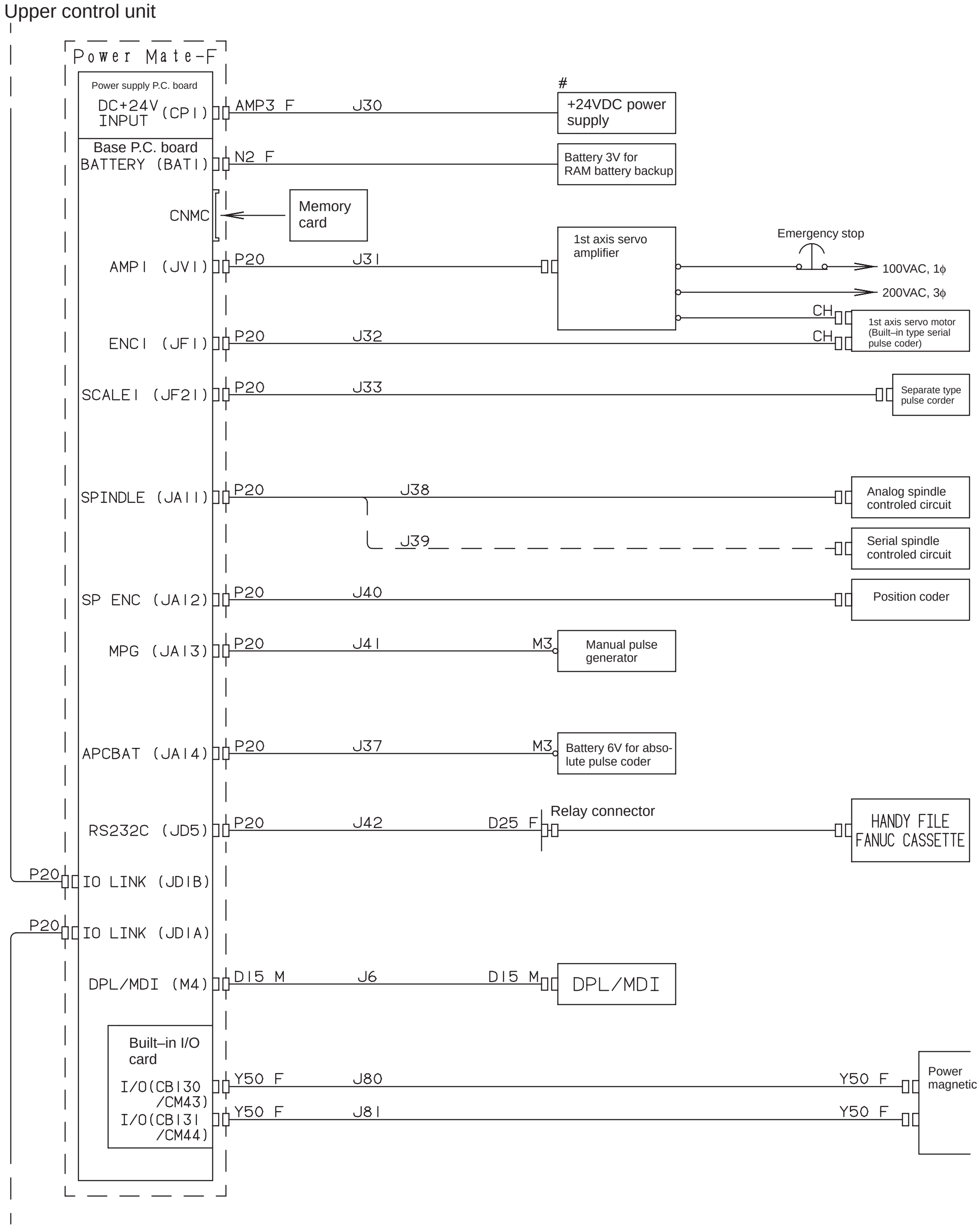
M : Male connector
F : Female connector

H50 : Honda Tsushin MR connector (50 pins)
H20 : Honda Tsushin MR connector (20 pins)
AMP3 : AMP Japan connector (3 pins)
D15 : D–sub connector (15 pins)
D25 : D–sub connector (25 pins)
P20 : Honda Tsushin PCR connector (20 pins)
BN3 : Burndy, brown (3 pins)
N2 : Japan Aviation Electronics (2 pins)
Y34 : Yamaichi (34 pins)
M3 : M3 screw terminal
CH : Varies with the AC motor

Note 2 : The +24 VDC power supply (marked #) and mode selection switch (marked #) should be prepared by the customer.

Note 3 : All cables except the RAM battery back–up battery cable should be prepared by the customer.

e) Power Mate–F (servo interface type A)



Note 1 : Connector and terminal symbols

M : Male connector
F : Female connector

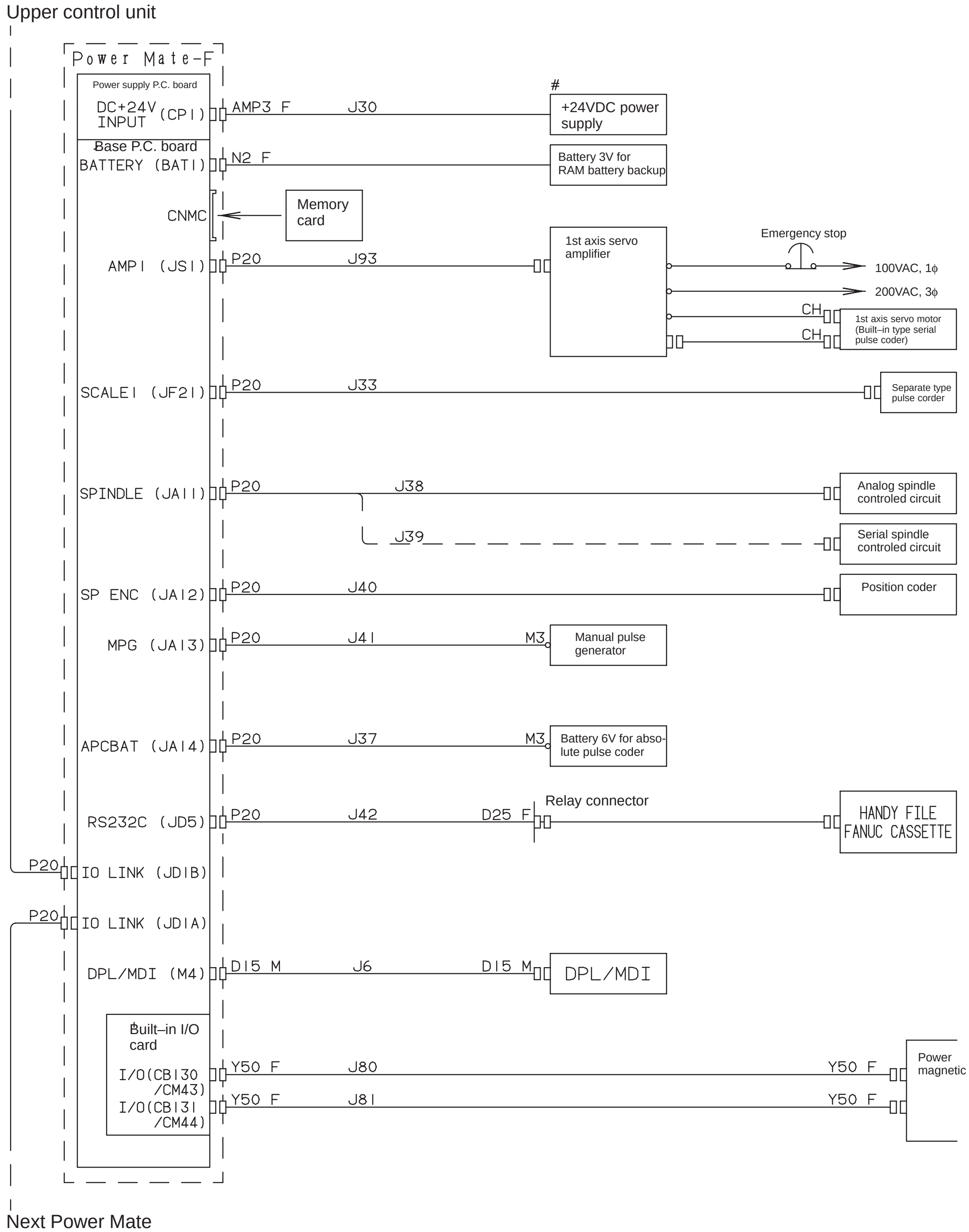
AMP3 : AMP Japan connector (3 pins)
D15 : D–sub connector (15 pins)
D25 : D–sub connector (25 pins)
Y50 : Yamaichi (50 pins)
P20 : Honda Tsushin PCR connector (20 pins)

N2 : Japan Aviation Electronics (2 pins)
M3 : M3 screw terminal
CH : Varies with the AC motor

Note 2 : The +24 VDC power supply (marked #) and mode selection switch (marked #) should be prepared by the customer.

Note 3 : All cables except the RAM battery back–up battery cable should be prepared by the customer.

f) Power Mate–F (servo inteface B)



Note 1 : Connector and terminal symbols

M : Male connector
F : Female connector

AMP3 : AMP Japan connector (3 pins)
D15 : D–sub connector (15 pins)
D25 : D–sub connector (25 pins)
Y50 : Yamaichi (50 pins)
P20 : Honda Tsushin PCR connector (20 pins)

N2 : Japan Aviation Electronics (2 pins)
M3 : M3 screw terminal
CH : Varies with the AC motor

Note 2 : The +24 VDC power supply (marked #) and mode selection switch (marked #) should be prepared by the customer.

Note 3 : All cables except the RAM battery back–up battery cable should be prepared by the customer.

2.2 INSTALLATION

2.2.1 Environmental Requirement

The peripheral units, such as the control unit and CRT/MDI, 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;
- Cabinet for housing the flexible turnkey system provided by FANUC ;
- Operation pendant, manufactured by the machine tool builder, for housing the CRT/MDI unit or operator’s panel.
- Equivalent to the above.

The environmental conditions when installing these cabinets shall conform to the following table.

Room temperature	In operation	Outer of Cabinet : 0°C to 45°C
		Inter of Cabinet : 0°C to 55°C
	In store or transportation	–20°C to 60°C
Change in temperature	1.1°C/minute max.	
Relative humidity	30% to 95% (no condensation)	
Vibration	In operation: 0.5G or less	
Environment	Outer of cabinets: If the cabinet is to be placed in an environment where there are relatively large amounts of pollutants (such as dust, coolant, organic solvents, acid, corrosive gas, and salt), special care should be taken. Inter of units: Each unit should be placed in a cabinet to keep it from pollutants such as those described above. Heat sink of outer of cabinet: The heat sinks should be protected from direct exposure to coolant, lubricant, and metal chips.	
Radiation (ionizing or nonionizing)	If a unit is to be used in an environment where it is likely to be exposed to radiations (such as microwave, ultraviolet rays, laser beams, and X–rays), a shielding provision should be available for it.	
Height above sea level	Up to 1,000 m	

2.2.2 Power Capacity

The units listed below require an external regulated supply voltage of 24 VDC +10% (including an instantaneous value).

Table 2.2.2 (a) Power supply capacity

Unit	Power supply capacity
Power Mate–D control unit	1.8A (another 1 A required for the RS–232–C interface) (*)
Power Mate–F control unit	1.6A (another 1 A required for the RS–232–C interface) (*)
CRT/MDI unit Picture display CRT/MDI unit	1.0A
Separate type CRT unit	0.8A
Separate type MDI unit Picture display separate type MDI unit	0.2A

Unit	Power supply capacity
Separate type PDP unit	2.0A
Separate type LCD unit	0.8A
Detachable LCD/MDI unit	1.0A
Handy operator's panel	0.2A
External I/O card	500 +7.3 x n (mA) where n is the number of input points that are turned on simultaneously (*)
I/O Unit–A	The required current varies depending on the number of modules. Refer to the I/O Unit–MODEL A Connection and Maintenance Manual (B–61813E).
I/O Link connection unit	0.2A
DPL/MDI switching circuit	0.2A

NOTE
With the Power Mate–D/F, it is necessary to externally supply 24 V power to external and built–in I/O cards having source–type DO points.

2.2.3 Action Against Noise

The motion controller has been steadily reduced in size using surface–mount and custom LSI technologies for electronic components. The motion controller 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 motion controller. This precaution improves the stability of the motion controller machine tool system.
The motion controller component units are often installed close to the parts generating noise in the power magnetics cabinet. Possible noise sources into the motion controller 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.

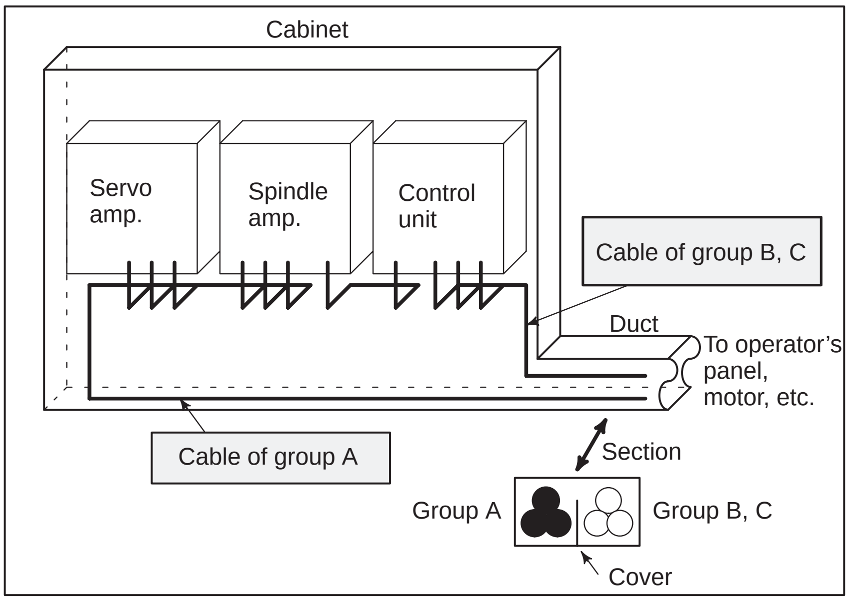
- **Separating signal lines**

The cables used for the machine 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). 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 motors or spindle motors)	
	AC/DC solenoid	
	AC/DC relay	
B	DC solenoid (24VDC)	Connect diodes with 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 more desirable to cover group B with the shield.
	DC relay (24VDC)	
	DC power line	
	DI/DO cable between the motion controller and power magnetics cabinet	
	DI/DO cable between the motion controller and machine	

Group	Signal line	Action
C	Cable between the motion controller and servo amplifier	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.
	Cable for position and velocity feedback	
	Cable between the motion controller and spindle amplifier	
	Cable for position coder	
	Cable for manual pulse generator	
	Cable for battery	
	Cable between the motion controller and the CRT/MDI	
	RS–232–C interface cable	
	Other cables to be covered with the shield	

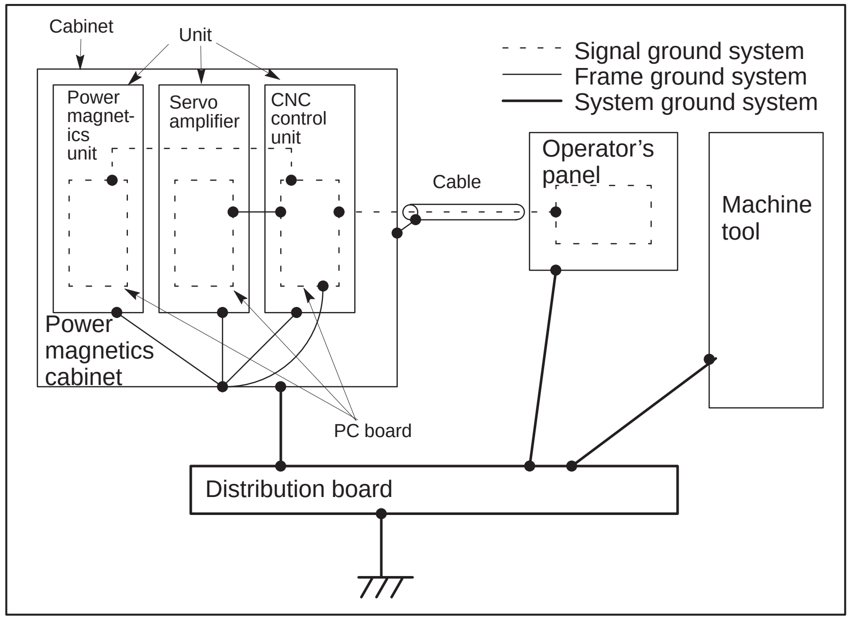
NOTE
1. The groups must be 100mm or more apart from one another when binding the cables in each group.
2. The electromagnetic shield refers to shielding between groups with grounded steel plates.



- **Ground**

The following ground systems are provided for the CNC machine tool:

- **Signal ground system (SG)**
  The signal ground (SG) supplies the reference voltage (0V) of the electrical signal system.
- **Frame ground system (FG)**
  The frame ground system (FG) is used for safety, and suppressing external and internal noises. In the frame ground system, the frames, cases of the units, panels, and shields for the interface cables between the units are connected.
- **System ground system**
  The system ground system is used to connect the frame ground systems connected between devices or units with the ground.

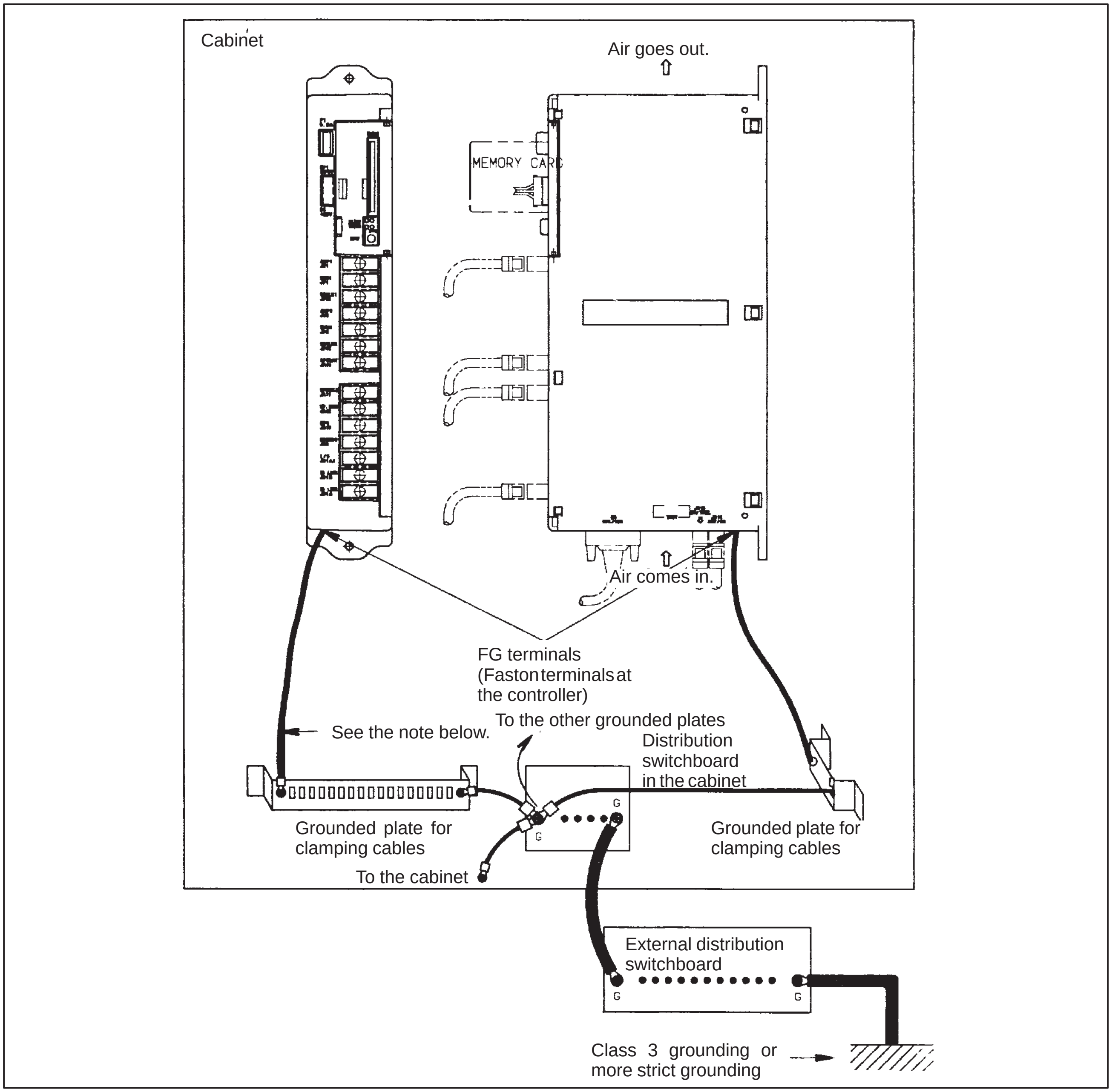


Notes on connecting the ground systems

- Connect the signal ground with the frame ground (FG) at only one place in the power motion controller control unit.
- The grounding resistance of the system ground shall be 100 ohms or less (class 3 grounding).
- The system ground cable must have enough cross–sectional area to safety carry the accidental current flow into the system ground when an accident such as a short circuit occurs.
  (Generally, it must have the cross–sectional area of the AC power cable or more.)
- Use the cable containing the AC power wire and the system ground wire so that power is supplied with the ground wire connected.

- **Connecting the Frame Ground (FG) of the Control Unit**

Connect the 0 V line of the electronic circuit in the control unit with the ground plate of the cabinet via the frame ground (FG) terminal.
The SG terminal is located on the printed circuit board at the rear of the control unit.



Most Importable Item

Use the Faston terminals (A65L–0001–0148/2) for the frame ground. Also use 100 to 300 mm stranded wire with a cross–section of 2 mm^2 or more. Be sure to connect the FG terminals of the Power Mate to the grounded plates in the cabinet as shown above.

• Noise Suppressor

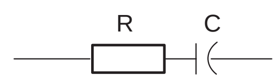
The AC/DC solenoid and relay are used in the power magnetics cabinet. A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage induced through the cable causes the electronic circuits to be disturbed.

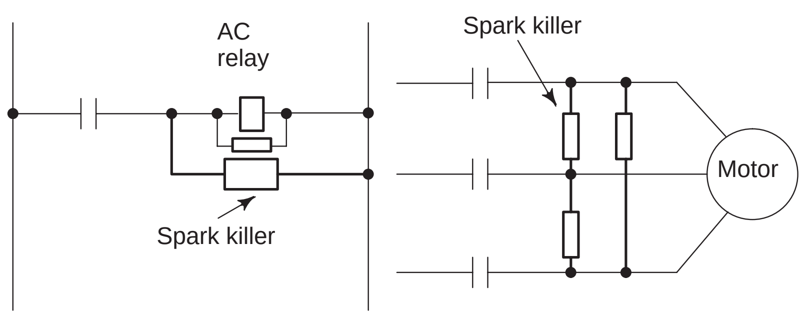
Notes on selecting the spark killer

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

  I : Current at stationary state of the coil

Equivalent circuit of the spark killer

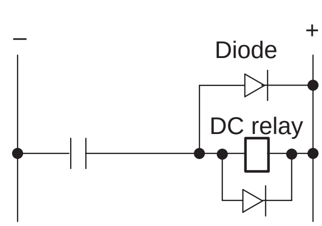




Mount the noise eliminator near a motor or a relay coil.

NOTE) Use a CR–type noise eliminator. Varistor–type noise eliminators clamp the peak pulse voltage but cannot suppress a sharp rising edge.

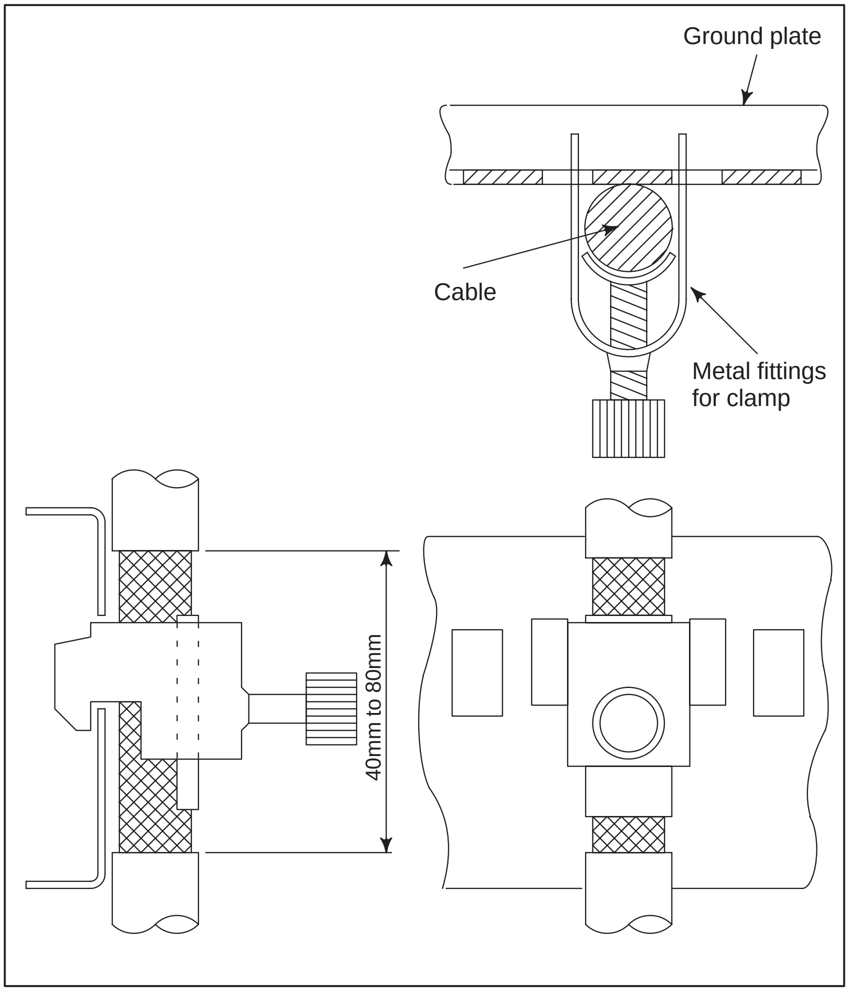
- Diode is used for direct–current circuits



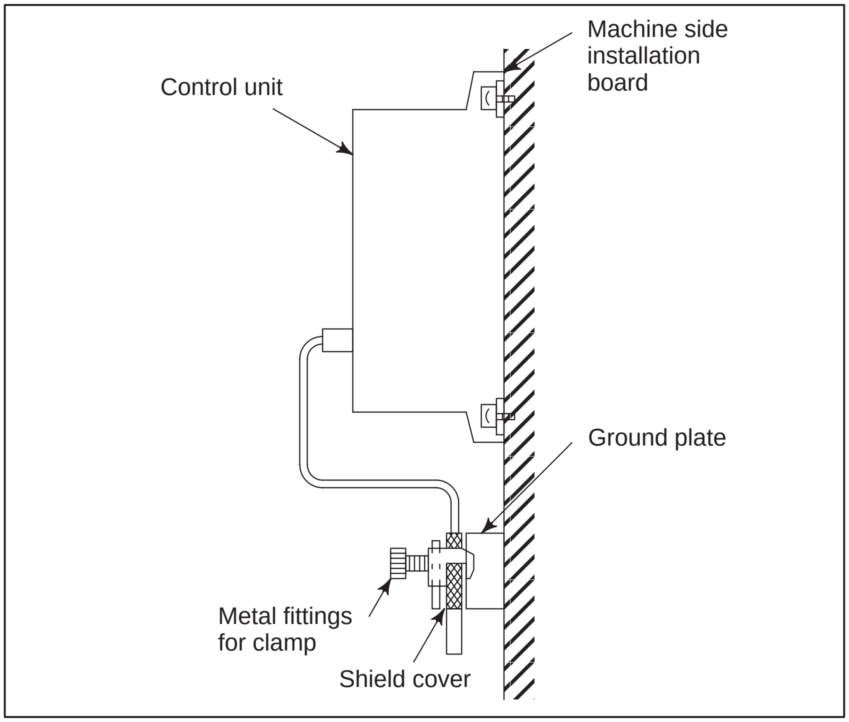
Use a diode which can withstand a voltage up to two times the applied voltage and a current up to two times the applied current.

- **Cable Clamp and Shield Processing**

The power motion controller cables that require shielding should be clamped by the method shown below. This cable clamp treatment is for both cable support and proper grounding of the shield. To insure stable CNC system operation, follow this cable clamp method.
Partially peel out the sheath and expose the shield. Push and clamp by the plate metal fittings for clamp at the part. The ground plate must be made by the machine tool builder, and set as follows :



Cable clamp (1)



Cable clamp (2)

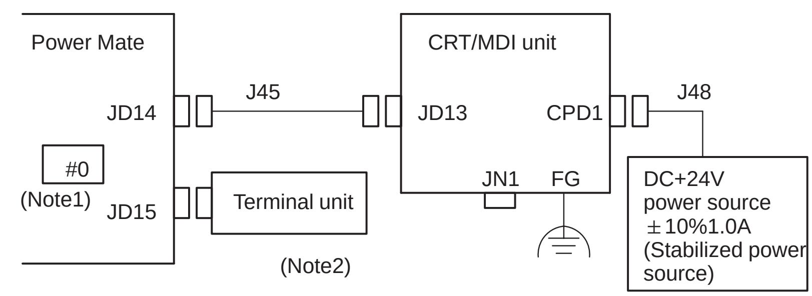
2.3 INTER–MACHINE CONNECTION

2.3.1 CRT/MDI Unit

This device–to–device connection method also applies when the separate MDI unit is used in combination with the separate CRT unit, separate PDP unit, or separate LCD unit. The Power Mate–F is not provided with a CRT/MDI interface.

- **Connection of Power Mate–D**

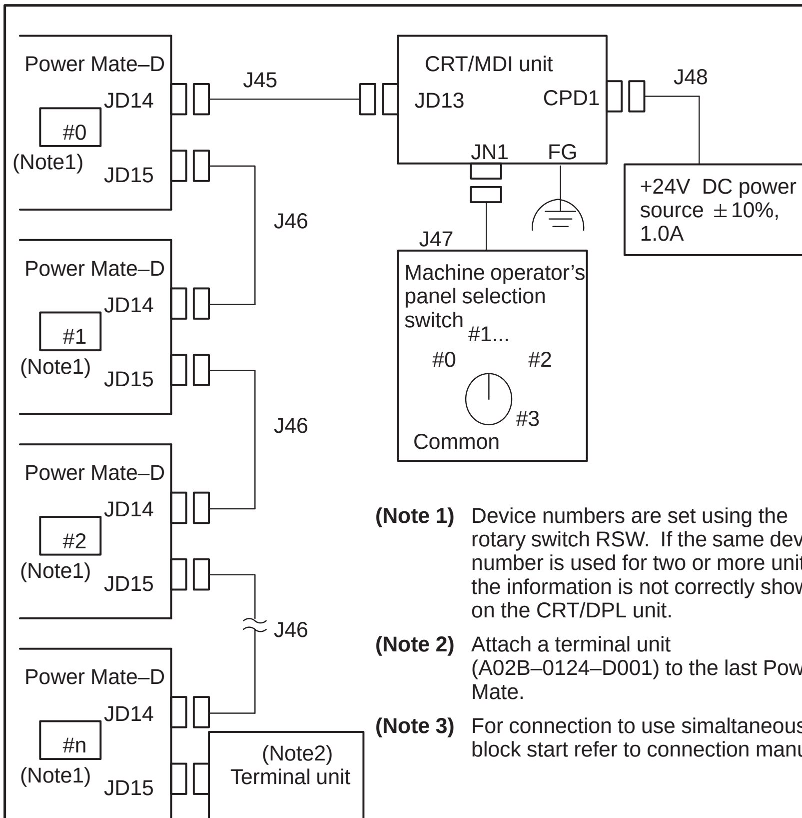
(1) When there is only one unit of Power Mate–D



(Note1) Device number 0 is set using the rotary switch. Refer to the section of 2.4.1 Rotary switch and constract of control unit for place of rotary switch.

(Note2) Mount a terminal unit (A02B–0124–D001)

(2) When multiple power Mates share one CRT/MDI Max.16 Power Mate–D units



(Note 1) Device numbers are set using the rotary switch RSW. If the same device number is used for two or more units, the information is not correctly shown on the CRT/DPL unit.

(Note 2) Attach a terminal unit (A02B–0124–D001) to the last Power Mate.

(Note 3) For connection to use simaltaneous block start refer to connection manual.

● Cable connection

Separate type MDI unit

Power Mate

JD14

(PCR–EV20MDT)

1	RXD	11	0V
2	*RXD	12	0V
3	TXD	13	(SI1)
4	*TXD	14	(*SI1)
5	(ITPGA)	15	(SI2)
6	(*ITPGA)	16	(*SI2)
7	(ITPGB)	17	(SI3)
8	(*ITPGB)	18	(*SI3)
9	(SIO)	19	
10		20	(*SI0)

J45

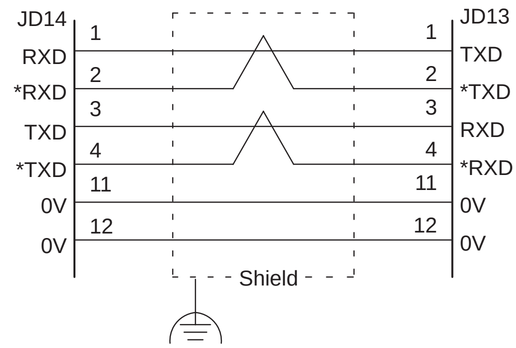
CRT/MDI unit

JD13

(PCR–EV20MDT)

1	TXD	11	0V
2	*TXD	12	0V
3	RXD	13	(SI1)
4	*RXD	14	(*SI1)
5	(ITPGA)	15	(SI2)
6	(*ITPGA)	16	(*SI2)
7	(ITPGB)	17	(SI3)
8	(*ITPGB)	18	(*SI3)
9	(SI0)	19	
10		20	(*SI0)

Cable connection (J45)



Power Mate

JD15

(PCR–EV20MDT)

1	RXD	11	0V
2	*RXD	12	0V
3	TXD	13	(SI1)
4	*TXD	14	(*SI1)
5	(ITPGA)	15	(SI2)
6	(*ITPGA)	16	(*SI2)
7	(ITPGB)	17	(SI3)
8	(*ITPGB)	18	(*SI3)
9	(SI0)	19	
10		20	(*SI0)

J46

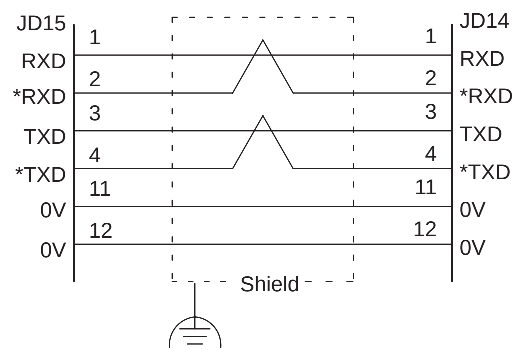
Next Power Mate

JD14

(PCR–EV20MDT)

1	RXD	11	0V
2	*RXD	12	0V
3	TXD	13	(SI1)
4	*TXD	14	(*SI1)
5	(ITPGA)	15	(SI2)
6	(*ITPGA)	16	(*SI2)
7	(ITPGB)	17	(SI3)
8	(*ITPGB)	18	(*SI3)
9	(SO0)	19	
10		20	(*SO0)

Cable connection (J46)



CRT/MDI unit (Separate type MDI unit)

CPD1

(AMP)

1	+24V
2	0V
3	

J48

External power source

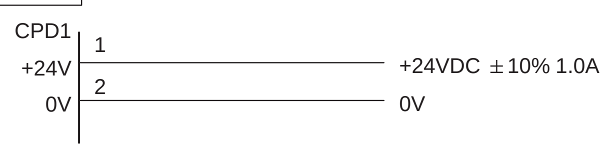
+24VDC power source
(Stabilized power source)

+24VDC ±10% 1.0A

FG

A stud is provided on the rear of the unit for connection to a frame ground.

Cable connection (J48)

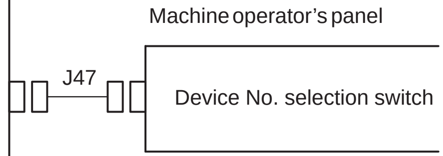


Separate type MDI unit

CRT/MDI unit

JN1
(PCR–EV20MDT)

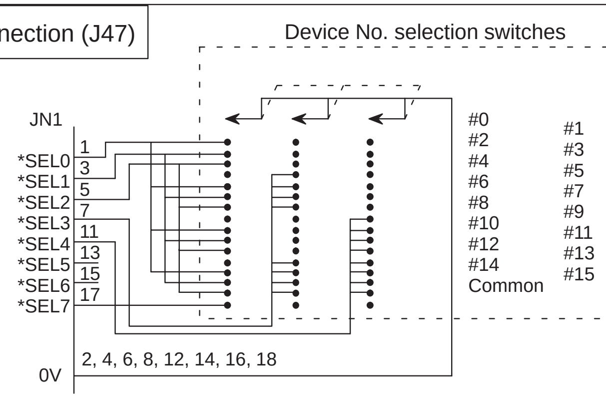
1	*SEL0	11	*SEL4
2	0V	12	0V
3	*SEL1	13	*SEL5
4	0V	14	0V
5	*SEL2	15	*SEL6
6	0V	16	0V
7	*SEL3	17	*SEL7
8	0V	18	0V
9		19	
10		20	



– Separate LCD unit
→ connect *SEL6 (15) and 0V (16).

– CRT link exceeding 50 m
→ connect *SEL5 (13) and 0V (14).

Cable connection (J47)



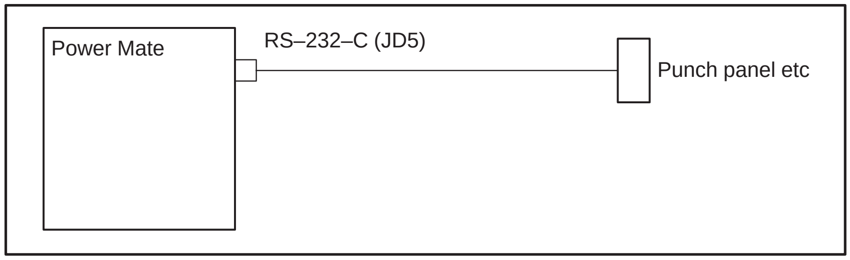
Relationship between selection switches and device numbers

Device No.	*SEL7	*SEL4	*SEL3	*SEL2	*SEL1	*SEL0
#0	×	×	×	×	×	×
#1	×	×	×	×	×	○
#2	×	×	×	×	○	×
#3	×	×	×	○	×	×
#4	×	×	○	×	×	×
#5	×	×	○	×	×	○
#6	×	×	○	×	○	×
#7	×	×	○	○	×	×
#8	×	○	×	×	×	×
#9	×	○	×	×	×	○
#10	×	○	×	×	○	×
#11	×	○	×	○	×	×
#12	×	○	○	×	×	×
#13	×	○	○	×	×	○
#14	×	○	○	×	○	×
#15	×	○	○	○	×	×
Common display	○	–	–	–	–	–

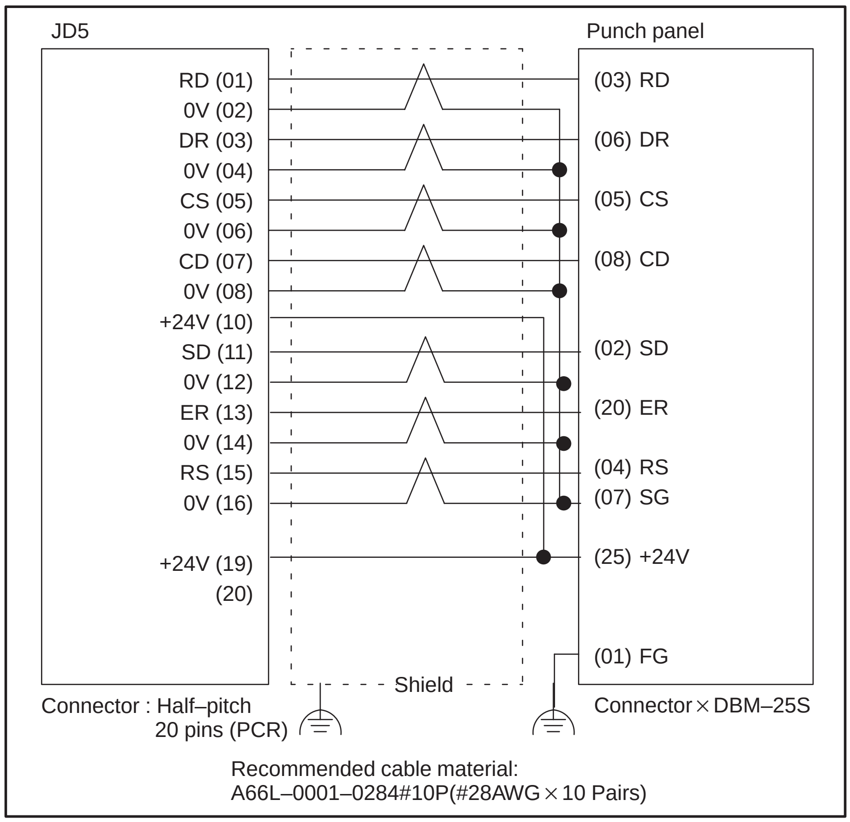
× : Switch open
○ : Switch closed
– : Either will do

2.3.2 Reader/Puncher Interface

- **Connection**



- **Cable connection**

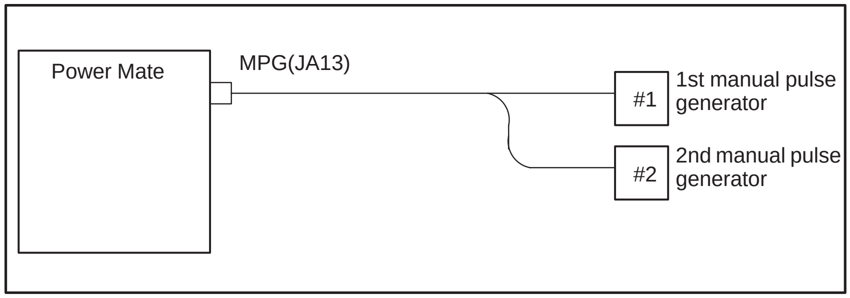


> **NOTE**
> Do not connect JD5 (10) and JD5 (19) if +24 V is not to be supplied from the Power Mate main unit.

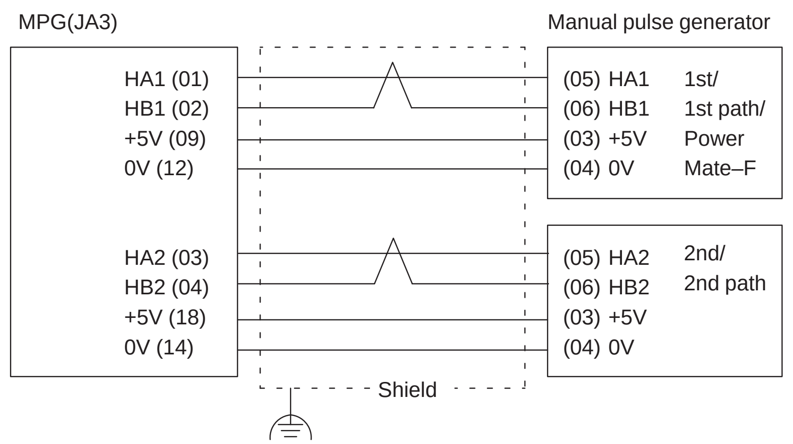
2.3.3 Manual Pulse Generator

Up to two manual pulse generators can be connected to a 1–path Power Mate–D. In a 2–path Power Mate–D, one manual pulse generator can be connected to each path. In the Power Mate–F, only one manual pulse generator can be connected.

- **Connection**



- **Cable connection**



Connector : Half–pitch
20–pins(Hirose)

Connect HA1 (01) and HB1 (02) to HA2 (03) and HB2 (04), respectively, if one manual pulse generator is shared by the 2–path Power Mate–D.

- **Voltage drop by cable length**

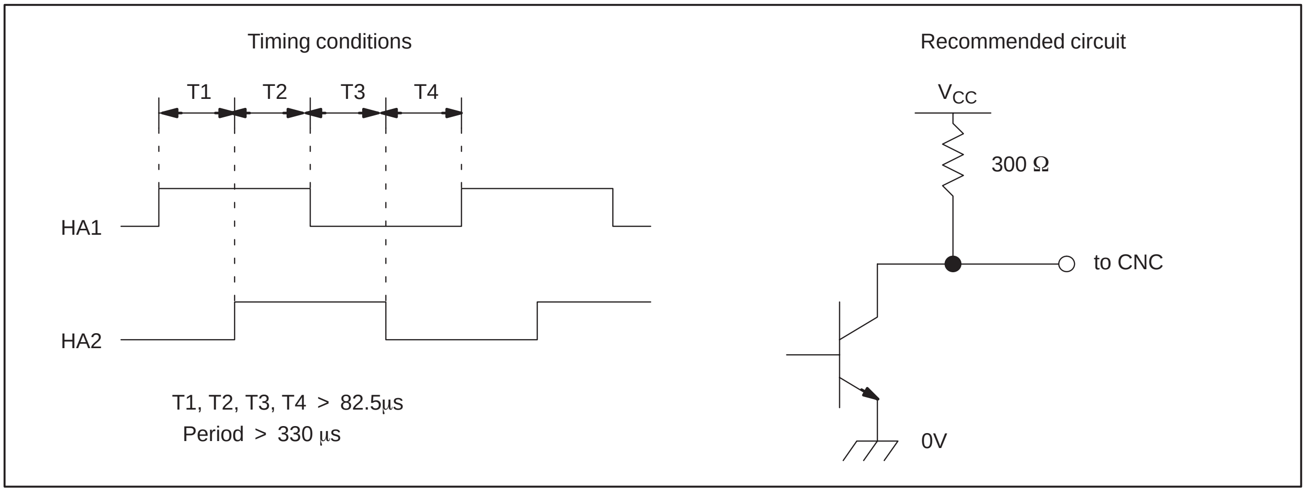
Restrict voltage drop by cable to less than 0.2V in accordance with +5V/0V.

$$\text{Voltage drop } V = \frac{A \times R \times 2L}{m}$$

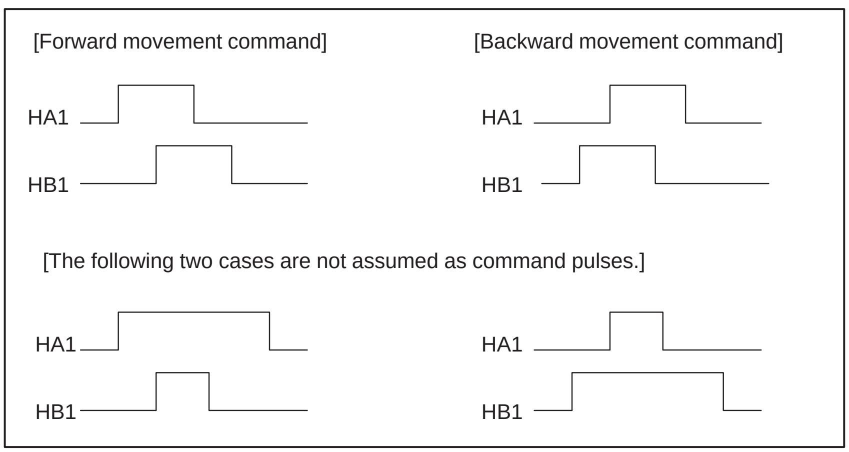
Where A : manual pulse generator’s current (0.1A)
R : Registance per cable length
L : Cable length
m : No. of cables

• Electrical characteristics

Parameter	Symbol	Standard		Units	Test conditions
		Min.	Max.		
Output voltage	V_{OH}	V_{CC} –0.2		V	R_L = ∞ Ω
		4.4		V	R_L = 4 kΩ
	V_{OL}		0.3	V	R_L = 200 Ω



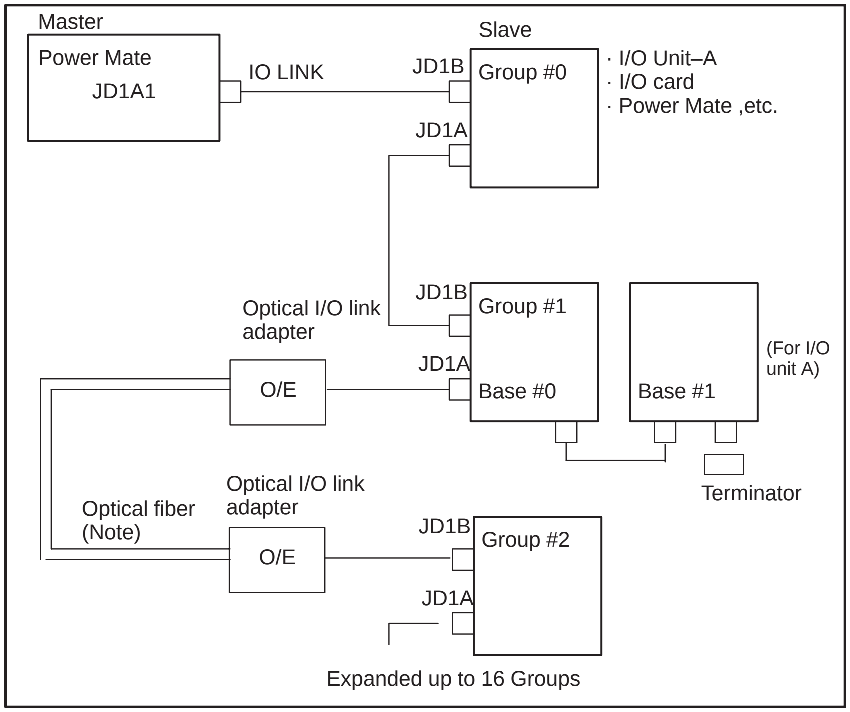
• Signal logics



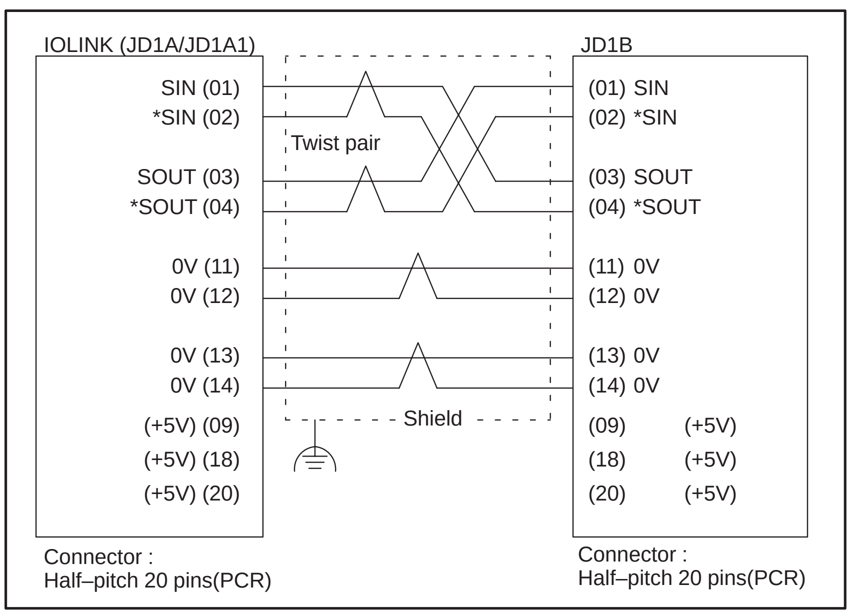
2.3.4 I/O Link

The Power Mate–D is provided with one I/O Link master channel and one I/O Link slave channel, while the Power Mate–F is provided with only one I/O Link slave channel.

- **Connection**



- **Cable connection within group**

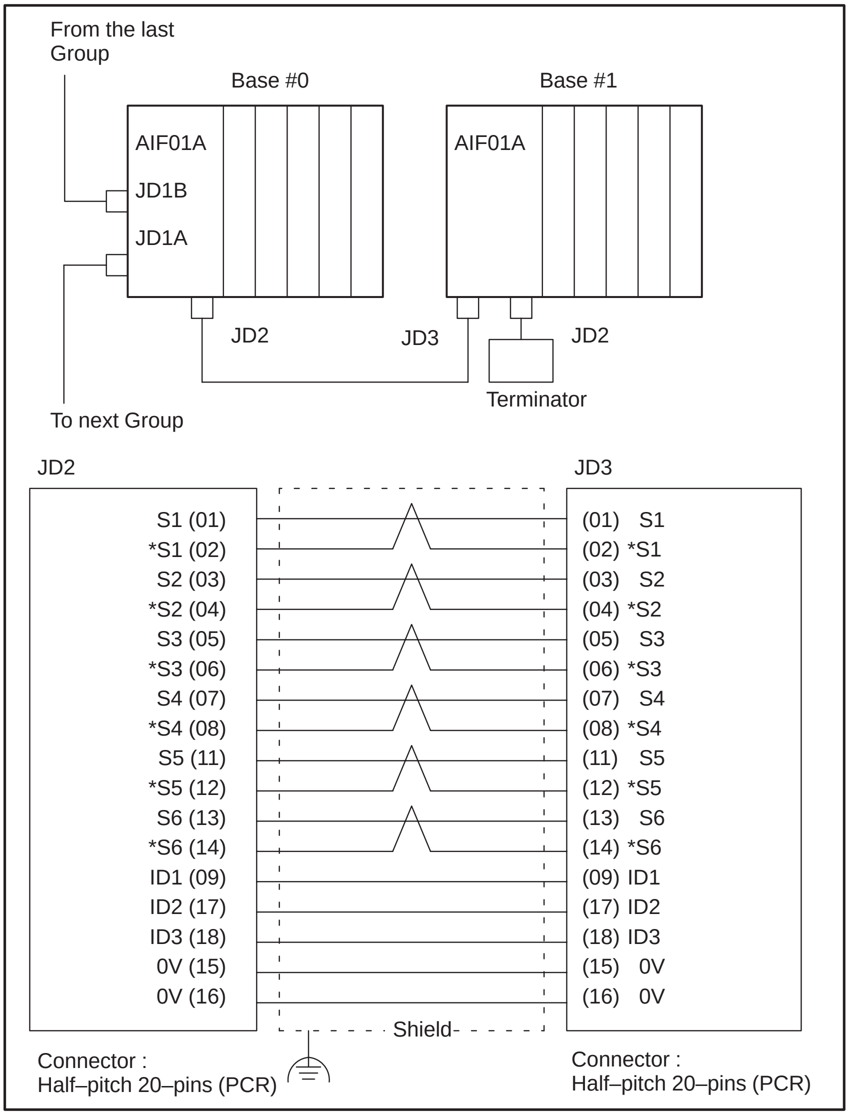


CAUTION

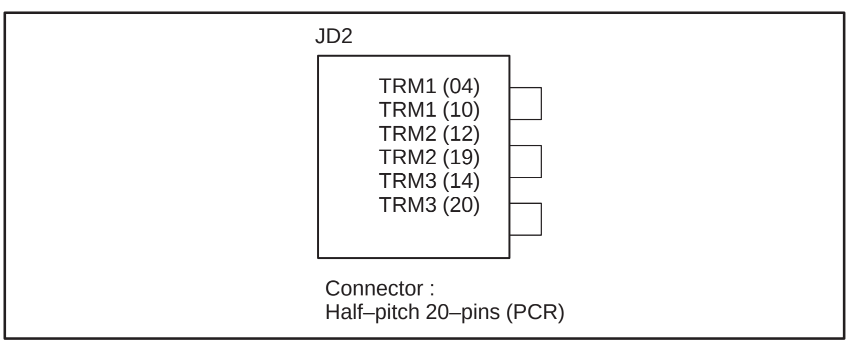
Connect +5V when optical I/O link adapter is used. Do not connect when metal cable is used. Otherwise, the two +5V lines will be short–circuited, leading to damage to the unit.

NOTE
When metal cable is used, cable length between units is extended by 10 m.
When optical I/O link adapter is used, cable length between units is extended by 200m.

- **Connection between bases (with I/O unit–A)**



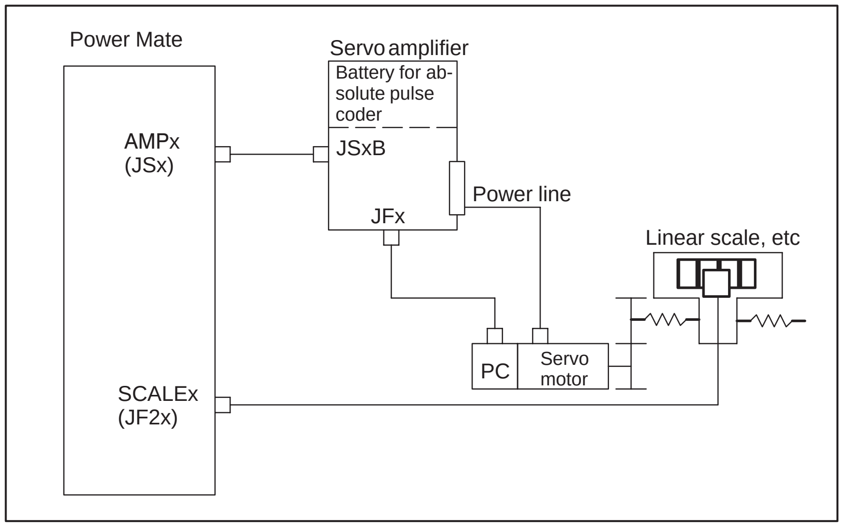
- **Cable connection in the terminator**



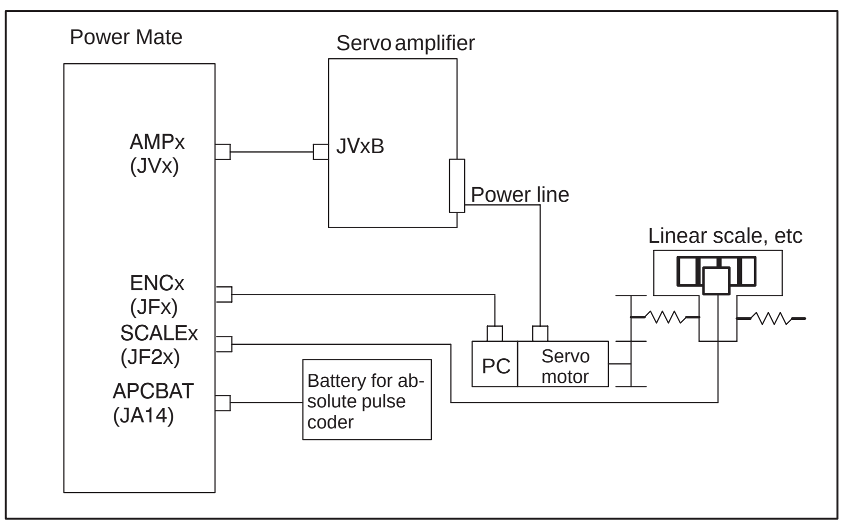
NOTE
If there is more than I/O unit A in the same group, a terminator is connected to the JP2 connector of the last AIF01B. No terminator is needed for the JD1A connector of the last unit on the I/O Link line.

2.3.5 Servo Interface

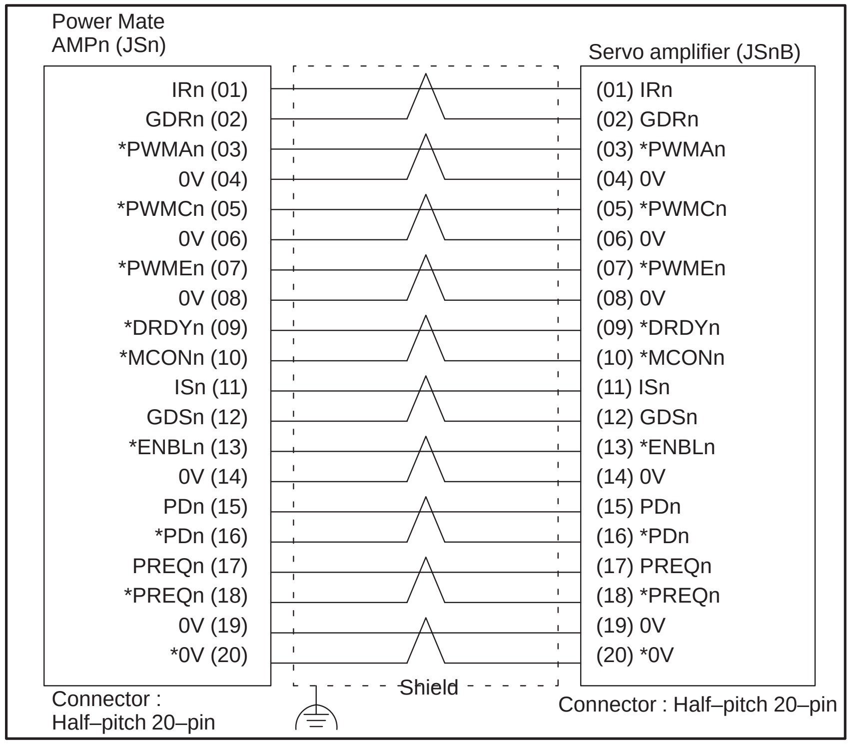
- **Inter face type B**



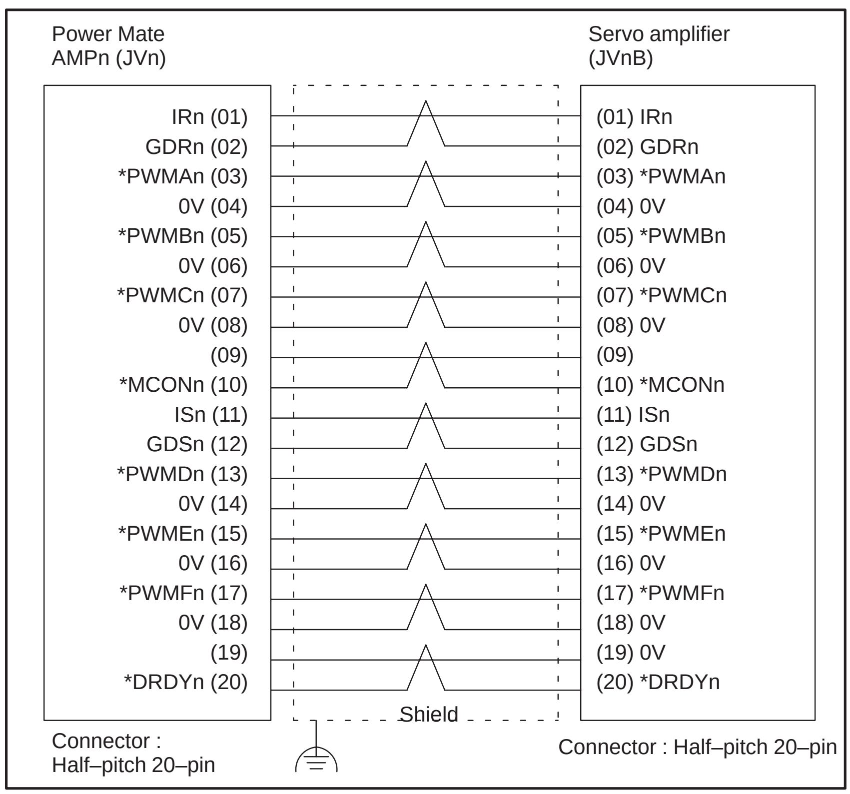
- **Interface type A**



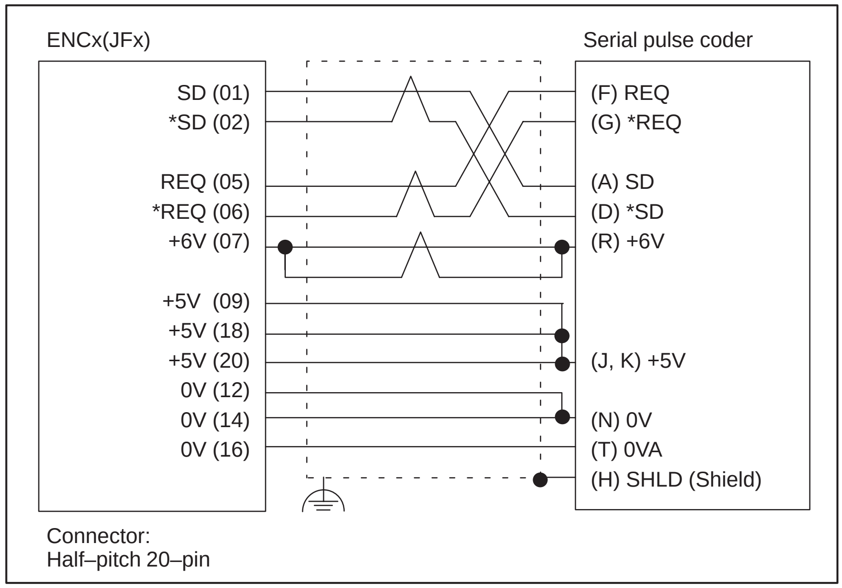
- **Connection to servo amplifier of interface type B**



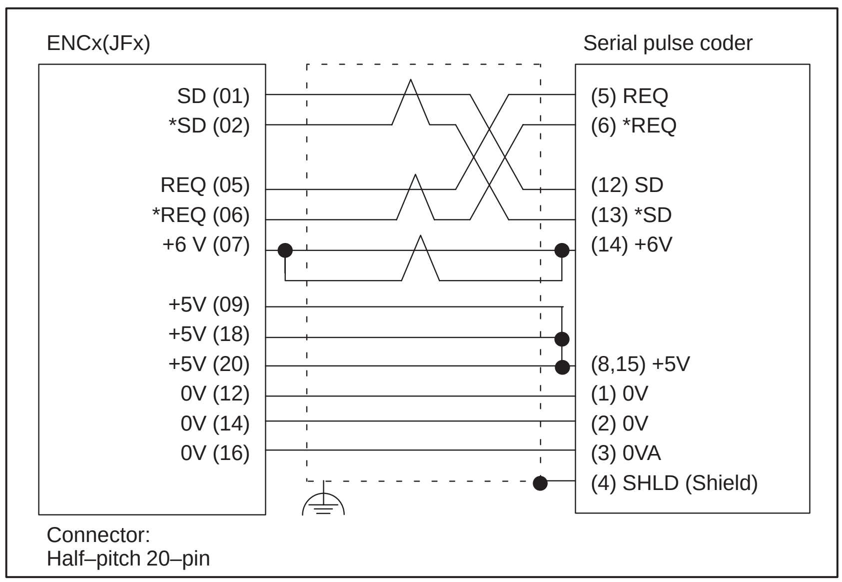
- **Connection to servo amplifier of interface type A**



- **Connection of serial pulse coder**
  (α3/3000 to α40/2000
  α3/2000 to αC22/1500)



- **Connection of serial pulse coder**
  (α1/3000 to α2/3000)



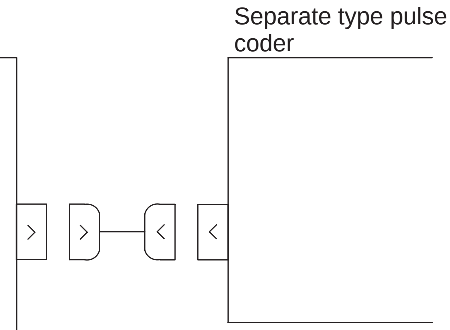
NOTE
Voltage drop caused by the cable resistance must be taken into consideration (0.5 Ω or less, total for both ways).

- **Separate type pulse coder interface**

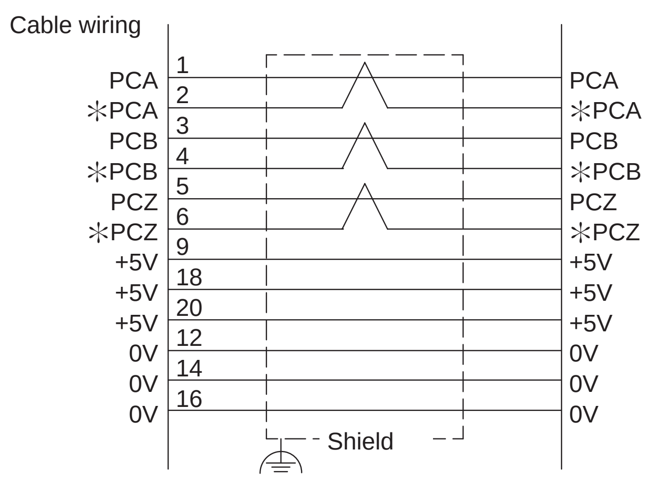
Power Mate

JF21–JF22
(PCR–EV20MDT)

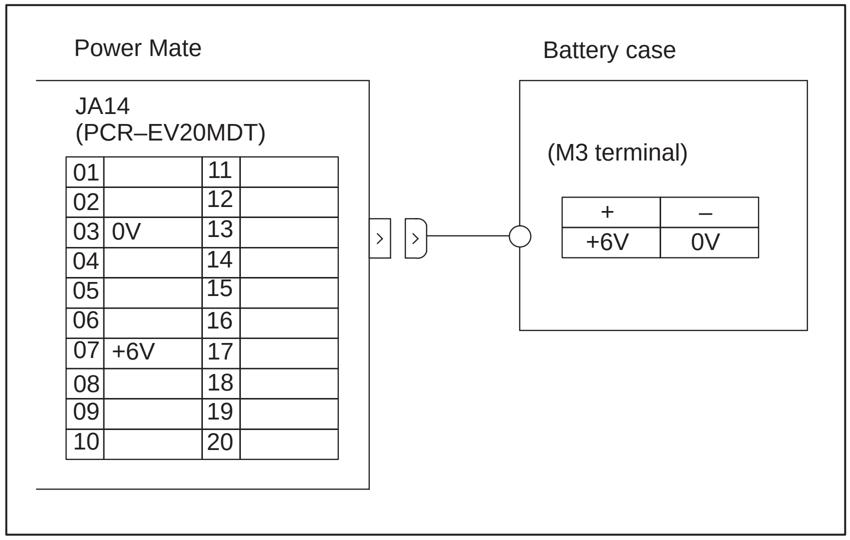
01	PCA	11	
02	✱PCA	12	0V
03	PCB	13	
04	✱PCB	14	0V
05	PCZ	15	
06	✱PCZ	16	0V
07	(+6V)	17	
08	(REQ)	18	+5V
09	+5V	19	
10		20	+5V

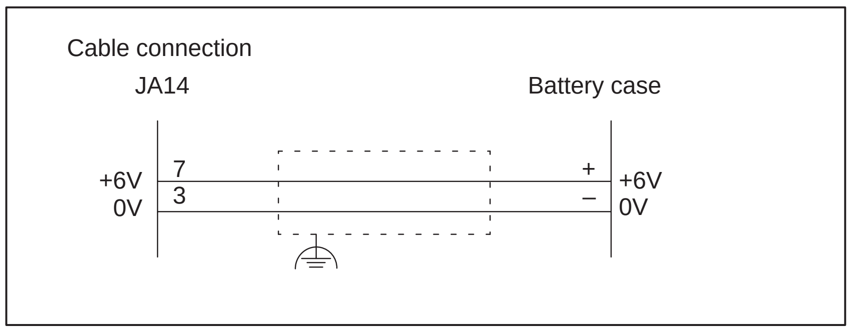


+6V and REQ are for separate absolute pulse coders.

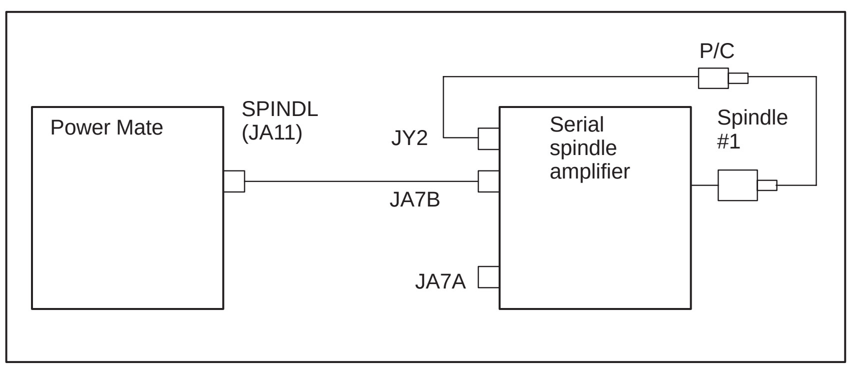


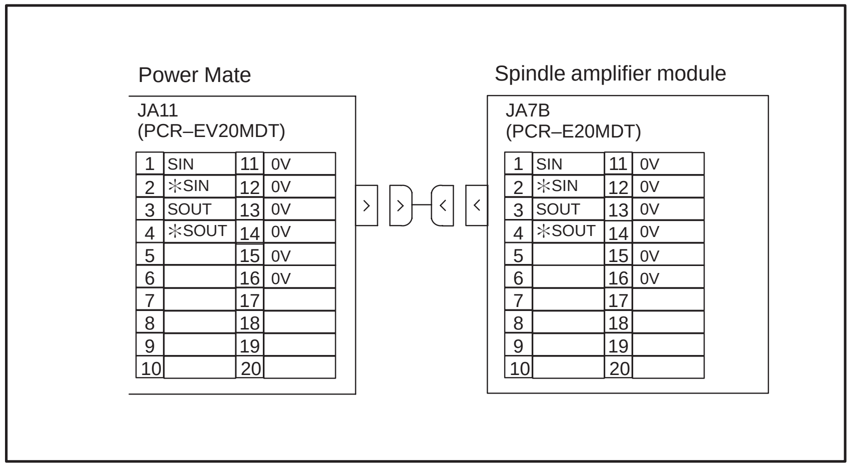
- **Connection to battery for absolute pulse coder**

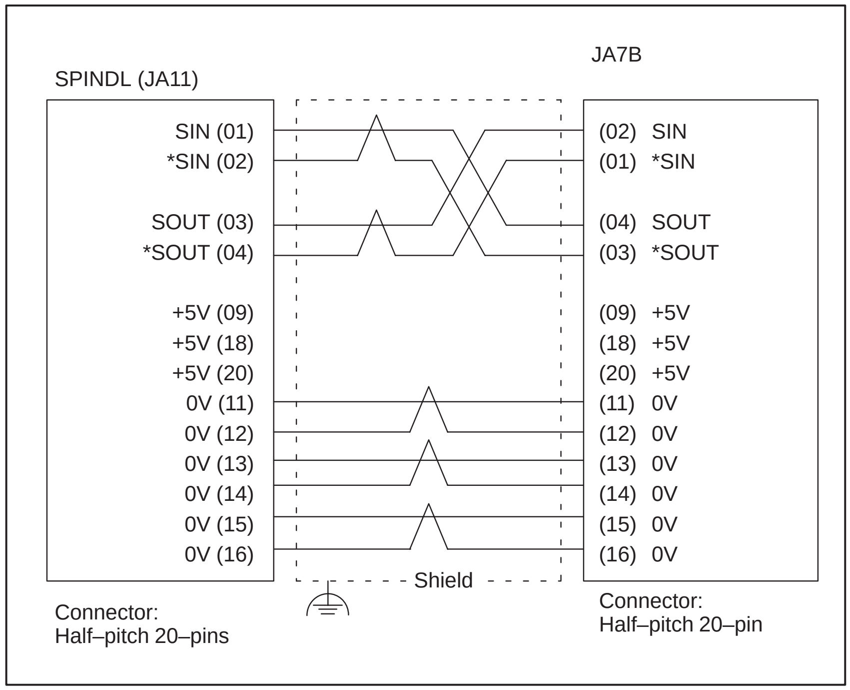




2.3.6 Connection to Serial Spindle Amplifier



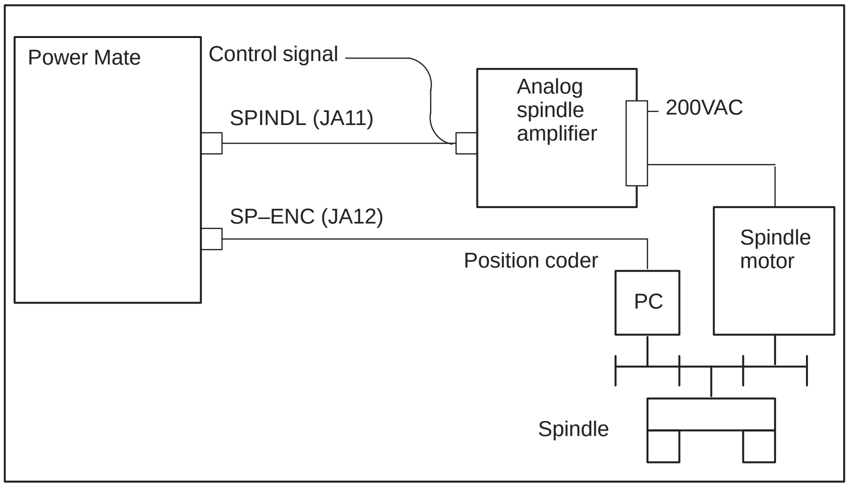




CAUTION

It is necessary to connect +5V (09, 18, 20) only when an optical adapter is used. Do not connect +5V (09, 18, 20) when the position coder is connected directly to the serial spindle amplifier.

2.3.7 Connection to Analog Spindle Amplifier

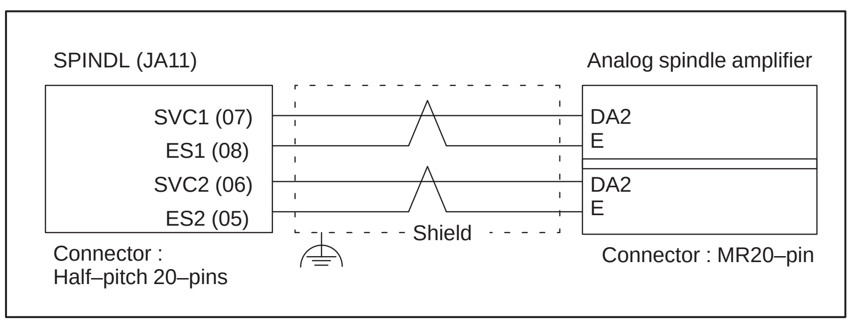


Power Mate

JA11
(PCR–EV20MDT)

1		11	
2		12	
3		13	
4		14	
5	ES2	15	
6	SVC2	16	
7	SVC1	17	
8	ES1	18	
9		19	
10		20	

Signal name	Description
SVCn, ESn	Spindle command voltage and common line



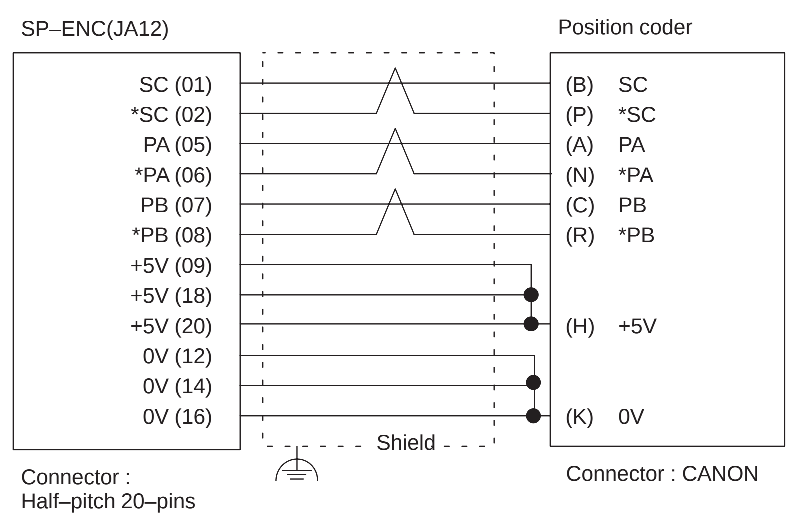
2.3.8 Position Coder Interface

Power Mate

JA12
(PCR–EV20MDT)

1	SC	11	
2	✻SC	12	0V
3	(SOUT)	13	
4	(✻SOUT)	14	0V
5	PA	15	
6	✻PA	16	0V
7	PB	17	
8	✻PB	18	+5V
9	+5V	19	
10		20	+5V

Name	Description
SC, ✻SC	Position coder C–phase signal
PA, ✻PA	Positon coder A–phase signal
PB, ✻PB	Position coder B–phase signal
SOUT, ✻SOUT	Signals for serial spindle (Note)



NOTE

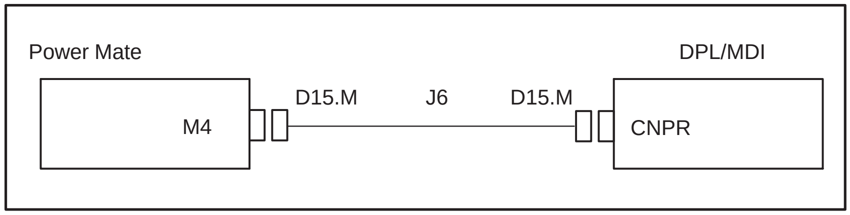
1 The SOUT and *SOUT signals are not used for an analog spindle but are used for a serial spindle. In other words, position coder feedback and a serial spindle are mutually exclusive.

2 In a 2–path Power Mate–D, the position coder interface is provided by the 1st path. The 2nd path has no position coder interface.

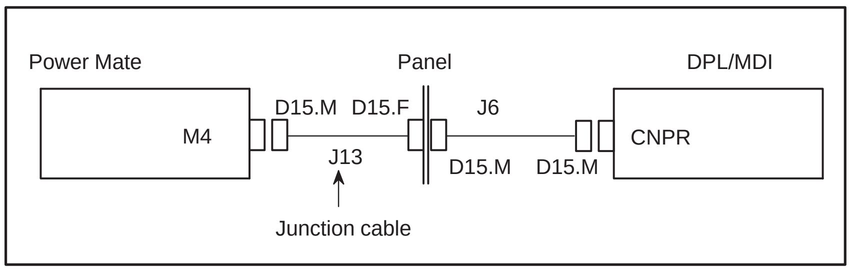
2.3.9 DPL/MDI Interface

- **Connection**

(1) Connection using no junction cable

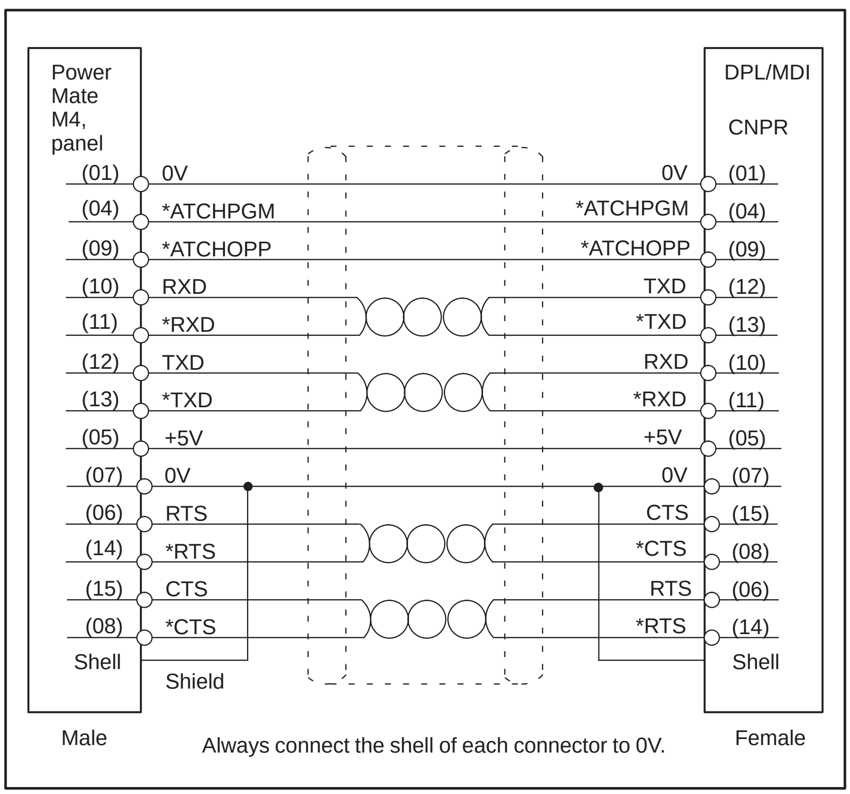


(2) Connection using junction cable J13

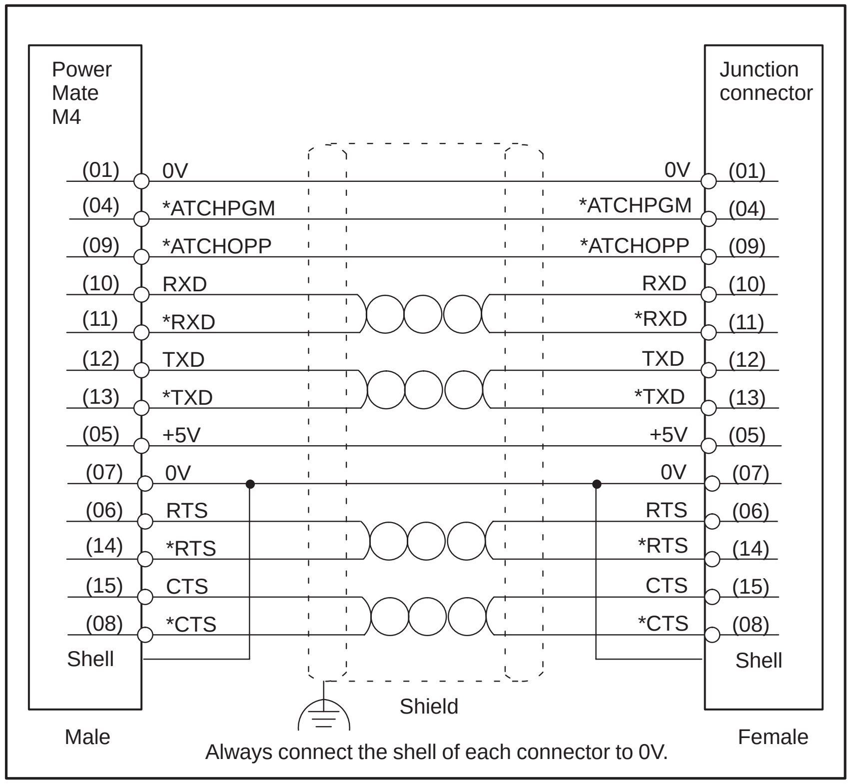


- **Cable connection**

Details of cable J6



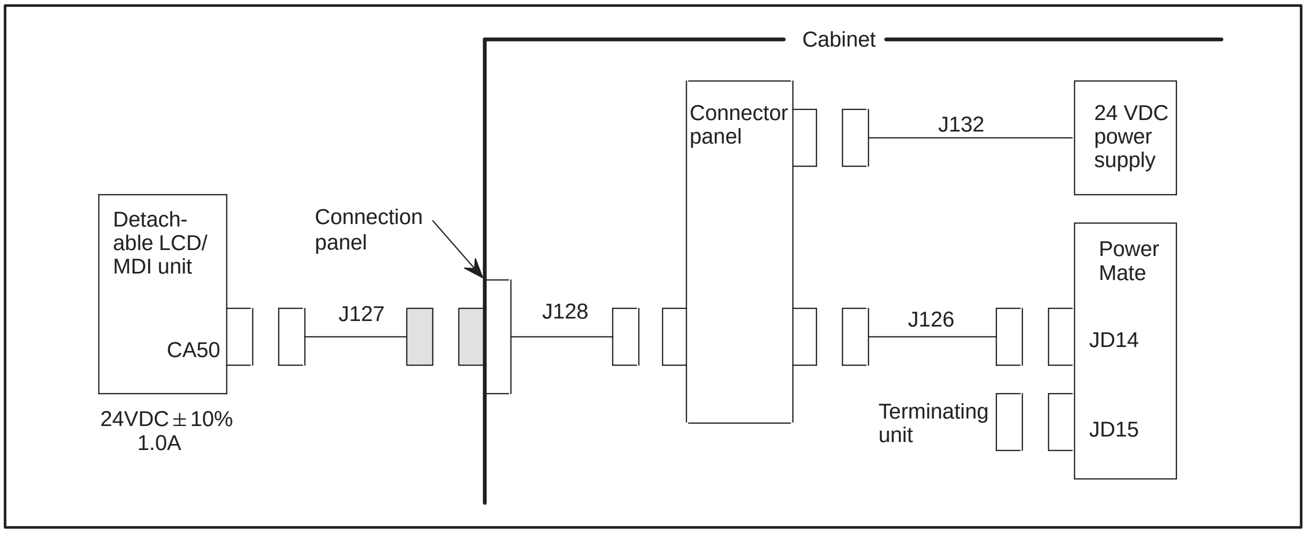
Details of cable J13



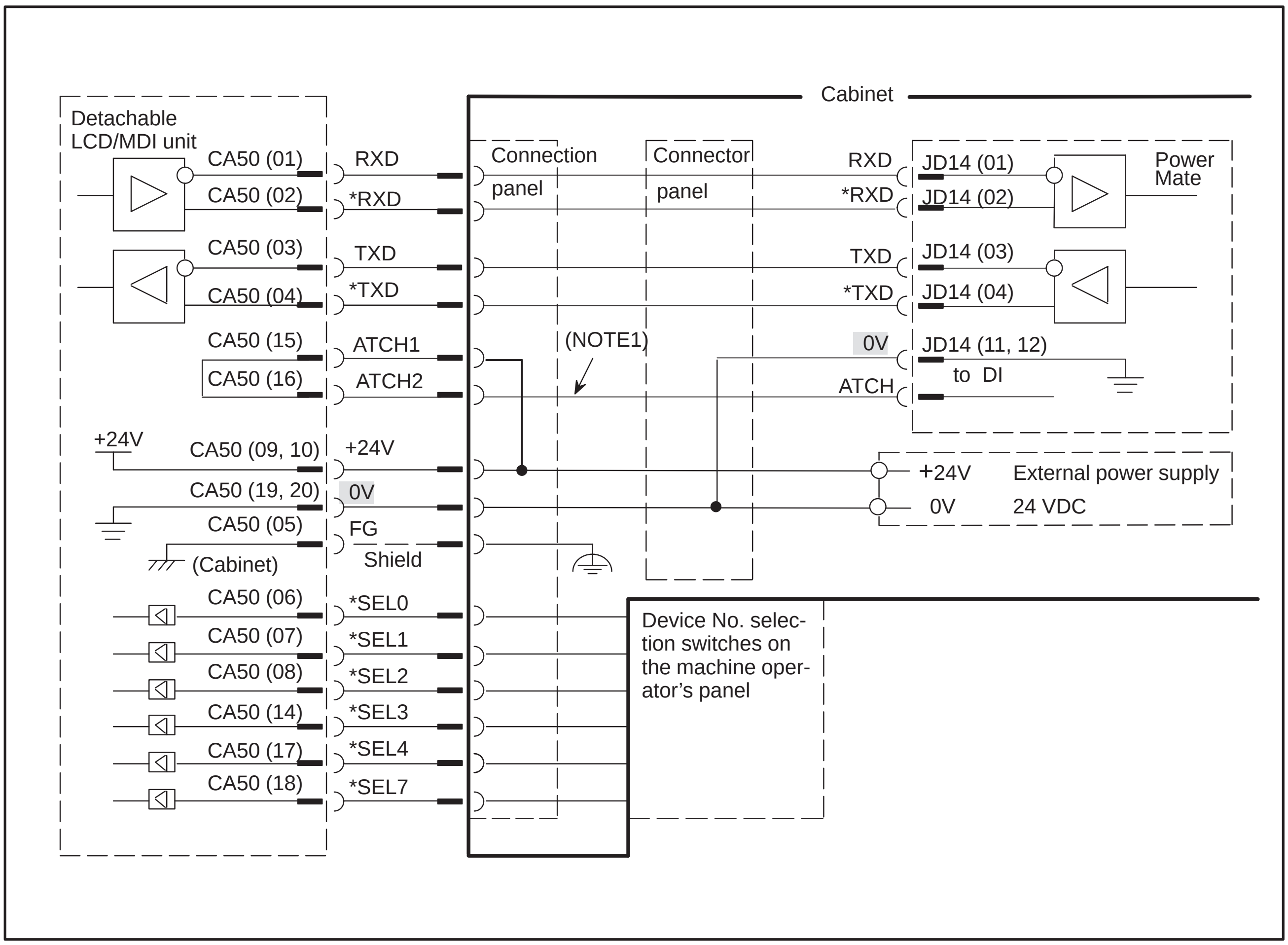
2.3.10 Detachable LCD/MDI Interface

Detachable LCD/MDI can not used at the Power Mate–F. See Connection Manual for details.

- **Connection**



- **Cable connection**



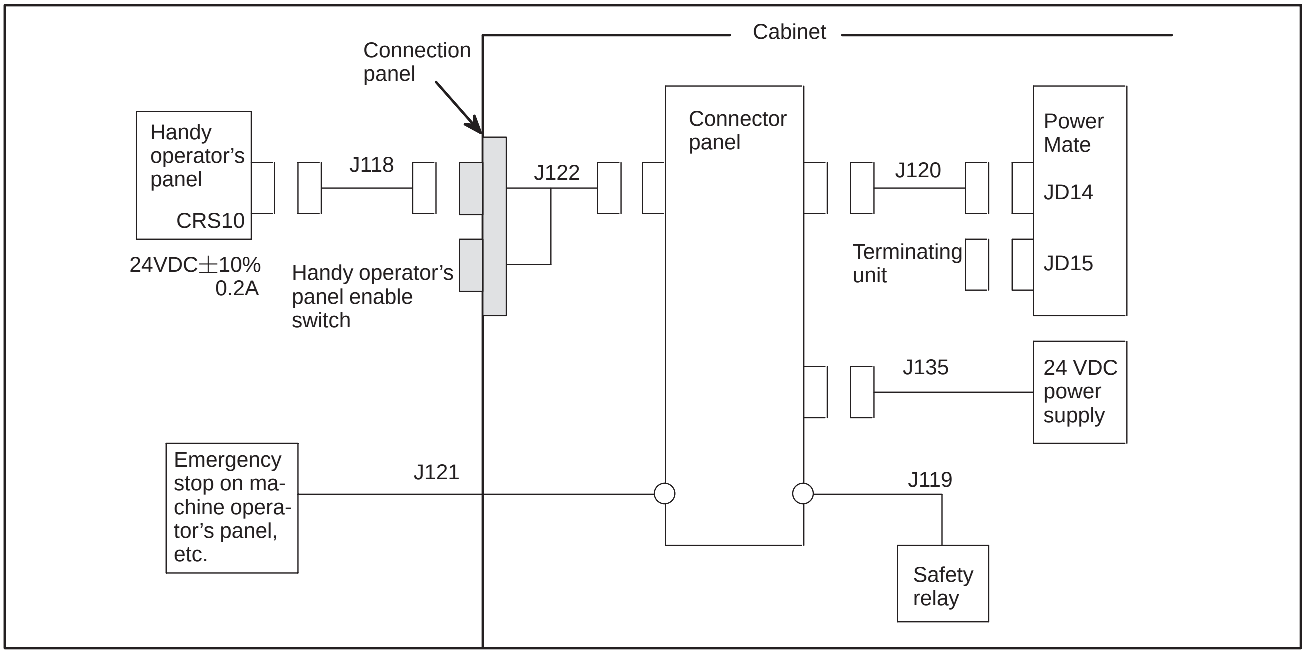
2.3.11 Handy Operator's Panel Interface

Handy operator's panel can not used at the Power Mate–F.

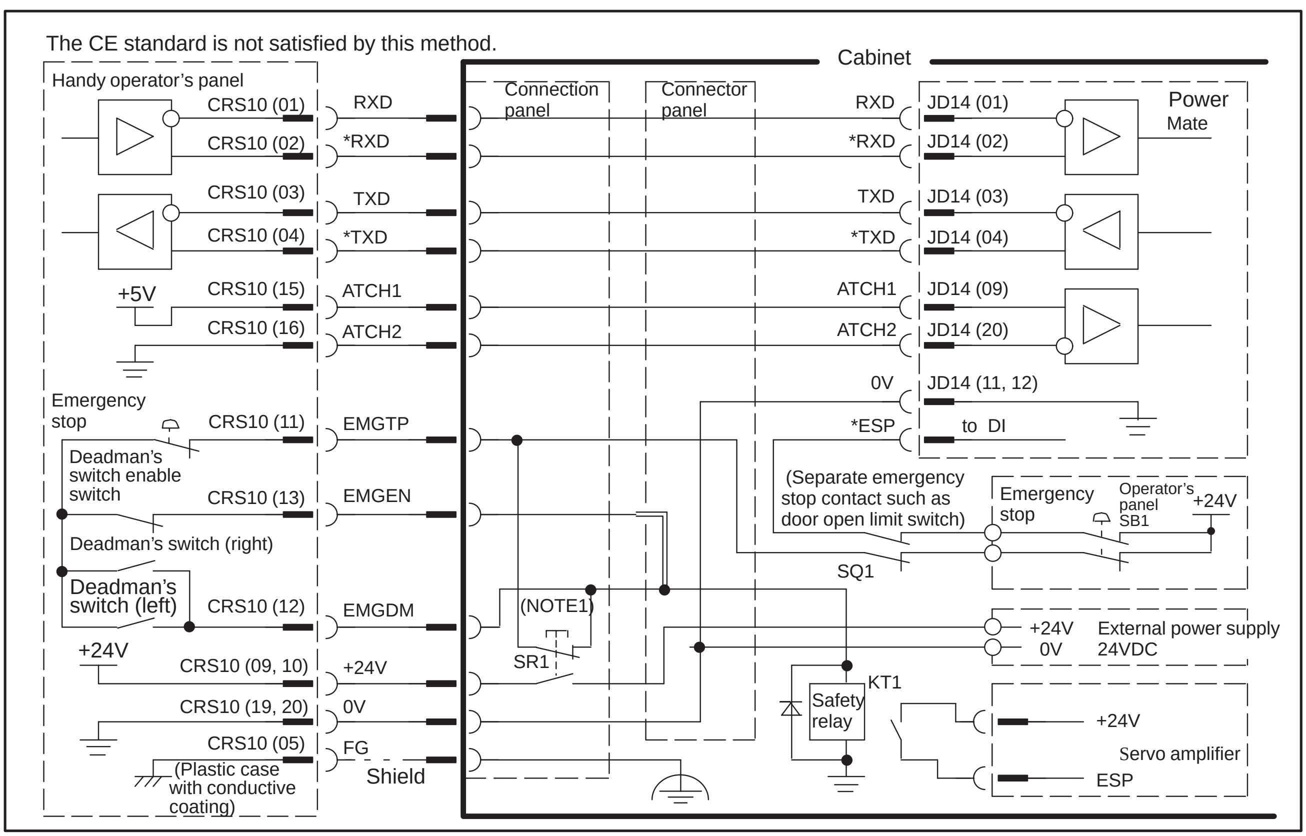
NOTE
1 If 24 V is not applied to emergency stop input EMGTP (CRS10–11) of the handy operator's panel, the handy operator's panel enters the emergency stop state.
2 The terminating unit connected to the JD15 connector of the Power Mate is not a CRT link terminating unit. This is the same as the touch panel terminating unit (2.3.12).
3 Set rotary switch MTSW of the Power Mate main unit to 3.

Connection Allowing the Handy Operator's Panel to be Detached

- **Connection**

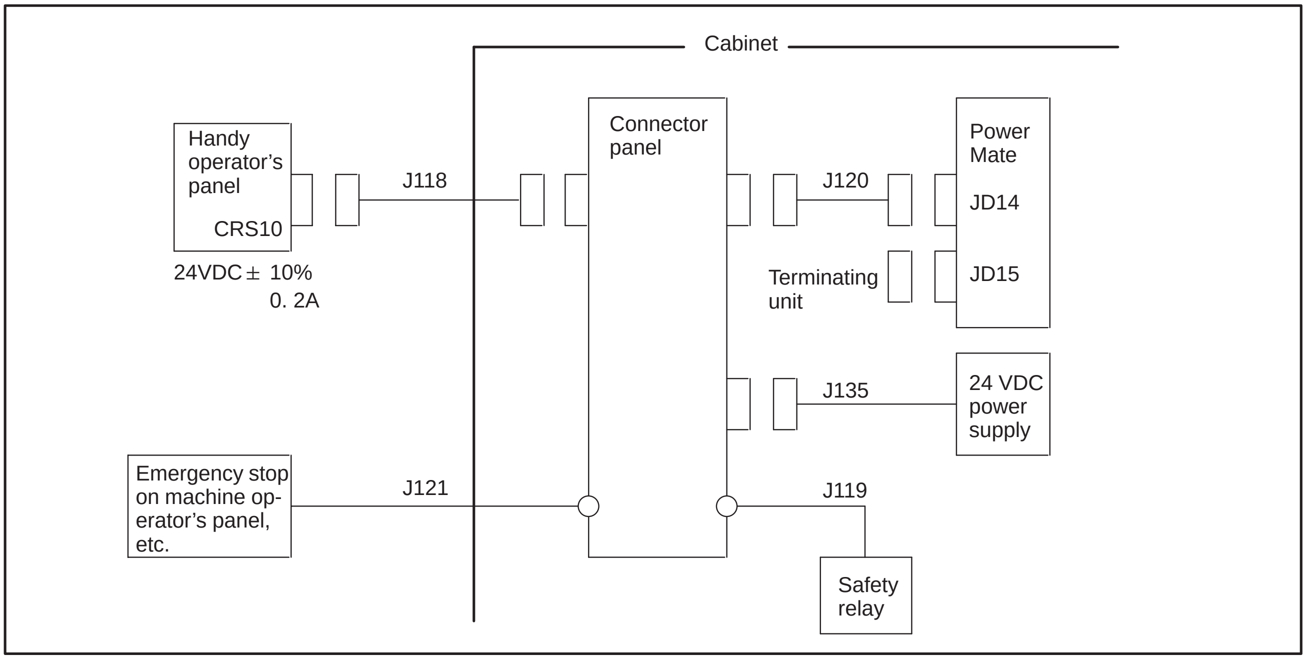


- **Cable connection**

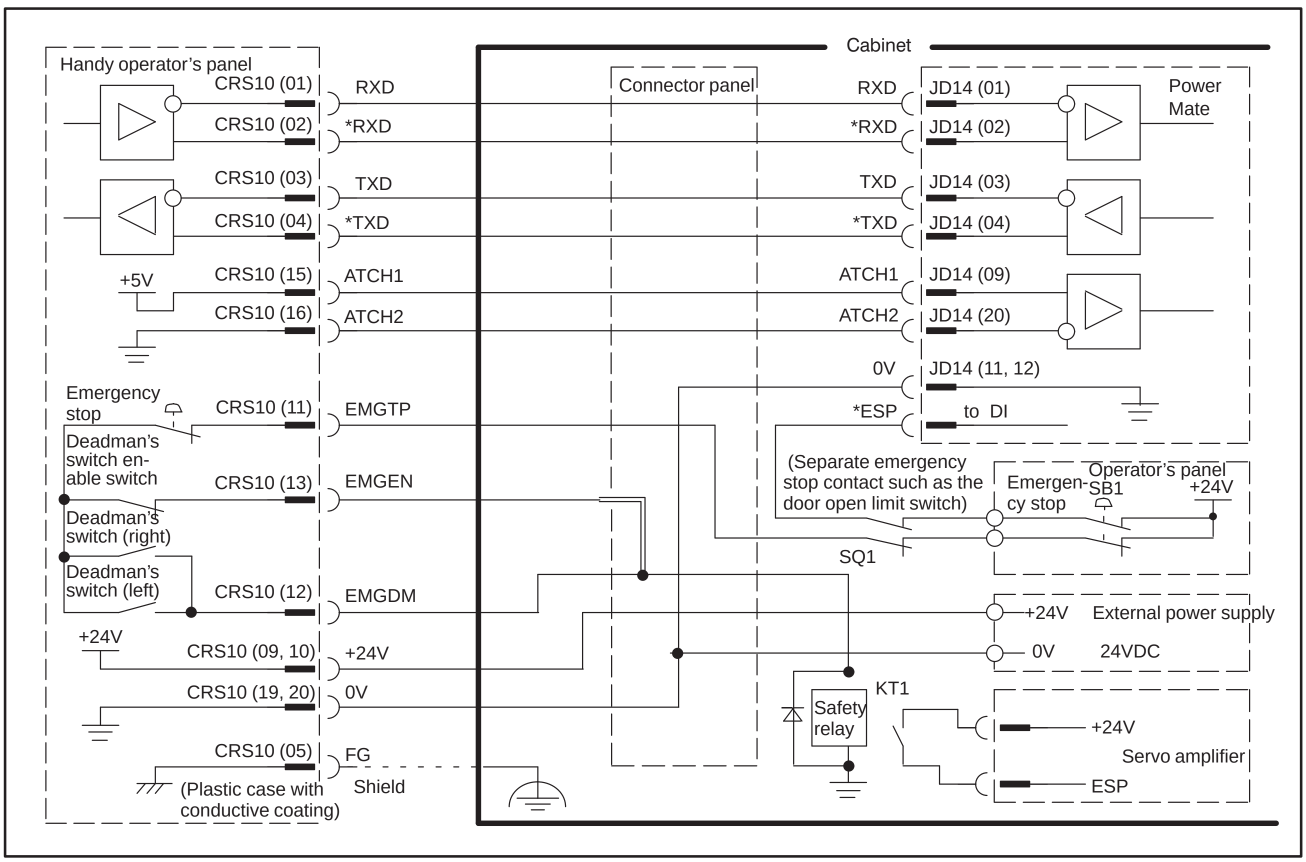


Keeping the Handy Operator's Panel Connected at All Times

- **Connection**



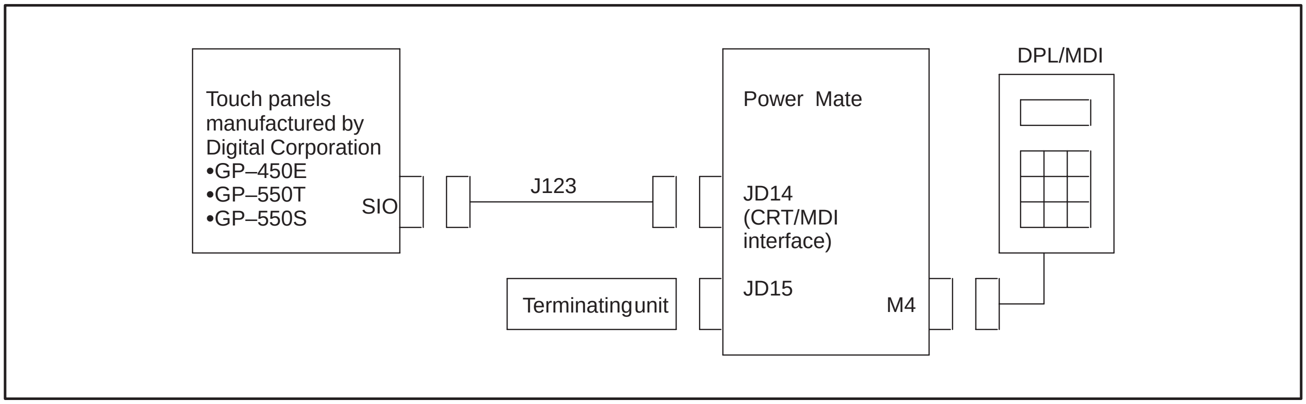
- **Cable connection**



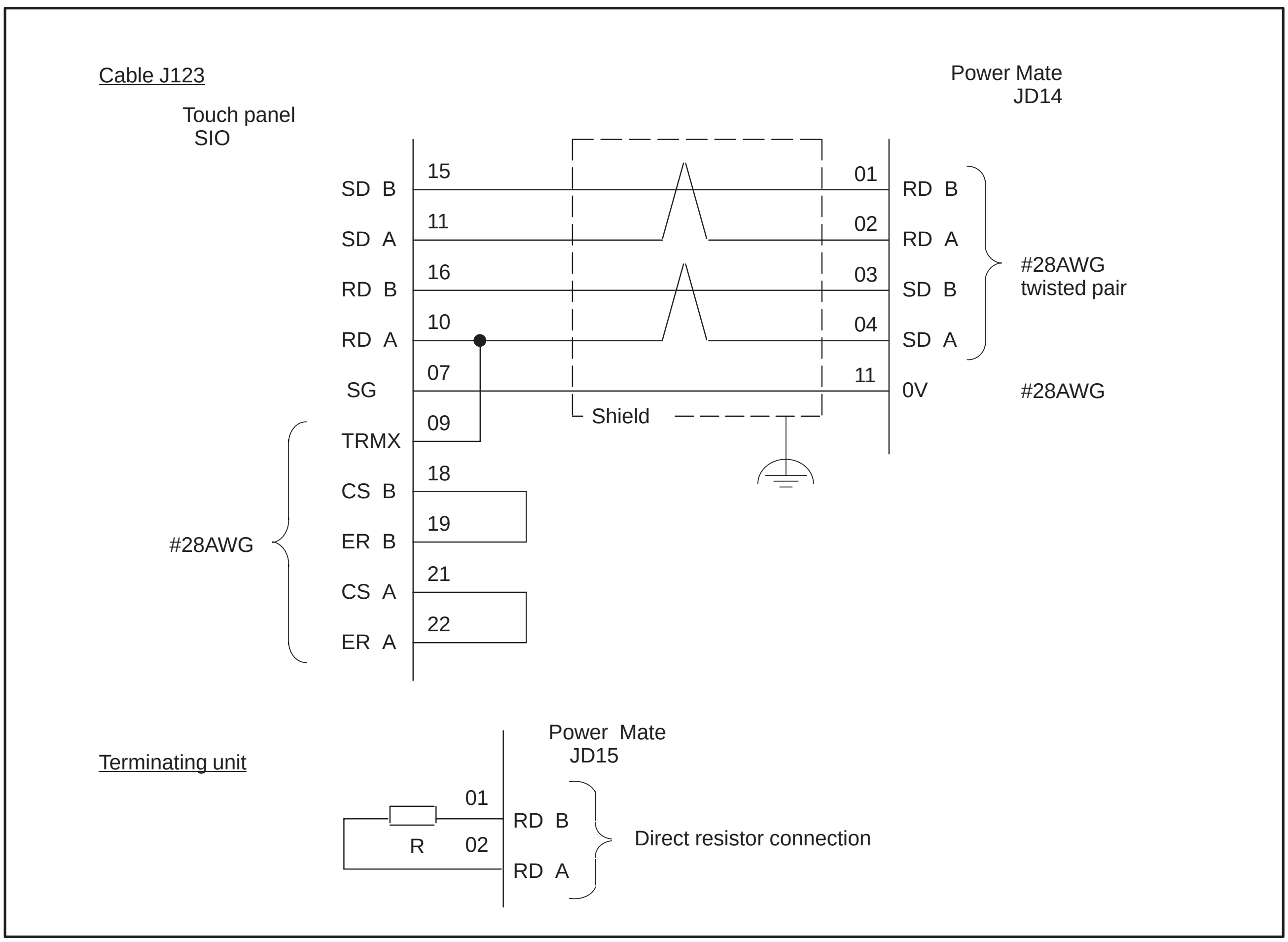
2.3.12 Touch panel Interface

Touch panel interface can not used at the Power Mate–F.

- **Connection**



- **Cable connection**



2.4 LED DISPLAY/ SETTING AND MODULE CONFIGURATION OF UNIT

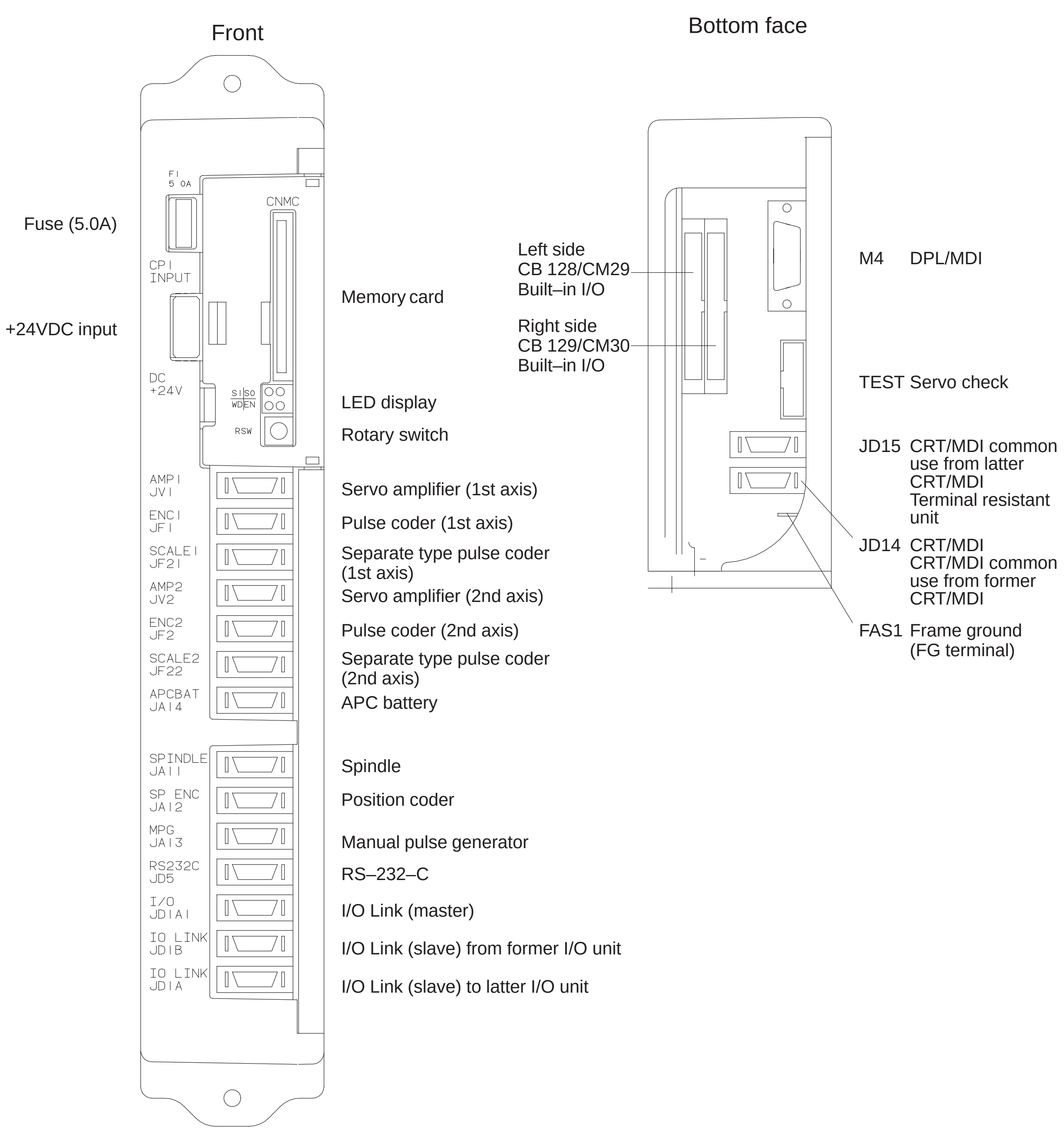
2.4.1 LED Display of Control Unit

If an alarm occurred, an alarm message is usually displayed on the DPL CRT, PDP, LCD, or handy operator's panel screen. However, it is possible that no alarm appears, if the display function is in trouble.
In such a case, the alarm occurrence are displayed by LED on the Controller.

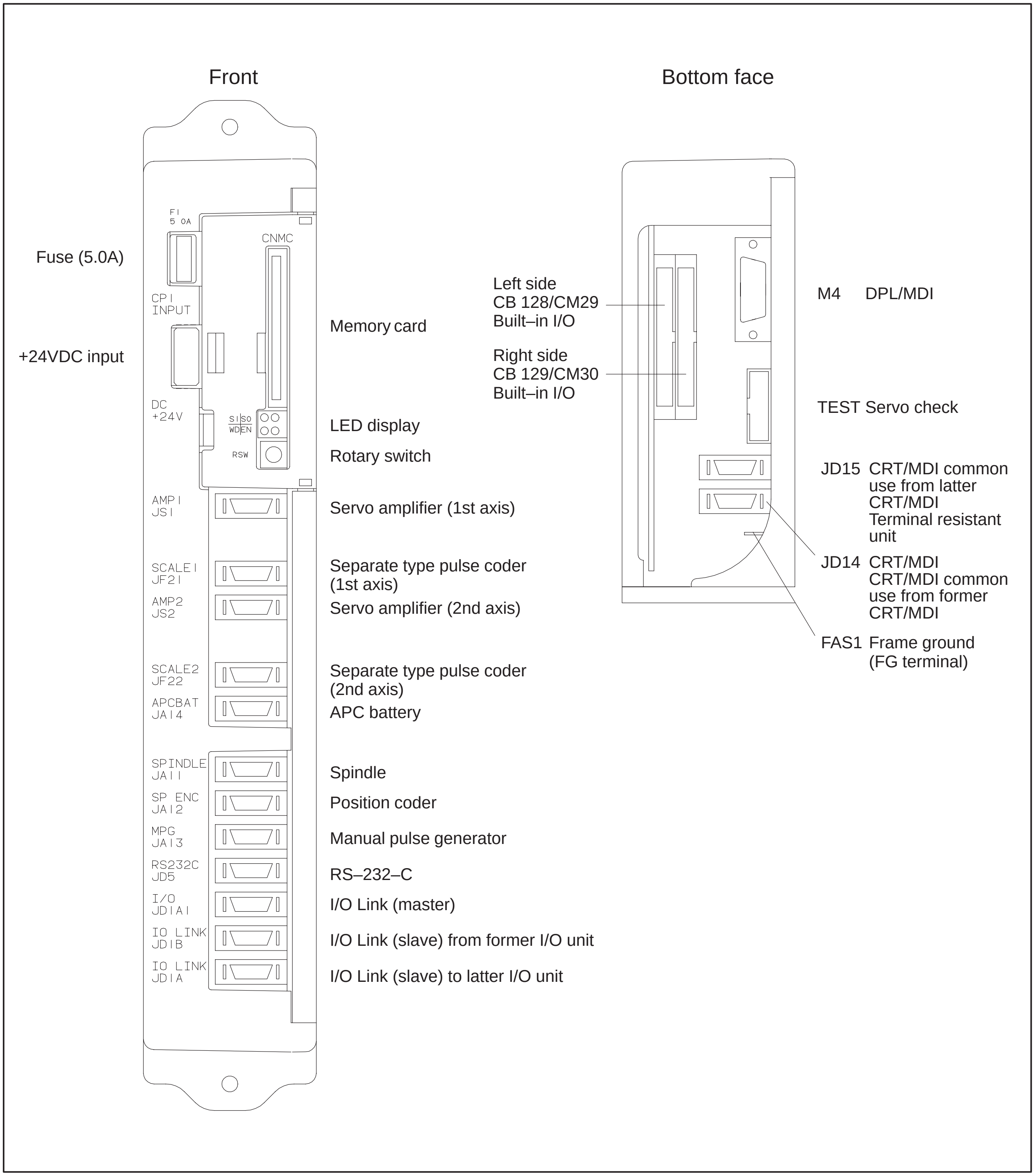
LED		Contents	Countermeasures
No.	Color		
S0	Green	No alarm Blinks during automatic operation. Remains on or off while automatic operation is not being performed.	
S1	Red	Lights with all alarms	An alarm No. is displayed in the DPL/MDI or CRT/MDI at the same time. Make a corrective measure by the alarm No.
EN	Green	This show to turn on power.	
WD	Red	Watch dog alarm	When display unit is connected at alarm is occured, it may be displaied the alarm number. Do some disposal of the alarm. If the all–clear operation does not release the alarm, replace the base PCB

2.4.2 Connector and Signal Name

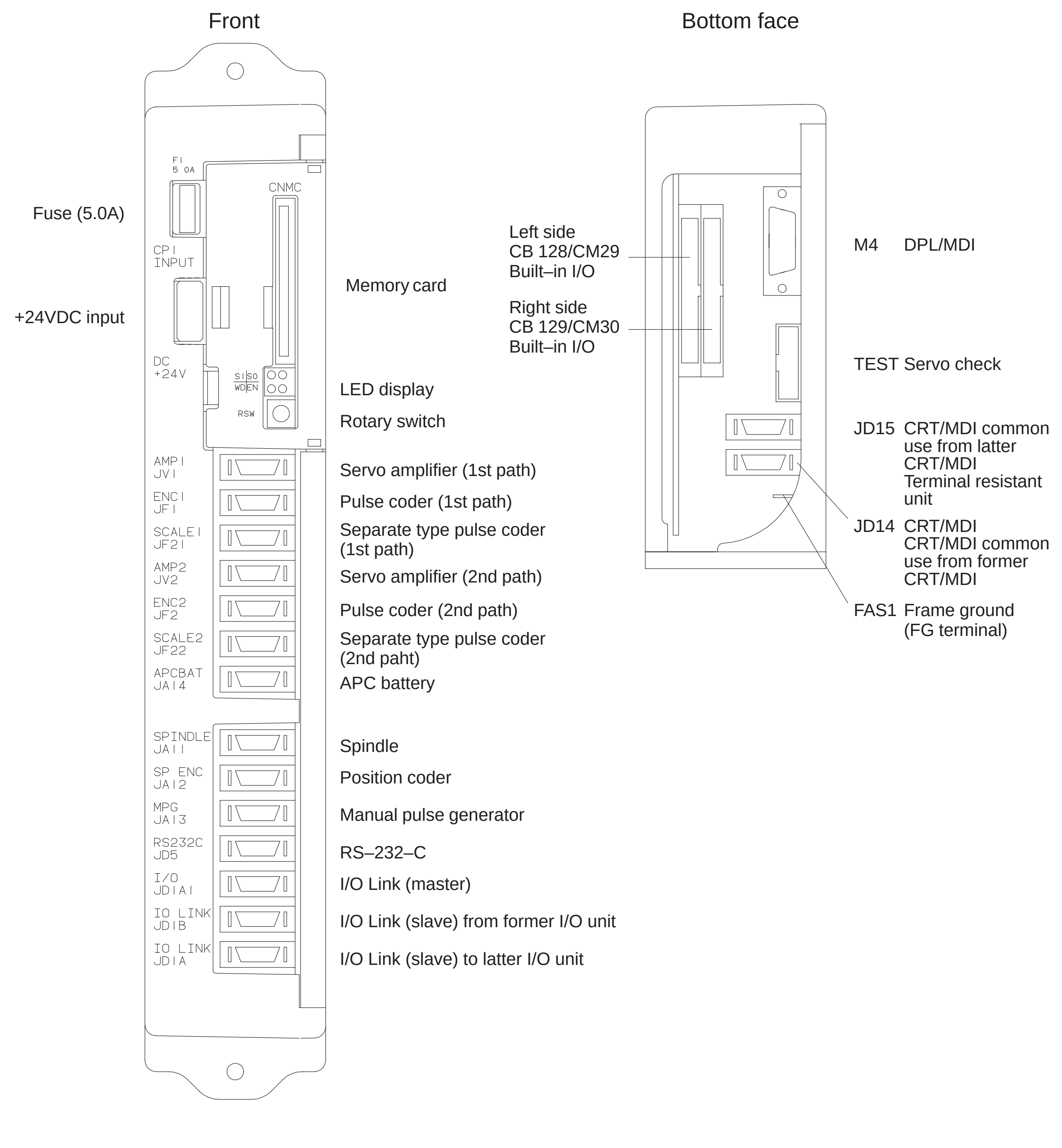
(a) 1–path Power Mate–D (servo interface type A)



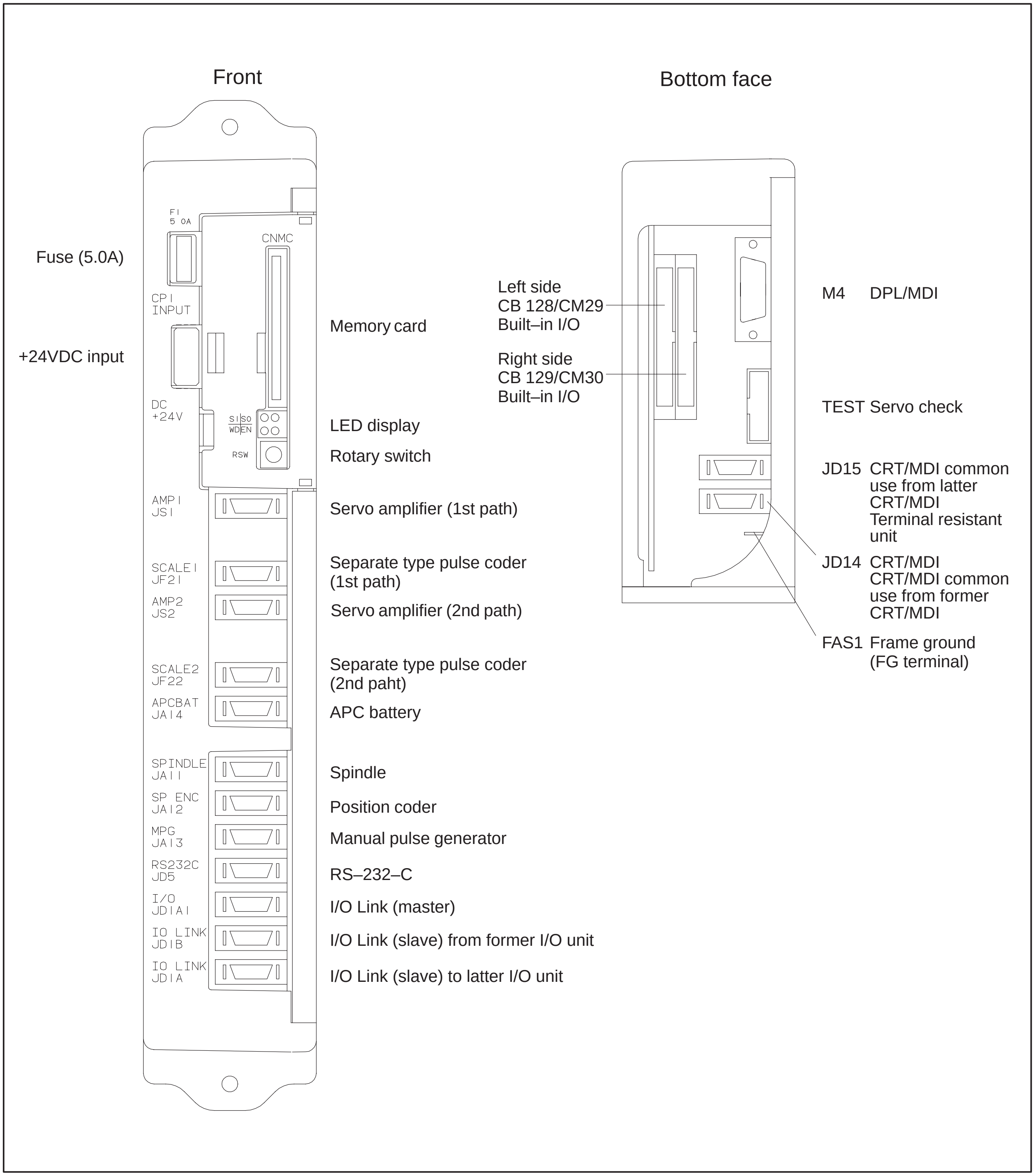
(b) 1–path Power Mate–D (Servo interface type B)



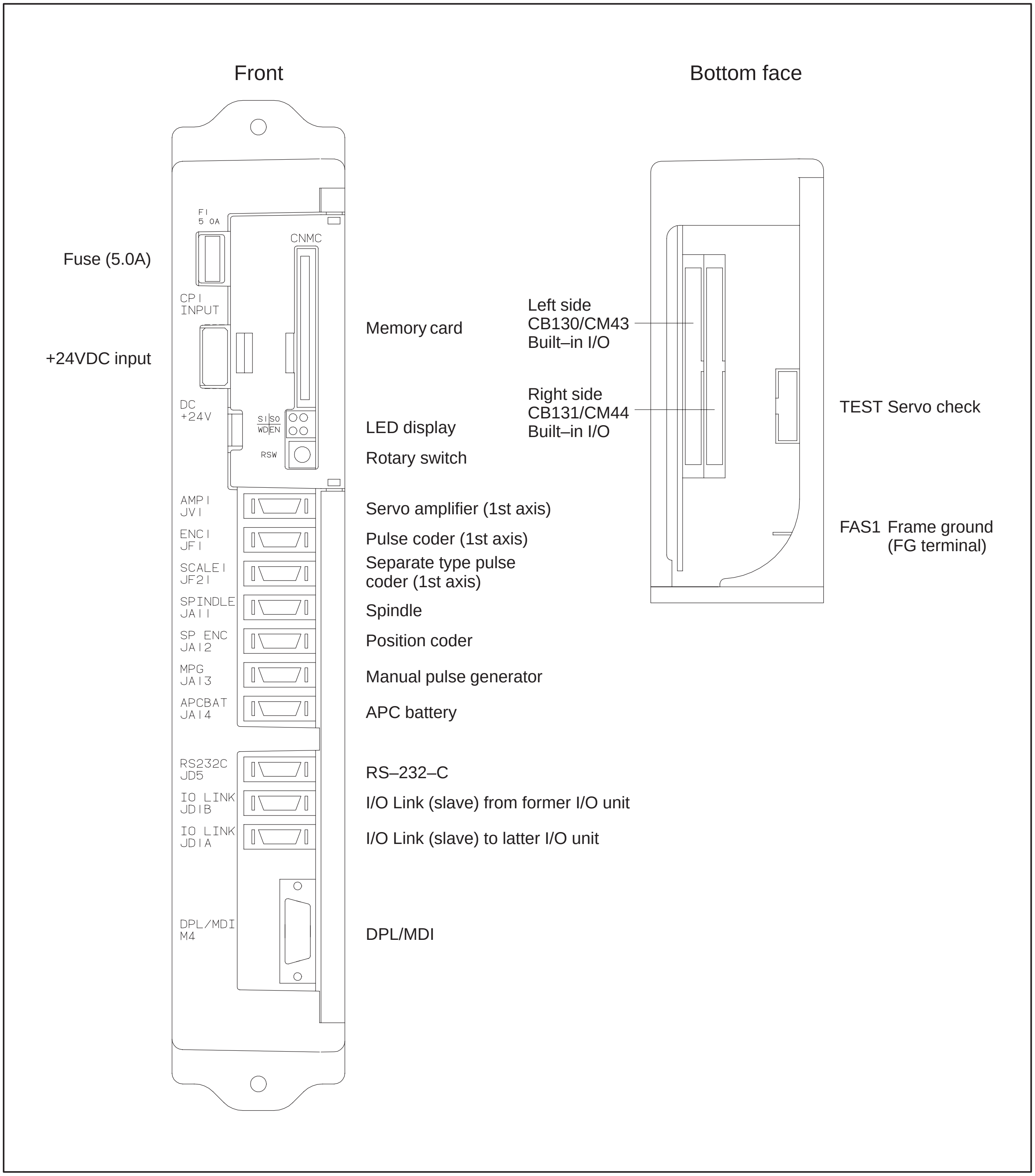
(c) 2–path Power Mate–D (servo interface type A)



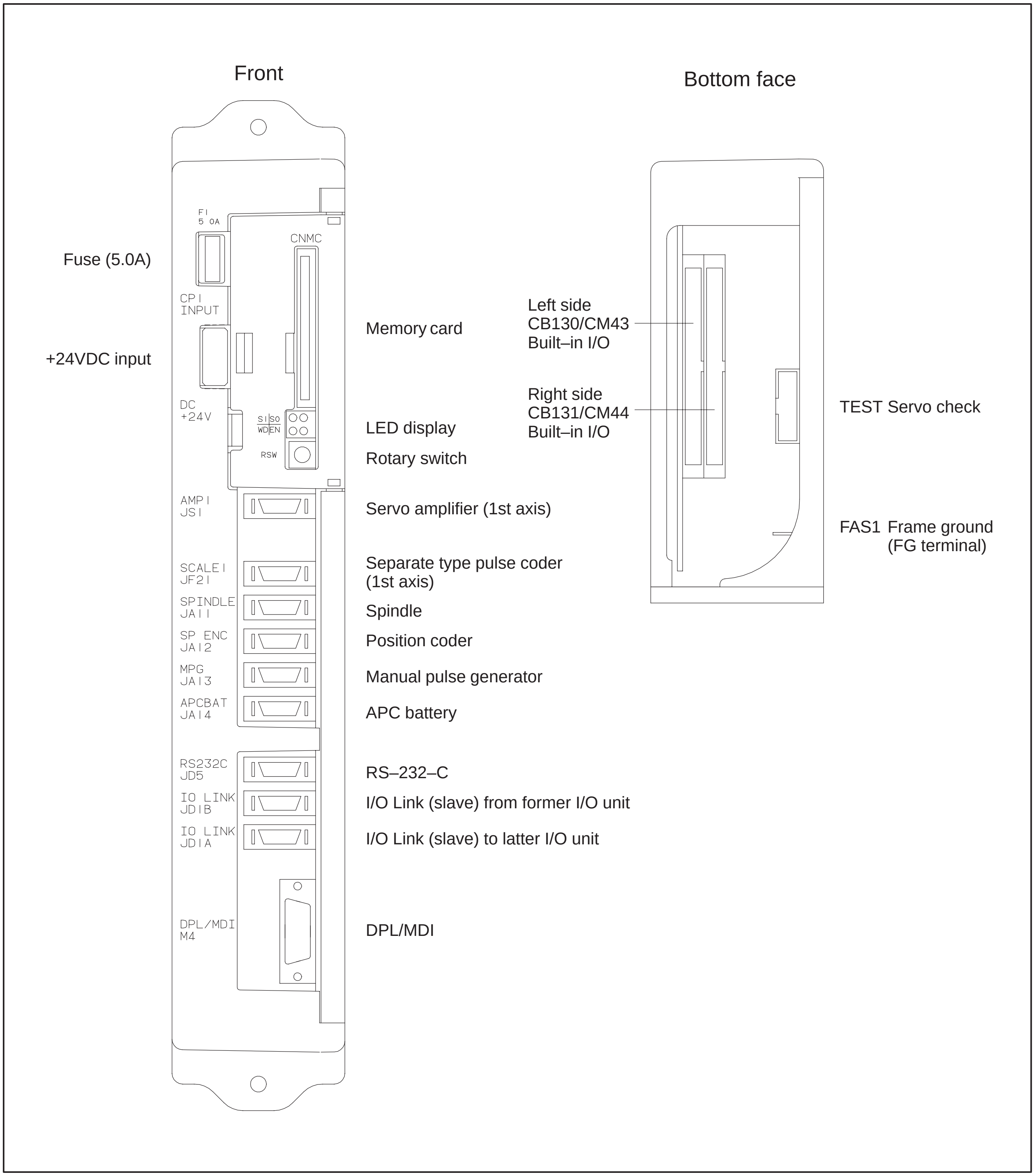
(d) 2–path Power Mate–D (servo interface type B)



(e) Power Mate–F (Servo interface type A)



(f) Power Mate–F (Servo inteface type B)



2.4.3 Fuse

Ordering code	Symbol	Rating	Individual code
A02B–0124–K101	F1	5.0A	A60L–0001–0046#5.0 or A60L–0001–0046#5.0R

2.4.4 Battery of Controller

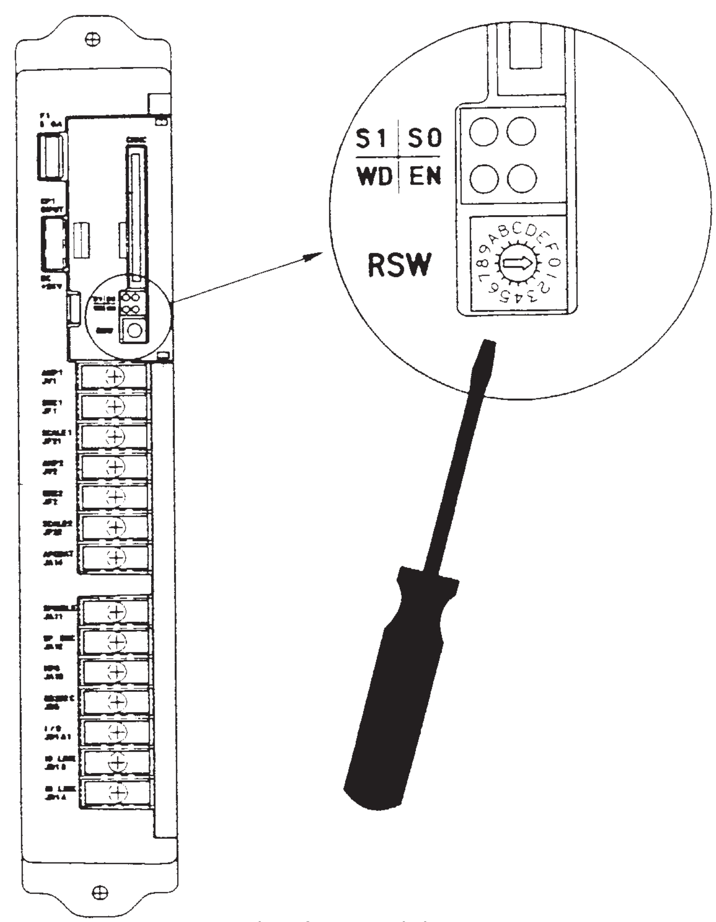
Lithium battery code : A20B–0118–K111

2.4.5 Setting the Rotary Switch RSW

When CRT/MDI common functions and RSW simaltaneous block start at the power Mate–D are used, set device numbers from 0 to 15 with the rotary switch (RSW). Assign the number from the first Power Mate–D in order.

Device No.	RSW setting
0	0
1	1
2	2
3	3

When CRT/MDI common functions and RSW simaltaneous block start are not used, set device number to 0.

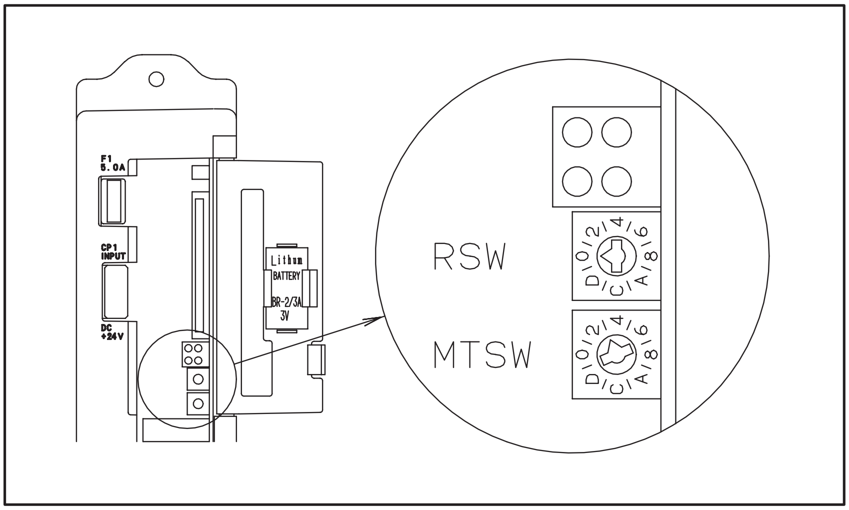


Setting of rotary switch RSW

NOTE
The Power Mate–F is not provided with rotary switch RSW.

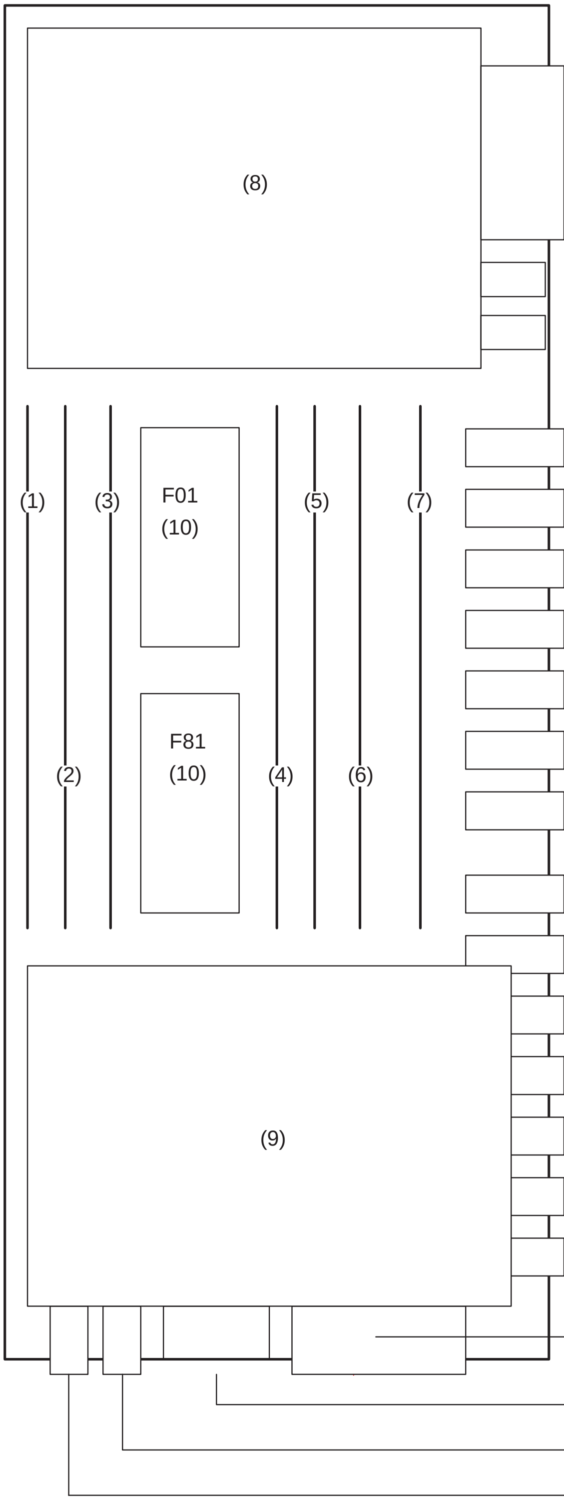
2.4.6 Rotary Switch MTSW

Set MTSW to 0 for general use.
When handy operator's panel is used, set MTSW to 3.
Normally, do not set other number except [0] and [3].



2.4.7 Location of Modules and Internal Printed Boards

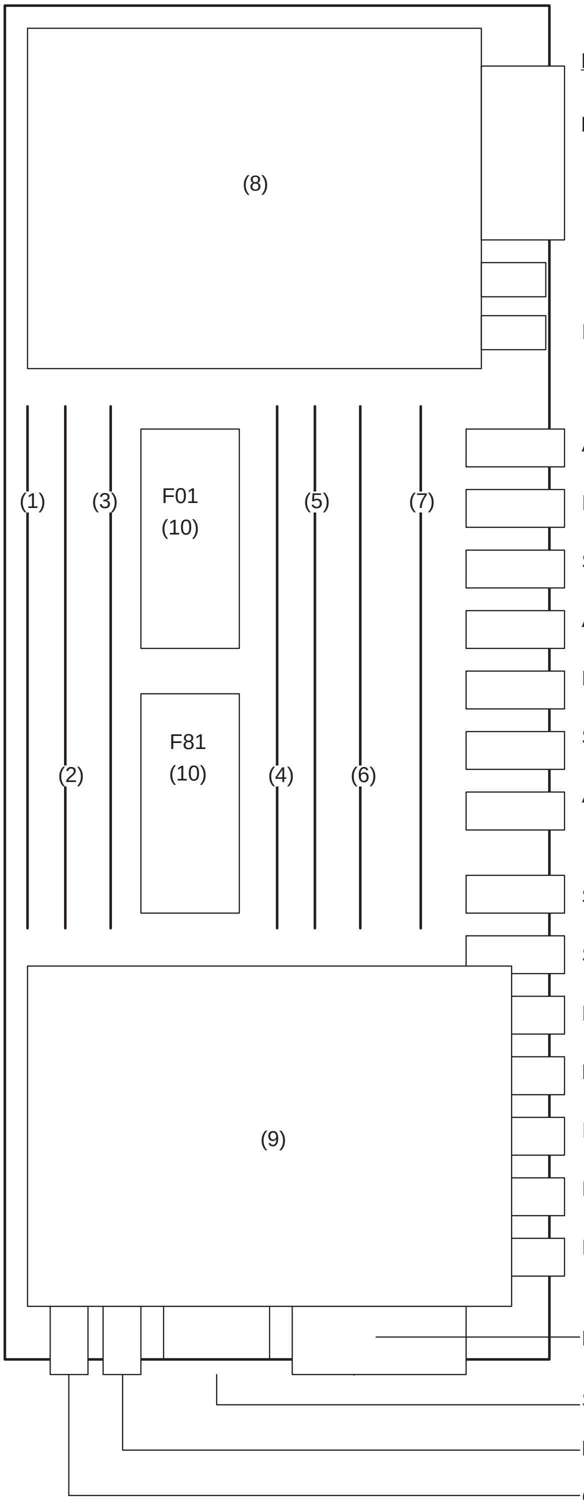
a) Power Mate–D (A02B–0166–B001)



NAME	NUMBER	USE
Memory card	CNMC	Memory card
LED	S1 / S0 WD / EN	LED display
Rotary switch	RSW	CRT common function
AMP1	JV1	Servo amplifier (1st axis)
ENC1	JF1	Pulse coder (1st axis)
SCALE1	JF21	Separate type pulse coder (1st axis)
AMP2	JV2	Servo amplifier (2nd axis)
ENC2	JF2	Pulse coder (2nd axis)
SCALE2	JF22	Separate type pulse coder (2nd axis)
APCBAT	JA14	APC battery
SPNDLE	JA11	Spindle
SP.ENC	JA12	Position coder
MPG	JA13	Manual pulse generator
RS232C	JD5	RS-232-C
I/O	JD1A1	I/O Link (master)
I/O Link	JD1B	I/O Link (slave)from previous step
I/O Link	JD1A	I/O Link (slave) to latter
DPL/MDI	M4	DPL/MDI
SVCHK	TEST	Servo check board
PM/TMNL	JD15	CRT Link to latter
CRT/PM	JD14	CRT Link from previous step

No.	NAME	Specification	Function	Display of system configuration screen
	Base PCB	A16B–2201–0630		–
(1)	PMC controled module A	A20B–2900–0142	PMC–PA1	PMC BIT
	PMC controled module B	A20B–2901–0660, 0662	PMC–PA3	PMC PMP+SLC
(2)	Memory module A	A20B–2900–0531	RAM 128KB	RAM 128KB
		A20B–2902–0332		
	Memory module B	A20B–2900–0530	RAM 256KB	RAM 256KB
		A20B–2902–0331		
	Memory module C	A20B–2900–0541	RAM 512KB	RAM 512KB
		A20B–2902–0330		
(3)	CPU module	A20B–2901–0500	CPU function	–
(4)	CRT controled module	A20B–2901–0480	CRT, PDP	SCA(CRT) 9”CRT
(5)	Spindle module	A20B–2900–0851	Analog spindle	POS LSI
		A20B–2900–0850	Serial spindle	SIC
		A20B–2901–0210	Analog input + Serial spindle	ANALOG INPUT SIC
(6)	Digital servo module	A20B–2900–0160	Servo function	SERVO 1/2
(7)	Digital servo interface module	A20B–2900–0380	Servo interface function	
(8)	Power supply PCB	A20B–1004–0960	Power supply	–
(9)	Sub PCB	A20B–2000–0670	Built–in I/O (sink type)	BLT I/O
		A20B–2001–0370	M–NET	M–NET
(10)	Basic ROM	A02B–0166–H501 #8830	Basic function	8830

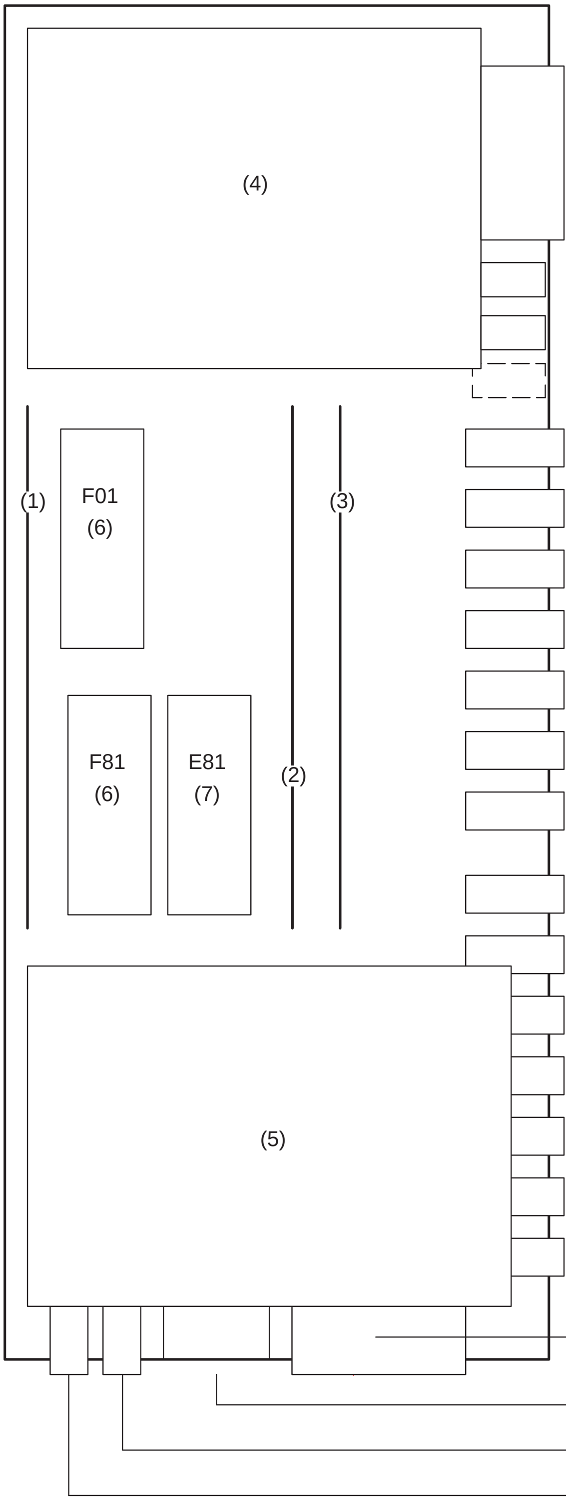
b) Power Mate–D (A02B–0166–B520)
For E series servo control (be able to controled α series servo)



NAME	NUMBER	USE
Memory card	CNMC	Memory card
LED	S1 | S0 WD | EN	LED display
Rotary switch	RSW	CRT common function
AMP1	JV1	Servo amplifier (1st axis)
ENC1	JF1	Pulse coder (1st axis)
SCALE1	JF21	Separate type pulse coder (1st axis)
AMP2	JV2	Servo amplifier (2nd axis)
ENC2	JF2	Pulse coder (2nd axis)
SCALE2	JF22	Separate type pulse coder (2nd axis)
APCBAT	JA14	APC battery
SPNDLE	JA11	Spindle
SP.ENC	JA12	Position coder
MPG	JA13	Manual pulse generator
RS232C	JD5	RS-232-C
I/O	JD1A1	I/O Link (master)
I/O Link	JD1B	I/O Link (slave)from previous step
I/O Link	JD1A	I/O Link (slave) to latter
DPL/MDI	M4	DPL/MDI
SVCHK	TEST	Servo check board
PM/TMNL	JD15	CRT Link to latter
CRT/PM	JD14	CRT Link from previous step

No.	NAME	Specification	Function	Display of system configuration screen
	Base PCB	A16B–2201–0630		–
(1)	PMC controled module A	A20B–2900–0142	PMC–PA1	PMC BIT
	PMC controled module B	A20B–2901–0660, 0662	PMC–PA3	PMC PMP+SLC
(2)	Memory module A	A20B–2900–0531	RAM 128KB	RAM 128KB
		A20B–2902–0332		
	Memory module B	A20B–2900–0530	RAM 256KB	RAM 256KB
		A20B–2902–0331		
	Memory module C	A20B–2900–0541	RAM 512KB	RAM 512KB
		A20B–2902–0330		
(3)	CPU module	A20B–2901–0500	CPU function	–
(4)	CRT controled module	A20B–2901–0480	CRT, PDP	SCA(CRT) 9”CRT
(5)	Spindle module	A20B–2900–0851	Analog spindle	POS LSI
		A20B–2900–0850	Serial spindle	SIC
		A20B–2901–0210	Analog input + Serial spindle	ANALOG INPUT SIC
(6)	Digital servo module	A20B–2901–0340	E series servo	SERVO 1/2
(7)	Digital servo interface module	A20B–2900–0380	Servo interface function	
(8)	Power supply PCB	A20B–1004–0960	Power supply	–
(9)	Sub PCB	A20B–2000–0670	Built–in I/O (sink type)	BLT I/O
		A20B–2001–0370	M–NET	M–NET
(10)	Basic ROM	A02B–0166–H501 #8831	Basic function	8831

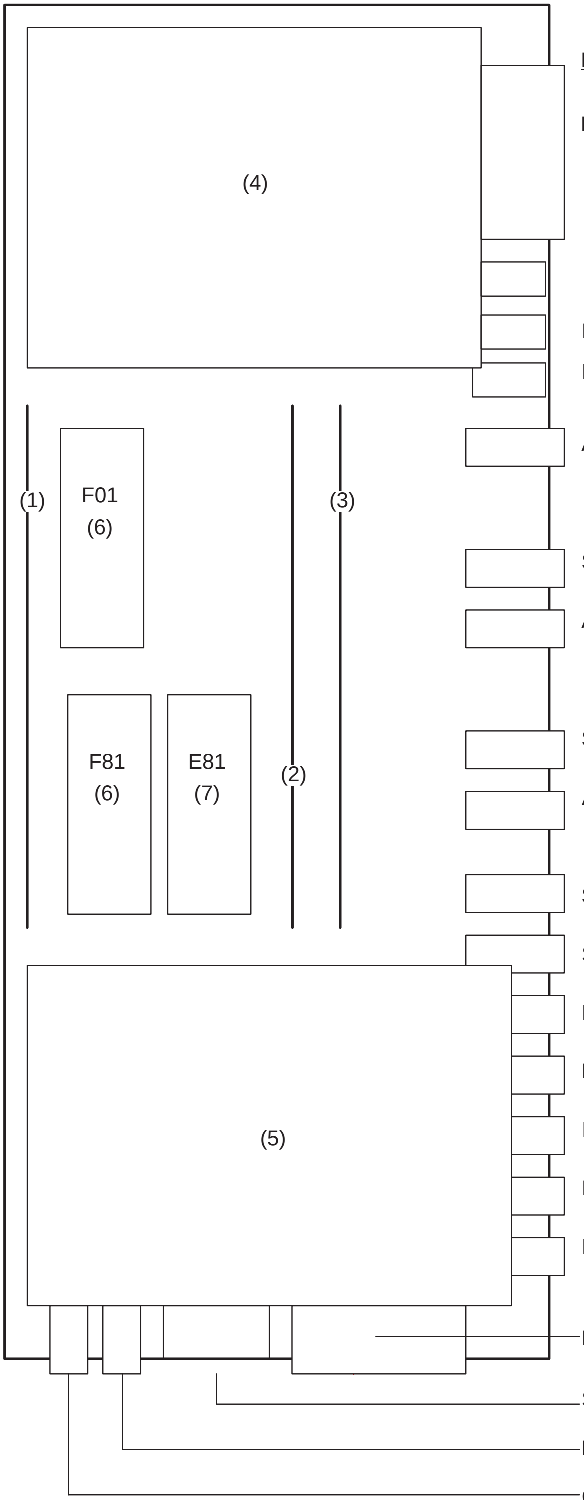
c) Power Mate–D (A02B–0166–B501, B502)
Conrresponding to 2–path (Interface type A)



NAME	NUMBER	USE
Memory card	CNMC	Memory card
LED	S1 | S0 WD | EN	LED display
Rotary switch	RSW	CRT common function
Rotary switch (Base PCB Version 04C or later)	MTSW	Maintenance function
AMP1	JV1	Servo amplifier (1st axis)
ENC1	JF1	Pulse coder (1st axis)
SCALE1	JF21	Separate type pulse coder (1st axis)
AMP2	JV2	Servo amplifier (2nd axis)
ENC2	JF2	Pulse coder (2nd axis)
SCALE2	JF22	Separate type pulse coder (2nd axis)
APCBAT	JA14	APC battery
SPNDLE	JA11	Spindle
SP.ENC	JA12	Position coder
MPG	JA13	Manual pulse generator
RS232C	JD5	RS-232-C
I/O	JD1A1	I/O Link (master)
I/O Link	JD1B	I/O Link (slave)from previous step
I/O Link	JD1A	I/O Link (slave) to latter
DPL/MDI	M4	DPL/MDI
SVCHK	TEST	Servo check board
PM/TMNL	JD15	CRT Link to latter
CRT/PM	JD14	CRT Link from previous step

No.	NAME	1–path	2–path	Specification	Function	Display of system configuration screen
	Base PCB (B501)	○	○	A20B–2100–0030	RAM 256KB Servo function Servo interface	RAM 256KB SERVO 1/2
	Base PCB (B502)	○	○	A20B–2100–0031		
	Base PCB (B501)	○	○	A20B–2001–0610		
(1)	PMC controled module A	○		A20B–2900–0142	PMC–PA1	PMC BIT
	PMC controled module B	○	○	A20B–2901–0660, 0662	PMC–PA3	PMC PMP+SLC
(2)	Memory module CSA		○	A20B–2902–0230	RAM addition 512KB Analog spindlex2	RAM 768KB POS LSI
	Memory module BSA		○	A20B–2902–0231	RAM addition 256KB Analog spindlex2	RAM 512KB POS LSI
	Memory module ASA		○	A20B–2902–0232	Analog spindlex2	POS LSI
	Memory module BSA	○		A20B–2902–0234	RAM addition 256KB Analog spindle	RAM 512KB POS LSI
	Memory module ASA	○		A20B–2902–0235	Analog spindle	POS LSI
	Memory module C		○	A20B–2902–0236	RAM addition 512KB	RAM 768KB
	Memory module B	○	○	A20B–2902–0237	RAM addition 256KB	RAM 512KB
	Memory module BSSA	○		A20B–2902–0221	RAM addition 256KB Serial spindle Analog input	RAM 512KB SIC ANALOG INPUT
	Memory module ASSA	○		A20B–2902–0222	Serial spindle Analog input	SIC ANALOG INPUT
	Memory module CSS		○	A20B–2902–0223	RAM addition 512KB Serial spindle	RAM 768KB SIC
	Memory module BSS	○	○	A20B–2902–0224	RAM addition 256KB Serial spindle	RAM 512KB SIC
	Memory module ASS	○	○	A20B–2902–0225	Serial spindle	SIC
(3)	CRT controled module	○	○	A20B–2901–0480	CRT,LCD,PDP,Handy operator's panel	SCA(CRT) 9"CRT
	Touch panel connection module	○	○	A20B–2902–0470	Touch panel connection	–
	HSSB module	○	○	A20B–2902–0540	HSSB function	–
(4)	Power supply PCB	○	○	A20B–1004–0960	Power supply	–
(5)	Sub PCB	○	○	A20B–2000–0670	Built–in I/O (sink type)	BLT I/O
		○	○	A20B–2001–0902	Built–in I/O C (source type)	BLT I/O SRC
		○		A20B–2100–0120	Profibus card	PROFIBUS
				A20B–8001–0500		
		○		A20B–8100–0060	Genius card	GENIUS
		○	○	A20B–2100–0040	I/O Link–II	I/O Link–2
		○	○	A20B–2001–0370	M–NET	M–NET
(6)	Basic ROM	○		A02B–0166–H511 #8831	For 1–path control Basic function	8831
		○		A02B–0166–H511 #8834	For 1–path control Basic function	8834
			○	A02B–0166–H511 #8836	For 2–path control Basic function	8836
			○	A02B–0166–H511 #8837	For 2–path control Basic function	8837
(7)	Option ROM	○		A02B–0166–H511 #8834	For 1–path control	8834
			○	A02B–0166–H511 #8837	For 2–path control	8837

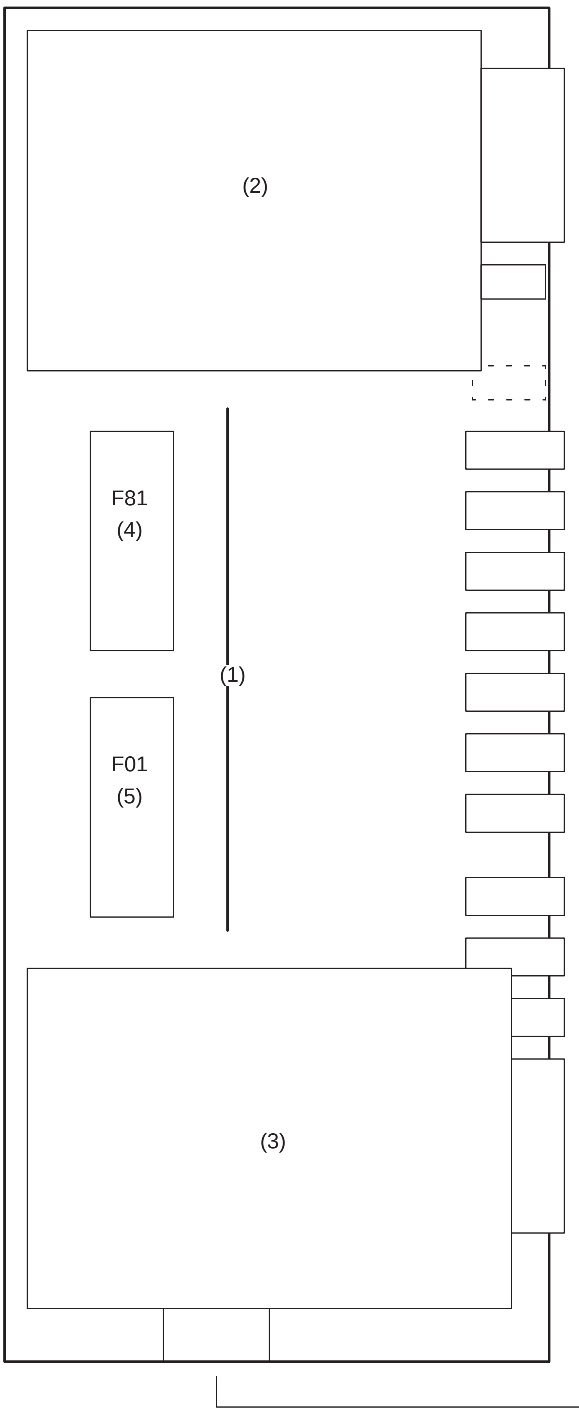
d) Power Mate–D (A02B–0166–B531)
Corresponding to 2–path (Interface type B)



NAME	NUMBER	USE
Memory card	CNMC	Memory card
LED	S1 | S0 / WD | EN	LED display
Rotary switch	RSW	CRT common function
Rotary switch	MTSW	Maintenance function
AMP1	JS1	Servo amplifier (1st axis)
SCALE1	JF21	Separate type pulse coder (1st axis)
AMP2	JS2	Servo amplifier (2nd axis)
SCALE2	JF22	Separate type pulse coder (2nd axis)
APCBAT	JA14	APC battery
SPNDLE	JA11	Spindle
SP.ENC	JA12	Position coder
MPG	JA13	Manual pulse generator
RS232C	JD5	RS-232-C
I/O	JD1A1	I/O Link (master)
I/O Link	JD1B	I/O Link (slave)from previous step
I/O Link	JD1A	I/O Link (slave) to latter
DPL/MDI	M4	DPL/MDI
SVCHK	TEST	Servo check board
PM/TMNL	JD15	CRT Link to latter
CRT/PM	JD14	CRT Link from previous step

No.	NAME	1–path	2–path	Specification	Function	Display of system configuration screen
	Base PCB	○	○	A20B–2100–0160	RAM 256KB Servo function Servo interface	RAM 256KB SERVO 1/2
(1)	PMC controled module A	○		A20B–2900–0142	PMC–PA1	PMC BIT
	PMC controled module B	○	○	A20B–2901–0660, 0662	PMC–PA3	PMC PMP+SLC
(2)	Memory module CSA		○	A20B–2902–0230	RAM addition 512KB Analog spindlex2	RAM 768KB POS LSI
	Memory module BSA		○	A20B–2902–0231	RAM addition 256KB Analog spindlex2	RAM 512KB POS LSI
	Memory module ASA		○	A20B–2902–0232	Analog spindlex2	POS LSI
	Memory module BSA	○		A20B–2902–0234	RAM addition 256KB Analog spindle	RAM 512KB POS LSI
	Memory module ASA	○		A20B–2902–0235	Analog spindle	POS LSI
	Memory module C		○	A20B–2902–0236	RAM addition 512KB	RAM 768KB
	Memory module B	○	○	A20B–2902–0237	RAM addition 256KB	RAM 512KB
	Memory module BSSA	○		A20B–2902–0221	RAM addition 256KB Serial spindle Analog input	RAM 512KB SIC ANALOG INPUT
	Memory module ASSA	○		A20B–2902–0222	Serial spindle Analog input	SIC ANALOG INPUT
	Memory module CSS		○	A20B–2902–0223	RAM addition 512KB Serial spindle	RAM 768KB SIC
	Memory module BSS	○	○	A20B–2902–0224	RAM addition 256KB Serial spindle	RAM 512KB SIC
	Memory module ASS	○	○	A20B–2902–0225	Serial spindle	SIC
(3)	CRT controled module	○	○	A20B–2901–0480	CRT,LCD,PDP,Handy operator's panel	SCA(CRT) 9"CRT
	Touch panel connection module	○	○	A20B–2902–0470	Touch panel connection	–
	HSSB module	○	○	A20B–2902–0540	HSSB function	–
(4)	Power supply PCB	○	○	A20B–1004–0960	Power supply	–
(5)	Sub PCB	○	○	A20B–2000–0670	Built–in I/O (sink type)	BLT I/O
		○	○	A20B–2001–0902	Built–in I/O C (source type)	BLT I/O SRC
		○		A20B–2100–0120	Profibus card	PROFIBUS
				A20B–8001–0500		
		○		A20B–8100–0060	Genius card	GENIUS
		○	○	A20B–2100–0040	I/O Link–II	I/O Link–2
		○	○	A20B–2001–0370	M–NET	M–NET
(6)	Basic ROM	○		A02B–0166–H511 #8834	For 1–path control Basic function	8834
			○	A02B–0166–H511 #8837	For 2–path control Basic function	8837
(7)	Option ROM	○		A02B–0166–H511 #8834	For 1–path control	8834
			○	A02B–0166–H511 #8837	For 2–path control	8837

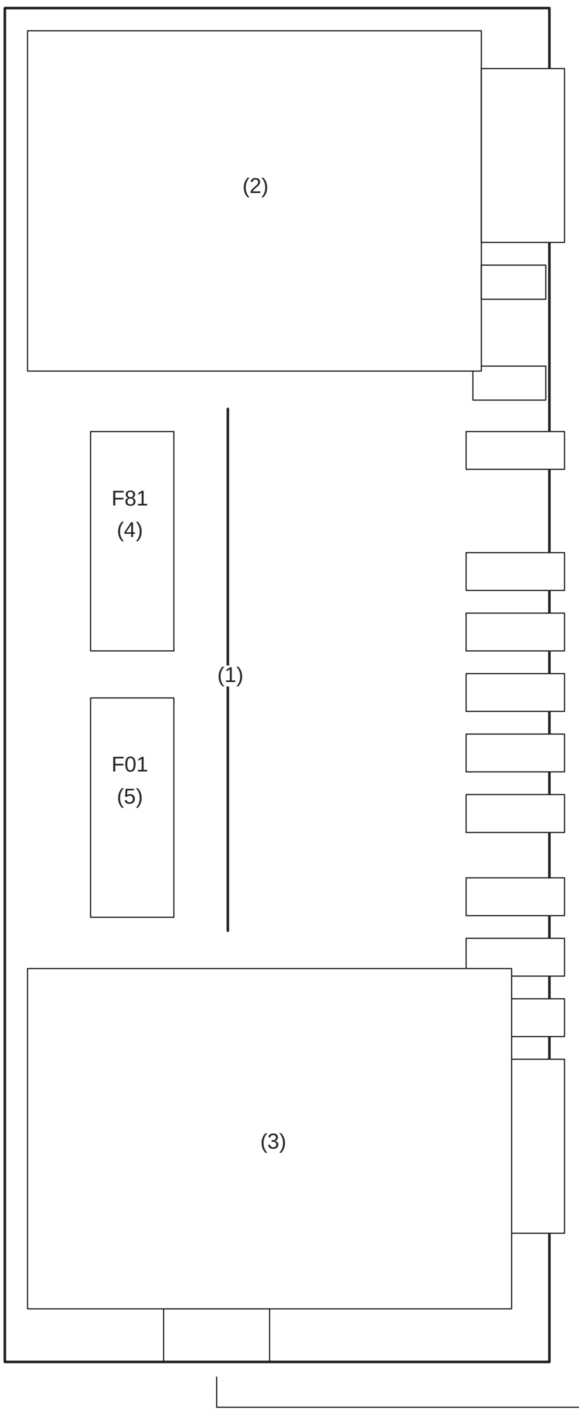
e) Power Mate–F (A02B–0198–B501)
Interface type A



NAME	NUMBER	USE
Memory card	CNMC	Memory card
LED	S1 | S0 / WD | EN	LED display
Rotary switch (Base PCB Version 06 or later)	MTSW	Maintenance function
AMP1	JV1	Servo amplifier (1st axis)
ENC1	JF2	Pulse coder (1st axis)
SCALE1	JF21	Separate type pulse coder (1st axis)
SPNDLE	JA11	Spindle
SP.ENC	JA12	Position coder
MPG	JA13	Manual pulse generator
APCBAT	JA14	APC battery
RS232C	JD5	RS-232-C
I/O Link	JD1B	I/O Link (slave)from previous step
I/O Link	JD1A	I/O Link (slave) to latter
DPL/MDI	M4	DPL/MDI
SVCHK	TEST	Servo check board

No.	NAME	Specification	Function
	Base PCB	A20B–2001–0620	RAM 256KB Servo function Servo interface
(1)	Spindle module (S analog)	A20B–2902–0235	Analog spindle
	Spindle module (S serial)	A20B–2902–0225	Serial spindle
(2)	Power supply PCB	A20B–1004–0960	Power supply
(3)	Sub PCB	A20B–2001–0630	Built–in I/O (sink type) 48/32
		A20B–2001–0631	Built–in I/O (sink type) 32/24
		A20B–2001–0900	Built–in I/O (source type) 48/32
		A20B–2001–0901	Built–in I/O (source type) 32/24
		A20B–2100–0040	I/O Link–II
		A20B–2001–0370	M–NET
(4)	Basic ROM	A02B–0198–H501 #8870	Basic function
(5)	Option ROM	A02B–0198–H501 #8870	Basic function

f) Power Mate–F (A02B–0198–B531)
Interface type B



NAME	NUMBER	USE
Memory card	CNMC	Memory card
LED	S1 | S0 / WD | EN	LED display
Rotary switch	MTSW	Maintenance function
AMP1	JV1	Servo amplifier (1st axis)
SCALE1	JF21	Separate type pulse coder (1st axis)
SPNDLE	JA11	Spindle
SP.ENC	JA12	Position coder
MPG	JA13	Manual pulse generator
APCBAT	JA14	APC battery
RS232C	JD5	RS-232-C
I/O Link	JD1B	I/O Link (slave)from previous step
I/O Link	JD1A	I/O Link (slave) to latter
DPL/MDI	M4	DPL/MDI
SVCHK	TEST	Servo check board

No.	NAME	Specification	Function
	Base PCB	A20B–2002–0370	RAM 256KB Servo function Servo interface
(1)	Spindle module (S analog)	A20B–2902–0235	Analog spindle
	Spindle module (S serial)	A20B–2902–0225	Serial spindle
(2)	Power supply PCB	A20B–1004–0960	Power supply
(3)	Sub PCB	A20B–2001–0630	Built–in I/O (sink type) 48/32
		A20B–2001–0631	Built–in I/O (sink type) 32/24
		A20B–2001–0900	Built–in I/O (source type) 48/32
		A20B–2001–0901	Built–in I/O (source type) 32/24
		A20B–2100–0040	I/O Link–II
		A20B–2001–0370	M–NET
(4)	Basic ROM	A02B–0198–H501 #8870	Basic function
(5)	Option ROM	A02B–0198–H501 #8870	Basic function

2.4.8 LED display of I/O Link Connection Unit

LED indications

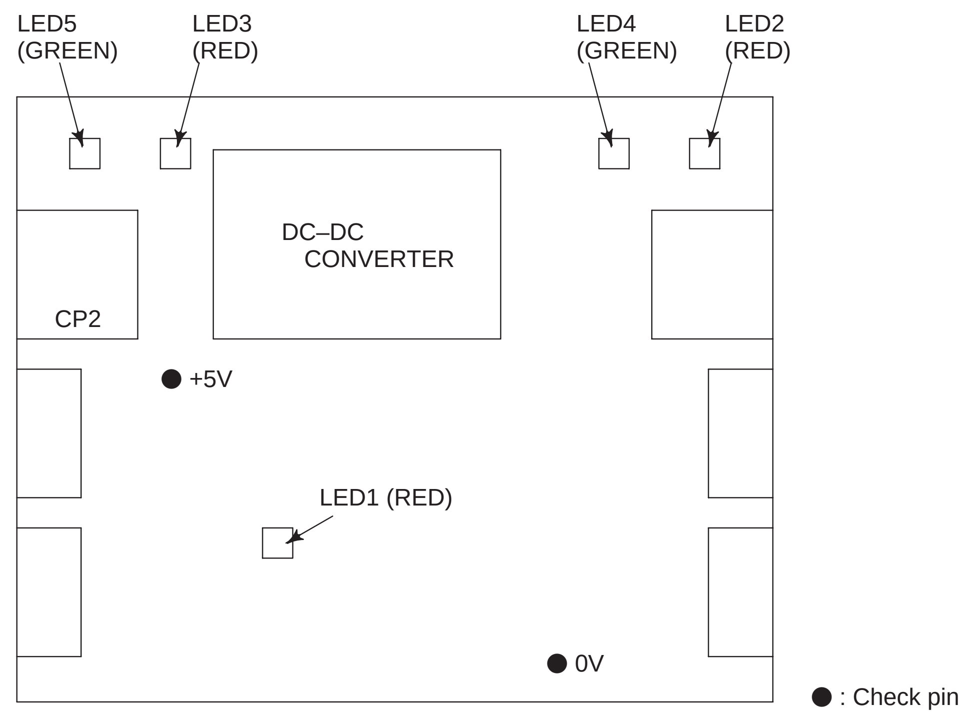


Fig.2.4.8 LED Installation Positions

	LED status		Description
1	LED1 □		Normal
	LED1 ■		A RAM parity error occurred. The hardware is out of order.
2	LED4 ■	LRD2 □	Normal
	LED4 □	LRD2 ■	No voltage is applied to CP1. The voltage applied to CP1 is insufficient.
	LED4 ■	LRD2 ■	A communication error occurred in a channel connected to CP1.
3	LED5 ■	LRD3 □	Normal
	LED5 □	LRD3 ■	No voltage is applied to CP2. The voltage applied to CP2 is insufficient.
	LED5 ■	LRD3 ■	A communication error occurred in a channel connected to CP2.

■ : Lit □ : Not lit

2.5 LIST OF PRINTED BOARD AND UNIT

2.5.1 Basic Unit

NAME		Specification	Servo interface	Remarks
Power Mate–D	Basic unit	A02B–0166–B001	TYPE A	
	Basic unit	A02B–0166–B520	TYPE A	Corresponding to E series servo
	Basic unit	A02B–0166–B501	TYPE A	Corresponding to 2–path control
	Basic unit	A02B–0166–B502	TYPE A	Corresponding to 2–path control
	Basic unit	A02B–0166–B531	TYPE B	Corresponding to 2–path control
Power Mate–F	Basic unit	A02B–0198–B501	TYPE A	
	Basic unit	A02B–0198–B531	TYPE B	

2.5.2 Control Unit Printed Board

NAME	D					F		Specification	Remarks
	B001	B520	B501	B502	B531	B501	B531		
Base PCB	○	○						A16B–2201–0630	TYPE A
			○					A20B–2001–0610	TYPE A, corresponding to 2–path
			○					A16B–2100–0030	TYPE A, corresponding to 2–path
				○				A16B–2100–0031	TYPE A, corresponding to 2–path
					○			A16B–2100–0160	TYPE B, corresponding to 2–path
						○		A20B–2001–0620	TYPE A
							○	A20B–2002–0370	TYPE B
Power supply PCB	○	○	○	○	○	○	○	A20B–1004–0960	
Built–in I/O card	○	○	○	○	○			A20B–2000–0670	DI:32, DO:24 (sink type)
Built–in I/O card C	○	○	○	○	○			A20B–2001–0902	DI:32, DO:24 (source type)
Built–in I/O card A						○	○	A20B–2001–0631	DI:32, DO:24 (sink type)
Built–in I/O card B						○	○	A20B–2001–0630	DI:48, DO:32 (sink type)
Built–in I/O card D1						○	○	A20B–2001–0901	DI:32, DO:24 (source type)
Built–in I/O card D2						○	○	A20B–2001–0900	DI:48, DO:32 (source type)
Profibus card			○	○	○			A20B–2100–0120 A20B–8001–0500	
Genius card			○	○	○			A20B–8100–0060	
I/O Link–II card			○	○	○	○	○	A20B–2100–0040	
M–NET card	○	○	○	○	○	○	○	A20B–2001–0370	
I/O card A	○	○	○	○	○			A16B–2201–0071	DI:48, DO:32 (sink type)
I/O card B	○	○	○	○	○			A16B–2201–0070	DI:96, DO:64 (sink type)
I/O card D	○	○	○	○	○			A16B–2202–0733	DI:48, DO:32 (source type)
I/O card E	○	○	○	○	○			A16B–2202–0732	DI:96, DO:64 (source type)

2.5.3 Module

NAME	D				F		Specification	Remarks
	B001	B520	B501	B531	B501	B531		
PMC controled module A	○	○	○	○			A20B–2900–0142	PMC–PA1
PMC controled module B	○	○	○	○			A20B–2901–0660	PMC–PA3
	○	○	○	○			A20B–2901–0662	PMC–PA3
Memory module A	○	○					A20B–2900–0531	RAM 128KB
	○	○					A20B–2902–0332	RAM 128KB
Memory module B	○	○					A20B–2900–0530	RAM 256KB
	○	○					A20B–2902–0331	RAM 256KB
Memory module C	○	○					A20B–2900–0541	RAM 512KB
	○	○					A20B–2902–0330	RAM 512KB
CPU module	○	○					A20B–2901–0500	
CRT controled module	○	○	○	○			A20B–2901–0480	
Touch panel connection module			○	○			A20B–2902–0470	Touch panel connection
HSSB module			○	○			A20B–2902–0540	HSSB function
Spindle module	○	○					A20B–2900–0851	Analog spindle
	○	○					A20B–2900–0850	Serial spindle
	○	○					A20B–2901–0210	Analog input\Serial spindle
Digital servo module	○						A20B–2900–0160	Corresponding to S series servo
		○					A20B–2901–0340	Corresponding to E, α series servo
Digital servo interface module	○	○					A20B–2900–0380	
Memory module CSA			○	○			A20B–2902–0230	RAM addition 512KB Analog spindlex2
Memory module BSA			○	○			A20B–2902–0231	RAM addition 256KB Analog spindlex2
Memory module ASA			○	○			A20B–2902–0232	Analog spindlex2
Memory module BSA			○	○			A20B–2902–0234	RAM addition 256KB Analog spindle
Memory module ASA Spindle module S analog			○	○	○	○	A20B–2902–0235	Analog spindle
Memory module C			○	○			A20B–2902–0236	RAM addition 512KB
Memory module B			○	○			A20B–2902–0237	RAM addition 256KB
Memory module BSSA			○				A20B–2902–0221	RAM addition 256KB Serial spindle Analog input
Memory module ASSA			○	○			A20B–2902–0222	Serial spindle Analog input
Memory module CSS			○	○			A20B–2902–0223	RAM addition 512KB Serial spindle
Memory module BSS			○	○			A20B–2902–0224	RAM addition 256KB Serial spindle
Memory module ASS Spindle module S serial			○	○	○	○	A20B–2902–0225	Serial spindle

2.5.4 CRT/MDI, DPL/MDI Unit

Name	D	F	Specifications	Remarks	
CRT/MDI unit	○		A02B–0166–C001	English key	
	○		A02B–0166–C003	English key, In–line connection type	
	○		A02B–0166–C201#R	English key	
	○		A02B–0166–C203#R	English key, In–line connection type	
	○		A02B–0166–C201#S	Symbol key	
	○		A02B–0166–C203#S	Symbol key, In–line connection type	
Separate type MDI unit	○		A02B–0166–C010	English key	
	○		A02B–0166–C210#R	English key	
	○		A02B–0166–C213#R	English key, In–line connection type	
	○		A02B–0166–C210#S	Symbol key	
	○		A02B–0166–C213#S	Symbol key, In–line connection type	
Picture display CRT/MDI unit	Δ		A02B–0166–C221#R	English key For 32 screen	
	Δ		A02B–0166–C221#S	Symbol key For 32 screen	
	Δ		A02B–0166–C222#R	English key For 64 screen	
	Δ		A02B–0166–C222#S	Symbol key For 64 screen	
Picture display separate type MDI unit	Δ		A02B–0166–C231#R	English key For 32 screen	
	Δ		A02B–0166–C231#S	Symbol key For 32 screen	
	Δ		A02B–0166–C232#R	English key For 64 screen	
	Δ		A02B–0166–C232#S	Symbol key For 64 screen	
Separate type CRT unit	○		A02B–0120–C111		
Separate type PDP unit	○		A02B–0120–C113	200V AC input	
	○		A02B–0200–C100	24V DC input	
Separate type LCD unit	○		A02B–0166–C251		
Detachable LCD/MDI unit	○		A02B–0166–C271#R	English key	
	○		A02B–0166–C271#S	Symbol key	
DPL/MDI unit	○	○	A02B–0168–K010	Table mount/FANUC	English key
	○	○	A02B–0168–K011	Wall mount/FANUC	English key
	○	○	A02B–0168–K012	Table mount/GE Fanuc	English key
	○	○	A02B–0168–K013	Wall mount/GE Fanuc	English key
Long distance type DPL/MDI unit	○	○	A02B–0118–C030	Table mount/FANUC	English key
	○	○	A02B–0118–C031	Wall mount/FANUC	English key
	○	○	A02B–0118–C032	Table mount/GE Fanuc	English key
	○	○	A02B–0118–C033	Wall mount/GE Fanuc	English key
Dust protected type DPL/MDI unit	○	○	A02B–0118–C130#R	Table mount/FANUC	English key
	○	○	A02B–0118–C130#S		Symbol key
	○	○	A02B–0118–C131#R	Wall mount/FANUC	English key
	○	○	A02B–0118–C131#S		Symbol key
	○	○	A02B–0118–C132#R	Table mount/GE Fanuc	English key
	○	○	A02B–0118–C132#S		Symbol key
	○	○	A02B–0118–C133#R	Wall mount/GE Fanuc	English key
	○	○	A02B–0118–C133#S		Symbol key
Position display unit		○	A02B–0118–C020		
DPL/MDI switch circuit	○	○	A16B–2600–0080		
CRT link terminal unit	○		A02B–0124–D001	For CRT, PDP, LCD	
CRT link intermediate unit	○		A02B–0124–D002		

Name	D	F	Specifications	Remarks
Handy operator’s panel	Δ		A02B–0211–C020#R	English key
	Δ		A02B–0211–C020#S	Symbol key
Touch panel end terminal unit	Δ		A02B–0166–D003	For touch panel and handy operator’s panel
HSSB adaptor	Δ		A02B–0211–C220	
I/O link–II terminal board	○	○	A08B–0048–C331	

NOTE
Δ indicates a unit that can be used with the A02B–0166–B501, –B502, and –B531 in the Power Mate–D.

2.5.5 CRT/MDI, DPL/MDI Printed Board

Name	D	F	Specifications	Remarks
CRT Control printed board	○		A20B–2000–0840	
	○		A20B–2000–0841	In–line connection type
	Δ		A20B–2100–0061	For picture display 32 screen
	Δ		A20B–2100–0060	For picture display 64 screen
DPL/MDI printed board	○	○	A20B–8000–0141	
Long distance type DPL/MDI for printed board	○	○	A20B–8000–0490	
Dust protected DPL/MDI P.C.B	○	○	A20B–8001–0310	
DPL/MDI switch board	○	○	A16B–2600–0080	
Handy operator’s panel	Δ		A20B–2002–0200	
HSSB adaptor	Δ		A20B–8001–0510	
Position display unit	○		A20B–1004–0360	
			A20B–1004–0370	

NOTE
Δ indicates a printed–circuit board that can be used with the A02B–0166–B501, –B502, and –B531 in the Power Mate–D.

2.6 HOW TO REPLACE THE BATTERIES

WARNING

1 Memory backup battery replacement
When replacing the memory backup batteries, keep the power to the machine (CNC) switched on, and hold the machine at an emergency stop. Because this work must be carried out while the power is kept switched on and the cabinet is open, only the personnel who have been trained for safety are allowed to engage in the work. When replacing the batteries, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover). If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

2 Absolute pulse coder battery replacement
When replacing the memory backup batteries, keep the power to the machine (CNC) switched on, and hold the machine at an emergency stop. Because this work must be carried out while the power is kept switched on and the cabinet is open, only the personnel who have been trained for safety are allowed to engage in the work. When replacing the batteries, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover). If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

2.6.1 Replace the Battery for Memory Back Up

Procedure for replacing the battery for memory back up.

1 Lithium battery (Order number is *A02B–0118–K111) is required.

2 Replace battery in the status that Power Mate power supply is ON.

3 The battery used for memory back up is located in the front door.

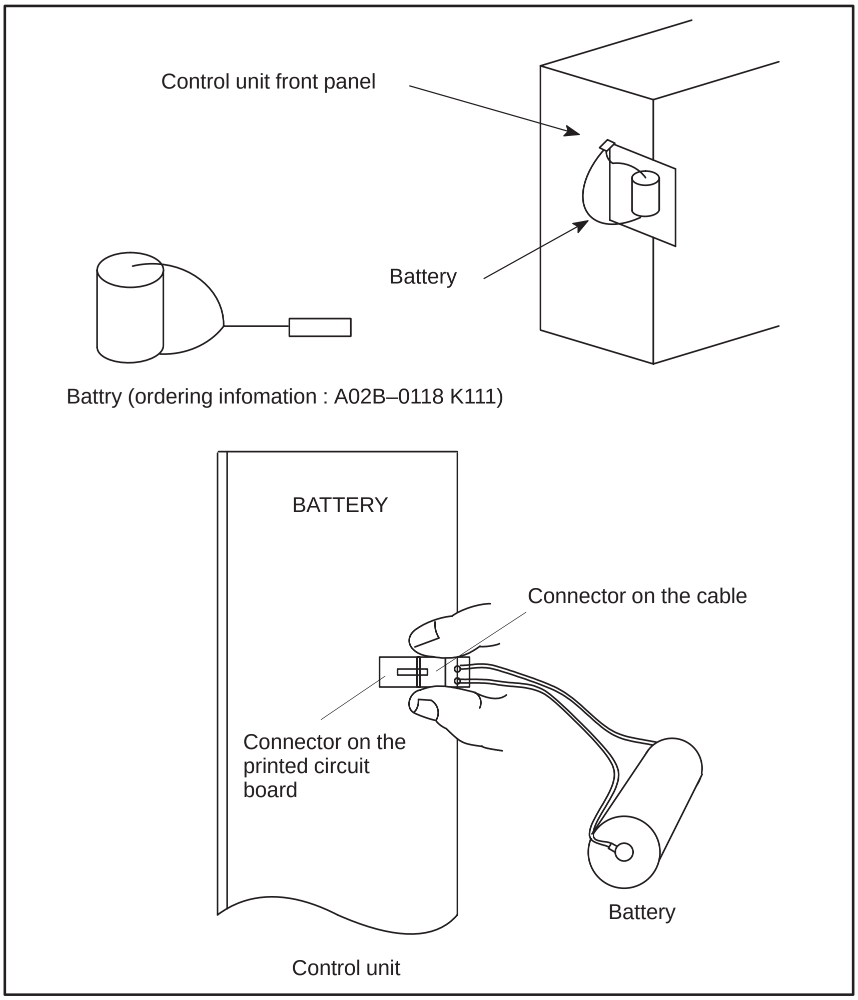
4 Open the door of controller and remove the battery from folder.

5 Pinch and remove the connector in the side of battery towards you.

6 Connect the connector of new battery to the connector.

7 Mount a battery to folder and close the cover in side of cable.

> **CAUTION**
> Ensure that the power to the CNC is turned on before attempting to replace the battery. Replacing the battery while the power is turned off will result in the loss of stored data such as programs and parameters.



2.6.2 Replacing Batteries for Absolute Pulse Coder (α Series Servo Amplifier/Built–in Type Battery)

Prepare lithium battery A06B–6073–K001(*) in advance.

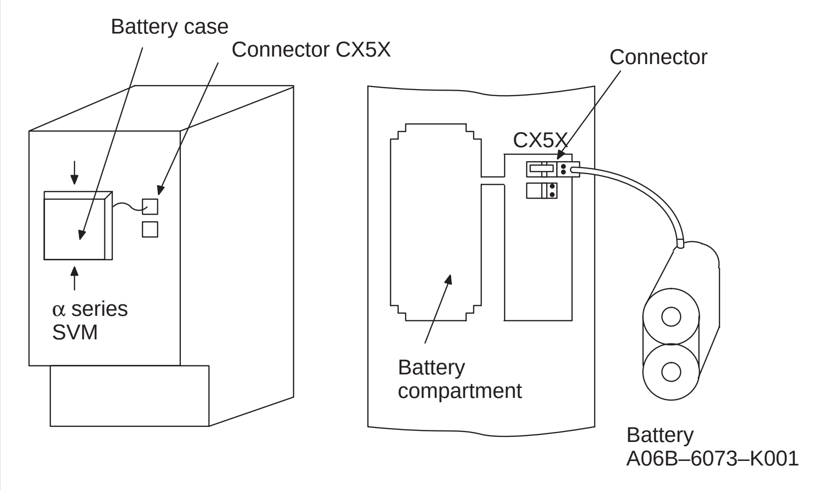
(*) FANUC specification: A98L–0001–0902

Procedure for replacing batteries for absolute pulse coder

Procedure

1 Turn machine (NC) power ON.

2 Remove the battery case on the front panel of α series Servo Amp Module (SVM).
The battery case can be removed by holding the top of the case and pulling the case towards you.



3 Remove the connector the battery.

4 Replace the battery, and connect the connector.

5 Attach the battery case.

6 Turn machine (NC) power OFF.

CAUTION
1 Replace the batteries for absolute pulse coder when NC power is ON.
Replacing the batteries with power OFF causes the absolute position stored in memory to be lost.
2 If your machine is equipped with a separate battery case, follow the instructions in 2.6.4

2.6.3 Replacing Batteries for Absolute Pulse Coder (β Series Servo Amp Module/Built–in Type Battery)

Prepare lithium battery A02B–0168–K111(*) in advance.

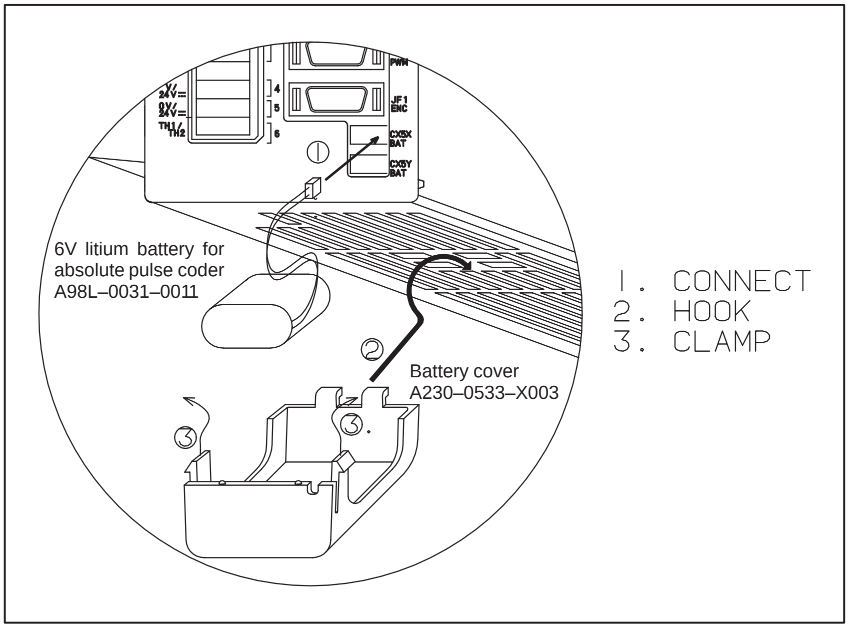
(*) FANUC specification: A98L–0031–0011

Procedure for replacing batteries for absolute pulse coder

Procedure

1 Turn machine (NC) power ON.

2 Remove the battery case from under the β series servo amplifier module by holding the case at both sides and pulling downwards.



3 Remove the connector the battery.

4 Replace the battery, and connect the connector.

5 Attach the battery case.

6 Turn machine (NC) power OFF.

CAUTION
1 Replace the batteries for absolute pulse coder when NC power is ON.
Replacing the batteries with power OFF causes the absolute position stored in memory to be lost.
2 If your machine is equipped with a separate battery case, follow the instructions in 2.6.4

2.6.4 Replacing Batteries for Absolute Battery

Prepare 4 alkaline batteries (UM–1type) commercially available in advance.

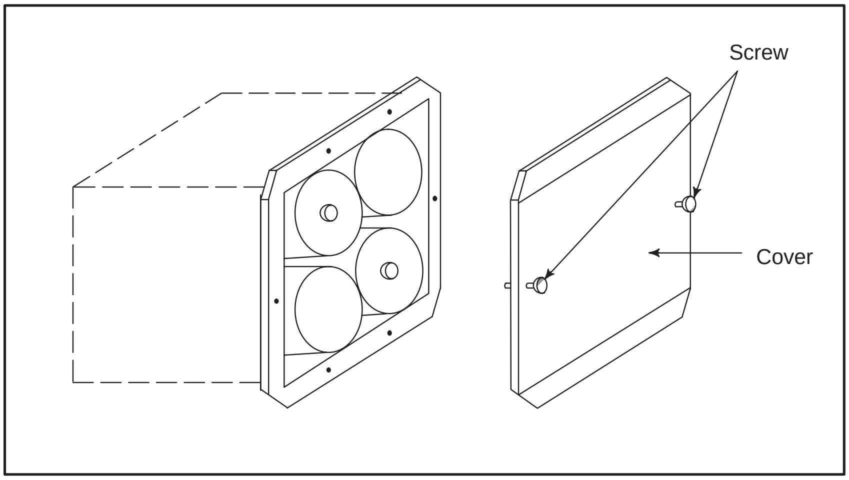
Procedure for replacing batteries for absolute pulse coder

Procedure

1 Turn machine (NC) power ON.

2 Loosen screws on the battery case to remove the cover. For placement of the battery case, refer to the machine tool builder's manual.

3 Replace the batteries in the case. Insert 2 batteries each in the opposite direction as illustrated below.



4 After replacement, install the cover.

5 Turn machine (NC) power OFF

CAUTION

Replace the batteries for absolute pulse coder when NC power is ON.

Replacing the batteries with power OFF causes the absolute position stored in memory to be lost.

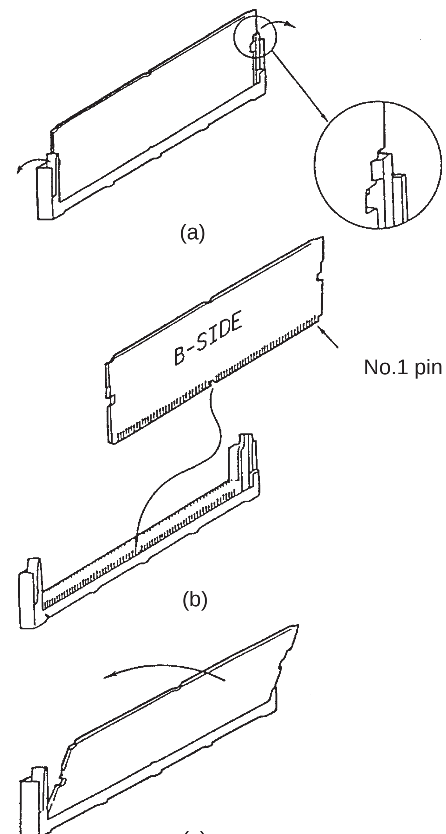
2.7 HOW TO REPLACE THE MODULES

2.7.1 Removing

1 Check that the power supply is not off.
2 Pull the latches of the module socket outwards. (Fig.(a))
3 Pull out the module upward. (Fig.(b))

2.7.2 Insertion

1 Check that the power supply is off.
2 Insert the new module board diagonally with B–SIDE outward (Fig.(b))
3 While pushing on the upper edge of the module board, raise it until it is locked (Fig.(c)).



(a) (b) (c)

CAUTION
1 Replacing the memory module results in the loss of stored data such as programs, parameters, and ladder. Before attempting to replace the memory module, therefore, make a backup copy of the stored data.
2 Make sure that the latches at both ends of the socket are correctly engaged with the module. If either latch is not engaged securely, it will not be possible to establish a satisfactory electrical contact, possibly leading to a malfunction of the NC unit.

2.8 REPLACING PRINTED CIRCUIT BOARD AND UNIT

2.8.1 The Base Printed Circuit Boards

1 Make sure that the power supply unit is turned off.

2 Disconnect all cables connected to the printed circuit board in the control unit. Pinch the 20–pin half–pitch connector to release the latch. Draw out the connector.

3 Remove the control unit from the wall.

4 Place the control unit with its left face upward, and press the two points shown in Fig. 2.8.1 (a) to remove the cover of the case.

5 Remove the battery.

6 Release the three latches shown in Fig. 2.8.1 (b), and remove the PC board.

7 Mount a new base PC board by following the steps above in reverse order.

8 Reconnect the cables to their original positions.

CAUTION

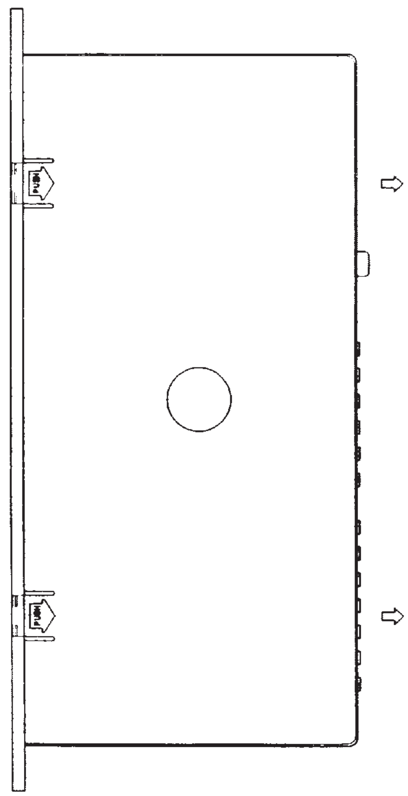
Replacing the base printed circuit board results in the loss of stored data such as programs and parameters. Before attempting to replace the memory module, therefore, make a backup copy of the stored data.

How to remove the plastic cover at the left side of the case

- Pull the cover in the direction of arrows as shown below while holding down two portions marked with PUSH.
- When mounting the cover, insert the cover in the direction opposite to that of the arrows while holding down the two portions marked with PUSH.

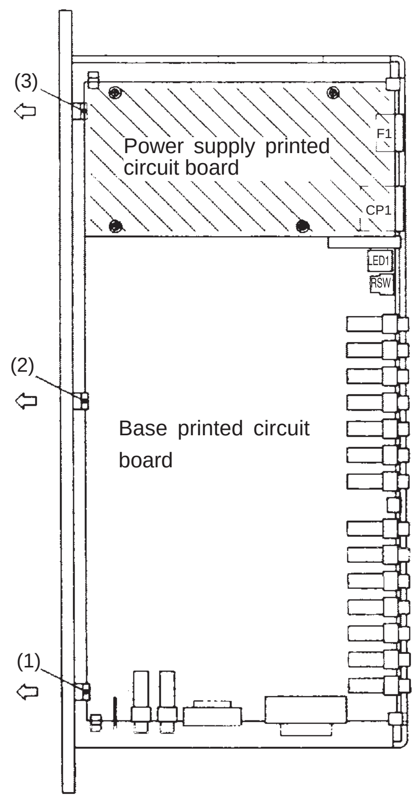
How to remove the base printed circuit board

- Remove the 3 V dry cell for backing up the RAM battery.
- There are three claws which hold the base printed circuit board. While moving one at a time to the left (in the direction of arrows shown below) in the order of (1), (2), and (3), pull the left side of the board to release the hold. When releasing the claws, be careful not to bend the pins of components on modules adjacent to the base printed–circuit board.
- Move the board to the left to remove it from the case.



(Left side view)

Fig. 2.8.1 (a)



(Left side view)

Fig. 2.8.1 (b)

2.8.2 The Power Supply Printed Circuit Boards and Sub Printed Board

1. Make sure that the power supply unit is turned off.
2. As in 2.8.1 above, remove the base PC board.
3. Remove the screws from the base PC board or sub printed board that are securing the power PC board, and replace the power PC board.
4. Put the base PC board in the case, and return it to the original position.
5. Reconnect the cables to their original positions.

2.8.3 The Fan motor

1 Remove the power PC board as in 2.8.2 above.

2 Remove the two screws from the fan motor on the power PC board, and replace the fan motor with a new one.

3 Mount the power PC board on the base PC board as in 2.8.2 above, and return the base PC board to the case.

4 Reconnect the cables.

2.8.4 The CRT Control Printed Circuit Board

1 Turn off the power to the CRT/MDI, separated type CRT/MDI unit and controller.

2 The CRT control PCB is located behind the MDI.
Remove all cables connected to the PCB.

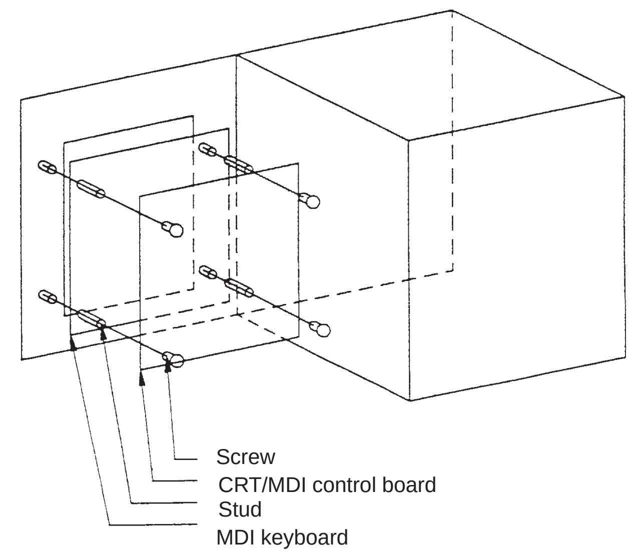
3 Remove the square screws from the CRT control board, and replace the PCB.

4 Reconnect the cables.

CAUTION
When the picture display CRT/MDI unit or separate picture display MDI unit is being used, reload the picture screen data.

2.8.5 The MDI Keyboard

1. The CRT control board that is behind the MDI keyboard can be seen from the rear of the CRT/MDI unit and separate type MDI unit. Remove the CRT control board as in 2.8.4 above.
2. Remove the two connectors from the back of the keyboard.
3. Remove the four studs from the back of the keyboard.
4. Since the MDI keyboard has no setscrews, the keyboard can be removed at this point.
5. Mount a new keyboard, and secure it with four studs.
6. Reconnect the two cables of the CRT control board.



2.8.6 The CRT Display

1. Check that the power supply is off.
2. Disconnect the CRT unit power cable and the video signal cable.
3. Remove the chloridized veneer cover and the four screws from the front of the CRT unit.
4. Install the new CRT unit.
5. Reconnect the CRT power supply cable and video signal cable to their original positions.

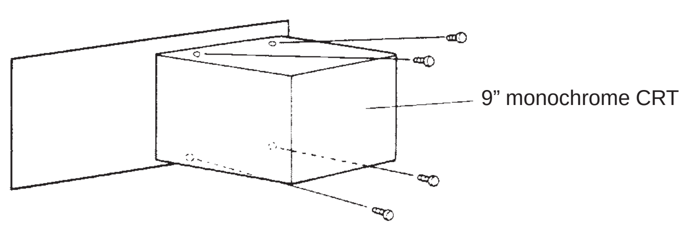


Fig.2.8.6 Replacing the CRT Display

2.9 MAINTENANCE OF HEAT PIPE TYPE HEAT EXCHANGER

Air filter cleaning and replacement

It is necessary to regulary clean the heat transformer, because the heat transformation ability will be reduced by the accumulation of dust. The frequency of the cleaning needed differs according to the installation environment and therefore should be determined by your own judgment accordint to the degree of dirt.

WARNING

The heat pipe–based heat exchanger section is applied with a high voltage.

When maintaining the heat pipe–based heat exchanger, keep the power to the machine (CNC) switched off.

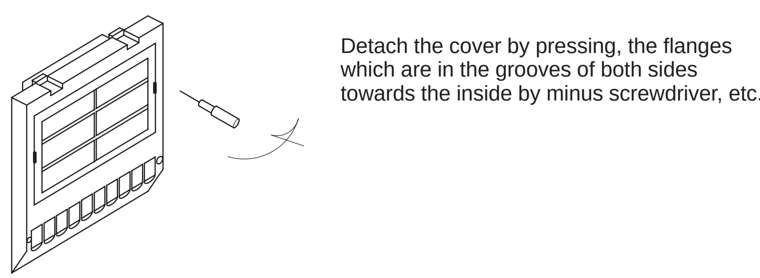
When replacing the heat pipe–based heat exchanger with the cabinet open, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover).

If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

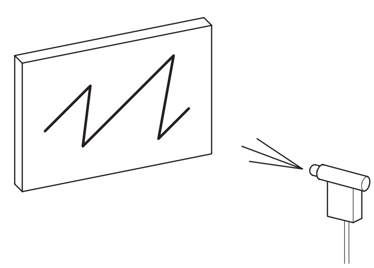
Air filter cleaning and replacement method

1 When cleaning and replacing the filter, be sure to cut off the fan's electric power source.

2 Detach the filter cover and take out the filter inside.



3 Protect the filter from silting due to dust by blowing air on both sides.



4 When dirt is conspicuous, press wash with a neutral detergent, rinse with fresh water, and the washing, allow to dry naturally. When replacing with the same product.

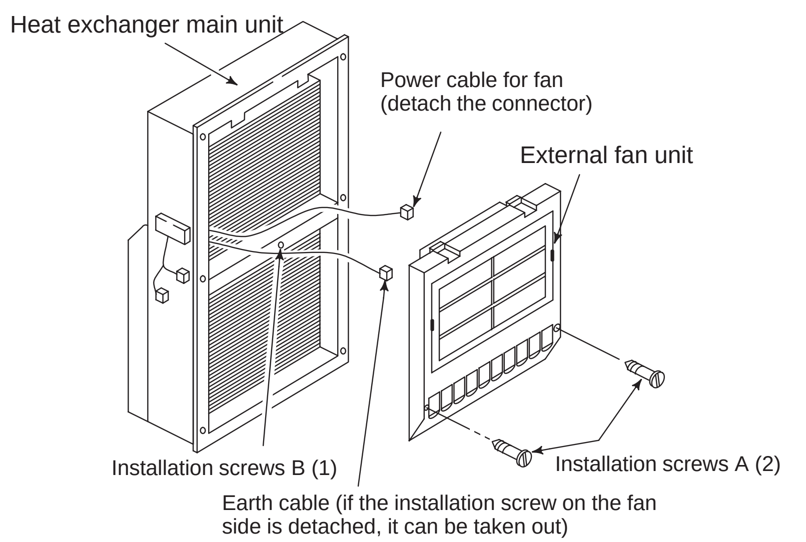
5 Insert the filter in the cover, align the flange in the groove, and install by pressing. Confirm that the cover will not come loose even if it is pulled.

Cleaning heat exchanger

Cleaning heat exchanger

1 When cleaning, be sure to cut off the fan power source.

2 Take out the external fan unit from the heat exchanger main unit.

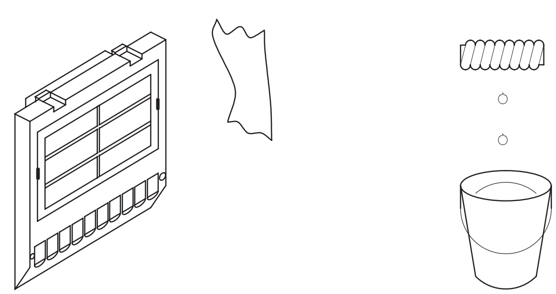


Detach the two installation screws (A) of the external fan unit, and detach the unit from the main unit by sliding it down. Detach the power source cable to the fan and the earth cable. Also detach installation screws (B).

- **Cleaning fan unit**

Method of cleaning fan unit

1 Wipe the dirt, condensation, etc., which has accumulated on the fan motor and fan installation case with a dry cloth, etc. When the condensation, etc. has accumulated and the dirt is difficult to remove, soak a cloth in neutral detergent, lightry sqeeze it and wipe away the dirt.
However, take care not to allow the detergent to enter the electrical sections such as the internal rotor of the fan motor.



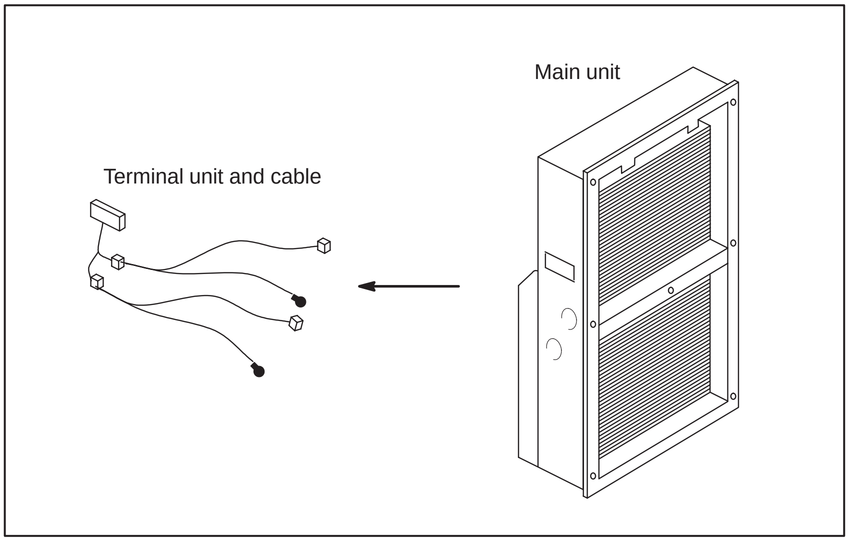
• Cleaning heat exchanger fan

Method of cleaning heat exchanger fan

1 Detach the heat exchanger format the unit and either blow off with air, wipe off with a dry cloth, or brush the accumulated dirt, condensation, etc.

When the dirt is especially severe

1 Detach the internal fan unit, the terminal unit, and the cable from the main unit.



2 Using a neutral detergent, remove the dirt from the main unit fan section by brushing. At this time, take care not to bend the fin of the element.

3 After cleaning, dry well.

• Installation

Method of installation after cleaning

After completing cleaning of the fan unit and heat transformer.

1 Install the terminal unit and cable in the original position.

2 Install the fan unit in the original position. At this time, do not forget to connect the fan power cable and the earth cable.

2.10 REPLACING THE FUSE

WARNING

Before replacing a blown fuse, it is necessary to remove the cause of the blown fuse. For this reason, only the personnel who have a working knowledge of maintenance and safety are allowed to carry out this work. When replacing a fuse with the cabinet open, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover). If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

2.10.1 The Power Mate Controller Fuse

This section describes the replacement of the Power Mate controller fuse.

The controller contains a +24 V power input fuse, F1. If LED EN does not light when +24 V power is supplied, fuse F1 may have blown. In such a case, remove the fuse from its socket, then check its continuity using a multimeter (or visually check whether it has blown). If the fuse has blown, investigate the cause, take appropriate action, then replace the fuse. The capacity, part number, and location of the fuse are as follows:

Table 2.10.1 Capacity and part number of Power Mate controller fuse

Name	Capacity	Part number
F1	5.0A	A60L-0001-0046#5.0R or A60L-0001-0046#5.0

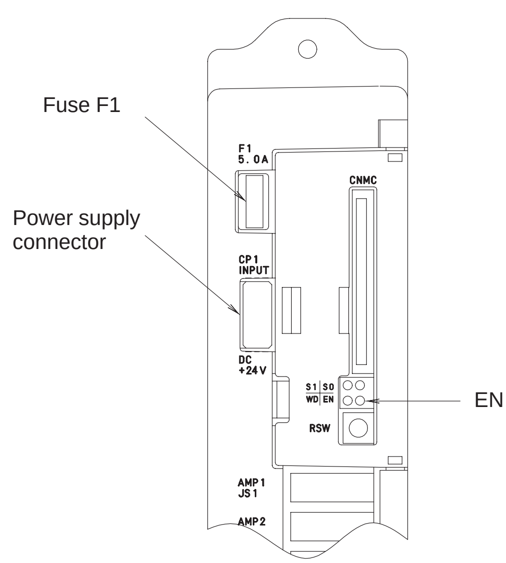


Fig.2.10.1 Location of Power Mate controller fuse

2.10.2 The CRT/MDI Control PCB Fuse

This section describes the replacement of the CRT/MDI controller PCB fuse of the Power Mate–D. The table below lists the drawing number of the CRT/MDI control PCB. The CRT/MDI control PCB is mounted on the back of the CRT/MDI unit or separate MDI unit.

Table 2.10.2(a) CRT/MDI control PCB drawing number

Name	Drawing number
CRT/MDI control PCB	A20B-2000-0840
	A20B-2000-0841
	A20B-2100-0061
	A20B-2100-0060

The CRT/MDI control PCB contains a +24 V power input fuse, FU1. If nothing appears on the screen when +24 V power is supplied to the CRT/MDI control PCB, fuse FU1 may have blown. In such a case, remove the fuse from its socket, then check its continuity using a multimeter (or visually check whether it has blown). If the fuse has blown, investigate the cause, take appropriate action, then replace the fuse. The capacity, part number, and location of the fuse are as follows:

Table 2.10.2(b) Capacity and part number of CRT/MDI control PCB fuse

Name	Capacity	Part number
FU1	3.2A	A60L-0001-0175#3.2A

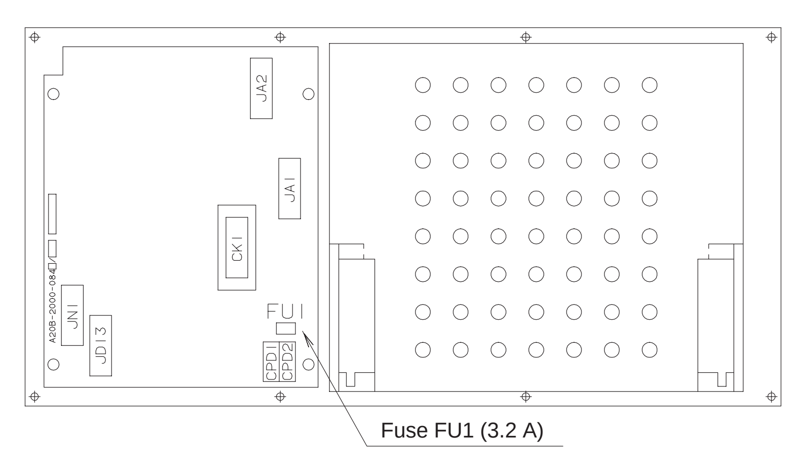


Fig.2.10.2(a) Location of CRT/MDI fuse

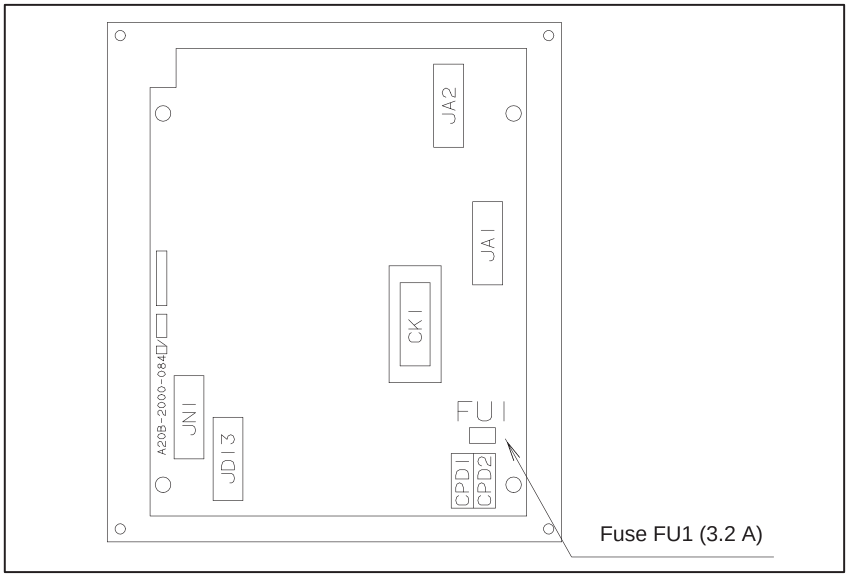


Fig.2.10.2(b) Location of separate MDI unit fuse

2.10.3 The I/O Card Fuses

This section describes the replacement of the Power Mate–D external I/O card fuses. The table below lists the names and drawing numbers of the I/O cards.

Table 2.10.3(a) I/O card drawing numbers

Name	Drawing number
I/O card A DI: 48 points, DO: 32 points	A16B-2201–0071
I/O card B DI: 96 points, DO: 64 points	A16B-2201–0070
I/O card D DI: 48 points, DO: 32 points	A16B-2202–0733
I/O card E DI: 96 points, DO: 64 points	A16B-2202–0732

The I/O card contains a +24 V power input fuse, FU1, and +5 V power output fuse, FU2. If +5 V is not output, fuse FU1 or FU2 may have blown. In such a case, remove the fuses from their sockets, then check their continuity using a multimeter (or visually check whether they have blown). If a fuse has blown, investigate the cause, take appropriate action, then replace the fuse. The capacity, part number, and location of the fuses are as follows:

Table 2.10.3(b) Capacity and part number of I/O card fuses

Name	Capacity	Ordering specification
FU1	3.2A	A60L-0001-0175#3.2A
FU2	5.0A	A60L-0001-0290#LM50

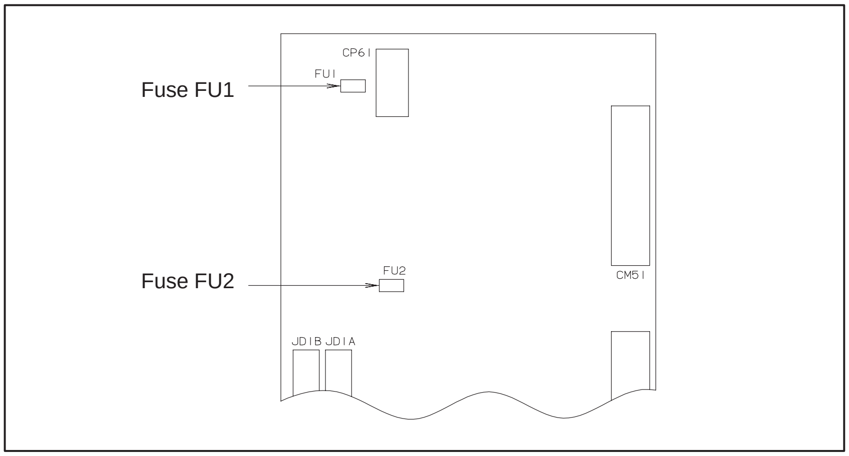


Fig.2.10.3 Location of I/O card fuses

2.10.4 The I/O Unit–MODEL A Fuses

Each of the following modules contains a fuse. If the fuse has blown, eliminate the cause, then replace the fuse.

Module	Indication of blown fuse	Capacity	Part number
Interface module AIF01A	PWR does not light.	3.2A	A60L-0001-0290#LM32
Interface module AIF01B	PWR does not light.	3.2A	A60L-0001-0290#LM32
Output module (DC, 8 points) OD08C	F lights.	5A	A60L-0001-0260#5R00
Output module (DC, 8 points) OD08D	F lights.	5A	A60L-0001-0260#5R00
Output module (AC, 5 points) AOA05E	F lights.	3.15A	A60L-0001-0276#3.15
Output module (AC, 8 points) AOA08E	F lights.	3.15A	A60L-0001-0276#3.15
Output module (AC, 12 points) AOA12F	F lights.	3.15A	A60L-0001-0276#3.15

The fuse is mounted on the internal PCB of each module. For details, refer to the I/O Unit–MODEL A Connection and Maintenance Manual.

2.10.5 Replacing the DPL/MDI Switcher Fuses

This section describes the replacement of the DPL/MDI switcher fuses of the Power Mate. The table below lists the drawing number of the DPL/MDI switcher.

Table 2.10.5(a) Drawing number of DPL/MDI switcher

Name	Drawing number
DPL/MDI switcher	A16B-2600-0080

The DPL/MDI switcher contains a +24 V power input fuse, F2, and +5 V power output fuse, F1. If the +5 V pilot lamp (green LED) does not light when +24 V power is supplied to the DPL/MDI switcher, fuse F1 or F2 may have blown. In such a case, remove the fuses from their sockets, check their continuity using a multimeter (or visually check whether they have blown). If a fuse has blown, investigate the cause, take appropriate action, then replace the fuse. The capacity, part number, and location of the fuses are as follows:

Table 2.10.5(b) Capacity and part number of the DPL/MDI switcher fuses

Name	Capacity	Ordering specification
F1	2.0A	A60L-0001-0175#2.0A
F2	2.0A	A60L-0001-0175#2.0A

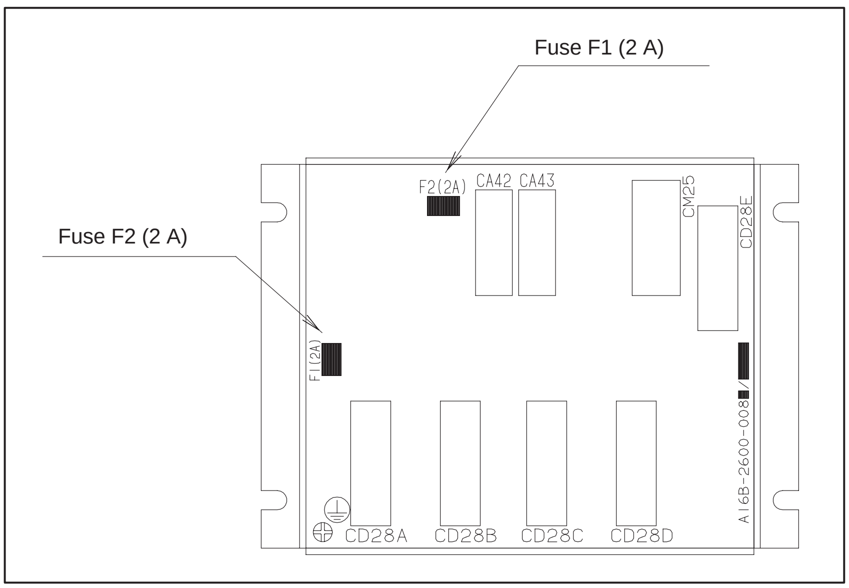


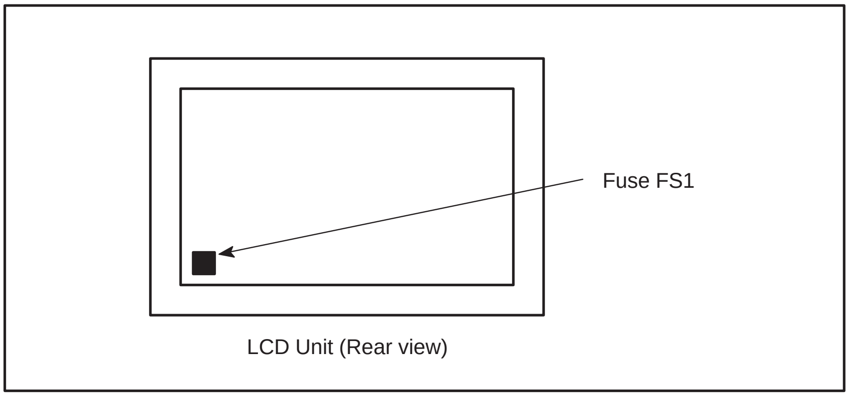
Fig.2.10.5 Location of DPL/MDI switcher fuses

2.10.6 Replacing the LCD Fuse

This section describes the location and replacement of the LCD fuse.

WARNING
Before replacing a blown fuse, it is necessary to remove the cause of the blown fuse. For this reason, only the personnel who have a working knowledge of maintenance and safety are allowed to carry out this work. When replacing a fuse with the cabinet open, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover). If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

- **Location of the LCD fuse**



- **Replacing the fuse**

(1) If the fuse blows, first find and eliminate the cause. Then, replace the fuse.

(2) Pull the old fuse up.

(3) Push a new fuse into the fuse holder.

- **Ordering information**

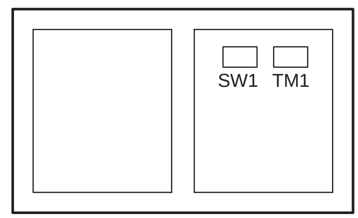
Ordering code : A02B–0200–K104*
Rating : 1.0 A

*In–house code: A60L–0001–0290#LM10

2.11 ADJUSTING THE PLASMA DISPLAY

Fine adjustment of the video signal is supported to enable its use with plasma displays. This adjustment is necessary to compensate for errors resulting from the combination of NC devices and cables.Adjustment of the video signal is necessary if you have replaced the display unit, cable, or a hardware component of the display circuit in the NC, either as part of regular field maintenance or the correct a failure.

Locations of switches and jumper pins



Plasma display (real view)

Adjustment

- **Eliminating flicker**

Switch TM1

If flicker occures, change the TM1 setting to another setting.

Normally one of these settings will eliminate flicker.

- **Adjusting the horizontal position**

Switch SW2

(1) The screen can be shifted horizontally in units of dots.

(2) Adjust the horizontal position such that the entire screen is visible. Only one setting can successfully realize this positioning.

CAUTION

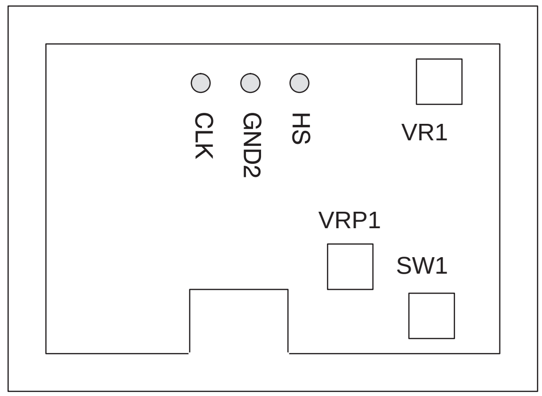
1 Do not attempt to change any controls or settings other than those described above.
If any controls or settings other than those described above are changed, the appearance of the display will be abnormal.

2 The plasma display unit cannot be switched between the Power Mate and other NC units, because its cable length requires careful adjustment.

2.12 7.2–INCH MONOCHROME LCD ADJUSTMENT

The 7.2–inch monochrome LCD is provided with a contrast adjustment potentiometer and video signal adjustment switches.
The contrast is adjusted when the LCD adapter or panel is replaced. Otherwise, it should not be necessary to use the adjustment switches.

Adjustment points



7.2–inch monochrome LCD (rear view)

Adjustment procedure

(1) Contrast adjustment

Potentiometer VRP1

This adjustment is made to compensate for variations between, individual LCD adapters and LCD panels. When an LCD adapter or panel is replaced, the following adjustment must be made. If the entire LCD unit is replaced, however, no adjustment is needed.

(a) First, adjust potentiometer VRP1 until the displayed characters (all black areas) appear white.

(b) Rotate the potentiometer in the opposite direction until the characters appear clear and black.

(2) Flicker adjustment

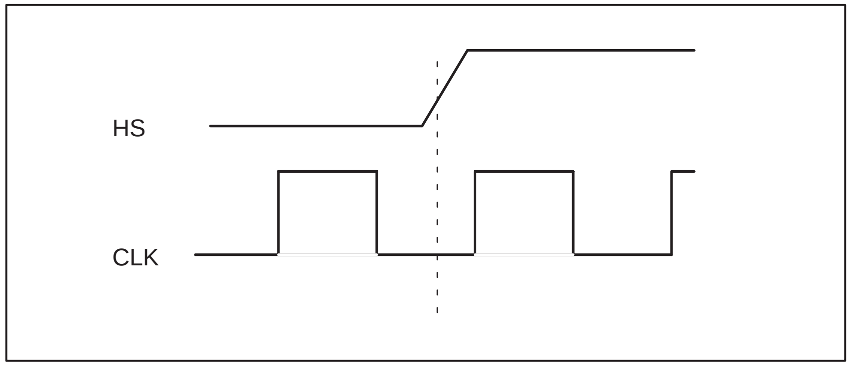
Potentiometer VR1

This potentiometer is factory–set and normally need not be adjusted by the user. If the setting is changed by mistake, re–adjust it according to the following procedure. Note that some versions of this printed–circuit board do not have this potentiometer; adjustment is performed automatically.

(a) Using the check pins, observe HS and CLK on an oscilloscope.

(b) Over part of the range of potentiometer VR1, the positive–going edge of HS will be almost in phase with the positive–going edge of the CLK. Rotating the potentiometer a little does not change the phase difference. Set the potentiometer to the midpoint of this range.

(c) After completing the adjustment, confirm that the display does not flicker.



(3) Horizontal position adjustment

Switch SW1

This switch is factory–set and normally need not be adjusted by the user. If the setting is changed by mistake, re–adjust it according to the following procedure.

(a) Switch SW1 is used to move the display horizontally in units of dots.

(b) Set the switch to the point between 8 and B where the entire display is visible.

(c) The default setting is 9.

2.13 REPLACING THE LCD BACKLIGHT

The LCD backlight must be replaced periodically. Replace the unit in which the LCD backlight is mounted.
The LCD backlight has a life of about 10,000 hours (54 hours guaranteed). (During its lifetime, the backlight should maintain a brightness exceeding 50% of that when new.)
Upon reaching the end of its service life, the LCD backlight unit must be replaced. The unit can be replaced either by the user or by a FANUC service engineer.

3 INPUT AND OUTPUT OF DATA

Data must be re–set if the base printed–circuit board is replaced or the memory module is replaced (or removed then mounted again).
This chapter describes the procedures to input and output the parameters, the part programs and the tool offset values.

With the Power Mate–F, the CRT/MDI cannot be used for parameter setting or data input/output.

3.1 SETTING PARAMETERS FOR INPUT/OUTPUT

- **Setting procedure of parameters (CRT/MDI)**

1. Set to MDI mode or emergency stop state.
2. Press OFFSET SETTING key several times or press soft key **[SETING]** 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 SYSTEM key several times to display the following screen.

```
PARAMETER (SETTING)                  O1234N12345
0000           SEQ             INI  ISO  TVC
       0    0    0    0    0    0    0    0
0001   0    0    0    0    0    0    0    0
0002   0    0    0    0    0    0    0    0
0012                     MIR
   X   0    0    0    0    0    0    0    0
   Y   0    0    0    0    0    0    0    0
0020 I/O  CHANNEL

ZRN **** *** ***        00:00:00
[ F SRH ][ READ  ][       ][DELETE ][      ]
```

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 (word type)
   5) Soft key **[INPUT]** : Input value is replaced with the value at cursor (word type)
   6) Soft key **[READ]** : Parameters are input from reader/puncher interface.
   7) Soft key **[PUNCH]** : 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 to release alram 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]

0		1234
0	⇒	4567
0		9999
0		0

(Ex.2) [1] [2] [3] [4] [EOB] [EOB] [9] [9] [9] [9] [INPUT]

0		1234
0	⇒	0
0		9999
0		0

3) 3 To set the same data use [S =].

(Ex.) [1] [2] [3] [4] [EOB] [S =] [EOB] [S =] [INPUT]

0		1234
0	⇒	1234
0		1234
0		0

4) 4 For bit parameters,

(Ex.) [1] [1] [EOB] [S =] [EOB] [S =] [INPUT]

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.

- **Setting parameters procedare (DPL/MDI)**

1. Set MDI mode or emergency stop.
2. Press the MENU VAR key to display the settings screen.
3. Use the cursor keys to position the cursor at PWE, then press the I key and the INPUT key, in that order, to enable parameters to be written. The Power Mate will generate P/S alarm 100.
4. Press the DGNOS PARAM key several time to display the parameter screen.

> &0001	00000000
&0002	00000000

5. Move the cursor to the number of the parameter to change.
   Method 1
   Use the cursor keys. The cursor will continue to move while a cursor key is being pressed.
   Method 2
   Press the following keys and enter data in the order shown :
   & @ No. **[(parameter No.)]** INPUT
6. Enter a parameter value with the data input keys.
7. Press the INPUT key. The parameter value is input and displayed.
8. After all parameters have been set and confirmed, retum to the settings screen and set PWE to 0.
9. Normally, in order to release the alarm state, press the CAN key. However, in order to release alarm No. 000, the power needs to be turned off and then on again.

3.2 INPUTTING/ OUTPUTTING DATA

Power Mate memorized the following data.
Outputting the newest data I/O device while the CNC is rurnning normally

(1) CNC paramter
(2) PMC parameter
(3) Custom macro variable values
(4) Tool compensation amount (offset data)
(5) Part program (Machining program, custom macro program)
(6) Ladder program
(7) Pitch error compensation value

3.2.1 Confirming the Parameters Required for Data input/Output

Be sure that data output cannot be done in an alarm status.
Parameters required for output are as follows :
(To change parameters, set MDI mode or emergency stop status)

Address	#7	#6	#5	#4	#3	#2	#1	#0
0000							ISO	

#1 (ISO) 0 : Output with EIA code
1 : Output with ISO code (FANUC cassette)

Address	
0020	Selection of I/O channel

0 : Channel 1 (JD5 of connector)
1 : Channel 1 (JD5 of connector)

1) I/O channel=0

Both I/O CHANNEL = 0 and I/O CHANNEL = 1 indicate channel 1. Separate parameters are, however, provided for each I/O CHANNEL, for setting the baud rate, stop bit, etc.

Address	#7	#6	#5	#4	#3	#2	#1	#0
0101	NFD				ASI			SB2

#7 (NFD) 0 : Feed is output when data is output.
1 : Feed is not output when data is output.
#3 (ASI)☆0 : EIA or ISO code is used for input data.
1 : ASCII code is used.
#0 (SB2) 0 : No. of stop bits is 1.
☆1 : No. of stop bits is 2.

(☆ : Standard setting)

Address	
0102	pecification number of input/output device

0	RS–232–C (control codes DC1 to DC4 used)
1	Not used
2	FANUC Floppy cassette adapter F1
3	PROGRAM FILE Mate. FANUC Handy File ,FANUC Floppy cassette adapter, FSP–H
4	Not used
5	Not used
6	FSP–G, FSP–H

Address	
0103	Baud Rate

7: 600 9: 2400 11:9600
8: 1200 ☆10: 4800 12:19200 [BPS]

2) I/O cahnnel=1

Set parameters to 0111, 0112, 0113.
Seeting contens are same as 0101, 0102, 0103.

3.2.2 Outputting CNC Parameters

- **Procedure (CRT/MDI)**

1. Select **EDIT** mode.
2. Press SYSTEM key and soft key **[PARAM]** to display parameter screen.
3. Press soft key **[(OPRT)]** ,and soft key ▷ .
4. Press soft key **[PUNCH]** and **[EXEC]**,and the parameters are started to be output.

- **Procedure (DPL/MDI)**

1. Select **EDIT** mode.
2. Select the parameter display screen by DGNOS PARAM key.
3. Press the WRITE key.
4. Execute file heading when required.
   For which file the parameter is output to refer to item Explanations (Output to a floppy).
5. While parameter, is being output, the display appears as below.

```
>#0100
                    WRITE
```

6. In order to stop output of data from a tape before it has finished, turn on external reset signal ERS (bit 7 of G008).
   Once data output from a tape has been stopped, it cannot be restarted.

Explanations (Output to a floppy)

- **File output location**

When output is conducted to the floppy, the program is output as the new file after the files existing in the floppy. New files are to be written from the beginning with making the old files invalid, use the above output operation after the N0 head searching.

- **An alarm while a program is output**

When P/S alarm (No.086) occurs during program output, the floppy is restored to the condition before the output.

- **Outputting a program after file heading**

When program output is conducted after N1 to N9999 head searching, the new file is output as the designated n–th position. In this case, 1 to n–1 files are effective, but the files after the old n–th one are deleted. If an alarm occurs during output, only the 1 to n–1 files are restored.

- **Efficient use of memory**

To efficiently use the memory in the cassette or card, output the program by setting parameter NFD (No.0101#7 or, No.0111#7) to 1. This parameter makes the feed is not output, utilizing the memory efficiently.

- **On the memo record**

Head searching with a file No. is necessary when a file output from the CNC to the floppy is again input to the CNC memory or compared with the content of the CNC memory. Therefore, immediately after a file is output from the CNC to the floppy, record the file No. on the memo.

3.2.3 Outputting PMC Parameters

- **Procedure (CRT/MDI)**

1. Select **EDIT** mode.
2. Press OFFSET SETTING key then soft key **[SETTING]** to select a setting screen.
3. Set the cursor to **PARAMETER WRITE** and input 1 and INPUT. At this time, alarm 100 will be generated.
4. Press SYSTEM key and soft key **[PMC]**.
5. Press soft key **[PMCPRM]** and soft key **[KEEPRL]**
6. Set the cursor to K17 and set the first bit to 1.

   × × × × × × 1 × INPUT

   Where, mark x is a former value

   Thus, data input/output screen has been selected.
7. Press soft key ◁ then key ▷.
8. Press soft key **[I/O]** and set the parameters on I/O. Item selection cursor moves to the following item after data of an item is set.
9. In CHANNEL NO item, input 1 INPUT to select I/O channel 1.
10. In DEVICE item, press soft key **[FDCAS]** to select the floppy cassette. It is also **[FDCAS]** for Handy File.
11. In KIND DATA item, press soft key **[PARAM]**.
12. In FUNCTION item, press soft key **[WRITE]**.
13. Press soft key **[EXEC]**. Then PMC parameters are started to be output.
14. After the PMC parameters have been output, set PARAMETER WRITE to 0.
15. Press RESET to release alarm 100.

- **Procedure (DPL/MDI)**

1. Select **EDIT** mode.
2. Press MENU VAR key several time then select a setting screen.
3. Set the cursor to PWE and input 1 and INPUT. At this time, alarm 100 will be generated.

4. Press DGNOS PARAM key several time to select diagnosis screen.
5. Press R D/R K, 1, 7 and INPUT key.
6. Set the first bit to 1.

   × × × × × × 1 × INPUT

   Where, mark x is a former value

7. Display the PMC parameter press & @ No. key then set file number.
8. Press WRITE. Then PMC parameters are started to be output.
9. After the PMC parameters have been output, set PWE to 0.
10. Reset Power Mate to release alarm 100.

3.2.4 Outputting Custom Macro Variable Values

- **Procedure (CRT/MDI)**

1. Select **EDIT** mode.
2. Press OFFSET SETTING key.
3. Press ▷ key and soft key **[MACRO]** to select custom macro variable screen.
4. Press soft key **[(OPRT)]** and then key ▷.
5. Press soft key **[PUNCH]** and **[EXEC]**, then custom macro variable values are output.

- **Procedure (DPL/MDI)**

1. Select **EDIT** mode.
2. Select the tool offset data display screen by pressing MENU VAR key.
3. Press the WRITE key.
4. While common variable is being output, the display appears as below.

```
>#0100
                     WRITE
```

5. In order to stop output of data from a tape before it has finished, turn on external reset signal ERS (bit 7 of G008).
   Once data output from a tape has been stopped, it cannot be restarted.

3.2.5 Outputting Tool Compensation Amount

- **Procedure (CRT/MDI)**

1. Select **EDIT** mode.
2. Press OFFSET SETTING key and soft key **[OFFSET]** to display the tool compensation amount screen.

3. Press **[(OPRT)]** key and soft key ▷.
4. Press soft key **[PUNCH]** an **[EXEC]** key, and the tool compensation amount is started to be output.

● Procedure (DPL/MDI)

1. Select **EDIT** mode.
2. Select the offset data display screen by pressing MENU VAR key.
3. Press the WRITE key.
4. While offset, is being output, the display appears as below.

```
>#0100
                WRITE
```

5. In order to stop output of data from a tape before it has finished, turn on external reset signal ERS (bit 7 of G008).
   Once data output from a tape has been stopped, it cannot be restarted.

3.2.6 Outputting Part Program

● Procedure (CRT/MDI)

1. Confirm the following parameters. If 1 is set, set to the EDIT mode and set it to 0.

Address	#7	#6	#5	#4	#3	#2	#1	#0
3202				NE9				NE8

#4(NE9)☆0 : Programs of 9000s are edited.
1 : Programs of 9000s can be protected.
#0(NE8)☆0 : Programs of 8000s are edited.
1 : Programs of 8000s can be protected.

2. Select EDIT mode.
3. Press PROG key and press soft key **[PRGRM]** to display program text.
4. Press **[(OPRT)]** key and press soft key ▷.
5. Input a program number to be output. To output all programs input as: O – 9 9 9 9
6. Press **[PUNCH]** and **[EXEC]** key, then program output is started.

● Procedure (DPL/MDI)

A program registered in memmory can be punched using the procedure below.

1. Confirm parameter as like above 1.
2. Select **EDIT** mode.
3. Press PRGRM to display the program screen.
4. Key in address O.

5. Key in a desired program number.
   Entering [–] [9] [9] [9] [9] causes all programs in memory to be output.
6. The number of input program is punched with pushing [WRITE].

3.2.7 Outputting Ladder Programs

- **Procedure (CRT/MDI)**

1. Select **EDIT** mode.
2. Press [OFFSET SETTING] key then soft key **[SETTING]** to select a setting screen.
3. Set the cursor to **PARAMETER WRITE** and input [1] and [INPUT]. At this time, alarm 100 will be generated.
4. Press [SYSTEM] key and soft key **[PMC]**.
5. Press soft key **[PMCPRM]** and soft key **[KEEPRL]**
6. Set the cursor to K17 and set the first bit to 1.
   [×] [×] [×] [×] [×] [×] [1] [×] [INPUT]
   Where, mark x is a former value
   Thus, data input/output screen has been selected.
7. Press soft key [◁] then key [▷].
8. Press soft key **[I/O]** and set the parameters on I/O.
   Item selection cursor moves to the following item after data of an item is set.
9. In CHANNEL NO item, input [1] [INPUT] to select I/O channel 1.
10. In DEVICE item, press soft key **[FDCAS]** to select the floppy cassette. It is also **[FDCAS]** for Handy File.
11. In KIND DATA item, press soft key **[PARAM]**.
12. In FUNCTION item, press soft key **[WRITE]**.
13. Press soft key **[EXEC]**. Then ladder programs are started to be output.
14. After the ladder programs have been output, set PARAMETER WRITE to 0.
15. Press [RESET] to release alarm 100.

- **Procedure (DPL/MDI)**

1. Select **EDIT** mode.
2. Press [DGNOS PARAM] key several time to select diagnosis screen.
3. Press [& @ No.] key in the diagnosis screen then set file number.
4. Press [WRITE], then ladder programs are started to be output.

3.2.8 Outputting Pitch Error Compensation Data

Procedure (CRT/MDI)

1 Make sure the output device is ready for output.

2 Specify the punch code system (ISO or EIA) using a parameter.

3 Press the EDIT switch on the machine operator's panel.

4 Press function key SYSTEM .

5 Press the rightmost soft key ▷ (next–menu key) and press chapter selection soft key **[PITCH]**.

6 Press soft key **[(OPRT)]**.

7 Press rightmost soft key ▷ (next–menu key).

8 Press soft keys **[PUNCH]** and **[EXEC]**.
All parameters are output in the defined format.

Procedure (DPL/MDI)

1 Select the EDIT mode.

2 Press the DGNOS PARAM key to display the pitch error compensation data screen.

3 Press the WRITE key.

4 When necessary, perform a file head search.

3.2.9 Inputting CNC Parameters

CAUTION
For a system using an absolute pulse coder, zero point setting is required once all parameters have been input.

● Procedure (CRT/MDI)

1. Set to the emergency stop state.
2. Confirm that the patameters required to input data is correct.

1) Press OFFSET SETTING key several times, and press **[SETING]** to display SETTING screen.

2) Parameters can be rewritten when PARAMETER WRITE ENABLE is 1.

3) Press SYSTEM key to select the parameter screen.

4)

Address	
0020	Selectionof I/O channel

☆0 : Channel 1 (JD5 of connector)
1 : Channel 1 (JD5 of connector)
I/O channel=0 Set parameters 0101, 0102, 0103
I/O channel=1 Set parameters 0111, 0112, 0113.

5)

Address	#7	#6	#5	#4	#3	#2	#1	#0
0101	NFD				ASI			SB2

#7(NFD) 0: Feed is output when punching out.
1 : Feed is not output when punching out.

#3(ASI) 0 : EIA or ISO code is used.
1 : ASCII code is used.

#0(SB2) 0 : No. of stop bits is 1.
☆ 1 : No. of stop bits is 2.

6)

Address	
0102	Specification number of I/O device

0	RS–232–C (control codes DC1 to DC4 are used.)
1	Not used
2	FANUCFloppy cassette F1
3	PROGRAM FILE Mate, Handy File, FANUC Floppy casette adapter, FSP–H
4	Not used
5	Not used
6	FSP–G, FSP–H

7)

Address	
0103	Baud rate

7:	600	9:	2400	11:	9600
8:	1200	☆10:	4800	12:	19200 [BPS]

3. Press soft key [▷]
4. Press soft key **[READ]** and **[EXEC]**. Then input of parameters are started.
5. After the parameters have been input, turn off the power once then turn it on because P/S alarm 000 is occured.
6. For a system using an absolute pulse coder, alarm 300 is issued. Perform zero point setting.

● Procedure (DPL/MDI)

1. Press the EMERGENCY STOP button on the machine side.
2. The parameter screen is selected by pressing the [DGNOS PARAM] key.
3. Set PWE on the setting screen to 1. Alarm PS100 is displayed at this time.
4. Perform the same operation as for program input.
5. NC parameters are input to the memory by this operation. Normally, alarm PS000 will activate after completion of parameter reading. Nomally, P/S alarm 000 is generated after parameters have finished being read in.
6. Set PWE on the setting parameter to 0.
7. Turn on the Power Mate power again.
8. For a system using an absolute pulse coder, alarm 300 is issued. Perform zero point setting.

3.2.10 Inputting PMC Parameters

- **Procedure (CRT/MDI)**

1. Set the emergency stop state.
2. Press OFFSET SETTING key and soft key **[SETTING]** to select the SETTING screen.
3. Confirm that PARAMETER WRITE=1.
4. Press SYSTEM key and soft key **[PMC]**.
5. Press soft key **[PMCPRM]** and soft key **[KEEPRL]**.
6. Set the cursor to K17 and set bit 1 to 1.
   × × × × × × 1 × INPUT .
   × means the setting value which is before input.
7. Press ◁ key and ▷ key.
8. Press soft key **[I/O]** and set the parameters required for I/O.
   Item selection cursor displays the next item after an item is set.
9. In CHANNEL item , press 1 INPUT to select channel 1.
10. In DEVICE item, press **[FDCAS]** key to select the floppy cassette.
11. In FUNCTION item, press soft key **[READ]** to input data
12. Press soft key **[EXEC]** and the PMC parameters are started to be input.
13. After data has been read, turn off power and turn it on.

- **Procedure (DPL/MDI)**

1. Set the emergency stop state.
2. Press MENU VAR key several times and soft key to select the SETTING screen.
3. Confirm that PWE=1.
4. Press DGNOS PARAM key several times and set diagnosis screen (@).
5. Press & @ No. then set the file number.
6. Press READ and the PMC parameters are started to be input.
7. After data has been read, turn off power and turn it on.

3.2.11 Inputting Custom Macro Variable Values

● Procedure (CRT/MDI)

1. Confirm that EDIT mode is selected.
2. Turn off the program protect key (KEY2=1).
3. Press PROG key then soft key **[PRGRM]** to display program contents.
4. Press soft key **[(OPRT)]** and key ▷.
5. Press address O P, a program number (0001 for example), soft key **[READ]** and **[EXEC]** key, then custom macro variable values are started to be input.
   Input a program number that is not used.
6. Select AUTO mode on the machine operator’s panel and press cycle start button.
   When the program is executed, macro variables are set.
7. Press OFFSET SETTING key, ▷ key and soft key **[MACRO]** to select the custom macro variable screen.
8. Press 5 0 0 and soft key **[NO SRH]** to display variable number 500 and confirm the custom macro variables are set correctly.
   Of the data displayed, 0 and vacant differ in meaning.
   Vacant is an undefined variable. To set vacant, press soft key **[INPUT]**.
9. Select EDIT mode again.
10. Press PROG key to select the program display screen.
11. Press address O P and a program number (0001 for example) ,then press DELETE to delete the program.

● Procedure (DPL/MDI)

1. Select **EDIT** mode.
2. Perform the same operation as for program input and read in the custom macro statements like a program.
3. After reading is finished, select AUTO mode. By executing the program that was read in, the values of the common variables will be stored in memory.

3.2.12 Inputting Tool Compensation Amount

● Procedure (CRT/MDI)

1. Select the EDIT mode.
2. Turn off the program protect (KEY=1).
3. Press PROG key, and press soft key**[PRGRM]** to display the program contents screen.

4. Press OFFSET SETTING key, and soft key **[OFFSET]** to display the tool compensation amount screen.
5. Press soft key **[(OPRT)]** and ▷ key.
6. Press **[READ]** key and **[EXEC]** key and data input is started.

- **Procedure (DPL/MDI)**

1. Select the **EDIT** mode.
2. Display the data display screen by pressing MENU VAR key.
3. Perform the same operation as for program input.
4. The input offset data will be displayed on the screen after completion of input operation.

3.2.13 Inputting Part Programs

Confirm the following parameters. If 1 is set, set it to 0.
(Change it in Emergency stop or MDI mode).

Address	#7	#6	#5	#4	#3	#2	#1	#0
3201		NPE					RAL	

#6 (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 porgram.

#1 (RAL) When programs are registered:
☆ 0 : All programs are registered.
1 : Only one program is registered.

Address	#7	#6	#5	#4	#3	#2	#1	#0
3202				NE9				NE8

#4 (NE9)☆0 : Programs of 9000s can be edited.
1 : Programs of 9000s are protected.

#0 (NE8)☆0 : Programs of 8000s can be edited.
1 : Programs of 8000s are protected.

- **Procedure (CRT/MDI)**

1. Confirm that mode is **EDIT** mode.
2. Turn off the program protect (KEY3=1).
3. Press PROG key and press soft key **[PRGRM]** to select a part program file.
4. Press soft ◁ key ,**[(OPRT)]** and ▷ key.
5. Press soft key **[READ]** and **[EXEC]**, then data input is started.

- **Procedure (DPL/MDI)**

1. Select EDIT mode.
2. Press PRGRM to display the program screen.

3. When the controller tape does not have a program number or a program number is to be changed, enter a desired program number. (When the controller tape has a program number and a program number is not changed, this operation is not necessary.)
   i) Key in address O Y .
   ii) Key in a desired program number.
4. Press the READ key.

3.2.14 Inputting PMC Ladder

- **Procedure (CRT/MDI)**

1. Set the emergency stop state.
2. Press OFFSET SETTING key and soft key **[SETTING]** to select the SETTING screen.
3. Confirm that PARAMETER WRITE=1.
4. Press SYSTEM key and soft key **[PMC]**.
5. Press soft key **[PMCPRM]** and soft key **[KEEPRL]**.
6. Set the cursor to K17 and set bit 1 to 1.
   × × × × × × 1 × INPUT .
   × means the setting value which is before input.
7. Press ◁ key and ▷ key.
8. Press soft key **[I/O]** and set the parameters required for I/O.
   Item selection cursor displays the next item after an item is set.
9. In CHANNEL item , press 1 INPUT to select channel 1.
10. In DEVICE item, press **[FDCAS]** key to select the floppy cassette.
11. In FUNCTION item, press soft key **[READ]** to input data. In DATA KIND item, not set the data.
12. Press soft key **[EXEC]** and the PMC ladder are started to be input.
13. After data has been read, turn off power and turn it on.

- **Procedure (DPL/MDI)**

1. Set the emergency stop state.
2. Press MENU VAR key several times and soft key to select the SETTING screen.
3. Confirm that PWE=1.
4. Press DGNOS PARAM key several times and set diagnosis screen (@).
5. Press & @ No. then set the file number.
6. Press READ and the ladder programs are started to be input.
7. After data has been read, turn off power and turn it on.

3.2.15 Inputting Pitch Error Compensation Data

Procedure (CRT/MDI)

1. Make sure the input device is ready for reading.
2. When using a floppy, search for the required file according to the procedure.
3. Press the EMERGENCY STOP button on the machine operator's panel.
4. Press function key OFFSET SETTING .
5. Press the soft key **[SETING]** for chapter selection.
6. Enter 1 in response to the prompt for writing parameters (PWE). Alarm P/S100 (indicating that parameters can be written) appears.
7. Press soft key SYSTEM .
8. Press the rightmost soft key ▷ (next–menu key)and press chapter selection soft key **[PITCH]**.
9. Press soft key **[(OPRT)]**.
10. Press the rightmost soft key ▷ (next–menu key).
11. Press soft keys **[READ]** and **[EXEC]**.
    Parameters are read into memory. Upon completion of input, the "INPUT" indicator at the lower–right corner of the screen disappears.
12. Press function key OFFSET SETTING .
13. Press soft key **[SETING]** for chapter selection.
14. Enter 0 in response to the prompt for writing parameters.
15. Turn the power to the NC back on.
16. Release the EMERGENCY STOP button on the machine operator's panel.

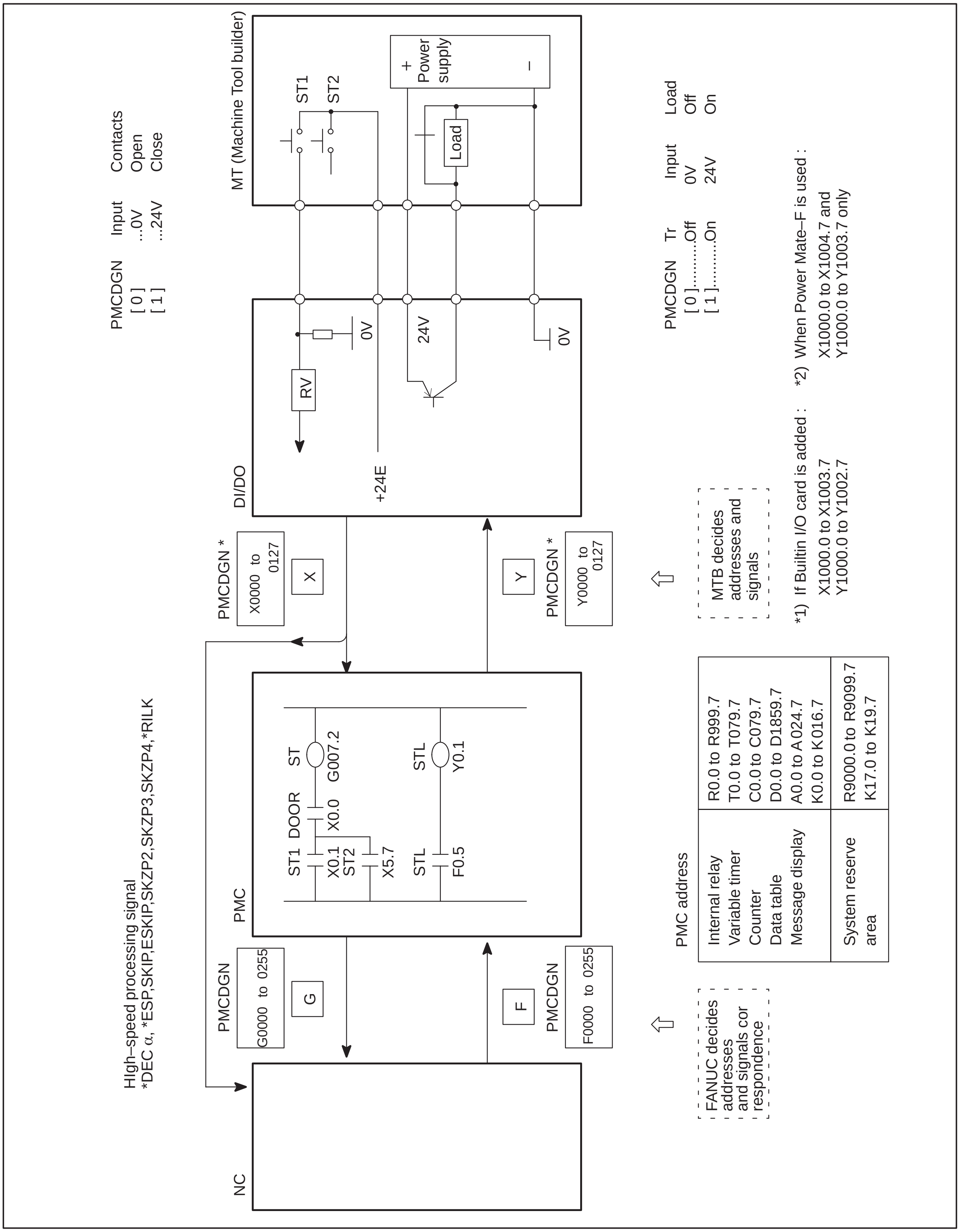
Procedure (DPL/MDI)

1. Select the EDIT mode.
2. Press the DGNOS PARAM key to display the pitch error compensation data screen.
3. Perform the same operation as for program input.
4. By performing this operation, pitch error compensation data is read into memory.

4 INTERFACE BETWEEN NC AND PMC

This chapter describes the signals between the machine operator's panel, magnetics cabinet and the PMC, connection of the signals between PMC and Power Mate, and confirmation method of on/off state of these signals. The chapter also describes how to display the PMC system configuration, parameters, and ladders on the CRT or DPL.
Note that the CRT/MDI cannot be used with the Power Mate–F.
It also describes a method of inputting/outputting PMC parameters to an external device.

4.1 GENERAL OF INTERFACE



4.2 SPECIFICATION OF PMC

4.2.1 Specification

Model		PMC–RA3	PMC–RA1
Programming method language		Ladder	Ladder
Number of ladder level		2	2
Level–1 Cycle Time		8 ms	8 ms
Basic Instruction Execution Time		0.15 (µs/step)	4.5 (µs/step)
Program capacity			
• Ladder (step)		Approx. 5,000 (Basic) Approx. 12,000 (Option)	Approx. 3,000
• Symbol/comment (Note)		1 to 128KB	1 to 128KB
• Message		0.1 to 64KB	0.1 to 64KB
• Language only		–	–
Instruction	(Basic)	14 kinds	12 kinds
	(Function)	64 kinds	47 kinds
Internal relay	(R)	1118 byte	1110 byte
Message request	(A)	25 byte	25 byte
Non–volatile			
• Var. Timer	(T)	80 byte	80 byte
• Counter	(C)	80 byte	80 byte
• Keep relay	(K)	20 byte	20 byte
• Data table	(D)	1860 byte	1860 byte
Fixed timer		Timer No. 100 devices specified	Timer No. 100 devices specified
Input/output			
• I/O Link	(I)	1024 points max.	1024 points max.
(master)	(O)	1024 points max.	1024 points max.
• I/O Link	(I)	256 points max.	256 points max.
(slave)	(O)	256 points max.	256 points max.
• Built–in I/O card	(I)	32 point max.	32 point max.
	(O)	24 point max.	24 point max.
Sequence program storage media		Back–up SRAM	Back–up SRAM

NOTE

1 Normal size of a symbol, a comment, and a message are 1KB, and 0.1KB, respectively. Max. size of a symbol and a comment are each 64KB.

2 In the case of the Power Mate–F, a ladder program can contain a maximum of only about 5,000 steps. In addition, the Power Mate–F is not provided with an I/O Link (master). The built–in I/O card supports a maximum of 48 and 32 input and output points, respectively.

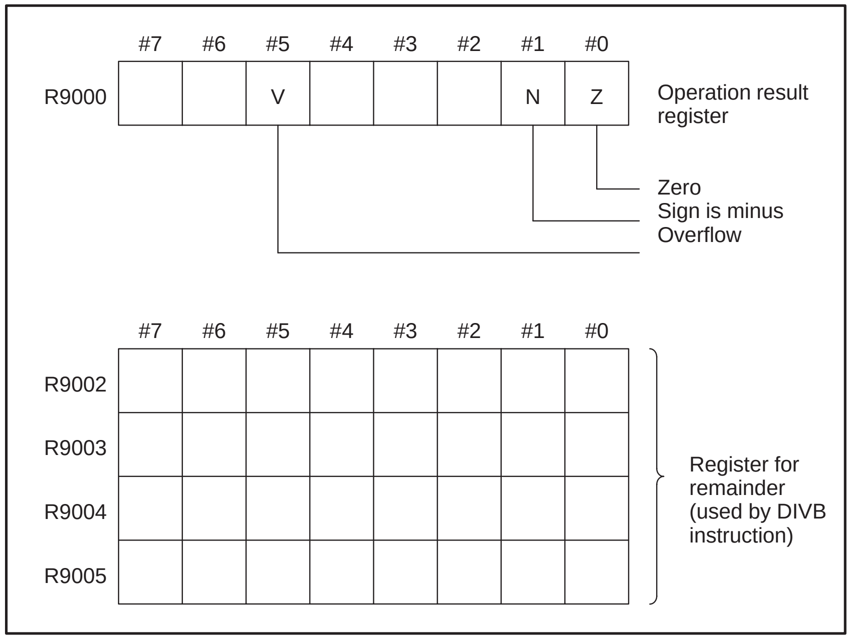
4.2.2 Address

	Type	Byte	Address	Explanation
G	PMC⇒CNC	256	G000.0 to G255.7	
F	CNC⇒PMC	256	F000.0 to F255.7	
Y	PMC⇒MT	168	Y000.0 to Y127.7	FANUC I/O Link (master)
			Y1000.0 to Y1002.7	Built–in I/O card<Power Mate–D>
			Y1000.0 to Y1003.7	Built–in I/O card<Power Mate–F>
			Y1020.0 to Y1051.7	FANUC I/O Link (slave)
X	MT⇒PMC	167	X000.0 to X127.7	FANUC I/O Link (master)
			X1000.0 to X1003.7	Built–in I/O card<Power Mate–D>
			Y1000.0 to Y1004.7	Built–in I/O card<Power Mate–F>
			X1020.0 to X1051.7	FANUC I/O Link (slave)
A	Massege display	25	A000.0 to A024.7	
R	Internal relay	1100	R000.0 to R999.7	
			R9000.0 to R9117.7	Operation result, system reserve area
T	Variable timer	80	T000.0 to T079.7	
K	Keep relay	20	K000.0 to K016.7	
			K017.0 to K019.7	System reserve area
C	Counter	80	C000.0 to C079.7	
D	Data table	1860	D0000.0 to D1859.7	

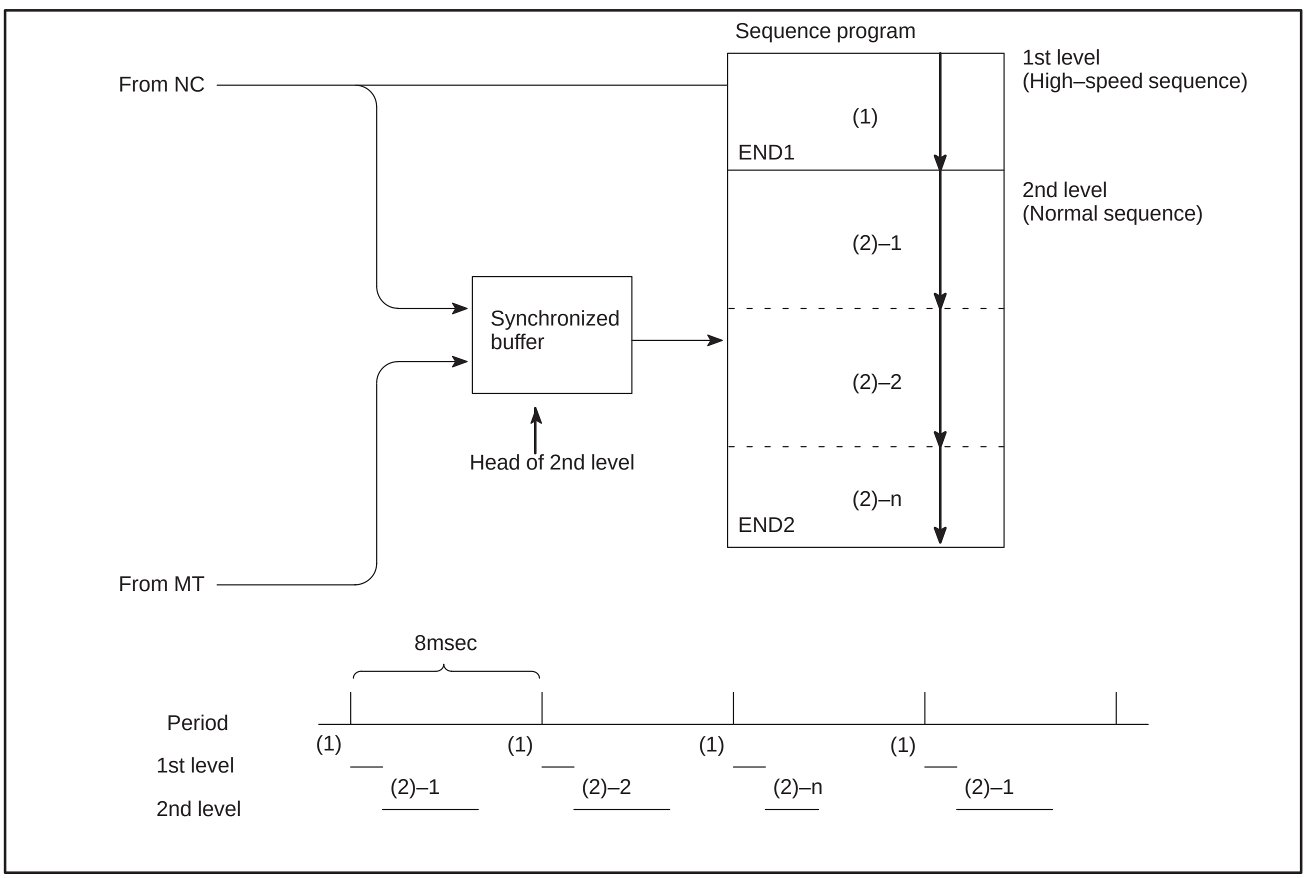
4.2.3 Built–in Debug Function

Function	Contents
Display of sequence program	Dynamic display of ladder diagram * This function is not provided by the Power Mate–F, handy operator’s panel, or DPL/MDI.
Diagnostic function	•Title data display • signal status (symbol can be displayed in the CRT/MDI) • PMC alarm display
Setting and displaying data	• Timer • Counter • Keep relay • Data table
Sequence program edit function	Ladder diagram editing (A ladder edit module for memory card is required) * In the case of the Power Mate–F, ladder charts are edited using mnemonics on the DPL/MDI. * Ladder chart editing and mnemonic editing are not supported by the handy operator’s panel.

4.2.4 System Reserve Area of Internal Relay



4.2.5 Execution Period of PMC



4.3 OPERATION ON THE CRT/MDI

4.3.1 Display Method

1. Press SYSTEM .
2. Press soft key **[PMC]**, then PMC screen is displayed and the following soft keys are displayed:

```
PMC CONTROL SYSTEM MENU          MONIT RUN

 SELECT ONE OF FOLLOWING SOFT KEYS

   PMCLAD    : DYNAMIC LADDER DISPLAY
   PMCDGN    : DIAGNOSIS FUNCTION
   PMCPRM    : PARAMETER (T/C/K/D)
   RUN/STOP  : RUN/STOP SEQUENCE PROGRAM
   EDIT      : EDIT SEQUENCE PROGRAM
   I/O       : I/O SEQUENCE PROGRAM
   SYSPRM    : SYSTEM PARAMETER

[ PMCLAD ][ PMCDGN ][ PMCPRM ][        ][        ]
```

When built–in programmer is running.

[PMCLAD] [PMCDGN] [PMCPRM] [ ] [ ]

- PMCPRM: System parameter screen
- PMCDGN: Status display of PMC I/O signal
- PMCLAD: Dynamic display of sequence program

[STOP] [EDIT] [I/O] [SYSPRM] [ ]

- SYSPRM: System parameter screen
- I/O: Input/output of sequence program
- EDIT: Editing sequence program
- STOP: RUN/STOP of sequence

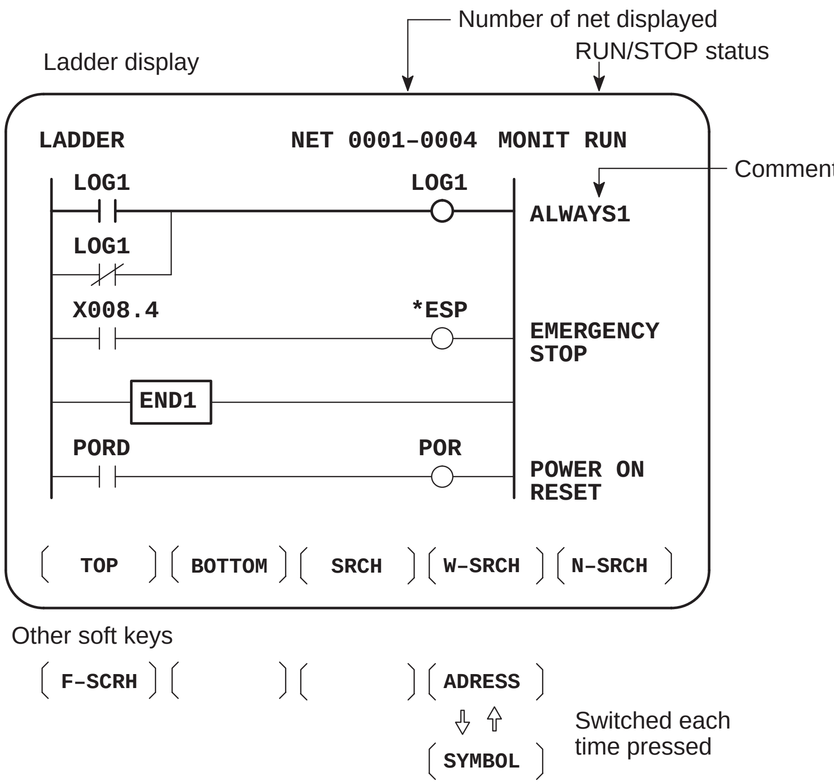
The no. of menus to be displayed changes depending on presence/absence of built–in programmer.

	PMC–PA3 (Without memory card for editing)	PMC–PA3 (With memory card for editing)
RUN/STOP	○	○
EDIT	×	○
I/O	○	○
SYSPRM	×	○

×: Cannot be displayed nor used.

4.3.2 PMCLAD SCREEN

Press soft key **[PMCLAD]**, and a sequence program is displayed dynamically and operation monitoring can be confirmed :



- **Contents displayed**

1. Low brightness display — Contacts : open — Relay : off
2. High brightness display — Contacts : closed — Relay : on

- **Search method**

1. Use the page keys and cursor keys to change display positions.
2. **[TOP]**:Searches top of ladder.
3. **[BOTTOM]**:Search bottom of ladder.
4. Address.bit,**[SRCH]** or Signal name, **[SRCH]**
5. Address.bit,**[W–SRCH]** or Signal name ,**[W–SRCH]**
6. Net no.**[N–SRCH]**:Ladder is displayed from the specified net.
7. Functional instruction no. **[F–SRCH]** or Functional instruction name**[F–SRCH]**
8. **[ADRESS]**:Signal is displayed by address and bit no.
9. **[SYMBOL]**:Signal is displayed by signal name (symbol).
   (If symbol is not registered at program preparation time, the address of the signal is displayed).

[Remarks]

- The search function searches a signal in the forward direction and displays the ladder with the searched signal at its head. Because there may exist plural contacts, repeat the search operation to find plural locations, repeat the search operation to find plural locations with the specified signal.
- If a specified signal is not found up to the end of the program (ladder), execution returns to the head of a program and search continues.

4.3.3 PMCDGN SCREEN

Press soft key **[PMCDGN]** then PMC's diagnostic screen is displayed.

- **TITLE screen**

The title data registered when a ladder program is prepared is displayed.

Page number

```
PMC TITLE DATA #1                MONIT RUN
         PMC PROGRAM NO.    :
         EDITION NO.        :
         PMC CONTROL PROGRAM
         SERIES  : 4075 EDITION : 01

             MEMORY USED     :   KB
             LADDER          :   KB
             SYMBOL          :   KB
             MESSAGE         :   KB
             SCAN TIME       :   MSEC

 [ TITLE ][ STATUS ][ ALARM ][ TRACE ][       ]
```

Other soft keys

```
 [ M.SRCH ][ ANALYS ][       ][       ][       ]
```

1st page PMC PROGRAM NO. :
EDITION NO. :
Set when PMC is prepared

PMC CONTROL PROGRAM
SERIES : EDITION : — Series and edition of PMC control software

MEMORY USED : KB
LADDER : KB
SYMBOL : KB
MESSAGE : KB
SCAN TIME : MSEC
Memory used and execution time is displayed.

2nd page MACHINE TOOL BUILDER NAME :
MACHINE TOOL NAME :
CNC & PMC TYPE NAME :
PROGRAM DRAWING NO. :

3rd page DATE OF DRAWING :
PROGRAM DESIGNED BY :
ROM WRITTEN BY :
REMARKS :

Set when PMC is prepared.

- **STATUS screen**

On/Off state of input/output signals and internal relay is displayed.

```
PMC SIGNAL STATUS                 MONIT RUN
ADDRESS    7    6    5    4    3    2    1    0
         ED7  ED6  ED5  ED4  ED3  ED2  ED1  ED0
G0000      0    0    0    0    1    0    1    0
        ED15 ED14 ED13 ED12 ED11 ED10  ED9  ED8
G0001      0    0    0    0    0    0    0    0
        ESTB  EA6  EA5  EA4  EA3  EA2  EA1  EA0
G0002      0    0    0    0    0    0    0    0

G0003      0    0    0    0    0    0    0    0
                              FIN
G0004      0    0    0    0    0    0    0    0


[SEARCH][      ][      ][      ][      ]
```

Signal name

Signal state
0:Off
1:On

Signal state reverses for signals with *.
0: On
1: Off

[Search Method]

- Page key :Forward and Backward by screen
- Cursor key :Forward and Backward by diagnostic number
- To search a specified address or signal name, input an address number or signal name and press **[SEARCH]**.

- **Alarm screen**

Displays an alarm generated in PMC.

```
PMC ALARM MESSAGE                 MONIT RUN

   ER32 NO I/O DEVICE








                                       ALM

[ TITLE ][ STATUS ][ ALARM ][ TRACE ][      ]
```

Alarm display

For details of alarms, refer to Appendix B List of Alarms.

Blinked

- **TRACE screen**

Every time a specified signal changes, the signal status is memorized in the trace memory. This function is useful for identifying intermittent troubles.

(1) Trace parameter screen

```
PMC SIGNAL TRACE                    MONIT RUN
 TRACE MODE                :
 (0:1BYTE/1:2BYTE/2:WORD)
 1ST TRACE  ADDRESS  CONDITION
     ADDRESS  TYPE         : (0:PMC/1:PHY)
     ADDRESS               :
     MASK  DATA            :
 2ND TRACE  ADDRESS  CONDITION
     ADDRESS  TYPE         : (0:PMC/1:PHY)
     ADDRESS               :
     MASK  DATA            :

[ T.DISP ][  EXEC  ][        ][        ][        ]
```

Changes to a trace memory display screen (Screen on the next page)

Select each item by cursor key

a. TRACE MODE: Select the trace mode
   0=Records changes of 1–byte signals
   1=Records changes of independent 2–byte signals
   2=Records changes of consecutive 2–byte signals

b. ADDRESS TYPE:
   0=PMC address is used for tracing address.
   1=Physical address is used for tracing address.
   (Mainly used for C–language program)

c. ADDRESS:Set a tracing address.

d. MASK DATA: The bits to be traced are specified by a hexadecimal number (2 digits).
   For example, to trace the signals at bit 7,6,5 and 0, set E1 (hexadecimal) to MASK DATA.

	#7	#6	#5	#4	#3	#2	#1	#0
E1%	1	1	1	0	0	0	0	1

   However, even if bit 4,3,2 and 1 changes, tracing (memory registration) cannot be done but signal status is memorized when a tracing is executed.
   [Correspondence of binary and hexadecimal number]
   $0000_2 : 0_{16}$ $0001_2 : 1_{16}$ $0010_2 : 2_{16}$ $0011_2 : 3_{16}$
   $0100_2 : 4_{16}$ $0101_2 : 5_{16}$ $0110_2 : 6_{16}$ $0111_2 : 7_{16}$
   $1000_2 : 8_{16}$ $1001_2 : 9_{16}$ $1010_2 : A_{16}$ $1011_2 : B_{16}$
   $1100_2 : C_{16}$ $1101_2 : D_{16}$ $1110_2 : E_{16}$ $1111_2 : F_{16}$

(2) Trace memory contents display screen

```
PMC SIGNAL TRACE                    MONIT RUN
 1ST ADDRESS=X008(E1) 2ND ADDRESS=G000(FF)
NO.    7 6 5 4 3 2 1 0         7 6 5 4 3 2 1 0
0000   . . . . . . . .         . . . . . . . .
0001   I * * * * * * *         * * * * * * * *
0002   I I * * * * * *         * * * * * * * *
0003   * I * * * * * *         * * * * * * * *
0004   . . . . . . . .         . . . . . . . .
0005   . . . . . . . .         . . . . . . . .
0006   . . . . . . . .         . . . . . . . .
0007   . . . . . . . .         . . . . . . . .
0008   . . . . . . . .         . . . . . . . .

[ TRCPRM ][ STOP ][ ][ ][ ]
```

Trace address and mask data

Latest status
I mark : 1
* mark : 0

10″LCD/14″CRT is displayed by 1 and 0.

a. Soft key **[TRCPRM]**: Return to the trace parameter setting screen (screen of previous page)

b. Soft key **[EXEC]**: Starts tracing.
Trace memory is cleared and each time a specified signal changes, its status is recorded. Trace memory is 256 bytes and if tracing is executed 128 times by 2–byte tracing, tracing is executed again from the head of memory.

c. Soft key **[STOP]**: Ends the tracing.

*The tracing parameters are held even if the power is turned off.

Address	#7	#6	#5	#4	#3	#2	#1	#0
k017								

#5 0 : Tracing starts by **[EXEC]**.
1 : Tracing starts automatically after power on

4.3.4 PMCRAM Screen

- **Inputting PMC parameters from the MDI**

(1) Set to MDI mode or emergency stop state.

(2) Set PARAMETER WRITE (on setting screen) to 1 or set the program protect signal (KEY4) to 1.

	PWE	KEY4	
Timer	○	–	
counter	○	○	Either one
Keep relay	○	–	
Data table	○	○	Either one

(3) Press a soft key and select a required screen.
[TIMER] :Timer screen
[COUNTR] :Counter screen
[KEEPRL] :Keep relay screen
[DATA] :Data table screen

(4) Press cursor key and move the cursor to a desired number.

(5) Input a numeric key and press INPUT key and data is input.

(6) After the data is input, set PARAMETER WRITE or KEY4 on setting screen to 0.

- **TIMER screen**

This screen is used for setting timer time of the functional instruction (SUB 3).

Page no. (screen is scrolled by page key)
Timer no. specified by functional instruction
Address specified by ladder

```
PMC PARAMETER (TIMER) #001        MONIT RUN

NO.   ADDRESS DATA       NO.   ADDRESS DATA
01    T00     480        11    T20     0
02    T02     960        12    T22     0
03    T04     0          13    T24     0
04    T06     0          14    T26     0
05    T08     0          15    T28     0
06    T10     0          16    T30     0
07    T12     0          17    T32     0
08    T14     0          18    T34     0
09    T16     0          19    T36     0
10    T18     0          20    T38     0

( TIMER )( COUNTR )( KEEPRL )( DATA )(      )
```

Timer delay time (msec)

Timer set time : Timer no. 1–8 is max. 1572.8 sec and its accuracy is 48ms.
Timer no. 9–40 is max. 262.1 sec and its accuracy is 8ms.

• COUNTER screen

This screen sets and displays max. value of counter and current value of the counter instruction (SUB 4).

Page no. (screen is scrolled by page key)

Max. value of counter (Minimum value is specified by counter ins.)

Current value of counter

PMC PARAMETER (COUNTER)#001 MONIT RUN

NO.	ADDRESS	PRESET	CURRENT
01	C00	100	1
02	C04	50	2
03	C08	0	0
04	C12	0	0
05	C16	0	0
06	C20	0	0
07	C24	0	0
08	C28	0	0
09	C32	0	0
10	C36	0	0

PRESET and CURRENT can be set up to 9999, respectively.

[TIMER] [COUNTR] [KEEPRL] [DATA] [ ]

Address specified by ladder

Counter number specified by functional instruction

• KEEP RELAY screen

Address specified by ladder

PMC PARAMETER (KEEP REALAY) #001 MONIT RUN

NO.	ADDRESS	DATA	NO.	ADDRESS	DATA
01	K00	00000000	11	K10	00000000
02	K01	00000000	12	K11	00000000
03	K02	00000000	13	K12	00000000
04	K03	00000000	14	K13	00000000
05	K04	00000000	15	K14	00000000
06	K05	00000000	16	K15	00000000
07	K06	00000000	17	K16	00000000
08	K07	00000000	18	K17	00000000
09	K08	00000000	19	K18	00000000
10	K09	00000000	20	K19	00000000

[TIMER] [COUNTR] [KEEPRL] [DATA] [ ]

Address specified by ladder

Used by PMC system

(1) Nonvolatile memory control

Address	#7	#6	#5	#4	#3	#2	#1	#0
k016								

#7(MWRTF2): For checking the writing status in nonvolatile memory
#6(MWRTF1): Writing status in nonvolatile memory

(2) PMC system parameter
The following keep relays are used by the system, therefore they cannot be used in the sequence program.

Address	#7	#6	#5	#4	#3	#2	#1	#0
k017								

#5 TRCSTAT

0 : Signal tracing starts by soft key **[EXEC]** in signal trace function.

1 : Signal tracing starts automatically by power on in signal trace function.

#4 MEMINP

0 : Data input cannot be done in memory contents display function.

1 : Data input can be done in memory contents display function.

#2 AUTORUN

0 : A sequence program is executed automatically after the power is turned on.

1 : A sequence program is executed by sequence program soft key.

#1 PRGRAM

0 : Built–in programmer is not used.

1 : Built–in programmer is used.

#0 LADMASK

0 : Dynamic display of ladder is executed.

1 : Dynamic display of ladder is not executed.

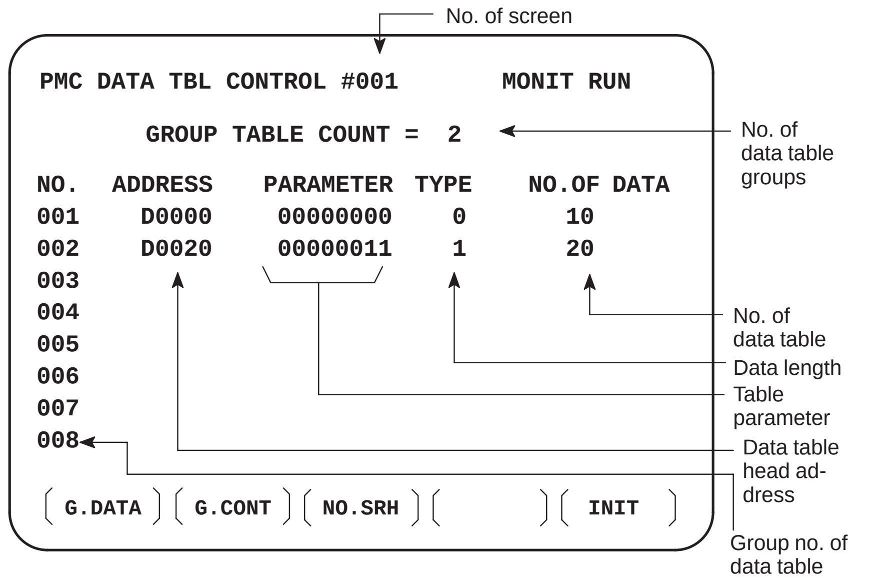
Address	#7	#6	#5	#4	#3	#2	#1	#0
k018								

Address	#7	#6	#5	#4	#3	#2	#1	#0
k019								

These bits are used by system. Do not change the values.
Usually all the bits are 0.

- **DATA TABLE screen**

(1) Data table setting screen



a. Soft key **[G.DATA]** : Select data display screen of data table. (Next screen)

b. NO. OF GROUPS **[G.CONT]** : Set the no. of groups of data table.

c. Group No. **[NO.SRH]**: Move the cursor to a specified group.

d. Soft key **[INIT]**: Initializes the setting of data table.
No. of groups is 1, ADDRESS is D0000, PARAMETER is 0000000, TYPE is 0, NO. OF DATA is 1860.

This operation is done usually when a sequence program is prepared. When PMC parameters are set, internal parameters are not affected.

PARAMETER

Address	#7	#6	#5	#4	#3	#2	#1	#0
k019								

#0: 0 : Binary format
1 : BCD format

#1: 0 : Without protection for input
1 : With protection for input

TYPE

0 : 1–byte length 1 : 2–byte length 2 : 4–byte length

e. Using the page key, next screen/previous screen can be selected.

(2) Data display screen

Group number
Page number

```
PMC PRM (DATA) 001/001          MONIT RUN

    NO.    ADDRESS      DATA
    000    D0000          0
    001    D0001          0
    002    D0002          0
    003    D0003          0
    004    D0004          0
    005    D0005          0
    006    D0006          0
    007    D0007          0
    008    D0008          0
    009    D0009          0

 ( C.DATA )( G–SRCH )( SEARCH )(        )(        )
```

a. Soft key **[C.DATA]** :Returns to the data table setting screen. (Previous screen)

b. Group No. **[G–SRCH]** : Head of the specified group is selected.

c. Address **[SEARCH]**: Searches an address in a group currently selected.

4.4 OPERATION ON THE DPL/MDI

The DPL/MDI panel is used to set PMC system parameters and create and execute the sequence program.

(1) Setting and displaying PMC system parameters (SYSTEM PARAM)
   – The type of counter data (BCD or binary) can be selected.

(2) Editing the sequence program (EDIT)
   – The sequence program can be edited (input, addition, search, and deletion) by using the ladder mnemonics display.

(3) Executing the sequence program (RUN/STOP)
   – The execution of the sequence program can be started and stopped.

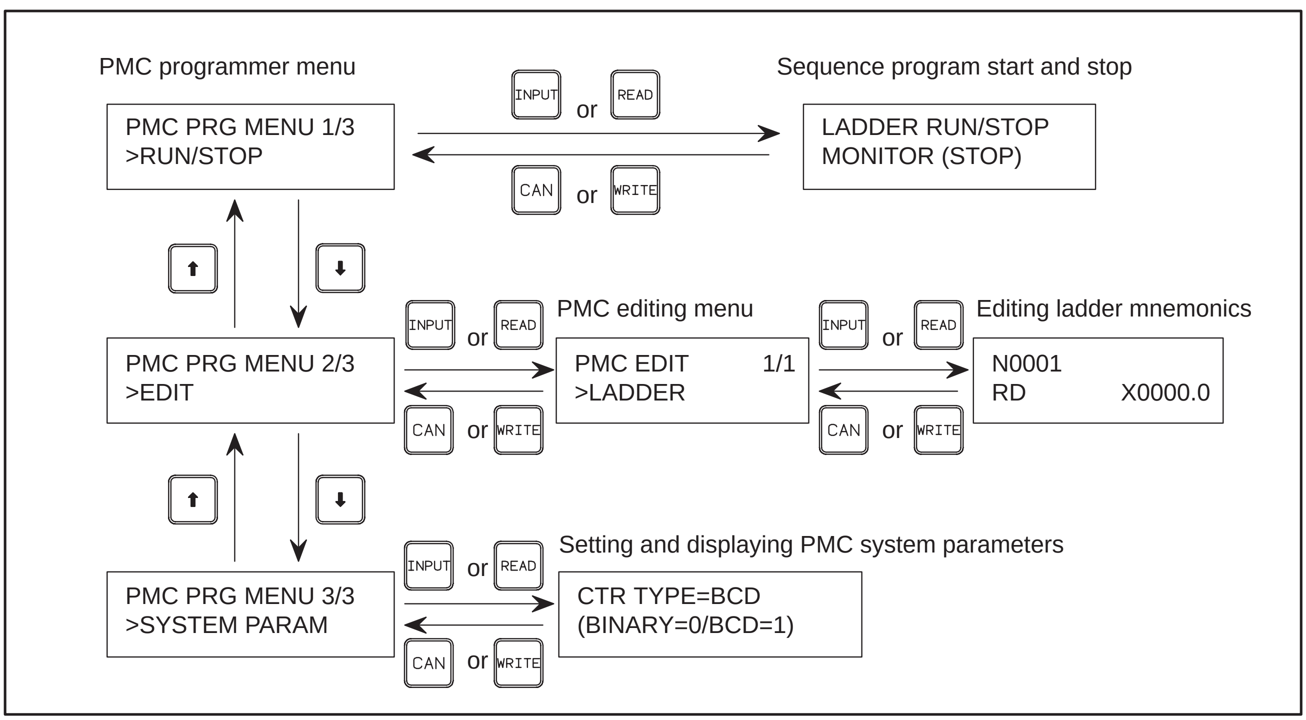
NOTE

1 The indication at the bottom left of each key applies to the PMC programmer (DPL/MDI) function.

2 For keys such as the R D/R K key, the indication on the left applies when the key is pressed once and that on the right applies when the key is pressed twice.

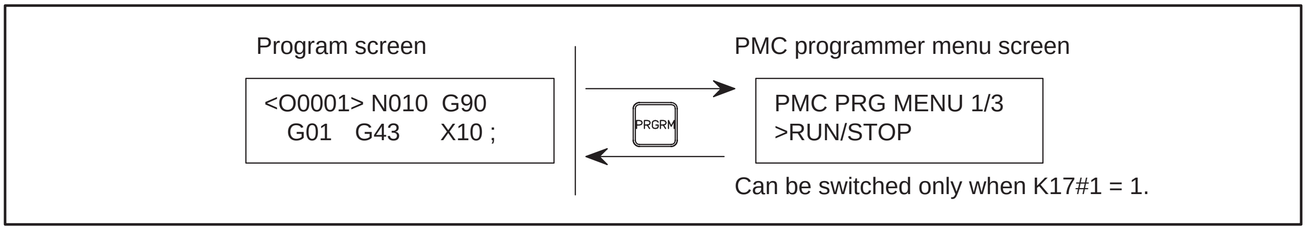
(Example) Pressing the R D/R K key once enters ”D” and pressing it twice enters ”R.”

The screen configuration for the PMC programmer (DPL/MDI) function is as follows:

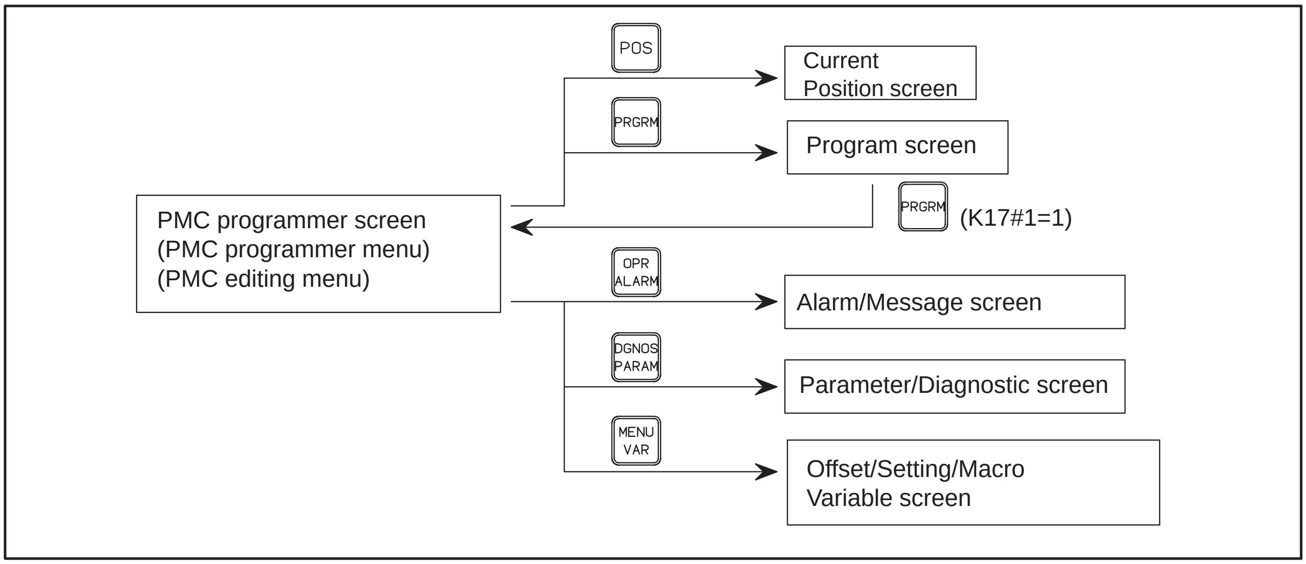


4.4.1 Selectingthe PMC Programmer Menu

To operate the PMC programmer, set K17#1 of the keep relay area for PMC parameters to 1, then press the PRGRM key two times on the DPL/MDI (press the PRGRM key further when the program screen is selected), thus causing the PMC programmer menu to be displayed.



To return to the CNC screen, press the POS, PRGRM, MENU VAR, DGNOS PARAM, or OPR ALARM key.



4.4.2 Setting and Displaying System Parameters (SYSTEM PARAM)

Selecting SYSTEM PARAM on the PMC programmer menu displays the system parameter screen. If the sequence program is running, selecting this function automatically stops the program.

1 Display the PMC programmer menu.

2 Display the SYSTEM PARAM item by pressing the ⬇ or ⬆ key.

```
PMC  PRG  MENU        3/3
>SYSTEM   PARAM
```

3 Press the INPUT or READ key. The system parameter screen appears.

```
CTR   TYPE = BIN
(BINARY=0/BCD=1)
```

4 The current counter data type is displayed on the screen.

(a) Specify the type of the counter value to be used for the CTR functional instruction, as binary or BCD (enter 0 for binary or 1 for BCD).

(b) Press the INPUT key.

The counter data type is set.

5 Pressing the CAN or WRITE key displays the PMC programmer menu.

4.4.3 Editing the Sequence Program (Edit)

Selecting EDIT on the PMC programmer menu displays the editing menu.

1 Display the PMC programmer menu.

2 Display the EDIT item by pressing the ⬇ or ⬆ key.

```
PMC  PRG  MENU      2/3
>EDIT
```

3 Press the INPUT or READ key. The PMC editing menu appears.

```
PMC  EDIT           1/1
>LADDER
```

To end editing and display the PMC programmer menu, press the CAN or WRITE key.

4.4.4 Editing Ladder Mnemonics

(1) Starting ladder mnemonics editing

Selecting LADDER on the PMC programmer menu displays the ladder mnemonics editing screen. If the sequence program is running, selecting this function automatically stops the program.

1 Display the PMC programmer menu.

2 Display the LADDER item by pressing the ⬇ or ⬆ key.

```
PMC  EDIT           1/1
>LADDER
```

3 Press the INPUT or READ key. The sequence program is displayed.

Step number

```
> N0001
  RD             X0000.0
```

Instruction

(2) Confirming the ladder mnemonics

1 Cursor scroll (scroll per step)

Pressing the ⬆ cursor key displays the instruction one step before that currently displayed. Pressing the ⬇ cursor key displays the instruction one step after that currently displayed.

2 Specifying the step number

Entering [& @ No.], <step number>, then [INPUT] displays the instruction having the entered step number.

(The [⬇] cursor key can be used instead of the [INPUT] key.)

(Example) [& @ No.], [1] [2] [3], [⬇]

```
N0123
SUB  50  PSGNL
```

3 Relay search

Entering <address number> then [⬇] searches for the relay including the entered address.

(Example) [X AXIS X] [0] [•] [2], [⬇]

```
N0105
AND                 X0000.2
```

4 Relay coil search

Entering [S WRT /SET], <address number>, then [⬇] searches for the relay coil including the entered address.

(Example) [S WRT /SET], [O Y] [3] [3] [•] [5], [⬇]

```
N0187
WRT. NOT            Y0033.5
```

5 Functional instruction search

Entering [H SUB], <functional instruction number>, then [⬇] searches for the entered functional instruction.

(Example) [H SUB], [5] [0], [⬇]

```
N0123
SUB  50  PSGNL
```

NOTE

1 Relay search, relay coil search, and functional instruction search are started from the current screen. If the relay, relay coil, or instruction is not found by the end of the ladder program, search is performed from the beginning of the ladder program to the step at which search was started. If still not found, ”NOT FOUND” is displayed.

```
N0105  NOT  FOUND
AND         X0000.2
```

2 Display of some instructions may differ from that for FAPT LADDER.

P–G, personal–computer FAPT LADDER	Ladder mnemonics editing
(a) RD.NOT.STK	RD.N.STK
(b) TMR timer–number	SUB 03 TMR P001 timer–number
(c) DEC code–signal–address (PRM) decode–instruction	SUB 04 DEC P001 code–signal–address P002 decode–instruction

The above also applies when modifying the ladder mnemonics.

(3) Modifying the ladder mnemonics

1 Changing an instruction

(a) Display the instruction to be changed.

(b) Enter a new instruction.

(c) Press the ALTER key.

(Example) # OR , 0 Y 3 2 • 4 , ALTER

```
N1234
AND                R0123.4
```

Before change

```
N1234
OR                 Y0032.4
```

After change

NOTE
If changing the instruction causes the memory capacity to be exceeded, the ALTER key is ignored without changing the instruction.

2 Deleting an instruction

(a) Display the instruction to be deleted.

(b) Press the DELET key.
The instruction is deleted and the next instruction is displayed.

3 Inserting an instruction

(a) Display the instruction after which an instruction is to be inserted.

(b) Enter the instruction to be inserted.

(c) Press the INSRT key.

(Example) / AND , EOB STK , INSRT

```
N1234
AND                R0123.4
```

Before insertion

```
N1234
AND.STK
```

After insertion

NOTE
If inserting the instruction causes the memory capacity to be exceeded, the INSRT key is ignored without inserting the instruction.

4 Deleting the ladder program

(a) Enter – 9 9 9 9 .

(b) Press the DELET key.

The whole ladder program is deleted.

(4) Ending ladder mnemonics editing

1 Press the CAN or WRITE key.

2 "EXECUTING" is displayed.

```
N0001
    EXECUTING
```

3 The PMC editing menu appears.

NOTE
1 If the sequence program contains an error, the PMC editing menu is not displayed but an error message appears on the screen.
(Example) Error message

```
END  FUNCTION
MISSING
```

Pressing the ⬇ or ⬆ cursor key displays the ladder mnemonics editing screen.

2 Pressing the POS, PRGRM, MENU VAR, DGNOS PARAM, or OPR ALARM key during the editing of the sequence program displays the CNC screen by forcibly terminating editing even if the program contains an error.

4.4.5 Starting and Stopping the Sequence Program (Run/Stop)

Selecting RUN/STOP on the PMC programmer menu displays the sequence program start/stop screen.

1 Display the PMC programmer menu.

2 Display the RUN/STOP item by pressing the ⬇ or ⬆ key.

```
PMC PRG MENU          1/3
>RUN/STOP
```

3 Press the INPUT or READ key. The sequence program start/stop screen appears.

```
LADDER RUN/STOP
  MONITOR  [RUN]
```

4 The current execution state of the sequence program is displayed on the screen.

Pressing the ⬇ or ⬆ key switches the state between running and stopped.

5 Pressing the CAN or WRITE key displays the PMC programmer menu.

4.4.6 Error Messages (for Ladder Mnemonics Editing)

	Displayed error message	Error description (operator action)
1	COIL NOTHING	No coil is specified for a functional instruction using a coil.
2	COM FUNCTION MISSING	The use of the COM (SUB9) functional instruction is incorrect.
3	END FUNCTION MISSING	The END1 or END2 functional instruction is missing (or ERROR NET).
4	JUMP FUNCTION MISSING	The use of the JMP (SUB10) functional instruction is incorrect.
5	LADDER BROKEN	The ladder program is corrupted.
6	OBJECT BUFFER OVER	The user program RAM is full. (Note) (Perform condensation or reduce the size of the ladder program.)
7	PLEASE CLEAR ALL	The sequence program has become unrecov-erable due to power–off during editing.
8	1ST LEVEL EXEC TIME OVER	The ladder first level is too great.

NOTE

Use a memory card for ladder diagram editing or the CONDENSE function of FAPT LADDER (for personal computers). These methods may, however, not be effective.

4.5 LIST OF SIGNALS BY EACH MODE

● Automatic operation

<table>
<tr><th colspan="2">MODE</th><th>INPUT/OUTPUT SIGNAL</th><th>FEED RATE, ETC</th></tr>
<tr><td rowspan="3">AUTOMATIC OPERATION</td><td>EDIT</td><td>[PMC ⇒ CNC]
KEY3(Program protect key)</td><td></td></tr>
<tr><td rowspan="2">MEM
MDI
RMT</td><td>[PMC ⇒ CNC]
ST (Cycle start)
*SP (Feed hold)
SBK (Single block)
DRN (Dry run)
BDT1 to 9(Block delete)
MIα (Mirror image)
PN1 to 8 (External program no. search)
DNCI (DNC input mode)
HSα1A to B
(Handle interrupt axis select)
AFL (Auxiliary function neglect)
FIN (Auxiliary function complete)
MFIN, SFIN, TFIN
(High speed M/S/T function complete)
*SSTP (Spindle stop)
SAR (Spindle speed arrival)
SOR (Spindle orientation)</td><td>[PMC ⇒ CNC]
*FV0 to 7
(Feed rate override)
OVC
(Override cancel)
ROV1,ROV2, HROV, *HROV0 to 6,
(Rapid traverse override)
SOV0 to 7
(Spindle speed override)</td></tr>
<tr><td>[CNC ⇒ PMC]
STL (Cycle start LED)
SPL (Feed hold LED)
MF, M00 to M31 (Miscellaneous function)
SF, S00 to S31 (Spindle speed function)
TF, T00 to T31 (Tool function)
DEN (Distribution end)
OP (automatic operating)
GR1O ot GR3O (Gear selection)</td><td></td></tr>
</table>

● Manual operation

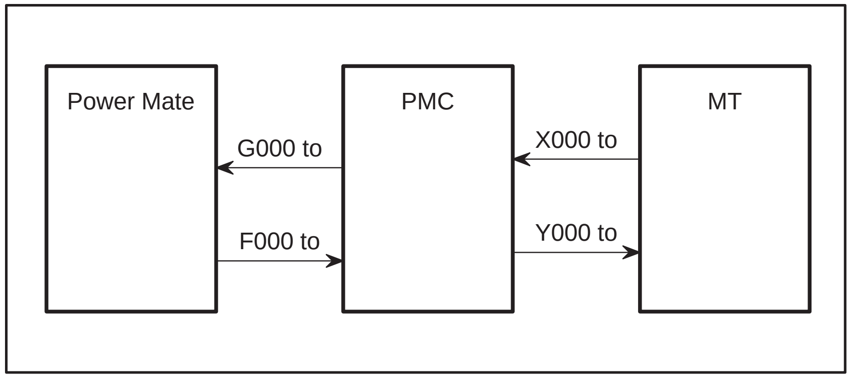
<table>
<tr><th colspan="3">MODE</th><th>INPUT/OUTPUT SIGNAL</th><th>FEED RATE, ETC</th></tr>
<tr><td rowspan="4">MANUAL OPERATION</td><td colspan="2">Handle/ incremental</td><td>[PMC ⇒ CNC]
HSnA to B
(Axis selection) n:1 to 2(No. of MPGs)
+α,– α (Jog feed)</td><td>[PMC ⇒ CNC]
MP1, MP2
(Multiplier)</td></tr>
<tr><td rowspan="3">JOG</td><td></td><td>[PMC ⇒ CNC]
RT (Rapid traverse)</td><td rowspan="3">[PMC ⇒ CNC]
*JV0 to 15
(Manual feedrate override)
+α, –α (Manual feed move command)
ROV1, ROV2
(Rapid traverse override)</td></tr>
<tr><td rowspan="2">ZRN</td><td>[PMC ⇒ CNC]
ZRN(Reference position return mode)
[MT ⇒ CNC]
*DECα (Reference position deceleration)</td></tr>
<tr><td>[CNC ⇒ PMC]
ZPα
ZP2α, ZP3α
(Reference position return completion)</td></tr>
</table>

• Others

Others	[PMC ⇒ CNC] MD1 to 4 (Mode selection) *ESP (Emergency stop) KEY1 to 4(Memory protection key) MLK (All axes machine lock) *IT,*ITα (All axes each axis machine lock) *±MITα (interlock per axis and direction) *ABSM (Manual absolute) SVFα (Servo off) *FLWP (Follow up) ERS (External reset) RRW (Reset & Rewind) ±LMα, RLSOT (Software limit external setting)
	[CMC ⇒ PMC] MA (NC ready) SA (Servo ready) AL (NC alarm) RST (Resetting) BAL (Battery alarm) INPα (In–position) MVα (Axis moving) TAP (Tapping)

4.6 ADDRESS LIST

Address of interface signal between Power Mate and PMC.



4.6.1 Power Mate–D for 1–path Control

MT → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
X000	SKIP	*RILK	*DEC1	*ESP		SKIP4	SKIP3	SKIP2
X001			*DEC2					

These addresses are applicable when an external input/output card and the MODEL–A input/output are used. Ehen a built–in input/output card is used., addresses X1000 to X1001 are used. When the built–in input/output card, external input/output card, and the MODEL A input/output unit are all being used, data is entered via the built–in input/output card.

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G004					FIN			
G005		AFL			TFIN	SFIN		MFIN
G006				OVC		*ABSM		
G007	RLSOT		*FLWU			ST		
G008	ERS	RRW	*SP	*ESP				*IT
G009	PN7	PN6	PN5	PN4	PN3	PN2	PN1	PN0
G010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0
G011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8
G012	*FV7	*FV6	*FV5	*FV4	*FV3	*FV2	*FV1	*FV0
G014							ROV2	ROV1
G018			HS2B	HS2A			HS1B	HS1A
G019	RT		MP2	MP1				
G029		*SSTP	SOR	SAR				
G030	SOV7	SOV6	SOV5	SOV4	SOV3	SOV2	SOV1	SOV0
G032	R08I	R07I	R06I	R05I	R04I	R03I	R02I	R01I
G033	SIND	SSIN	SGN		R12I	R11I	R10I	R09I
G041			HS2IB	HS2IA			HS1IB	HS1IA
G043	ZRN		DNCI			MD4	MD2	MD1
G044							MLK	BDT1
G045	BDT9	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
G046	DRN	KEY4	KEY3	KEY2	KEY1		SBK	
G053					UNIT			
G054	UI7	UI6	UI5	UI4	UI3	UI2	UI1	UI0
G055	UI15	UI14	UI13	UI12	UI11	UI10	UI9	UI8
G058					EXWT	EXSTP	EXRD	

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G061								RGTAP
G066		EPCON						IGNVRY
G070	MRDY	ORCM	SFR	SRV	CTH1	CTH2	TLMH	TLML
G071	RCH	RSL		SOCN			*ESPS	ARST
G072					DEFMOD	NRRO	ROTA	INDX
G078	SHA07	SHA06	SHA05	SHA04	SHA03	SHA02	SHA01	SHA00
G079					SHA11	SHA10	SHA09	SHA08
G100							+J2	+J1
G102							–J2	–J1
G106							MI2	MI1
G110							+LM2	+LM1
G112							–LM2	–LM1
G124							DTCH2	DTCH1
G126							SVF2	SVF1
G130							*IT2	*IT1
G132							+MIT2	+MIT1
G134							–MIT2	–MIT1
G136							EAX2	EAX1
G142	EBUFA	ECLRA	ESTPA	ESOFA	ESBKA			EFINA
G143	EMSBKA	EC6A	EC5A	EC4A	EC3A	EC2A	EC1A	EC0A
G144	EIF7A	EIF6A	EIF5A	EIF4A	EIF3A	EIF2A	EIF1A	EIF0A
G145	EIF15A	EIF14A	EIF13A	EIF12A	EIF11A	EIF10A	EIF9A	EIF8A
G146	EID7A	EID6A	EID5A	EID4A	EID3A	EID2A	EID1A	EID0A
G147	EID15A	EID14A	EID13A	EID12A	EID11A	EID10A	EID9A	EID8A
G148	EID23A	EID22A	EID21A	EID20A	EID19A	EID18A	EID17A	EID16A
G149	EID31A	EID30A	EID29A	EID28A	EID27A	EID26A	EID25A	EID24A

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G150	DRNE	RTE	OVCE				ROV2E	ROV1E
G151	*FV7E	*FV6E	*FV5E	*FV4E	*FV3E	*FV2E	*FV1E	*FV0E
G154	EBUFB	ECLRB	ESTPB	ESOFB	ESBKB			EFINB
G155	EMSBKB	EC6B	EC5B	EC4B	EC3B	EC2B	EC1B	EC0B
G156	EIF7B	EIF6B	EIF5B	EIF4B	EIF3B	EIF2B	EIF1B	EIF0B
G157	EIF15B	EIF14B	EIF13B	EIF12B	EIF11B	EIF10B	EIF9B	EIF8B
G158	EID7B	EID6B	EID5B	EID4B	EID3B	EID2B	EID1B	EID0B
G159	EID15B	EID14B	EID13B	EID12B	EID11B	EID10B	EID9B	EID8B
G160	EID23B	EID22B	EID21B	EID20B	EID19B	EID18B	EID17B	EID16B
G161	EID31B	EID30B	EID29B	EID28B	EID27B	EID26B	EID25B	EID24B
G204	LED08	LED07	LED06	LED05	LED04	LED03	LED02	LED01
G205								LED09
G212	SKIPP	ZPEXT1	GST	ZR1		RTN31	RTN21	RTN11
G213	ACT	ZPEXT2		ZR2		RTN32	RTN22	RTN12
G214	RTNT		CTCHK		WFN4	WFN3	WFN2	WFN1
G216							TRQ2E	TRQ1E
G217	TRQ17	TRQ16	TRQ15	TRQ14	TRQ13	TRQ12	TRQ11	TRQ10
G218	TRQ27	TRQ26	TRQ25	TRQ24	TRQ23	TRQ22	TRQ21	TRQ20
G219	PALM	PAL6	PAL5	PAL4	PAL3	PAL2	PAL1	PAL0
G251	EDGN	EPARM	EVAR	EPRG				IOLNK
G252	EDG07	EDG06	EDG05	EDG04	EDG03	EDG02	EDG01	EDG00
G253	EDG15	EDG14	EDG13	EDG12	EDG11	EDG10	EDG09	EDG08
G254	EDN07	EDN06	EDN05	EDN04	EDN03	EDN02	EDN01	EDN00
G255	EDN15	EDN14	EDN13	EDN12	EDN11	EDN10	EDN09	EDN08

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F000	OP	SA	STL	SPL				RWD
F001	MA		TAP	ENB	DEN	BAL	RST	AL
F002		CUT				CSS		
F003	MTCHIN	MEDT	MAUT	MRMT	MMDI	MJ	MH	
F004			MZRN					
F007					TF	SF		MF
F009	DM00	DM01	DM02	DM30				
F010	M07	M06	M05	M04	M03	M02	M01	M00
F011	M15	M14	M13	M12	M11	M10	M09	M08
F012	M23	M22	M21	M20	M19	M18	M17	M16
F013	M31	M30	M29	M28	M27	M26	M25	M24
F022	S07	S06	S05	S04	S03	S02	S01	S00
F023	S15	S14	S13	S12	S11	S10	S09	S08
F024	S23	S22	S21	S20	S19	S18	S17	S16
F025	S31	S30	S29	S28	S27	S26	S25	S24
F026	T07	T06	T05	T04	T03	T02	T01	T00
F027	T15	T14	T13	T12	T11	T10	T09	T08
F028	T23	T22	T21	T20	T19	T18	T17	T16
F029	T31	T30	T29	T28	T27	T26	T25	T24
F034						GR3O	GR2O	GR1O
F036	R08O	R07O	R06O	R05O	R04O	R03O	R02O	R01O
F037					R12O	R11O	R10O	R09O
F045	ORAR	TLM	LDT2	LDT1	SARS	SDT	SST	ALMS
F046					RCFN	RCHP		
F053				BGEACT	RPALM	RPBSY		

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F054	UO7	UO6	UO5	UO4	UO3	UO2	UO1	UO0
F055	UO15	UO14	UO13	UO12	UO11	UO10	UO9	UO8
F056	UO107	UO106	UO105	UO104	UO103	UO102	UO101	UO100
F057	UO115	UO114	UO113	UO112	UO111	UO110	UO109	UO108
F058	UO123	UO122	UO121	UO120	UO119	UO118	UO117	UO116
F059	UO131	UO130	UO129	UO128	UO127	UO126	UO125	UO124
F065							RGSPM	RGSPP
F070	PSW08	PSW07	PSW06	PSW05	PSW04	PSW03	PSW02	PSW01
F071							PSW10	PSW09
F072	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
F073				ZRNO		MD4O	MD2O	MD1O
F075	*SPO	KEYO	DRNO	MLKO	SBKO	BDTO		
F076			ROV2O	ROV1O			MP2O	MP1O
F077		RTO					HS1BO	HS1AO
F078	*FV7O	*FV6O	*FV5O	*FV4O	*FV3O	*FV2O	*FV1O	*FV0O
F079	*JV7O	*JV6O	*JV5O	*JV4O	*JV3O	*JV2O	*JV1O	*JV0O
F080	*JV15O	*JV14O	*JV13O	*JV12O	*JV11O	*JV10O	*JV9O	*JV8O
F081					–J2O	+J2O	–J1O	+J1O
F094							ZP2	ZP1
F096							ZP22	ZP21
F098							ZP32	ZP31
F104							INP2	INP1
F106							MVD2	MVD1
F110							MDTCH2	MDTCH1
F120							ZRF2	ZRF1
F129	*EAXSL		EOV0					

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F130	EBSYA	EOTNA	EOTPA	EGENA	EDENA	EIALA	ECKZA	EINPA
F131								EMFA
F132	EM28A	EM24A	EM22A	EM21A	EM18A	EM14A	EM12A	EM11A
F133	EBSYB	EOTNB	EOTPB	EGENB	EDENB	EIALB	ECKZB	EINPB
F134								EMFB
F135	EM28B	EM24B	EM22B	EM21B	EM18B	EM14B	EM12B	EM11B
F168	SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1
F169	SW16	SW15	M–OPE	SW13	SW12	SW11	SW10	SW 9
F170	SW24	SW23	SW22	SW21	SW20	SW19	SW18	SW17
F171	SW32	SW31	SW30	SW29	SW28	SW27	SW26	SW25
F172	SW40	SW39	SW38	SW37	SW36	SW35	SW34	SW33
F173	SW48	SW47	SW46	SW45	SW44	SW43	SW42	SW41
F174	SW56	SW55	SW54	SW53	SW52	SW51	SW50	SW49
F175				SW61	SW60	SW59	SW58	SW57
F180							CLRCH1	CLRCH0
F206	AD07	AD06						
F207	AD15	AD14	AD13	AD12	AD11	AD10	AD09	AD08
F208	SVER2	IPL2	SUP2		SVER1	IPL1	SUP1	
F209	CTOPN		RTPT	WVRDY	WAT4	WAT3	WAT2	WAT1
F210	K7	K6	K5	K4	K3	K2	K1	K0
F211	KCAN	KEOB	KSLH	KNO	KPRD	KMNS	K9	K8
F212		KRED		KWRT	KINP	KDLT	KINS	KALT
F213			KALM		KPRM	KVAR	KPRG	KPOS
F214		KH	KQ	KP			KUP	KDWN
F217				KX	KR	KG	KN	KO
F218	KSHRP	KT	KS	KM	KF			

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F250		ALSV	ALOH	ALOT	ALPS	ALPS3	ALPS2	ALPS1
F251						ALPS4	ALSPD	ALAPC
F252	APBL1	APBV1	APBZ1	APPS1	APPE1	APFE1	APOV1	APCM1
F253	APBL2	APBV2	APBZ2	APPS2	APPE2	APFE2	APOV2	APCM2
F254						DPL2	DPL1	DPL0

4.6.2
Power Mate–D for 2–path Control

MT → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
X000	SKIP#1	*RILK#1	*DEC#1	*ESP#1		SKIP4#1	SKIP3#1	SKIP2#1
X001	SKIP#2	*RILK#2	*DEC#2	*ESP#2		SKIP4#2	SKIP3#2	SKIP2#2

THese addresses are applicable when an external input/output card and the MODEL A input/output unit are used. When a built–in input/output card is used, addresses X1000 to X1001 are used. When the built–in input/output card, external input/output card, and the MODEL A input/output unit are all being used, data is entered via the built–in input/output card.

The G/F address or path 2 is obtained by adding 1000 to the addresses of path 1.

(Example) ST#1 <G007#2> ST#2 <G1007#2>

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G004					FIN			
G005		AFL			TFIN	SFIN		MFIN
G006				OVC		*ABSM		
G007	RLSOT		*FLWU			ST		
G008	ERS	RRW	*SP	*ESP				*IT
G009	PN7	PN6	PN5	PN4	PN3	PN2	PN1	PN0
G010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0
G011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8
G012	*FV7	*FV6	*FV5	*FV4	*FV3	*FV2	*FV1	*FV0
G014							ROV2	ROV1
G018								HS1A
G019	RT		MP2	MP1				
G029		*SSTP	SOR	SAR				
G030	SOV7	SOV6	SOV5	SOV4	SOV3	SOV2	SOV1	SOV0
G032	R08I	R07I	R06I	R05I	R04I	R03I	R02I	R01I
G033	SIND	SSIN	SGN		R12I	R11I	R10I	R09I
G043	ZRN					MD4	MD2	MD1
G044							MLK	BDT1
G045	BDT9	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
G046	DRN	KEY4	KEY3	KEY2	KEY1		SBK	
G053					UNIT			
G054	UI7	UI6	UI5	UI4	UI3	UI2	UI1	UI0
G055	UI15	UI14	UI13	UI12	UI11	UI10	UI9	UI8
G058					EXWT	EXSTP	EXRD	

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G061								RGTAP
G066		EPCON						IGNVRY
G070	MRDY	ORCM	SFR	SRV	CTH1	CTH2	TLMH	TLML
G071	RCH	RSL		SOCN			*ESPS	ARST
G072					DEFMOD	NRRO	ROTA	INDX
G078	SHA07	SHA06	SHA05	SHA04	SHA03	SHA02	SHA01	SHA00
G079					SHA11	SHA10	SHA09	SHA08
G100								+J1
G102								–J1
G106								MI1
G110								+LM1
G112								–LM1
G124								DTCH1
G126								SVF1
G130								*IT1
G132								+MIT1
G134								–MIT1
G204	LED08	LED07	LED06	LED05	LED04	LED03	LED02	LED01
G205								LED09
G212	SKIPP	ZPEXT1	GST	ZR1		RTN31	RTN21	RTN11
G213	ACT							
G214	RTNT		CTCHK					
G215								PATHS
G216								TRQ1E
G217	TRQ17	TRQ16	TRQ15	TRQ14	TRQ13	TRQ12	TRQ11	TRQ10
G219	PALM	PAL6	PAL5	PAL4	PAL3	PAL2	PAL1	PAL0

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G251	EDGN	EPARM	EVAR	EPRG				IOLNK
G252	EDG07	EDG06	EDG05	EDG04	EDG03	EDG02	EDG01	EDG00
G253	EDG15	EDG14	EDG13	EDG12	EDG11	EDG10	EDG09	EDG08
G254	EDN07	EDN06	EDN05	EDN04	EDN03	EDN02	EDN01	EDN00
G255	EDN15	EDN14	EDN13	EDN12	EDN11	EDN10	EDN09	EDN08

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F000	OP	SA	STL	SPL				RWD
F001	MA		TAP	ENB	DEN	BAL	RST	AL
F002		CUT				CSS		
F003	MTCHIN	MEDT	MAUT		MMDI	MJ	MH	
F004			MZRN					
F007					TF	SF		MF
F009	DM00	DM01	DM02	DM30				
F010	M07	M06	M05	M04	M03	M02	M01	M00
F011	M15	M14	M13	M12	M11	M10	M09	M08
F012	M23	M22	M21	M20	M19	M18	M17	M16
F013	M31	M30	M29	M28	M27	M26	M25	M24
F022	S07	S06	S05	S04	S03	S02	S01	S00
F023	S15	S14	S13	S12	S11	S10	S09	S08
F024	S23	S22	S21	S20	S19	S18	S17	S16
F025	S31	S30	S29	S28	S27	S26	S25	S24
F026	T07	T06	T05	T04	T03	T02	T01	T00
F027	T15	T14	T13	T12	T11	T10	T09	T08
F028	T23	T22	T21	T20	T19	T18	T17	T16
F029	T31	T30	T29	T28	T27	T26	T25	T24
F034						GR3O	GR2O	GR1O
F036	R08O	R07O	R06O	R05O	R04O	R03O	R02O	R01O
F037					R12O	R11O	R10O	R09O
F045	ORAR	TLM	LDT2	LDT1	SARS	SDT	SST	ALMS
F046					RCFN	RCHP		
F053				BGEACT	RPALM	RPBSY		

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F054	UO7	UO6	UO5	UO4	UO3	UO2	UO1	UO0
F055	UO15	UO14	UO13	UO12	UO11	UO10	UO09	UO08
F056	UO107	UO106	UO105	UO104	UO103	UO102	UO101	UO100
F057	UO115	UO114	UO113	UO112	UO111	UO110	UO109	UO108
F058	UO123	UO122	UO121	UO120	UO119	UO118	UO117	UO116
F059	UO131	UO130	UO129	UO128	UO127	UO126	UO125	UO124
F065							RGSPM	RGSPP
F072	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
F073				ZRNO		MD4O	MD2O	MD1O
F075	*SPO	KEYO	DRNO	MLKO	SBKO	BDTO		
F076			ROV2O	ROV1O			MP2O	MP1O
F077		RTO						HS1AO
F078	*FV7O	*FV6O	*FV5O	*FV4O	*FV3O	*FV2O	*FV1O	*FV0O
F079	*JV7O	*JV6O	*JV5O	*JV4O	*JV3O	*JV2O	*JV1O	*JV0O
F080	*JV15O	*JV14O	*JV13O	*JV12O	*JV11O	*JV10O	*JV9O	*JV8O
F081							–J1O	+J1O
F094								ZP1
F096								ZP21
F098								ZP31
F104								INP1
F106								MVD1
F110								MDTCH1
F120								ZRF1
F168	SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1
F169	SW16	SW15	M–OPE	SW13	SW12	SW11	SW10	SW 9
F170	SW24	SW23	SW22	SW21	SW20	SW19	SW18	SW17

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F171	SW32	SW31	SW30	SW29	SW28	SW27	SW26	SW25
F172	SW40	SW39	SW38	SW37	SW36	SW35	SW34	SW33
F173	SW48	SW47	SW46	SW45	SW44	SW43	SW42	SW41
F174	SW56	SW55	SW54	SW53	SW52	SW51	SW50	SW49
F175				SW61	SW60	SW59	SW58	SW57
F180								CLRCH0
F208					SVER1	IPL1	SUP1	
F209	CTOPN		RTPT	WVRDY				
F210	K7	K6	K5	K4	K3	K2	K1	K0
F211	KCAN	KEOB	KSLH	KNO	KPRD	KMNS	K9	K8
F212		KRED		KWRT	KINP	KDLT	KINS	KALT
F213			KALM		KPRM	KVAR	KPRG	KPOS
F214		KH	KQ	KP			KUP	KDWN
F217				KX	KR	KG	KN	KO
F218	KSHRP	KT	KS	KM	KF			
F250		ALSV	ALOH	ALOT	ALPS	ALPS3	ALPS2	ALPS1
F251						ALPS4	ALSPD	ALAPC
F252	APBL1	APBV1	APBZ1	APPS1	APPE1	APFE1	APOV1	APCM1
F254	PATHO					DPL2	DPL1	DPL0

4.6.3 Power Mate–F

MT → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
X1000	SKIP	*RILK	*DEC	*ESP		SKIP4	SKIP3	SKIP2

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G004					FIN			
G005		AFL			TFIN	SFIN		MFIN
G006				OVC		*ABSM		
G007	RLSOT		*FLWU			ST		
G008	ERS	RRW	*SP	*ESP				*IT
G009	PN7	PN6	PN5	PN4	PPN3	PN2	PN1	PN0
G010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0
G011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8
G012	*FV7	*FV6	*FV5	*FV4	*FV3	*FV2	*FV1	*FV0
G014							ROV2	ROV1
G018								HS1A
G019	RT		MP2	MP1				
G029		*SSTP	SOR	SAR				
G030	SOV7	SOV6	SOV5	SOV4	SOV3	SOV2	SOV1	SOV0
G032	R08I	R07I	R06I	R05I	R04I	R03I	R02I	R01I
G033	SIND	SSIN	SGN		R12I	R11I	R10I	R09I
G041								HS1IA
G043	ZRN		DNCI			MD4	MD2	MD1
G044							MLK	BDT1
G045	BDT9	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
G046	DRN	KEY4	KEY3	KEY2	KEY1		SBK	
G053								
G054	UI7	UI6	UI5	UI4	UI3	UI2	UI1	UI0
G055	UI15	UI14	UI13	UI12	UI11	UI10	UI9	UI8
G058					EXWT	EXSTP	EXRD	

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G061								RGTAP
G066		EPCON						IGNVRY
G070	MRDY	ORCM	SFR	SRV	CTH1	CTH2	TLMH	TLML
G071	RCH	RSL		SOCN			*ESPS	ARST
G072					DEFMOD	NRRO	ROTA	INDX
G078	SHA07	SHA06	SHA05	SHA04	SHA03	SHA02	SHA01	SHA00
G079					SHA11	SHA10	SHA09	SHA08
G100								+J1
G102								–J1
G106								MI1
G110								+LM1
G112								–LM1
G124								DTCH1
G126								SVF1
G130								*IT1
G132								*MIT1
G134								–MIT1
G136								EAX1
G142	EBUFA	ECLRA	ESTPA	ESOFA	ESBKA			EFINA
G143	EMSBKA	EC6A	EC5A	EC4A	EC3A	EC2A	EC1A	EC0A
G144	EIF7A	EIF6A	EIF5A	EIF4A	EIF3A	EIF2A	EIF1A	EIF0A
G145	EIF15A	EIF14A	EIF13A	EIF12A	EIF11A	EIF10A	EIF9A	EIF8A
G146	EID7A	EID6A	EID5A	EID4A	EID3A	EID2A	EID1A	EID0A
G147	EID15A	EID14A	EID13A	EID12A	EID11A	EID10A	EID9A	EID8A
G148	EID23A	EID22A	EID21A	EID20A	EID19A	EID18A	EID17A	EID16A
G149	EID31A	EID30A	EID29A	EID28A	EID27A	EID26A	EID25A	EID24A

PMC → CNC

Address	#7	#6	#5	#4	#3	#2	#1	#0
G150	DRNE	RTE	OVCE				ROV2E	ROV1E
G151	*FV7E	*FV6E	*FV5E	*FV4E	*FV3E	*FV2E	*FV1E	*FV0E
G212	SKIPP	ZPEXT1	GST	ZR1		RTN31	RTN21	RTN11
G213	ACT							
G214	RTNT		CTCHK		WFN4	WFN3	WFN2	WFN1
G216								TRQ1E
G217	TRQ17	TRQ16	TRQ15	TRQ14	TRQ13	TRQ12	TRQ11	TRQ10
G219	PALM	PAL6	PAL5	PAL4	PAL3	PAL2	PAL1	PAL0
G250	DPOSV	DPOSM						
G251	EDGN	EPARM	EVAR	EPRG				IOLNK
G252	EDG07	EDG06	EDG05	EDG04	EDG03	EDG02	EDG01	EDG00
G253	EDG15	EDG14	EDG13	EDG12	EDG11	EDG10	EDG09	EDG08
G254	EDN07	EDN06	EDN05	EDN04	EDN03	EDN02	EDN01	EDN00
G255	EDN15	EDN14	EDN13	EDN12	EDN11	EDN10	EDN09	EDN08

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F000	OP	SA	STL	SPL				RWD
F001	MA		TAP	ENB	DEN	BAL	RST	AL
F002		CUT						
F003	MTCHIN	MEDT	MAUT	MRMT	MMDI	MJ	MH	
F004			MZRN					
F007					TF	SF		MF
F009	DM00	DM01	DM02	DM30				
F010	M07	M06	M05	M04	M03	M02	M01	M00
F011	M15	M14	M13	M12	M11	M10	M09	M08
F012	M23	M22	M21	M20	M19	M18	M17	M16
F013	M31	M30	M29	M28	M27	M26	M25	M24
F022	S07	S06	S05	S04	S03	S02	S01	S00
F023	S15	S14	S13	S12	S11	S10	S09	S08
F024	S23	S22	S21	S20	S19	S18	S17	S16
F025	S31	S30	S29	S28	S27	S26	S25	S24
F026	T07	T06	T05	T04	T03	T02	T01	T00
F027	T15	T14	T13	T12	T11	T10	T09	T08
F028	T23	T22	T21	T20	T19	T18	T17	T16
F029	T31	T30	T29	T28	T27	T26	T25	T24
F034						GR3O	GR2O	GR1O
F036	R08O	R07O	R06O	R05O	R04O	R03O	R02O	R01O
F037					R12O	R11O	R10O	R09O
F045	ORAR	TLM	LDT2	LDT1	SARS	SDT	SST	ALMS
F046					RCFN	RCHP		
F053				BGEACT	RPALM	RPBSY		

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F054	UO7	UO6	UO5	UO4	UO3	UO2	UO1	UO0
F055	UO15	UO14	UO13	UO12	UO11	UO10	UO9	UO8
F056	UO107	UO106	UO105	UO104	UO103	UO102	UO101	UO100
F057	UO115	UO114	UO113	UO112	UO111	UO110	UO109	UO108
F058	UO123	UO122	UO121	UO120	UO119	UO118	UO117	UO116
F059	UO131	UO130	UO129	UO128	UO127	UO126	UO125	UO124
F065							RGSPM	RGSPP
F070	PSW08	PSW07	PSW06	PSW05	PSW04	PSW03	PSW02	PSW01
F071							PSW10	PSW09
F094								ZP1
F096								ZP21
F098								ZP31
F104								INP1
F106								MVD1
F110								MDTCH1
F120								ZRF1
F129	*EAXSL		EOV0					
F130	EBSYA	EOTNA	EOTPA	EGENA	EDENA	EIALA	ECKZA	EINPA
F131								EMFA
F132	EM28A	EM24A	EM22A	EM21A	EM18A	EM14A	EM12A	EM11A
F180								CLRCH0
F208					SVER1	IPL1	SUP1	
F209	CTOPN		RTPT	WVRDY	WAT4	WAT3	WAT2	WAT1
F210	K7	K6	K5	K4	K3	K2	K1	K0
F211	KCAN	KEOB	KSLH	KNO	KPRD	KMNS	K9	K8
F212		KRED		KWRT	KINP	KDLT	KINS	KALT

CNC → PMC

Address	#7	#6	#5	#4	#3	#2	#1	#0
F213			KALM		KPRM	KVAR	KPRG	KPOS
F214		KH	KQ	KP			KUP	KDWN
F217				KX	KR	KG	KN	KO
F218	KSHRP	KT	KS	KM	KF			
F250		ALSV	ALOH	ALOT	ALPS	ALPS3	ALPS2	ALPS1
F251						ALPS4	ALSPD	ALAPC
F252	APBL1	APBV1	APBZ1	APPS1	APPE1	APFE1	APOV1	APCM1
F254						DPL2	DPL1	DPL0

4.7 SIGNAL AND SYMBOL CORRESPONDENCE TABLE

Symbol	Signal name	PMC address
*ABSM	Manual absolute signal	G006#2
ACT	Temporary interrupt detection signal	G213#7
AD06 to AD15	Analog input signal	F206 to F207
AFL	Auxiliary function lock signal	G005#6
AL	CNC alarm signal	F001#0
ALAPC	APC alarm signal (alarm classification signal)	F251#0
ALOH	Overheat alarm signal (alarm classification signal)	F250#5
ALOT	Over travel alarm signal (alarm classification signal)	F250#4
ALPS	P/S alarm signal (alarm classification signal)	F250#3
ALPS1	P/S alarm 100 signal (alarm classification signal)	F250#0
ALPS2	P/S alarm 000 signal (alarm classification signal)	F250#1
ALPS3	P/S alarm 101 signal (alarm classification signal)	F250#2
ALPS4	PS alarm 5000–5999 signal (alarm classification signal)	F251#2
ALSPD	Spindle alarm signal (alarm classification signal)	F251#1
ALSV	Servo alarm signal (alarm classification signal)	F250#6
APBL1, APBL2	APC battery LOW alarm 2 signal (APC alarm type signal)	F252#7, F253#7
APBV1, APBV2	APC battery LOW alarm 1 signal (APC alarm type signal)	F252#6, F253#6
APBZ1, APBZ2	APC battery zero alarm signal (APC alarm type signal)	F252#5, F253#5
APCM1, APCM2	APC communication error signal (APC alarm type signal)	F252#0, F253#0
APFE1, APFE2	APC framing error signal (APC alarm type signal)	F252#2, F253#2
APOV1, APOV2	APC over time error signal (APC alarm type signal)	F252#1, F253#1
APPE1, APPE2	APC parity error signal (APC alarm type signal)	F252#3, F253#3
APPS1, APPS2	APC pulse miss error signal (APC alarm type signal)	F252#4, F253#4
ARST	Alarm reset signal	G071#0
BAL	Battery alarm signal	F001#2
BDT1, BDT2 to BDT9	Optional block skip signal	G044#0, G045
BDTO	Optional block skip signal (software operator's panel)	F075#2
BGEACT	Background editing signal	F053#4
CLRCH1, CLRCH2	Current limit arrival signal	F180#0, #1
CSS	Constant speed signal	F002#2

Symbol	Signal name	PMC address
CTCHK	Chaser status check signal	G214#5
CTH1,CTH2	Gear select signal(serial spindle)	G070#3, #2
CTOPN	Chaser open signal	F209#7
CUT	Signal under cutting	F002#6
*DEC1, *DEC2	Reference position return deceleration signal	X000#5, X001#5
DEFMOD	Differential rigid tap signal	G072#3
DEN	Distribution end signal	F001#3
DM00, DM01, DM02, DM30	M decode signals	F009#4 to #7
DNCI	DNC operation signal	G043#5
DPL0 to DPL2	Screen status signal	F254#0 to #2
DPOSV, DPOSM	Position display unit select signal	G250#6, #7
DRN	Dry run signal	G046#7
DRNE	Dry run signal (Axis control by PMC)	G150#7
DRNO	Dry run signal (software operator’s panel)	F075#5
DTCH1, DTCH2	Controlled axis detach signal	G124#0, #1
EAX1, EAX2	Controlled axis selection signal (Axis control by PMC)	G136#0, #1
*EAXSL	Controlled axis select state signal	F129#7
EBSYA, EBSYB	Axis control command read signal (Axis control by PMC)	F130#7, F133#7
EBUFA, EBUFB	Axis control command completed signal (Axis control by PMC)	G142#7, G154#7
EC0A to EC6A, EC0B to EC6B	Axis control command signal (Axis control by PMC)	G143#0 to #6, G155#0 to #6
ECKZA, ECKZB	Error zero checking signal (Axis control by PMC)	F130#1, F133#1
ECLRA, ECLRB	Reset signal (Axis control by PMC)	G142#6,G154#6
EDENA, EDENB	Miscellaneous function executing signal (Axis control by PMC)	F130#3, F133#3
EDG00 to EDG15	External punch start number signal (I/O device external control function)	G252, G253
EDGN	Diagnose selection signal (I/O device external control function)	G251#7
EDN00 to EDN15	Signal of external punch total number (I/O device external control function)	G254, G255
EFINA, EFINB	Miscellaneous function complete signal (Axis control by PMC)	G142#0, G154#0
EGENA, EGENB	Axis moving signal (Axis control by PMC)	F130#4, F133#4
EIALA, EIALB	Alarm signal (Axis control by PMC)	F130#2, F133#2
EID0A to EID31A, EID0B to EID31B	Axis move distance, Dwell time , Auxiliary function code (Axis control by PMC)	G146 to G149, G158 to G161
EIF0A to EIF15A, EIF0B to EIF15B	Feedrate (Axis control by PMC)	G144, G145,G156, G157
EINPA, EINPB	In–positioning signal (Axis control by PMC)	F130#0, F133#0

Symbol	Signal name	PMC address
EM11A to EM28A, EM11B to EM28B	Miscellaneous BCD code (Axis control by PMC)	F132, F135
EMFA, EMFB	Miscellaneous function read signal (Axis control by PMC)	F131#0, F134#0
EMSBKA, EMSBKB	Block stop inhibit signal (Axis control by PMC)	G143#7, G155#7
ENB	Spindle enable signal	F001#4
EOTNA, EOTNB	Overtravel in negative direction signal (Axis control by PMC)	F130#6, F133#6
EOTPA, EOTPB	Overtravel in positive direction signal (Axis control by PMC)	F130#5, F133#5
EOV0	Override 0% signal (Axis control by PMC)	F129#5
EPARM	Parameter selection signal (I/O device external control function)	G251#6
EPCON	External pulse input/output signal	G066#6
ERS	External reset signal	G008#7
ESBKA, ESBKB	Block stop signal (Axis control by PMC)	G142#3, G154#3
ESOFA, ESOFB	Servo off signal (Axis control by PMC)	G142#4, G154#4
*ESP	Emergency stop signal	G008#4, X000#4
*ESPS	Emergency stop signal (serial spindle)	G071#1
ESTPA, ESTPB	Axis control stop signal (Axis control by PMC)	G142#5, G154#5
EVAR	Variable selection signal (I/O device external control function)	G251#5
EXF1 to 5	Speed change signal	X000#0, #1, #2, X011#4, #5, X1000#0, #1, #2
EXPRG	Program selection signal (I/O device external control function)	G251#4
EXRD	External read start signal	G058#1
EXSTP	External read/punch stop signal	G058#2
EXWT	External punch start signal	G058#3
FIN	End signal	G004#3
*FLWU	Follow–up signal	G007#5
*FV0 to *FV7	Feedrate override signal	G012
*FV0E to *FV7E	Override signal (Axis control by PMC)	G151
*FV0O to *FV7O	Feedrate override signal (software operator’s panel)	F078
GR1O, GR2O, GR3O	Gear selection signal	F034#0 to #2
GST	Spindle gear shift signal	G212#5
HS1A, HS1B, HS2A, HS2B	Manual handle feed axis select signal	G018#0, #1, #4, #5
HS1AO, HS1BO	Manual handle feed axis select signal (software operator’s panel)	F077#0, #1
HS1IA, HS1IB, HS2IA, HS2IB	Axis select signal for handle interrupt	G041#0, #1, #4, #5

Symbol	Signal name	PMC address
IGNVRY	Speed control servo alarm ignored signal	G066#0
INDX	Orientation stop position change command (serial spindle control)	G072#0
INP1, INP2	In–position signal	F104#0, #1
IOLNK	FANUC I/O LINK signal	G251#0
IPL1, IPL2	Distribution signal (axis status signal)	F208#2, #6
*IT	Interlock signal	G008#0
*IT1, *IT2	Each axis interlock signal	G130#0, #1
+J1, +J2, –J1, –J2	Feed axis direction select signal	G100#0, #1, G102#0, #1
+J1O, –J1O, +J2O, –J2O	Manual feed	F081#0 to #3
*JV0 to *JV15	Manual feedrate override signal	G010, G011
*JV0O to *JV15O	Jog feedrate setting signal	F079, F080
K0 to K9, KMNS, KPRD, KNO, KSLH, KEOB, KCAN, KALT, KINS, KDLT, KINP, KWRT, KRED, KPOS, KPRG, KVAR, KPRM, KALM, KDWN, KUP, KP, KQ, KH, KO, KN, KG, KR, KX, KF, KM, KS, KT, KSHRP	Key data reference function by PMC	F210 to F218
KEY1, KEY2, KEY3, KEY4	Memory protection key	G046#3 to #6
KEYO	Program protect signal (software operator’s panel)	F075#6
LDT1	Load detection signal 1	F045#4
LDT2	Load detection signal 2	F045#5
LED01 to LED09	Handy operator’s panel signal	G204 to G205
+ LM1, +LM2, –LM1, –LM2	Software limit external setting signal	G110#0, #1, G112#0, #1
M00 to M31	M function code signal	F010 to F013
M2RN	Manual reference position return check signal	F004#5
MA	Ready signal	F001#7
MAUT	Automatic operation (AUTO) check signal	F003#5
MD1 ,MD2, MD4	Mode select signal	G043#0 to #2
MD1O ,MD2O, MD4O	Software operator’s panel signal	F073#0, F073#1, F073#2
MDTCH0, MDTCH1	Controlled axis detaching signal	F110#0, #1
MEDT	Memory edit (EDIT) check signal	F003#6
MF	M code output end signal	F007#0

Symbol	Signal name	PMC address
MFIN	M function end signal	G005#0
MH	Manual handle or step feed (HANDLE/STEP) check signal	F004#1
MI1, MI2	Mirror image signal	G106#0, #1
+MIT1, +MIT2, –MIT1, –MIT2	Interlock signal for each axis and direction	G132#0, #1, G134#0, #1
MJ	Jog feed (JOG) check signal	F003#2
MLK	Machine lock signal	G044#1
MLKO	Machine lock signal (software operator's panel)	F075#4
MMDI	Manual data input (MDI) check signal	F003#3
MP1, MP2	Incremental feed signal	G019#4, #5
MP1O, MP2O	Incremental feed signal (software operator's panel)	F076#0, #1
MRDY	Ready signal (serial spindle)	G070#7
MRMT	Tape command (RMT) check signal	F004#4
MTCHIN	TEACH IN JOG STEP check signal	F003#7
MVD1, MVD2	Moving direction signals	F106#0, #1
NRRO	Short path control command at change of orientation stop position (serial spindle control)	G072#2
OP	Automatic operation signal	F000#7
ORAR	Spindle orientation completion signal	F045#7
ORCM	Orientation command signal	G070#6
OUT0 to OUT7	Software operator's panel general purpose switch signal	F072
OVC	Override cancel signal	G006#4
OVCE	Override cancel signal (Axis control by PMC)	G150#5
PAL0 to PAL6	Alarm number specification signal (Display of alarms from PMC)	G219#0 to #6
PALM	PMC alarm generation selection signal (Display of alarms from PMC)	G219#7
PATHO	Displaying path check signal	F254#7
PATHS	Path switch signal	G215#0
PN0 to PN7	Workpiece number search signal	G009
PSW01 to PSW10	Position switch signal	F070 to 71
R01I to R12I	Spindle speed binary signal input	G032, G033#0 to #3
R01O to R12O	Spindle speed binary signal output	F036, F037#0 to #3
RCFN	Exit switch completion signal	F046#3
RCH	Power line state confirmation signal (serieal)	G071#7
RCHP	Exit switch signal	F046#2
RGSPM	Spindle rotation direction signal (minus)	F065#1

Symbol	Signal name	PMC address
RGSPP	Spindle rotation direction signal (plus)	F065#0
RGTAP	Rigid tapping signal	G061#0
*RILK	High–speed interlock signal	X000#6
RLSOT	Software limit external setting signal	G007#7
ROTA	Rotation direction command at change of orientation stop position (serial spindle control)	G072#1
ROV1, ROV2	Rapid traverse override signal	G014#0, #1
ROV1E, ROV2E	Rapid traverse override signal (axis control by PMC)	G150#0, #1
ROV1O, ROV2O	Rapid traverse override signal (software operator's panel)	F076#4, #5
RPALM	Read/punch alarm signal	F053#3
RPBSY	Reading/punching signal	F053#2
RRW	Reset & rewind signal	G008#6
RSL	Output change request signal (serial)	G071#6
RST	CNC reset signal	F001#1
RT	Manual rapid traverse select signal	G019#7
RTE	Manual rapid traverse signal (axis control by PMC)	G150#6
RTN11 to RTN31	Return signal	G212#0 to #2
RTN12 to RTN32	Return signal	G213#0 to #2
RTNT	Rigid tapping return signal	G214#7
RTO	Manual rapid traverse signal (software operator's panel)	F077#6
RTPT	Rigid tapping return signal	F209#5
RWD	Rewinding signal	F000#0
S00 to S31	Spindle function code signal	F022 to F025
SA	Servo ready signal	F000#6
SAR	Spindle speed arrival signal	G029#4
SARS	Speed arrival signal	F045#3
SBK	Single block signal	G046#1
SBKO	Single block signal (software operator's panel)	F075#3
SDT	Speed detection signal	F045#2
SF	Spindle function strobe signal	F007#2
SFIN	S function end signal	G005#2
SFR	Spindle CW command signal	G070#5
SGN	Spindle polarity select signal	G033#5
SHA00 to SHA11	Spindle orientation external stop position command signal	G078#0 to G079#3
SIND	Spindle analog voltage control signal	G033#7

Symbol	Signal name	PMC address
SKIP, SKIP2, SKIP3, SKIP4	Skip signal	X000#7, #0, #1, #2
SKIPP	Skip signal from PMC	G212#7
SOCN	Soft start/stop cancel signal (serial)	G071#4
SOR	Spindle orientation signal	G029#5
SOV0 to SOV7	Spindle speed override signal	G030
*SP	Feed hold signal	G008#5
*SPO	Feed hold signal (software operator’s panel)	F075#7
SPL	Feed hold lamp signal	F000#4
SRV	Spindle CCW command signal	G070#4
SSIN	Spindle polarity control select signal	G033#6
SST	Speed detection 0 signal	F045#1
*SSTP	Spindle stop signal	G029#6
ST	Cycle start signal	G007#2
STL	Cycle start lamp signal	F000#5
SUP1, SUP2	Acceleration/deceleration signal (axis motion status signal)	F208#1, #5
SVER1, SVER2	Servo position deviation monitor signal	F208#3, #7
SVF1, SVF2	Servo off signal	G126#0, #1
SW1 to 61	Handy operator’s panel signal	F168 to F175
T00 to T31	Tool function code signal	F026 to F029
TAP	Tapping signal	F001#5
TF	Tool function strobe signal	F007#3
TFIN	T function end signal	G005#3
TLM	Torque limiting signal	F045#6
TLMH	High–speed torque limit signal	G070#1
TLML	Low–speed torque limit signal	G070#0
TRQ10 to TRQ17	Torque limit signal	G217#0 to #7
TRQ1E, TRQ2E	Torque limit enable signal	G216#0, #1
TRQ20 to TRQ27	Torque limit signal	G218#0 to #7
UI0 to UI15	Custom macro input signal	G054, G055
UINT	Custom macro interrupt signal	G053#3
UO0 to UO15 UO100 to UO131	Custom macro output signal	F054, F055, F056 to F059
WAT1 to WAT4	Waiting signal (waiting function)	F209#0 to #3
WFN1 to WFN4	Waiting complete signal (waiting function)	G214#0 to #3
WVRDY	V–READY waiting signal	F209#4

Symbol	Signal name	PMC address
ZP1, ZP2	Reference position return end signal	F094#0, #1
ZP21, ZP22	2nd reference position return end signal	F096#0, #1
ZP31, ZP32	3rd reference position return end signal	F098#0, #1
ZPEXT1, ZPEXT2	External reference position setting signal	G212#6, G213#6
ZR1, ZR2	Dogless reference position setting signal	G212#4, G213#4
ZRF1, ZRF2	Reference position establishment signal	F120#0, #1
ZRN	Manual reference position return selection signal	G043#7
ZRNO	Reference position return signal (software operator’s panel)	F073#4

5 DIGITAL SERVO

This chapter describes servo tuning screen required for maintenance of digital servo and adjustment of reference position.

5.1 INITIAL SETTING SERVO PARAMETERS

This section describes how to set initial servo parameters, which is used for field adjustment of tool.
A servo adjustment screen is not provided by the Power Mate–F or the DPL/MDI.

1. Turn on power at the emergency stop condition.
2. Set the parameter to display the servo tuning screen.

	#7	#6	#5	#4	#3	#2	#1	#0
3111								SVS

#0 (SVS) 0 : Servo tuning screen is not displayed.
1 : Servo tuning screen is displayed.

3. Turn off the power once then turn it on again.
4. Display the servo parameter setting screen by the following operation: SYSTEM key ▷ [SV.PARA].
5. Input data required for initial setting using the cursor and page key.

```
SERVO SETTING
                          X AXIS      Y AXIS
(1) INITIAL SET BIT     00000000    00000000   <= PRM 2000
(2) MOTOR ID NO.              47          47   <= PRM 2020
(3) amr                 00000000    00000000   <= PRM 2001
(4) cmr                        2           2   <= PRM 1820
(5) FEED GEAR N                1           1   <= PRM 2084
(6)          (N/M)  M        125         125   <= PRM 2085
(7) DIRECTION SET            111         111   <= PRM 2022
(8) VELOCITY PULSE NO.      8192        8192   <= PRM 2023
(9) POSITION PULSE NO.     12500       12500   <= PRM 2024
(10)REF.COUNTER             8000        8000   <= PRM 1821
```

(1) INITIAL SET BIT

	#7	#6	#5	#4	#3	#2	#1	#0
2000					PRMCAL		DGPRM	PLC01

#3 (PRMCAL) 1 : Turns to 1 when the initial setting is done.
The following parameters are set automatically in accordance with the no. of pulses of pulse coder:
PRM 2043(PK1V), PRM 2044(PK2V),
PRM 2047(POA1), PRM 2053(PPMAX),
PRM 2054(PDDP), PRM 2056(EMFCMP),
PRM 2057(PVPA), PRM 2059(EMFBAS),
PRM 2074(AALPH),PRM 2076(WKAC)

#1 (DGPRM)☆ 0 : Initial setting of digital servo parameter is done.
1 : Initial setting of digital servo parameter is not done.

#0 (PLC01) 0 : Values of parameter 2023 and 2024 are used as they are:
1 : Values of parameter 2023 and 2024 are multiplied by 10.

(2) MOTOR NUMBER

DGN	2020	Motor type no. per axis

Motor type no. that can be set are 3 to 62.

Format number	**3**	**4**	**5**	**7**	**8**	**9**
Model name	α12HV	α22HV	α30HV	αC3/2000	αC6/2000	αC12/2000
Drawing number	0176	0177	0178	0142	0123	0127

Format number	**10**	**13**	**15**	**16**	**17**	**18**
Model name	αC22/1500	α0.5	α3/3000	α6/2000	α6/3000	α12/2000
Drawing number	0128	0142	0123	0127	0128	0142

Format number	**19**	**20**	**21**	**22**	**23**	**24**
Model name	α12/3000	α22/2000	α22/3000	α30/2000	α30/3000	αM3/3000
Drawing number	0143	0147	0148	0152	0153	0161

Format number	**25**	**26**	**27**	**28**	**29**	**30**
Model name	αM6/3000	αM9/3000	α22/1500	α30/1200	α40/2000 with FAN	α40/2000 without FAN
Drawing number	0162	0163	0146	0151	0158	0157

Format number	**33**	**34**	**35**	**36**	**46**	**56**
Model name	αE3/2000 β3/2000	αE6/2000 β6/2000	αE1/3000 β1/3000	αE2/3000 β2/3000	α2/2000	αL3/2000
Drawing number	0105	0106	0101	0102	0372	0561

Format number	**57**	**58**	**59**	**60**	**61**	**62**
Model name	αL6/3000	αL9/3000	αL25/3000	αL50/2000	α1/3000	α2/3000
Drawing number	0562	0564	0571	0572	0371	0373

(3) CMR

DGN	1820	Command multiply ratio

1 When CMR is 1/2 to 1/27 Set value= $\frac{1}{CMR}$ +100

2 When CMR is 1 to 48 Set value=2 × CMR

(4) Turn off power once, then turn it to on.

(5) Feed gear n/m

FRM	2084	n of flexible feed gear
FRM	2085	m of flexible feed gear

1) For serial pulse coder A or B, and serial a pulse coder.

$$\frac{n}{m} = \frac{\text{No. of feedback pulses per revolution of motor}}{1000000}$$

For serial pulse coder B, set 250,000 pulses or less to parameter 2084.

Examples of calculation

	1/1000 mm	1/10000 mm
1 rotation of motor 8mm 10mm 12mm	n=1/m=125 n=1/m=100 n=3/m=250	n=2/m=25 n=1/m=10 n=3/m=25

2) For serial pulsecoder C

$$\frac{n}{m} = \frac{\text{No. of feedback pulses per revolution of motor}}{40000}$$

Examples of calculation

	1/1000 mm
1 rotation of motor 8mm 10mm 12mm	n=1/m=5 n=1/m=4 n=3/m=10

(6) Direction of Travel

PRM	2022	Direction of motor rotation

111 : Positive (CCW) –111 : Reverse (CW)

(7) No. of velocity pulses and position pulses

1) For serial pulse coder A or B and serial α pulse coder

	Para–meter no.	Resolution 1/1000mm		Resolution 1/10000mm	
		Full close	Semi close	Full close	Semi close
High resolu-tion setting	2000	xxxx xxx 0		xxxx xxx 1	
Separate detector	1815	0010 0010	0010 0000	0010 0010	0010 0000
Velocity feed-back pulses	2023	8192		819	
Position feed-back pulses	2024	NS	12500	NS/10	1250

2) For serial pulse coder C

	Para–meter no.	Resolution 1/1000mm	
		Full close	Semi close
High resolu-tion setting	2000	xxxx xxx1	
Separate detector	1815	0000 0010	0000 0000
Velocity feed-back pulses	2023	4000	
Position feed-back pulses	2024	NS/10	4000

NS is the no. of position feedback pulses times 4.
For 5–0S to 3–0S motor, since the no. of poles is different, set parameter 2001.
Even if the system is of full closed loop PMR 2002#3=1 #4=0.

(8) Reference counter

PRM	1821	Reference counter capacity(0 to 99999999)

6. Turn off power then turn on power.

5.2 SERVO TUNING SCREEN

5.2.1 Parameter Setting

Set a parameter to display the servo tuning screen.
A servo adjustment screen is not provided by the Power Mate–F or the DPL/MDI.

	#7	#6	#5	#4	#3	#2	#1	#0
3111								SVS

#0 (SVS) 0 : Servo tuning screen is not displayed.
1 : Servo tuning screen is displayed.

5.2.2 Displaying Servo Tuning Screen

1. Press SYSTEM key ▷ and soft key **[SV. PARA]** in this order.
2. Press soft key **[SV.TUN]** to select the servo tuning screen.

```
     SERVO TUNING                              01234 N12345
     (PAMAMETER)                               (MONITOR)
(1)  FUN.BIT          00000000    ALARM 1       00000000   (9)
(2)  LOOP GAIN            3000    ALARM 2       00000000   (10)
(3)  TURNING SET.            0    ALARM 3       10000000   (11)
(4)  SET PERIOD             50    ALARM 4       00000000   (12)
(5)  INT.GAIN              113    ALARM 5       00000000   (13)
(6)  PROP.GAIN           -1015    LOOP GAIN         2999   (14)
(7)  FILER                   0    POS ERROR          556   (15)
(8)  VELOC.GAIN            125    CURRENT%            10   (16)
                                  SPEED RPM          100   (17)

     [ SV SET ][ SV TUN ][        ][        ][  OPE  ]
```

1	Function bit	: PRM 2003
2	Loop gain	: PRM 1825
3	Tuning start	: (Used by automatic servo tuning function)
4	Set period	: (Used by automatic servo tuning function)
5	Integral gain	: PRM 2043
6	Proportional gain	: PRM 2044
7	Filter	: PRM 2067
8	Velocity gain	: Set value= $\frac{\text{(PRM 2021)}+256}{256} \times 100$
9	Alarm 1	: DGN 200 (Details of alarm 400 and 414)
10	Alarm 2	: DGN 201 (Details of disconnection alarm, overload)
11	Alarm 3	: DGN 202 (Details of alarm 319)
12	Alarm 4	: DGN 203 (Details of alarm 319)
13	Alarm 5	: DGN 204 (Details of alarm 414)
14	Loop gain	: Actual loop gain
15	Position error	: Actual position error(DGN 300)
16	Current(%)	: Indicate current with % to the rated value.
17	Speed RPM	: Number of motor actual rotation

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm1	OVL	LV	OVC	HCA	HVA	DCA	FBA	OFA

DGN (200) :
#7 (OVL) : Overload alarm
#6 (LV) : Insufficient voltage alarm
#5 (OVC) : Overcurrent alarm
#4 (HCA) : Abnormal current alarm
#3 (HVA) : Excessive voltage alarm
#2 (DCA) : Discharge alarm
#1 (FBA) : Disconnection alarm
#0 (OFA) : Overflow alarm

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm2	ALD			EXP				

DGN (201)⇓

Over-load alarm	0	—	—	—	Amplifier overheat
	1	—	—	—	Motor overheat
Discon-nection alarm	1	—	—	0	Built–in pulse coder disconnection (Hardware)
	1	—	—	1	Separate type pulse coder disconnection (Hardware)
	0	—	—	0	Pulse coder disconnection (software)

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm3		CSA	BLA	PHA	RCA	BZA	CKA	SPH

DGN (202) :
#6 (CSA) : Hardware of serial pulse coder is abnormal.
#5 (BLA) : Battery voltage is in low (warning).
#4 (PHA) : Serial pulse coder or feedback cable is abnormal. Counting the feedback signal is in error.
#3 (RCA) : Serial pulse coder is faulty.
Counting is in error.
If the RCA bit is set to 1 when both the FBA bit (bit 1 of alarm 1) and ALD bit of alarm 2 are set to 1 and the EXP bit of alarm 2 (internal hardware disconnection) is set to 1, a count miss alarm (CMAL) occurs in the α pulse coder.
#2 (BZA) : Battery voltage becomes 0.
Replace batteries and set the reference position.
#1 (CKA) : Serial pulse coder is faulty.
Internal block has stopped.
#0 (SPH) : Serial pulse coder or feedback cable is faulty.
Counting the feedback signal is in error.

		#7	#6	#5	#4	#3	#2	#1	#0
Alarm4		DTE	CRC	STB					

DGN (203) :

#7 (DTE) : Communication error of serial pulse coder. There is no response.

#6 (CRC) : Communication error of serial pulse coder. Transmitted data is in error.

#5 (STB) : Communication error of serial pulse coder. Transmitted data is in error.

		#7	#6	#5	#4	#3	#2	#1	#0
Alarm3			OFS	MCC	LDM	PMS			

DGN (204) :

#6 (OFS) : A/D conversion of current value of digital servo is abnormal.

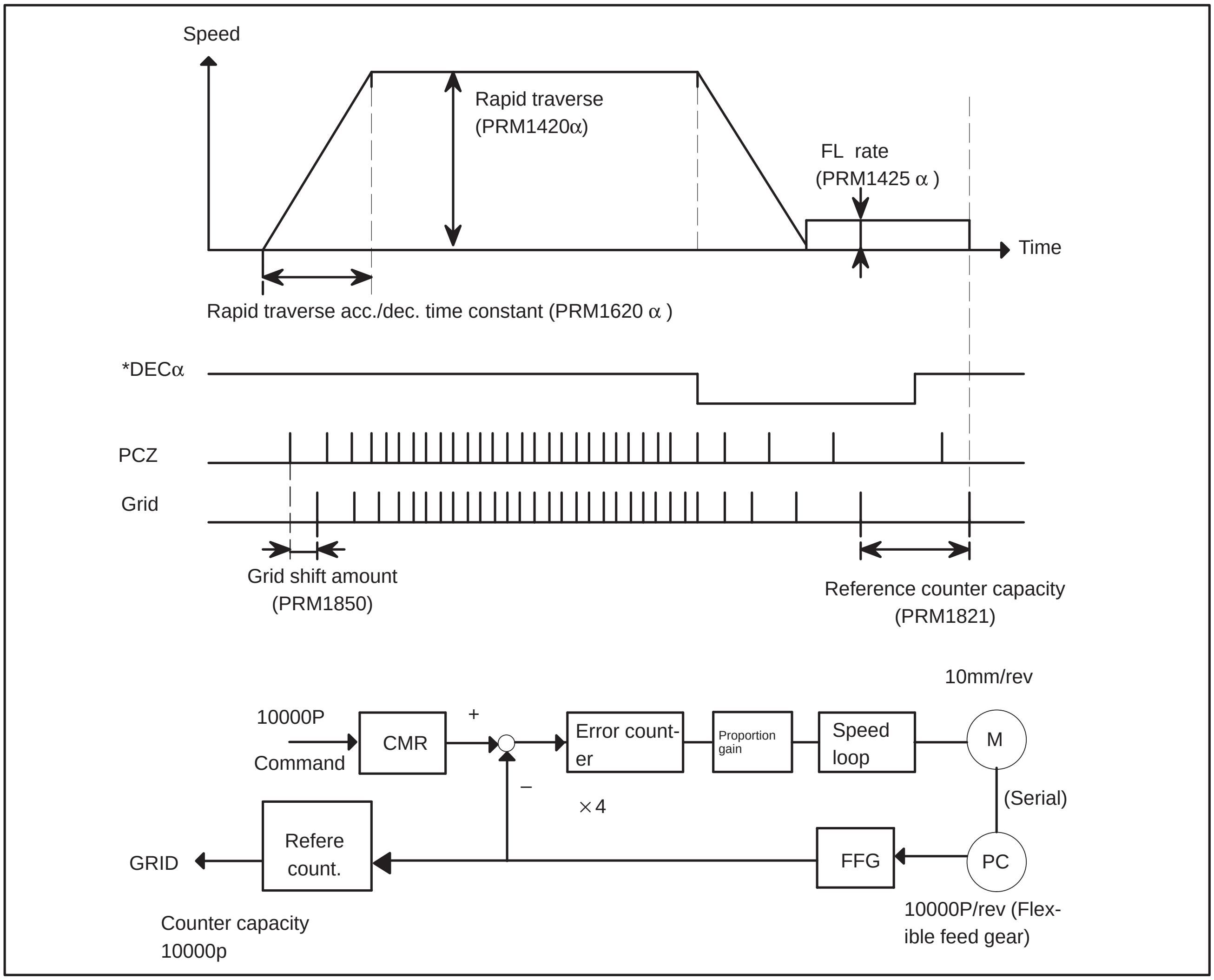
#5 (MCC) : Contacts of electro–magnetic contactor of servo amplifier is blown

#4 (LDM) : LED of serial pulse coder C is abnormal.

#3 (PMS) : No. of feedback pulses are in error because serial pulse coder or feedback cable is faulty.

5.3 ADJUSTING REFERENCE POSITION (DOG METHOD)

5.3.1 General



- **Parameter**

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	1002							DLZ	

#1(DLZ)☆ 0 : Reference position return method is normal (dog).
1 : Dogless reference position setting is used.

PRM	1821	Reference counter capacity [P]

No. of feedback pulses or its division by an integer is set.

PRM	1850	Grid shift amount per axis [P]

* This parameter is set using a value ten times the unit of detection, if the input system uses units of 0.0001 mm.

PRM		#7	#6	#5	#4	#3	#2	#1	#0
	1815			APC	APZ		OPT		

#5(APC) 0 : Position detector is other than absolute pulse coder.
1 : Position detector is absolute pulse coder.

#4(APZ) Zero position of absolute pulse coder is:
0 : Not established
1 : Established
(Turns to 1 after establishment)
To manually change the value of the APZ bit from 0 to 1 without first returning to the reference position when using serial pulse coder α, follow this procedure: Back up the data with the battery and give the motor one or more turns.
Turn the power off then on again, then change the APZ bit setting from 0 to 1.

#1(OPT) 0 : The pulse coder built into the motor is used for position detection.
1 : A separate pulse coder or linear scale is used for position detection.

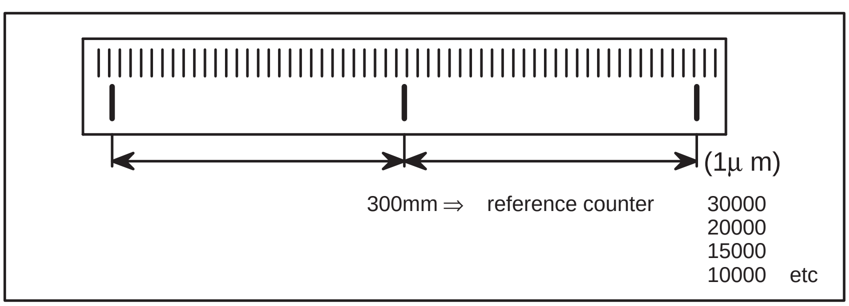
- **Separate Type Pulse Coder or Linear Scale is Used**

PRM	1821	Reference counter capacity per axis [P]

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 interfer may be used as a reference counter capacity:

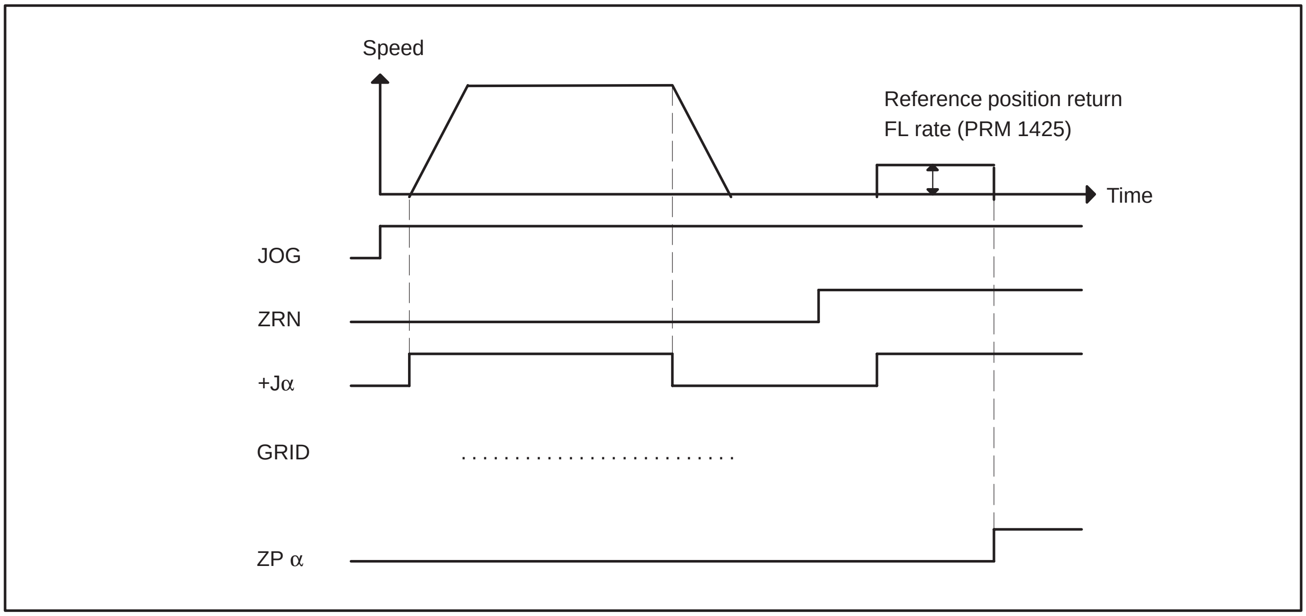
Example)



5.4 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.

5.4.1 General



5.4.2 Operation

1 Move the tool near the reference position using a manual operation.
2 Select the reference position return mode or switch.
3 Press a button for an axis–and–direction–select–signal + or –, and the machine moves to the next grid, then stops.
(This position is set as the reference position).
After the reference position has been set, select the reference position return mode (ZRN signal is 1) and turn on an axis–and–direction–select signal, then the tool returns to the reference position.

5.4.3 Associated Parameters

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	1002							DLZ	

#1(DLZ) 0 : Dog is used for reference position return
1 : Dogless reference position setting

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	1006			ZMI					

#5(ZMI) 0 : Reference position return and backlash initial direction is +.
1 : Reference position return and backlash initial direction is –.
After ZRN signal becomes 1, manual feed direction is always the direction set by this parameter irrespective of an axis selection signal.

6 AC SPINDLE (SERIAL INTERFACE)

This chapter describes the parameter tuning screen of serial interface spindle amplifier.

On the serial interface spindle amplifier, the following specification number is printed on upper part of the spindle unit

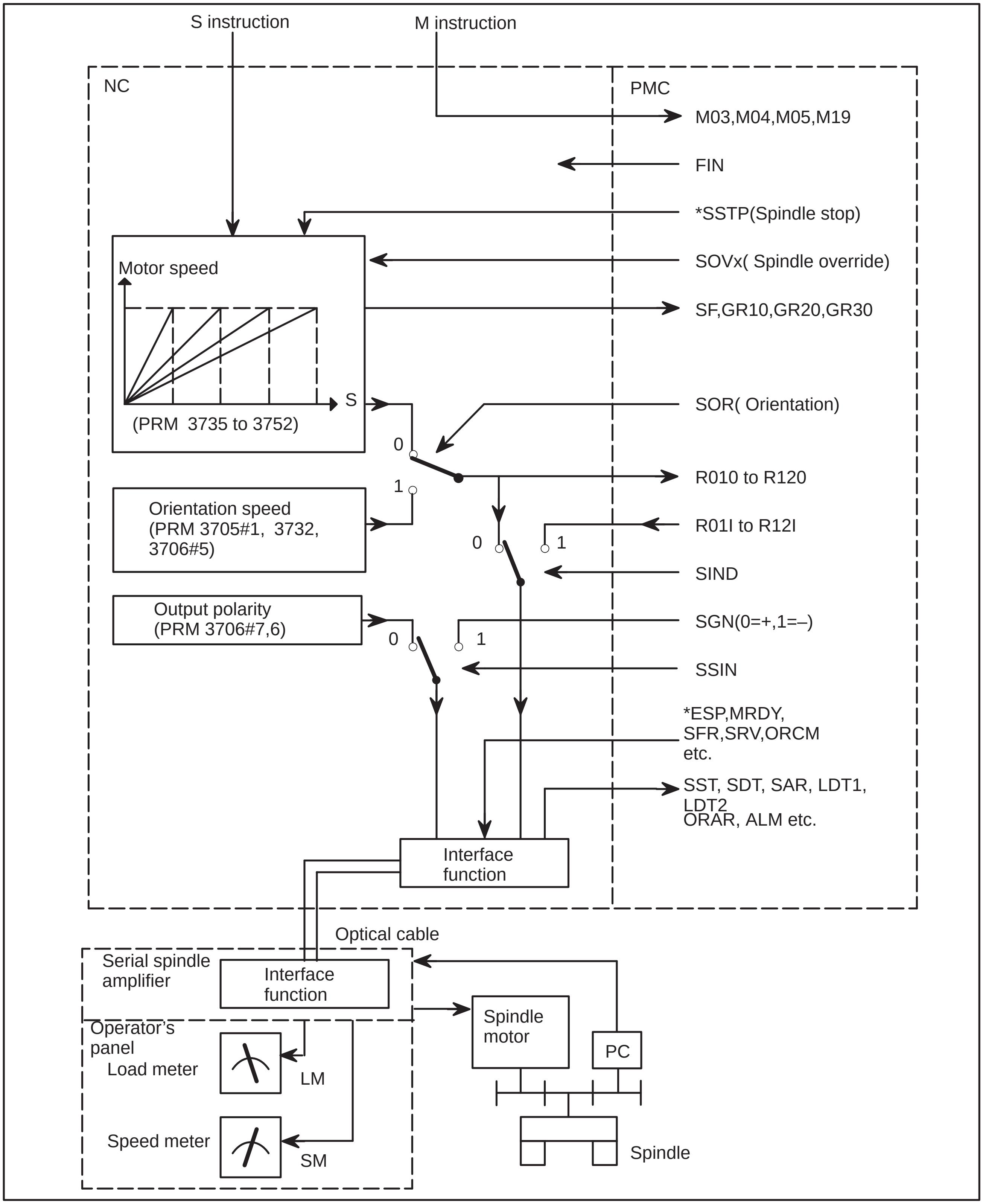
A06B–6063–Hxxx or

A06B–6064–Hxxx or

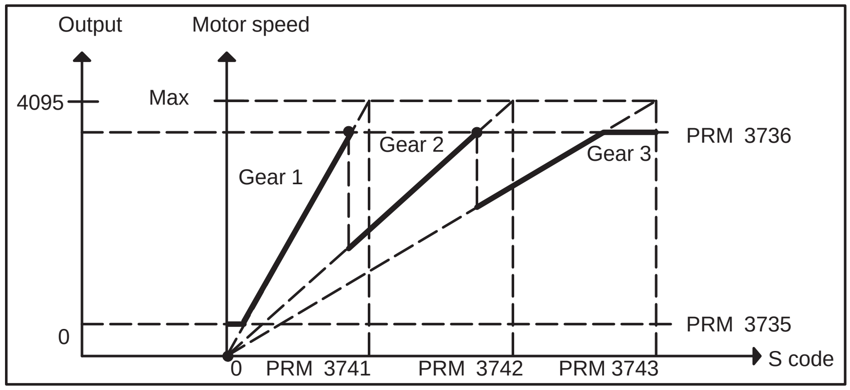
A06B–6065–Hxxx

(xxx is any)

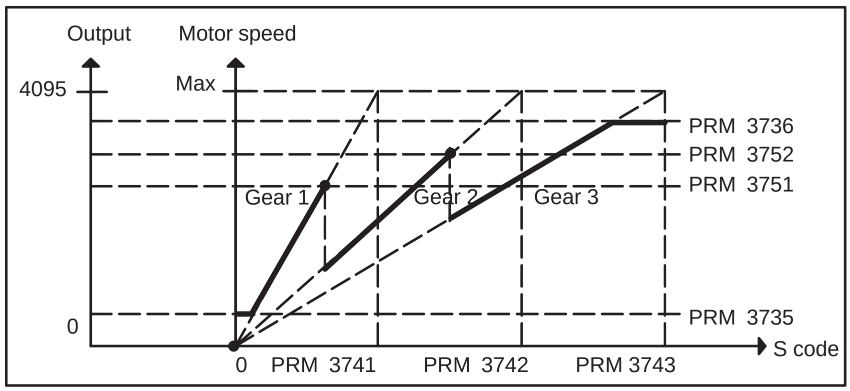
6.1 GENERAL OF SPINDLE CONTROL (SERIAL INTERFACE)



6.1.1 Method A of Gear Change (PRM3705#2=0)



6.1.2 Method B of Gear Change (PRM 3705#2=1)

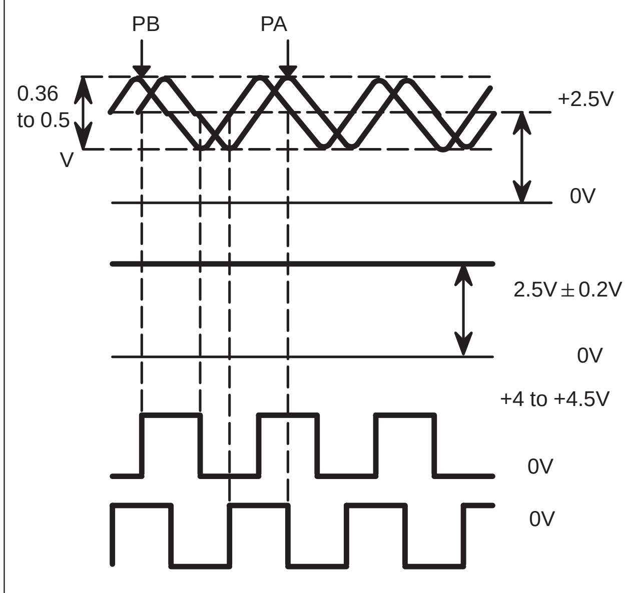
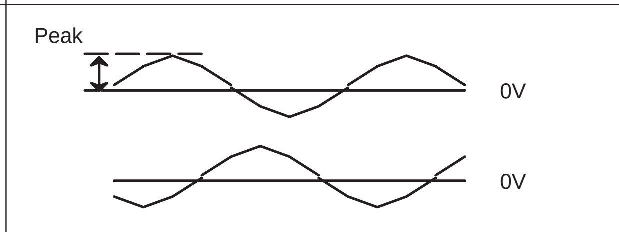
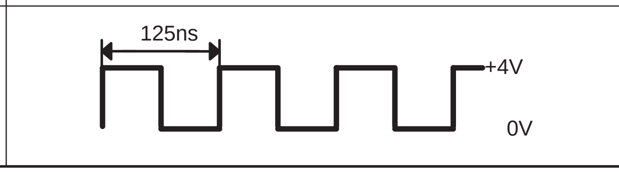


6.2 TABLE OF TEST POINTS

6.2.1 Printed Circuit Board (A16B–2201–0440)

<table>
<tr><th>Name</th><th>Signal</th><th>Remarks</th></tr>
<tr><td>PA</td><td>Pulse–generator phase A</td><td>90°advance for PB in a CW rotation
Vpp=0.36 to 0.5V</td></tr>
<tr><td>PB</td><td>Pulse–generator phase B</td><td>90° delay for PA in a CW rotation
Vpp=0.36 to 0.5V</td></tr>
<tr><td>RA</td><td>Phase–A reference voltage</td><td>+2.5VDC ±0.2</td></tr>
<tr><td>RB</td><td>Phase–B reference voltage</td><td>+2.5VDC ±0.2</td></tr>
<tr><td>PAAS</td><td>Signal with the amplitude 10 times that of PA</td><td>90° advance for PB in a clockwise direction,$V_{p–p}$=3.6 to 0.5V</td></tr>
<tr><td>PBAS</td><td>Signal with the amplitude 10 times that of PB</td><td>90 delay for PA in a clockwise direction,$V_{p–p}$=3.6V to 5.0V</td></tr>
<tr><td>PAA</td><td>A phase pulse waveform</td><td>Duty 50% (ON/ OFF ratio)</td></tr>
<tr><td>PBA</td><td>B phase pulse waveform</td><td>Duty 50% (ON/ OFF ratio)</td></tr>
<tr><td>*ITP1</td><td>ITP pulse</td><td>Synchronous signal from the CNC</td></tr>
<tr><td>TR</td><td>Serial data transmission signal</td><td>The high level of this signal indicates that serial data is being transmitted from the CNC</td></tr>
<tr><td>MSA</td><td>Magnetic sensor output MSA signal</td><td>One signal per rotation</td></tr>
<tr><td>LSA</td><td>Magnetic sensor output LAS signal</td><td>One signal per rotation</td></tr>
<tr><td>*LS</td><td>LSA pulse signal</td><td>One signal per rotation</td></tr>
<tr><td>PAE2</td><td>Position–coder phase A</td><td>Duty 50% (ON/ OFF ratio)</td></tr>
<tr><td>PBE2</td><td>Posiiton–coder phase B</td><td>Duty 50% (ON/ OFF ratio)</td></tr>
<tr><td>PSE2</td><td>Position–coder phase Z</td><td>1 pulse/rotation</td></tr>
<tr><td>*PELS</td><td>Position coder cable is broken</td><td>The low level of this signal indicates that the wire is broken.</td></tr>
<tr><td>CLK1</td><td>Clock signal</td><td>8MHz, 50% duty</td></tr>
<tr><td>VDC</td><td>DC link voltage signal</td><td>Voltage that is 1/100 of the DC link voltage</td></tr>
<tr><td>SDC</td><td>Control power DC link voltage signal</td><td>Voltage that is 1/100 of the DC voltage of the input power</td></tr>
<tr><td>+24V</td><td>+24V DC voltage</td><td>+20V to +26V</td></tr>
<tr><td>+15V</td><td>+15V DC voltage</td><td>+15V±4%</td></tr>
<tr><td>+5V</td><td>+5V DC voltage</td><td>+5V±2%</td></tr>
<tr><td>–15V</td><td>–15V DC voltage</td><td>–15V±4%</td></tr>
<tr><td>0V</td><td></td><td></td></tr>
<tr><td>IU</td><td>U–phase current detection signal</td><td rowspan="2"><table>
<tr><th>Amplifier</th><th>Current</th></tr>
<tr><td>Model 1S to 3S</td><td>21.9A/V</td></tr>
<tr><td>Model small 6S,6S to 12S</td><td>33.3A/V</td></tr>
<tr><td>Model 15S</td><td>41.7A/V</td></tr>
<tr><td>Model 15S to 22S</td><td>66.7A/V</td></tr>
<tr><td>Model 26S</td><td>83.3A/V</td></tr>
<tr><td>Model Small 30S</td><td>111.1A/V</td></tr>
<tr><td>Model 30S</td><td>83.3A/V</td></tr>
<tr><td>Model 40S</td><td>104.2A/V</td></tr>
<tr><td>Model 30HV,40HV</td><td>50.5A/V</td></tr>
<tr><td>Model 60HV</td><td>94.7A/V</td></tr>
</table></td></tr>
<tr><td>IV</td><td>V–phase current detection signal</td></tr>
</table>

6.2.2 Signal Waveform a Test Points

Check terminal	Waveform	Remarks
PA PB RA RB PAA PBA		Pulse generator output Phase difference between PA and PB is 90° Nominal voltage Signal formed by PA/PB
IU IV		Current feedback signal of each phase Peak value is proportional to current value
CLK1		Clock 8MHz

6.3 CONFIRMING POWER SUPPLY (SERIAL INTERFACE)

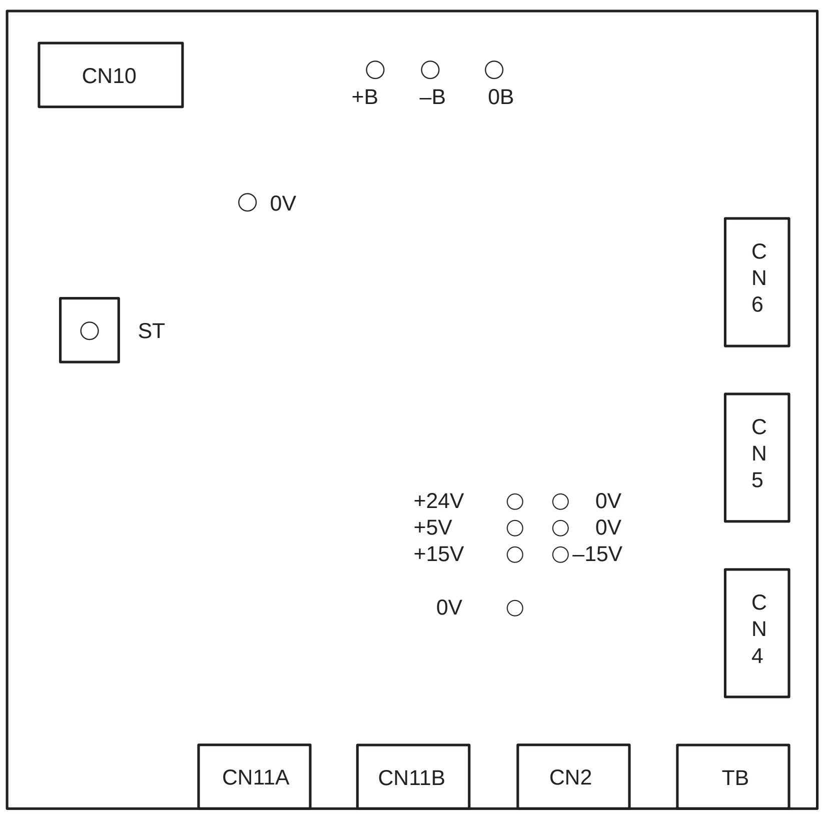
6.3.1 Power Supply

Confirm AC power voltage and DC current on spindle control circuit PCB as follows:

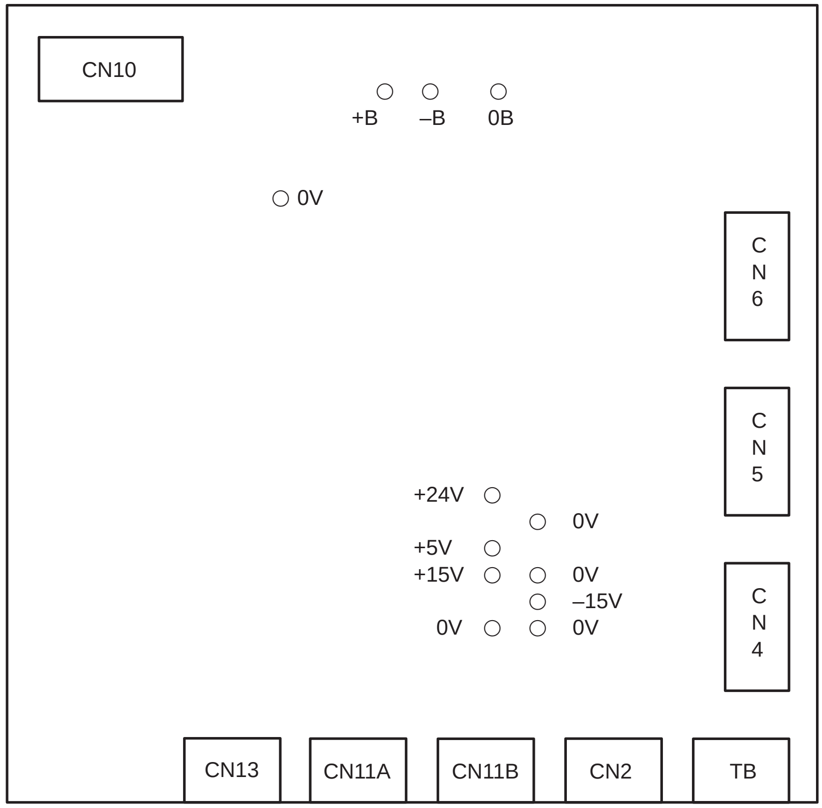
AC power supply	Check terminals R,S,T,G		
	Volt	**Test points**	**Rated value**
DC voltage on spindle control circuit PCB	+24V	Across +24V to 0V	+20 to +26V
	+15V	Across +15V to 0V	+15V ± 4%
	+5V	Across +5V to 0V	+5V ± 2%
	–15V	Across –15V to 0V	–15V ± 4%

6.3.2 Test Points

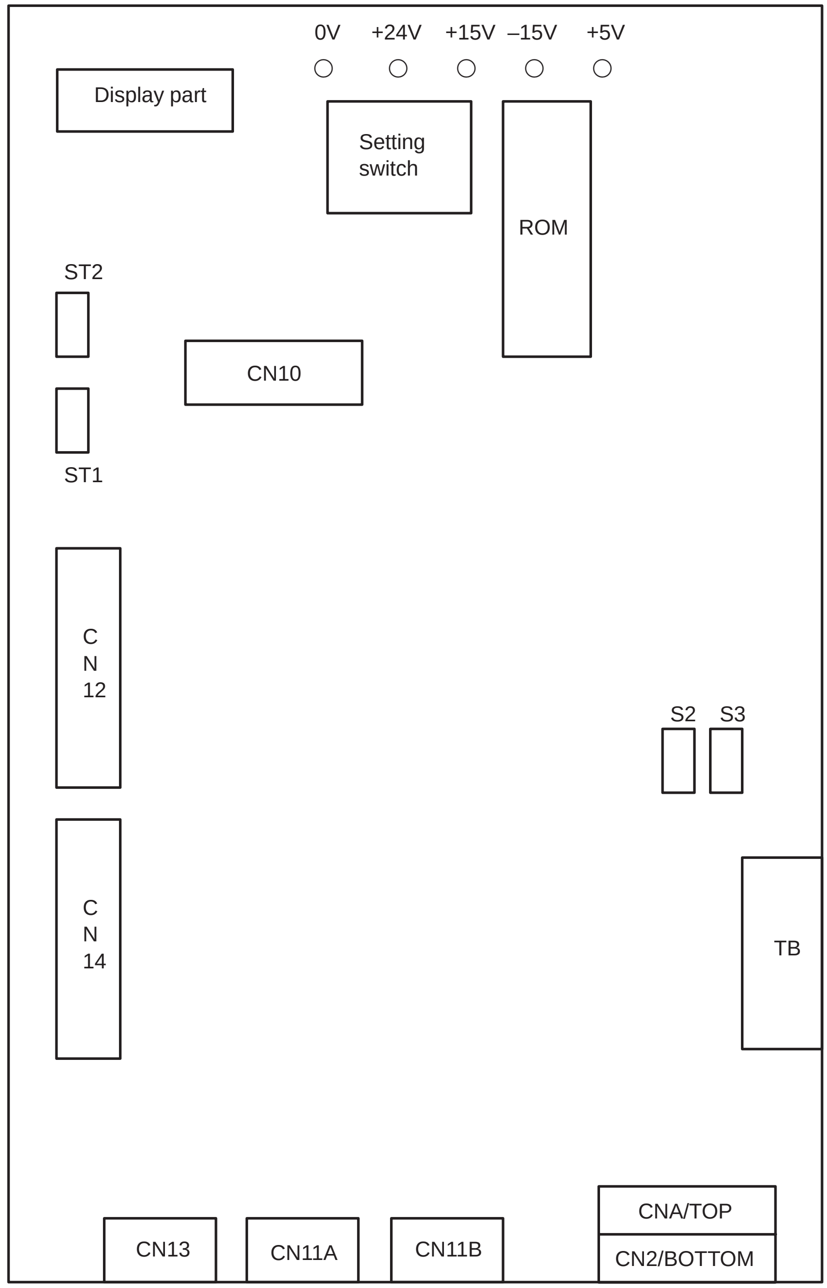
- **A20B–1003–0550**



- **A20B–1003–0920**



- **A16B–2201–0010**
  A16B–2201–0440



6.4 SPINDLE SETTING AND TUNING SCREEN

Spindle setting and tuning screen is not used at the Power Mate–F or DPL/MDI

6.4.1 Display Method

1. Confirm the parameters

	#7	#6	#5	#4	#3	#2	#1	#0
3111							SPS	

#1 (SPS) 0 : Spindle tunign screen is not displayed.
☆ 1 : Spindle tuning screen is displayed.

2. Press SYSTEM key.
3. Press soft key ▷.
4. Press soft key **[SP–PRM]** and the spindle tuning screen is displayed.
5. The following screens are available and they can be selected by soft key.
   1) **[SP.SET]** : Spindle setting screen
   2) **[SP.TUN]** : Spindle tuning screen
   3) **[SP.MON]** : Spindle monitor screen

6.4.2 Spindle Setting Screen

```
SPINDLE SETTING
GEAR SELECT     : 1
SPINDLE         : S11

  (PARAMETER)
GEAR RATIO            50
MAX SPINDLE SPEED   3000
MAX MOTOR SPEED     6000
```

- **Gear select**

Shows gear selected on the machine side.

Display	CTH1	CTH2
1	0	0
2	0	1
3	1	0
4	1	1

- **Parameter**

	S11:1st Main
Gear ratio(HIGH)	4056
Gear ratio(MIDIUM HIGH)	4057
Gear ratio(MIDIUM LOW)	4058
Gear ratio(LOW)	4059
Max. spindle rpm (Gear1)	3741
Max. spindle rpm (Gear2)	3742
Max. spindle rpm (Gear3)	3743
Max. motor speed	4020

6.4.3 Spindle Tuning Screen

```
SPINDLE TUNING

OPERATION    : NORMAL OPERATION
GEAR SELECT  : 1
SPINDLE      : S11

(PARAMETER)                (MONITOR)
PROP.GAIN      20          MOTOR SPEED   100
INT.GAIN       50          SPINDLE SPEED 150
MOTOR VOLT     30
REGE. POWER   100
```

- **Operation mode**

1 : Normal operation
2 : Spindle Orientation
3 : Rigid tapping

- **Display of parameter**

Display of parameter contents changes depending on operation mode.

	Normal operation	Orientation	Rigid tapping
Proportional gain	○	○	○
Integral gain	○	○	○
Position loop gain	–	○	○
Motor voltage	○	○	○
Regenerative power	○	–	–
ZRN gain %	–	–	○
Shift reference point	–	○	○
Shift spindle stop pos.	–	○	–
ORAR gain (%)	–	○	–

Refer to Subsec. 6.4.5 for correspondence between operation mode and parameters.

- **Display of monitor**

Display of monitor contents changes depending on operation mode.

	Normal operation	Orientation	Rigid tapping
Motor speed	○	○	○
Spindle speed	○	○	○
Position deviation S1	–	○	○
Position deviation Z	–	–	○
Synchronous deviation	–	–	○

$$1)\ \text{Motor speed [rpm]} = \frac{\text{Spindle data}}{16383} \times \text{Max. Motor rpm.(*)}$$

(*) PRM 4020: Main Sp.
PRM 4196: Sub. Sp.

6.4.4 Spindle Monitor Screen

```
SPINDLE MONITOR SCREEN
 ALARM          : AL–27(POSITION CODER DIS.)
 OPERATION      : NORMAL OPERATION
 SPINDLE SPEED  : 100 DEG/MIN
 MOTOR SPEED    : 150 RPM

                     0   50  100  150  200
  LOAD METER (%)    ■■■■■

  CONTROL INPUT : ORCM MRDY *ESP
  CONTROL OUTPUT : SST SDT ORAR
```

- **Spindle alarm**

1: Motor overheated
2: Speed deviation excessive
3: Fuse blow of DC link
4: Fuse blow of AC inputline
5: Fuse blow of DC voltage
7: Excessive speed
9: Heat sink overheat
10: Low voltage of AC input
11: Excess voltage in DC link
12: Excess current in DC link
13: CPU internal data memory error
18: ROM SUM check error
19: U phase current offset excessive
20: V phase current offset excessive
24: Serial data transmission abnormal and stop
25: Serial data transmission stop
27: Position coder signal disconnection
29: Short time overload
30: Input circuit excess current
31: Speed detecting signal disconnection
32: SLC LSI internal RAM abnormal
33: DC link charging insufficient
34: Parameter abnormal setting
35: Gear ratio data excessive
36: Error counter overflow
37: Speed detecting unit error setting
38: Magnetic sensor signal abnormal
41: Erroneous detection of the position coder one revolution signal
42: Undetection of the position coder one revolution signal
46: Erroneous detection of the position coder one revolution signal on threading
47: Abnormal position coder signal
48: Erroneous detection of position coder one revolution signal

- **Operation**

Following 6 modes are available:

a. Normal operation
b. Orientation
c. Rigid tapping

- **Load meter**

The load meter displays spindle load in a unit of 10%.

1) Load meter[%] $= \dfrac{\text{Load meter data}}{32767}$ timesMax.output value of load meter (*)

(*) PRM 4127: Main
PRM 4274: Sub.

- **Control input signal**

Max.10 signals those are ON are displayed from the following signals:

TLML	:	Torque limit command (low)	SPSL	:	Spindle selection signal
TLMH	:	Torque limit command (high)	MCFN	:	Power line switching
CTH1	:	Gear signal 1	SOCN	:	Soft start/stop cancel
CTH2	:	Gear signal 2	RSL	:	Output switching request
SRV	:	Spindle reverse rotation	RCH	:	Power line state confirm
SFR	:	Spindle forward rotation	INDX	:	Orientation stop pos. change
ORCM	:	Spindle orientation	ROTA	:	Rotation direction of ORCM
MEDY	:	Machine ready	NRRO	:	Shor–cut of ORCM
ARST	:	Alarm reset signal	INTG	:	Speed integral control signal
*ESP	:	Emergency stop	DEFM	:	Referencial mode command

- **Control output signals**

Max. 10 signals those are ON are displayed from the following signals:

ALM	:	Alarm signal	TML5	:	Torque limitation
SST	:	Speed zero signal	ORAR	:	Orientation end signal
SDT	:	Speed detecting signal	CHP	:	Power line switched signal
SAR	:	Speed arrival signal	CFIN	:	Spindle switch complete
LDT1	:	Load detecting signal 1	RCHP	:	Output switch signal
LDT2	:	Load detecting signal 2	RCFN	:	Output switch complete signal

6.4.5 Correspondence Between Operation Mode and Parameters on Spindle Tuning Screen

- **Speed control mode (Normal mode)**

Numerals are parameter numbers :

Proportional gain(HIGH)	4040
Proportional gain (LOW)	4041
Integral gain(HIGH)	4048
Integral gain(LOW)	4049
Motor voltage	4083
Regenerative power	4080

- **Spindle orientation mode**

Numerals are parameter numbers :

Proportional gain(HIGH)	4042
Proportional gain (LOW)	4043
Integral gain(HIGH)	4050
Integral gain(LOW)	4051
Position loop gain(HIGH)	4060
Position loop gain (MID,HIGH)	4061
Position loop gain (MID,LOW)	4062
Position loop gain(LOW)	4063
Motor voltage	4084
Change of position gain	4064
Stop position shift amount	4077
Orientation by PC method	4031

- **Rigid tapping mode**

Numerals are parameter numbers :

Proportional gain(HIGH)	4044
Proportional gain (LOW)	4045
Integral gain(HIGH)	4052
Integral gain(LOW)	4053
Position loop gain(HIGH)	4065
Position loop gain (MID,HIGH)	4066
Position loop gain (MID,LOW)	4067
Position loop gain(LOW)	4068
Motor voltage	4085
ZRN gain %	4091
Grid shift amount	4073

6.5 AUTOMATIC SETTING OF STANDARD PARAMETER

Standard parameters those are specific to each motor model can be set at a time by this operation.

Note that, however, depending on the conditions under which a motor is used, the machine tool builder may determine unique values to the parameters.

Therefore, always set the parameters (No.4000 and later) according to the parameter list attached to the machine.

1. Turn on power under emergency stop condition.
2. Set PRM4019#7 to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
4019	LDSP							

#7(LDSP) Serial interface spindle parameters are:

0 : Not set automatically.

☆ 1 : Set automatically.

3. Set a motor model code.

4133	Motor model code

Code	Motor model	Code	Motor model
0	3S (1500/6000rpm)	10	18P (750/6000rpm)
1	6S (1500/6000rpm)	11	22P (750/6000rpm)
2	8S (1500/6000rpm)	12	40P (575/4500rpm)
3	12S (1500/6000rpm)	13	30P (575/4500rpm)
4	15S (1500/6000rpm)	14	50P (575/4500rpm)
5	18S (1500/4500rpm)	15	1S (3000/8000rpm)
6	30S (1150/4500rpm)	16	1.5S (1500/8000rpm)
7	8P (750/6000rpm)	17	2S (1500/8000rpm)
8	12P (750/6000rpm)	18	3S (1500/6000rpm)
9	15P (750/6000rpm)	23	0.5S (3000/8000rpm)

4. Turn off power once, then turn it on again.

   “PLoAd” is displayed on the spindle amplifier PCB and the standard parameters are read.

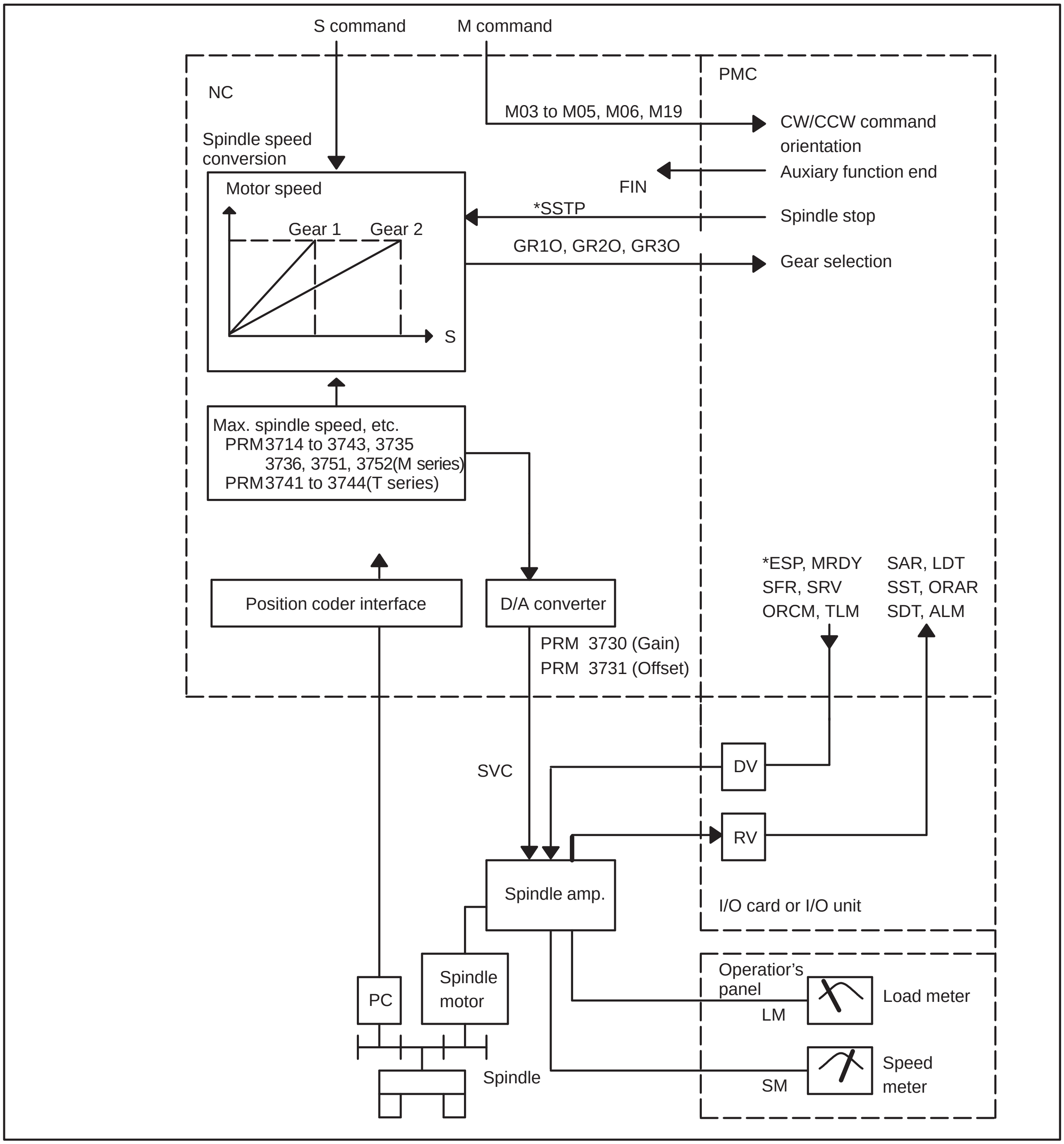
7 AC SPINDLE (ANALOG INTERFACE)

This chapter describes connection between the analog interface spindle amplifier, block diagram, setting method of standard parameters and function confirmation procedure of the spindle amplifier.

The following specification number is printed on the spindle unit for the analog interface spindle amplifier.
A06B–6059–Hxxx (xxx is any)

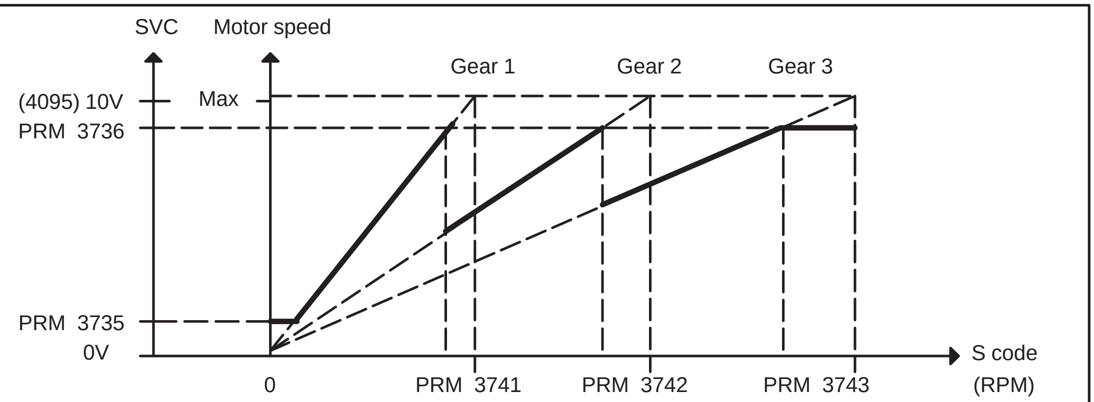
7.1 GENERAL OF SPINDLE CONTROL (ANALOG INTERFACE)

7.1.1 Block Diagram

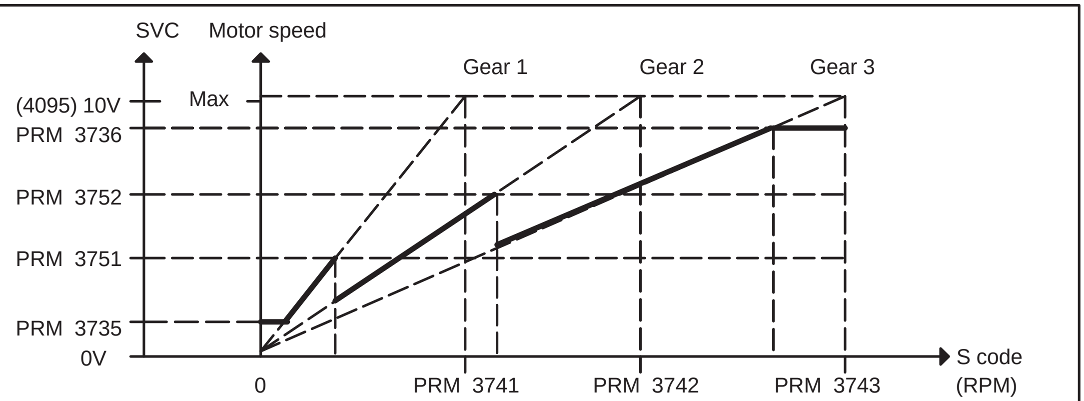


7.1.2 Calculation of S Analog Voltage and Associated Parameters

1 Gear change method A(PRM3705#2=0)



2 Gear change method B(PRM3705#2=1)



	#7	#6	#5	#4	#3	#2	#1	#0
3706	TCW	CWM						

TCW	CWM	Sign of output voltage
0	0	+ with M03 or M04
0	1	– with M03 or M04
1	0	+ with M03, – with 04
1	1	– with M03, + with M04

	#7	#6	#5	#4	#3	#2	#1	#0
3705						SGB		

#2 (SGB) Spindle speed taken when gear is changed is

0 : Max. speed for each gear

1 : Set by respective parameters (PRM542, 543, 585, 586)

3741	Max. spindle speed of gear 1 (1 to 9999) [rpm]
3742	Max. spindle speed of gear 2 (1 to 9999) [rpm]
3743	Max. spindle speed of gear 3 (1 to 9999) [rpm]
3736	Upper limit of the output to the spindle motor
3735	Lower limit of the output to the spindle motor

$$\text{Set value} = \frac{\text{Spindle speed Z(upper limit/lower limit)}}{\text{Max. spindle speed}} \times 4095$$

7.1.3 Tuning S Analog Voltage (D/A Converter)

Gear 1 is used in the following explanation, although any gear may be applied.
For the T series, select gear 1 manually or an M code.

(1) Change upper and lower limit as follows:
- For gear change method A: PRM 3736=4095, PRM 3735=0
- For gear change method B: PRM 3751=4095, PRM 3735=0
  This is not required for T series.

(2) Tuning offset of D/A converter
Command spindle speed 0 and tune the following prameter so that voltage at test point DA2 on the spindle amplifier PCB becomes 0mV.

S0 ; (Command by MDI operation and press the cycle start button)

DGN	3731	Spindle speed (D/A converter) offset compensation value

(3) Tune the gain of D/A converter
Command the maximun spindle speed of gear 1 and tune the following parameter so that voltage at test point DA2 on the spindle amplifier PCB becomes 10.0V.

S××××; (×××× is a value of parameter 3741) (Specify by MDI operation and press the cycle start button.)

DGN	3741	Max. spindle speed of gear 1 (1–9999) [rpm]

Usually a voltage is output from the D/A converter by only an S command execution. However, CW rotation command (M03) may be required on some machines.

(4) If the output voltage is not correct, perform the following calculation, change the value of parameter no. 3730 and tune the gain of D/A converter.

$$\text{Setting value} = \frac{10\text{V}}{\text{measured voltage}} \times \text{(Current value of PRM 3730)}$$

(5) Execute an S command again and confirm that the output voltage is correct.

Return the parameters to the previous values.

7.2 TABLE OF TEST POINTS

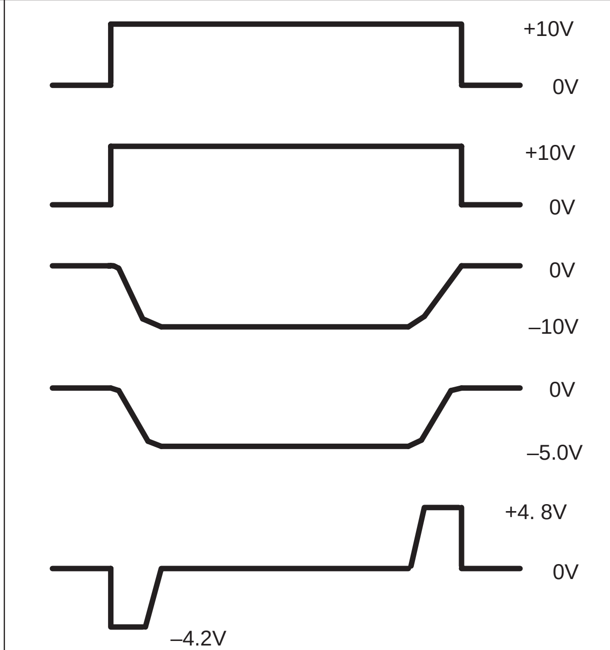
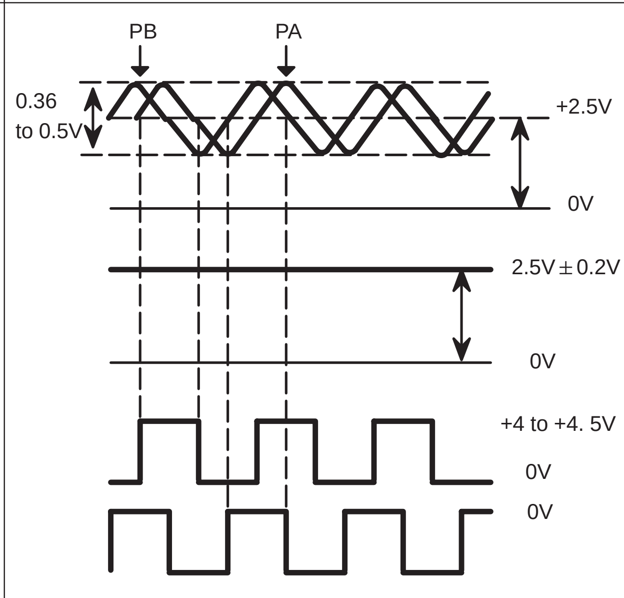
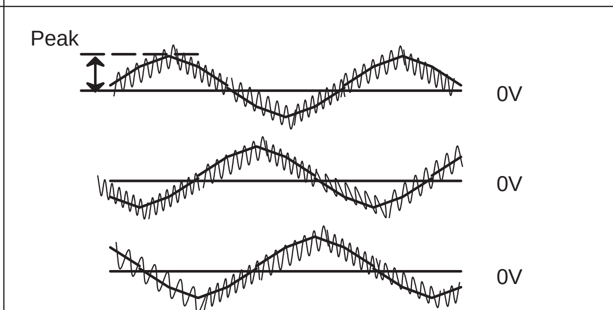
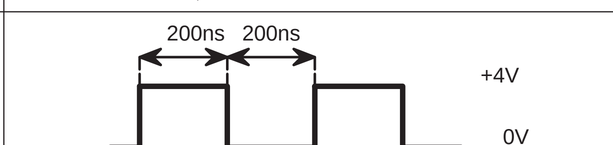
7.2.1 Model 1S to 3S (Amp. Specification : A06B–6059–H00x)

Name	Signal	Remarks
DA2	Analog speed command voltage (SVC)	0 to +10V, Rated speed at 10V
PA	Pulse generator output A–phase	90° advance by PB at CW rotation V_{p-p} =0.36–0.5V
PB	Pulse generator output B–phase	90° delay by PA at CW rotation V_{p-p} =0.36–0.5V
RA	A–phase standard voltage	+2.5VDC ±0.2V
RB	B–phase standard voltage	+2.5VDC ±0.2V
PAP	A phase pulse waveform	Duty 50% (ON/ OFF ratio)
PBP	B phase pulse waveform	Duty 50% (ON/ OFF ratio)
TSA	Speed feedback signal	±10V at rated max. speed of motor (CW:+,CCW:–)
TS2	Low–speed detection signal	Adjustment of each model by RV6
TS3	Speed pulse F/V conversion signal	At CCW (forwar rotation) 6000rpm, –4.65 to –6.15V
VCMD	Speed command voltage	0 to ±10V,(CCW:+, CW: –)
FWP	CCW rotation pulse	Pulse width=3.2μs, occurs only at CCW (forward rotation)
RVP	CW rotation pulse	Pulse width=3.2μs, occurs only at CW (backward rotation)
ER	Error voltage	–4.2 to +4.8V
CLK1	Clock signal	2.5MHz, duty 50%
SLIP	Slip pulse	
VDC	DC link voltage signal	Voltage 1/100 of DC link voltage
DTDC	DC form voltage of input AC voltage	Voltage 1/100 of DC form voltage of input AC voltage
IU	U–phase current detection signal	22.2 A/V
IV	V–phase current detection signal	
IW	W–phase current detection signal	
+24V	+24V DC voltage	About 23V ±4%
+15V	+15V DC voltage	+15V±4%
+5V	+5V DC voltage	+5V±4%
–15V	–15V DC voltage	–15V±4%
0V		
SM	Speed meter signal	At maximum rated max. rotation +10V
LM	Loadmeter signal	At maximum rated max. output +10V

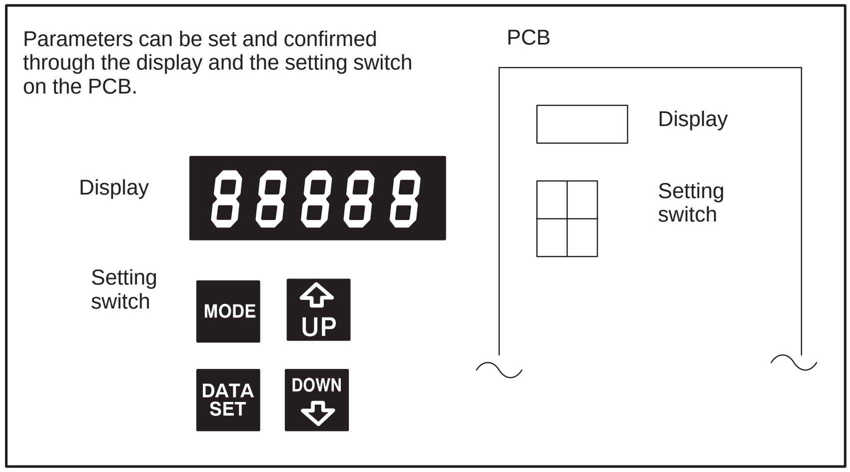
7.2.2 Models 6S to 26S (Amp. specification: A06B–6059–H2xx)

<table>
<tr><th>Name</th><th>Signal contents</th><th>Remarks</th></tr>
<tr><td>DA2</td><td>Analog speed command voltage (SVC)</td><td>0 to +10V, Rated speed at 10V</td></tr>
<tr><td>PA</td><td>Pulse generator output A–phase</td><td>90° advance by PB at CW rotation
V_{p-p}=0.36–0.5V</td></tr>
<tr><td>PB</td><td>Pulse generator output B–phase</td><td>90° delay by PA at CW rotation
V_{p-p}=0.36–0.5V</td></tr>
<tr><td>RA</td><td>A–phase standard voltage</td><td>+2.5VDC ±0. 2V</td></tr>
<tr><td>RB</td><td>B–phase standard voltage</td><td>+2.5VDC ±0. 2V</td></tr>
<tr><td>PAP</td><td>A phase pulse waveform</td><td>Duty 50% (ON/ OFF ratio)</td></tr>
<tr><td>PBP</td><td>B phase pulse waveform</td><td>Duty 50% (ON/ OFF ratio)</td></tr>
<tr><td>TSA</td><td>Speed feedback signal</td><td>At maximum rated max. rotation
±10V(CW:+,CCW:–)</td></tr>
<tr><td>TS2</td><td>Low–speed detection signal</td><td>At CCW (forward rotation)
22.5rpm , –1.4V±0.3V</td></tr>
<tr><td>TS3</td><td>Speed pulse F/V converi-son signal</td><td>At CCW (forward rotation)
6000 rpm , –4.65 to –6.15V</td></tr>
<tr><td>VCMD</td><td>Speed command voltage</td><td>0∼ ±10V, (CCW:+, CW: –)</td></tr>
<tr><td>TSAF</td><td>CCW rotation speed detection signal</td><td>At CCW (forward rotation)
6000 rpm , 0. 82V ±82mv</td></tr>
<tr><td>TSAR</td><td>CW rotation speed detection signal</td><td>At CW (backward rotation)
6000 rpm , 0. 82V ±82mv</td></tr>
<tr><td>ER</td><td>Error voltage</td><td>–4.2 to +4.8V</td></tr>
<tr><td>CLK1</td><td>Clock signal</td><td>2. 5MHz , duty 50%</td></tr>
<tr><td>SLIP</td><td>Slip pulse</td><td></td></tr>
<tr><td>VDC</td><td>DC link voltage signal</td><td>Voltage 1/100 of DC link voltage</td></tr>
<tr><td>SDC</td><td>Control power DC link voltage</td><td>Voltage 1/100 of control power DC link voltage</td></tr>
<tr><td>ADIN</td><td>A/D converter input signal</td><td></td></tr>
<tr><td>IU</td><td>U–phase current detection signal</td><td rowspan="3"><table><tr><td>Model</td><td>6S to 12S</td><td>15S to 22S</td><td>26S</td></tr><tr><td>Current value</td><td>33.3 A/V</td><td>66.6 A/V</td><td>83.3 A/V</td></tr></table></td></tr>
<tr><td>IV</td><td>V–phase current detection signal</td></tr>
<tr><td>IW</td><td>W–phase current detec-tion signal</td></tr>
<tr><td>+24V</td><td>+24V DC voltage</td><td>About 23V ±4%</td></tr>
<tr><td>+15V</td><td>+15V DC voltage</td><td>+15V±4%</td></tr>
<tr><td>+5V</td><td>+5V DC voltage</td><td>+5V±4%</td></tr>
<tr><td>–15V</td><td>–15V DC voltage</td><td>–15V±4%</td></tr>
<tr><td>0V</td><td></td><td></td></tr>
<tr><td>*RGHLD</td><td>Regenerative stop signal</td><td></td></tr>
</table>

7.2.3 Test Points Signal Waveform

Check terminal	Waveform	Remarks
DA2 VCMD TSA TS3 ER		+10V at maximum rated rotation (0V at 0 rpm) At CCW (Minus for reverse rotation) Speed feedback voltage (Pulse for reverse rotation) F/V converter output (Pluse for reverse rotation) Velocity deviation voltage
PA PB RA RB PAP PBP		Pulse generator output Phase difference between PA and PB is 90°. Nominal voltage Signal formed by PA/PB
IU IV IW		Current feedback signal of each phase Peak value is proportional to current value
CLK1		Clock 2. 5MHz

7.3 SETTING PARAMETERS (DIGITAL AC SPINDLE)



1. If the PCB is mounted a jumper SH, set it to SET.
2. Press the setting switch MODE, DATA SET, ⇑ UP and DOWN ⇓ at the same time for more than 1 second and when the display shows FFFFF, release the buttons.
3. Press the MODE button and a parameter (mode) no. is displayed.
4. Press and hold the MODE button and press the ⇑ UP or DOWN ⇓ button, then the number increases or decreases by 1.
5. Value of parameter is shown on the display in 4 digits about 0.5 second after the MODE button is released.
6. Value of parameter increases by one by ⇑ UP button and decreases by one by DOWN ⇓ button.
7. Perform the same operation for another parameters.
8. Press DATA SET button at last.

   When the display shows 88888, the setting value is stored in memory.

   * If you turn off power before pressing DATA SET button, the values of parameters return to the previous values.

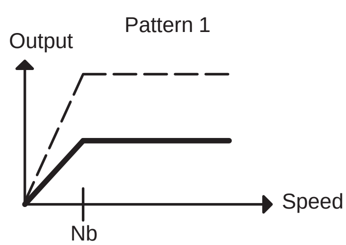
7.4 SETTING STANDARD PARAMETERS

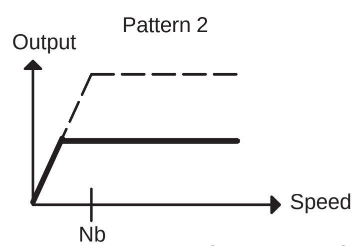
The standard parameters are stored in ROM. If the parameter list attached to the machine is lost or when an accident occurs and no parameter can be set, perform the setting of standard parameters.
Also when a ROM is replaced with different maximum speed applied to different motor model, perform the following procedure.
However, since the standard parameters are set to each motor, some parameters must be modified by the parameter list according to the machine's unique characteristics.

1. Turn off power.
2. Set jumper S1 on the PCB to TEST.
3. If the PCB is provided with jumper SH, set it to SET.
4. Turn on power and confirm that display shows 00000, 11111, ..., and FFFFF repeatedly.
5. Press the setting switch [MODE], [DATA SET], [⇑ UP] and [DOWN ⇓] at the same time for more than 1 second and when the display shows FFFFF, release the buttons.
6. Press the [MODE] button and the display shows FC–00.
7. Press and hold the [MODE] button and press [DOWN ⇓] button to display FC–22 on the display and release the [MODE] button. (Display changes to that of step 4)
   Other number shows other meaning, therefore select the number correctly.
8. Press [DATA SET] button more than one second.
9. When the display shows GOOD, the standard parameters have been set correctly.
10. Turn power off and set jumper S1 and SH to the DRIVE side.
11. Modify the standard parameters those are specific to the machine or the PCB as required. Refer to 7.6 "Tuning after replacing PCB".

7.5 LIST OF PARAMETER

<table>
<tr><th>No.</th><th>Contents</th><th>Setting value</th></tr>
<tr><td>F–00</td><td>The speed of the motor is displayed. (rpm)</td><td></td></tr>
<tr><td>F–01</td><td>Machine ready signal (MRDY) is 0: not used 1: used</td><td></td></tr>
<tr><td>* F–02</td><td>Spindle speed override is 0: not used 1: used</td><td></td></tr>
<tr><td>* F–03</td><td>Upper limit of speed override is 0: 100% 1: 120%</td><td></td></tr>
<tr><td>F–04</td><td>none</td><td></td></tr>
<tr><td>* F–05</td><td>Setting of maximum speed

Standard : 256p/ rev (Detector I)
High–speed : 128p/ rev (Detector II)
<table>
<tr><th></th><th>Standard</th><th>High–speed</th></tr>
<tr><td>0</td><td>Max. 5000</td><td>Max. 10000</td></tr>
<tr><td>1</td><td>Max. 6000</td><td>Max.12000</td></tr>
<tr><td>2</td><td></td><td>Max. 15000</td></tr>
<tr><td>3</td><td></td><td>Max. 20000</td></tr>
</table></td><td></td></tr>
<tr><td>F–06</td><td>Setting of output limit pattern
<table>
<tr><th>Pattern 1</th><th>Pattern 2</th><th>Content</th></tr>
<tr><td>0</td><td>0</td><td>The output is not limit</td></tr>
<tr><td>1</td><td>4</td><td>Limited at acc./dec. time</td></tr>
<tr><td>2</td><td>5</td><td>Limited under normal operation</td></tr>
<tr><td>3</td><td>6</td><td>Limited under all operation</td></tr>
</table>




Nb: Base speed</td><td></td></tr>
<tr><td>F–07</td><td>Limit value at output limited (The max. rated output is 100)</td><td></td></tr>
<tr><td>F–08</td><td>Delay time to motor power interruption (Standard setting × 40msec)</td><td></td></tr>
<tr><td>F–09</td><td>Excitation interruption of motor power using MRDY signal is
0: not used 1: used</td><td></td></tr>
<tr><td>F–10</td><td>Adjustment of speed error offset at the time of the forward rotation command</td><td></td></tr>
<tr><td>F–11</td><td>Adjustment of speed error offset at the time of the reverse rotation command</td><td></td></tr>
<tr><td>F–12</td><td>Adjustment of speed error offset at the time of the orientation command</td><td></td></tr>
<tr><td>* F–13</td><td>Speed at forward rotation command (Model 1S to 3S is RV1)</td><td></td></tr>
</table>

Parameters marked with *does not exist in models 1S to 3S.

	No.	Contents	Setting value
*	F–14	Speed at reverse rotation command (Refer to RV2 for Models 1S to 3S)	
	F–15	Motor peed when spindle speed command voltage is 10V (Setting value=Speed/100)	
	F–16	Detection range of speed arrival signal(SAR) (Detection range=command speed × setting value %)	
	F–17	Detection range of speed detecting signal (SDT) (Maximum speed) × (Setting data %)	
	F–18	Torque limit value when the torque limit signal (TLMH) is turned on	
	F–19	Acceleration /deceleration time (Setting value=(Acceleration time [sec]) × 2)	
	F–20	Limit of regenerative power	
	F–21	Speed control phase compensation P : HIGH gear (CTH=1)	
	F–22	Speed control phase compensation P : LOW gear (CTH=0)	
	F–23	Speed control phase compensation P in orientation : HIGH gear (CTH=1)	
	F–24	Speed control phase compensation P in orientation : LOW gear (CTH=0)	
	F–25	Speed control phase compensation I : HIGH gear (CTH=1)	
	F–26	Speed control phase compensation I : LOW gear (CTH=0)	
	F–27	Speed control phase compensation I in orientation : HIGH gear (CTH=1)	
	F–28	Speed control phase compensation I in orientation : LOW gear (CTH=0)	
*	F–29	Speed detection offset (Refer to RV3 for models 1S to 3S)	
	F–30	Display of motor speed (value is 1 when rigid tapping is used)	
	F–31	Setting of rigid tap mode	
	F–32	Motor voltage at normal operation	
	F–33	Motor voltage in orientation	
	F–34	Motor voltage in rigid tap mode	
	F–35	Setting of detection ragne of zero–speed signal (SST) (The detection range=(maximum speed) × (The setting data/100))	
	F–36	Detection range of load detection signal (LDT)	
*	F–37	Time constant of torque deviation at deceleration start	
	F–38	Characteristics of control in deceleration (When the gear noises at deceleration, set the data to 1)	
	F–39	Characteristics of control in stable rotation with no load (When the motor speed may undulate in the stable rotation , set the data to 1)	
	F–40	Characteristics of control in torque limitation (When using mechanical orientation)	

Parameters marked with * does not exist in models 1S to 3S.

Following are the parameters relating to the motor characteristics. Therefore, do not change the settings.
If you changed these parameter, perform the standard setting of the parameters.

No.	Content	Setting value
F–41	Current loop I gain	
F–42	Slip compensation constant	
F–43	Slip constant	
F–44	Voltage compensation	
F–45	PWM maximum amplitude	
F–46	Second current command	
F–47	Current assumed constant	
F–48	Fixed torque point	
F–49	Excitation weak point	
F–50	Voltage conversion constant	
F–51	Selection of speed detector	
F–52	Current conversion constant	
F–53	Current loop P gain	

7.6 TUNING AFTER REPLACING PCB (S SERIES AC SPINDLE)

1. Set jumpers on the PCB to the previous satate.
2. Check whether ROM is mounted or not and confirm version of ROM. If ROM is not mounted or ROM series is different, remove the ROM from the old PCB and mount it on new PCB.
3. Install the PCB to the unit and set the system to the emergency stop state. Then turn on power and measure voltage on the PCB.

Test points	Rating
+24V	About 23V ±4%
+15V	+15V ±4%
+5V	+5V ±2%
–15V	–15V ±2%

☞For the amplifiers for models 1S to 3S, RV4 can be used to adjust +5 V.

4. If the PCB mounts jumper SH, set it to SET. (Depending on version of PCB, there is no jumper SH.)
5. Confirm that jumper S1 is set to DRIVE and turn on power.
6. Press [MODE], [DATA SET], [⇑ UP] and [DOWN ⇓] buttons at the same time for more than one second to enable writing parameters.

   When the display shows [FFFFF], it is a state that parameters can be written.
7. Set parameters according to the parameter list attached to the machine.
   1) When you press and hold [MODE] button and press [⇑ UP] or [DOWN ⇓] key, you can change parameter number.
   2) When you press [⇑ UP] or [DOWN ⇓] key without pressing [MODE] key, you can change the values of parameters.
8. After you have completed the setting of parameters, release the emergency stop, rotate the spindle at a low speed to see whether problem does not occur.
   * At first, check from low speed to midium speed.
   * You should be ready to press the emergency stop button to escape from accidental problem.
9. Turn off rotation commands to make fine adjustment of the PCB. The PCB for model 1S to 3S mounts the following volumes.

RV1	Adjusting forward rotation speed	Used for fine adjustment of max. speed
RV2	Adjusting reverse rotation speed	
RV3	Adjusting velocity detection circuit offset	Set check terminal TS3 to 0mV at stop.
RV4	Adjusting +5V	Adjust +5V ±0.1V
RV5	Gain when changing a gain	Standard setting 50 %
RV6	Velocity detection circuit gain at low speed	Do not change setting

10. Measure test point TS3 with a digital tester and adjust parameter [F–29] so that it becomes 0mV at a stop state.
Adjust this item with volume RV3(velocity detection circuit offset adjustment) on the PCB for models 1S to 3S.
11. Execute spindle speed command S0 and spindle forward command M03. Tune offset speed by parameter [F–10] so that the spindle does not rotate by M03. In some machines, rotational direction of motor and M03 are reverse. Therefore, if motor speed does not change with M03, command M04.
12. Execute spindle speed command S0 and spindle reverse command M04. Tune offset speed by parameter [F–11] so that the spindle does not rotate by M04.
13. When the orientation function is equipped, execute orientation command M19 or perform orientation by a manual operation.
Tune [F–12] so that INPOS–FINE (magnetic sensor method) or INPOS–ADJUST(position coder method) is lit when an orientation completes.
14. Tune [F–12] so that motor speed becomes that specified by a command duning forward rotation.
* When you halt the setting switch operations, the display shows 5–digit motor speed in a few seconds and you confirm the speed.
For model 1S to 3S, tune this item by volume RV1 (forward rotation speed adjustment) on the PCB.
15. Tune [F–14] so that motor speed becomes that specified by a command during reverse rotation.
For model 1S to 3S, tune this item by volume RV2 (reverse rotation speed adjustment) on the PCB.
16. Press [DATA SET] button for more than one second to memorize parameters.When they are memorized, the display shows [88888].
Note 1) If you turn off power without pressing [DATA SET] button, the parameters become invalid.

CAUTION
This operation cannot be accepted when a rotation command is specified.
Always perform this operation with the spindle stopped.

17. Turn off the power and return jumper S1 and SH to DRIVE.

8 TROUBLESHOOTING

This chapter describes troubleshooting procedure.

NOTE

The following example describes the addressing of two Power Mate–D axes. In a 2–path Power Mate–D, each path corresponds to one axis. For the G and F addresses, the first path corresponds to the first–axis address, and the second path corresponds to an address 1000 greater than the first–axis address. The Power Mate–F corresponds to the first–axis address.

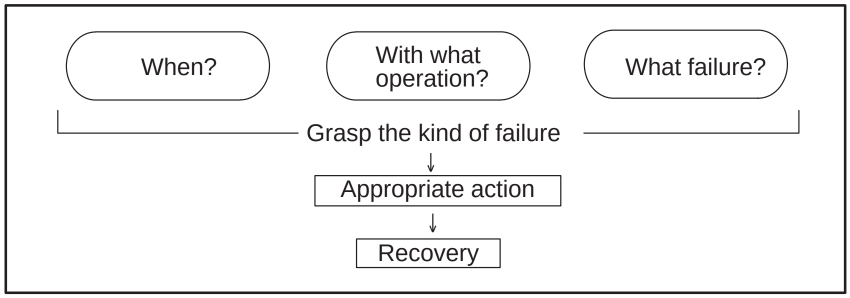
Example)

		#1	#0
G130		*IT2	*IT1

Two–axis Power Mate–D :G130#0. #1
Single–axis Power Mate–D :G130#0
2–path Power Mate–D :G130#0 (first path)
:G1130#0 (second path)
Power Mate–F: G130#0

8.1 CORRECTIVE ACTION FOR FAILURES

When a failure occurs, it is important to correctly grasp what kind of failure occured and take appropriate action, to promptly recover the machine.
Check for the failure according to the following procedure :



8.1.1 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 Power Mate mode when the failure occurred? (Jog mode/AUTO operation mode /MDI mode /reference position return mode)
- 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 ?

<Feed axes and spindle>

- For a failure related to feed axis servo
  1) Occurred at both low feedrate and high feedrate ?
  2) Ocurred only for a certain axis ?
- For a failure related to spindles
  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 on the CRT?
  (Check the axis along which an alarm has occurred for alarms 300 to 599.)
- For alarm 350: Examine diagnostic 202
  For alarm 351: Examine diagnostic 203
  For alarm 414: What does diagnostic display 200,201,204 indicate ?
- For alarm 751 or 761 : Which spindle alarm is indicated ?
  (indicated by AL–XX (XX is a number))
- Is the CRT screen correct ?
- If machining dimensions are incorrect
  1) How large is the error ?
  2) Is the position display on the CRT correct ?
  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?
- 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?
  (0°C to 55°C during operation)
  Refer to manual about noise.
- Has excessive vibration been applied to the control unit?
  (0.5 G or less during operation)

5 When you contact our service center, specify the following items :

1) Name of the unit
2) Name of the machine tool builder and type of machine
3) Software series/version of the Power Mate
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)
6) Name and contact of the person who is most familiar with the failure conditions
   (for a failure related to the servo)
   - See the drawing issued by the machine tool builder for the locations of the Power Mate and servo/spindle amplifiers.
   - We use the following specification codes :
     Servo/Spindle amplifier : A06B–□□□□–H□□□
     Servo/Spindle motor : A06B–□□□□–B□□□
     (□ represents a number)

The above information is required by FANUC to determine the cause of the failure. The information is used to attempt to reproduce the failure at the service center.

8.2 POWER CANNOT BE TURNED ON

Points

Confirm the green LED EN on the front of controller.

When green LED EN is turned on, power of Power Mate is ON.

Causes and Remedies

(1) Fuse F1 on the controller front panel is blown.
  (a) Input power voltage is too high.
  (b) External 24DCV power supply is faulty.
  (c) 24–V power line short–circuit (line–to–line or line–to–ground)

(2) Input voltage is low
  Measure voltage at S terminals of 0V and 24V to confirm 24VDC ±100 % is supplied.
  If it is not normal, check machine side magnetics circuit.

(3) Power supply printed board in controller is faulty.
  When 24 V is found to be input normally in step (2), but 5 V is not output to the 0 V and 5 V terminals, the power PCB in the controller may be defective.

(4) Power leakage from other units
  Disconnect all cables other than the power cable of the Power Mate, then retry.

8.3 NO MANUAL OPERATION NOR AUTOMATIC OPERATION CAN BE EXECUTED

Points

(1) Execute the following procedure when no manual nor automatic operation is done

(2) Check whether position display shows correct position

(3) Check Power Mate status display

(4) Check Power Mate internal status using diagnostic function

Causes and Countermeasures

1. Position display (relative, absolute, machine coordinate) does not change

(1) Check CNC status display (Refer to **2.10 NC STATUS DISPLAY FOR DETAIL**)

(a) Emergency stop status (Emergency stop signal is turned on)

If status display shows EMG the emergency stop signal is input. Check the following signal using the PMC's diagnostic function (PMCDGN).

1 When built in I/O card is used.

	#7	#6	#5	#4	#3	#2	#1	#0
X1000				*ESP				
G0008				*ESP				

ESP=0 indicates that emergency stop signal is input.

2 When emergency stop is input from I/O card (Parameter No.3001#3=1). (FANUC I/O Link)

	#7	#6	#5	#4	#3	#2	#1	#0
X1000				*ESP				
G0008				*ESP				

ESP=0 indicates that emergency stop signal is input.

(b) It is a reset status

When RESET is displayed, any of a reset is functioned. Check the following signal using the PMC's diagnostic funciton (PMCDGN).

1 An input signal from the PMC functions

	#7	#6	#5	#4	#3	#2	#1	#0
G0008	ERS	RRW						

When ERS is 1, external reset signal is input.
When RRW is 1, reset & rewing signal is input.

2 RESET key on the MDI keyboard functions

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 CRT as follows :
If nothing is displayed, mode select signal is not input. Check mode select signal using PMC's diagnostic function (PMCDGN).
For details, refer to section **1.7 STATUS DISPLAY**.

(Example of display)

JOG : Manual continuous feed (JOG) mode
STEP : Manual handle/Step feed (HANDLE/STEP)
MDI : Manual data input (MDI) mode
AUTO : Automatic operation (Memory) mode
EDIT : EDIT (Memory edit) mode

<Mode select signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1

	MD4	MD2	MD1
Manual continuous (JOG) mode	1	0	1
Manual handle/Step feed (HANDLE/STEP) mode	1	0	0
Manual data input (MDI) mode	0	0	0
Automatic operation (AUTO) mode	0	0	1
EDIT (Memory edit) mode	0	1	1
TEACH IN STEP/HANDLE	1	1	1
TEACH IN JOG	1	1	0

(2) Check diagnostic data 000 to 025 of the CNC Check an item for which 1 is displayed

No.	Message	Display
000	WAITING FOR FIN SIGNAL	: 0
001	MOTION	: 0
002	DWELL	: 0
a. 003	IN–POSITION CHECK	: 0
004	FEEDRATE OVERRIDE 0%	: 0
b. 005	INTERLOCK (Example)	: 1
010	PUNCHING	: 0
011	READING	: 0
012	WAITING FOR (UN) CLAMP	: 0
c. 013	JOG FEEDRATE OVERRIDE 0%	: 0
d. 014	WAITING FOR RESET, ESP, RRW OFF	: 0
015	EXTERNAL PROGRAM NUMBER SEARCH	: 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 diagnostic number. (It is 1 in the following condition)

DGN 0300 $\boxed{\text{Position Error}}$ >PARAM 1826 $\boxed{\text{In–positio width}}$

1 Check the parameters according to the parameter list

1825	Servo loop gain per axis (Normal : 3000)

2 Servo system may be abnormal. Refer to alarm 400, 410, and 411.

b. Interlock 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					DIT	ITX	HITL	ITL

#0 ITL=0 shows interlock signal *IT is effective. To 1
#1 HITL = 1 shows interlock signal *RILK is effective. To 2
#2 ITX=0 shows interlock signal *ITn is effective. To 3
#3 DIT=0 shows interlock signal ±MITn is effective. To 4
Check state of effective interlock signals using the diagnostic function (PMCDGN) of the PMC.

1 Interlock signal (*IT) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0008								*IT

*IT=0 shows that interlock signal is input.

2 High–speed interlock signal (*RILK) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
X0000 or X1000		*RILK						

*RILK = 0 shows interlock signal is input.

3 Axis interlock signal (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130							*IT2	+IT1

*ITn=0 shows interlock signal is input.

4 Interlock signal per axis and direction (+/– MITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0132							+MIT2	+MIT1
G0134							–MIT2	–MIT1

±MITn=1 shows interlock signal per axis and direction is input.

c. Jog feedrate override is 0%

Check the signals using PMC's diagnostic function (PMCDGN)

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0
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%

d. Power Mate is in a reset state

In this case, RESET is also displayed on the status display. Check it using the procedure of 1 above.

2. When machine coordinate value does not update on position display

(1) Machine lock signal (MLK) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0044							MLK	

MLK : All axes machine lock
When the signal is 1, the corresponding machine lock signal is input.

8.4 JOG OPERATION CANNOT BE DONE

Points

(1) Check whether position display is operating.

(2) Check status display

(3) Check internal status using Diagnostic funciton

Causes and Remedies

1. Position display (relative, absolute, machine cooordinate) does not change

(1) Check mode selection status (JOG mode is not selected)

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 PMC's diagnostic function (PMCDGN).

<Mode select signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1

	MD4	MD2	MD1
Manual operation (JOG) mode	1	0	1

(2) Feed axis and direction select signal is not input Check the signal using PMC's diagnostic function (PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0100							+J2	+J1
G0102							–J2	–J1

Example)

When +X button is pressed on the operator's panel, signal+J1 turns to 1. This signal is effected at its rise. If axis selection signal is input before JOG mode is selected, axis movement does not occur. Turn the signal to off, then on.

(3) Check CNC's diagnostic function 000 to 015. Check the items for which 1 is displayed at right side.

	No.	Message	Display
	000	WAITING FOR FIN SIGNAL	: 0
	001	MOTION	: 0
	002	DWELL	: 0
a.	003	IN–POSITION CHECK	: 0
	004	FEEDRATE OVERRIDE 0%	: 0
b.	005	INTERLOCK (Example)	: 1
	010	PUNCHING	: 0
	011	READING	: 0
	012	WAITING FOR (UN) CLAMP	: 0
c.	013	JOG FEEDRATE OVERRIDE 0%	: 0
d.	014	WAITING FOR RESET, ESP, RRW OFF	: 0
	015	EXTERNAL PROGRAM NUMBER SEARCH	: 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 diagnostic number. (It is 1 in the following condition)

DGN 0300 $\boxed{\text{Position Error}}$ >PARAM 1826 $\boxed{\text{In–positio width}}$

1 Check the parameters according to the parameter list

1825	Servo loop gain per axis (Normal : 3000)

2 Servo system may be abnormal. Refer to alarm 400, 410, and 411.

b. Interlock 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
PARAM	3003					DIT	ITX	HITL	ITL

#0 ITL=0 shows interlock signal *IT is effective. To 1
#1 HITL = 1 shows interlock signal *RILK is effective. To 2
#2 ITX=0 shows interlock signal *ITn is effective. To 3
#3 DIT=0 shows interlock signal ±MITn is effective. To 4
Check state of effective interlock signals using the diagnostic function (PMCDGN) of the PMC.

1 Interlock signal (*IT) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0008								*IT

*IT=0 shows that interlock signal is input.

2 High–speed interlock signal (*RILK) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
X0000 or X1000		*RILK						

*RILK = 0 shows interlock signal is input.

3 Axis interlock signal (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130							*IT2	+IT1

*ITn=0 shows interlock signal is input.

4 Interlock signal per axis and direction (± MITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0132							+MIT2	+MIT1
G0134							–MIT2	–MIT1

±MITn=1 shows interlock signal per axis and direction is input.

c. Jog feedrate override is 0%

Check the signals using PMC's diagnostic function (PMCDGN)

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0
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%

d. NC is in a reset state

In this case, RESET is also displayed on the status display. Check it using the procedure of 1 above.

(4) Jog feed rate setting (Parameter) is not correct

1423	Jog feedrate per axis

(5) Check whether a torque limit is in effect.

8.5 HANDLE OPERATION (MPG) CANNOT BE DONE

Points

(1) Check another manual operation (JOG) is accepted.

(2) Check status display

Causes and Countermeasure

1 JOG operation is not acceptable, either

Consult with Sec. 8.3 and 8.4.

2 When only handle operation cannot be done

(1) Check CNC status display at lower left corner of the CRT
(Refer to **1.7 STATUS DISPLAY** for details)
When the status display shows STEP, mode selection is correct.
If it is not STEP, mode select signal is not input correctly. Check the mode select signal using the PMC's diagnostic function(PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1

↓ ↓ ↓

Manual handle mode						1	0	1

(2) Manual handle feed axis select signal is not input
Check the signals using PMC's diagnostic function (PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0018			HS2B	HS2A		HS1C	HS1B	HS1A

When axis select switch for manual pulse generator is selected on the machine operator's panel, if the signals are input as follows, it is normal.

Selected axis	HSnB	HSnA
no selection	0	0
1st axis	0	1
2nd axis	1	0

n represents the manual pulse generator (MPG) number.

(3) Magnification selection of manual handle feed is not correct

Check the following signals using PMC's PCDGN. Also confirm the following parameters based on the parameter list.

	#7	#6	#5	#4	#3	#2	#1	#0
G0019			MP2	MP1				

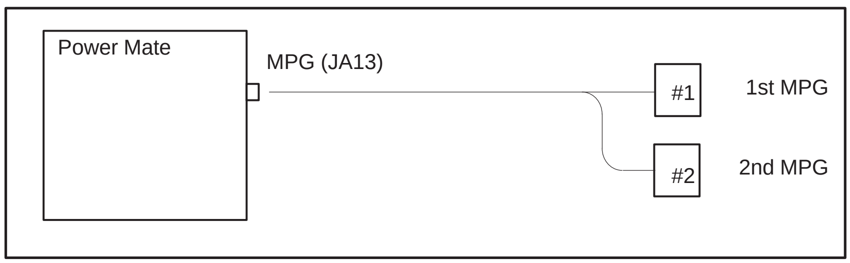
MP1	MP2	Multiplication
0	0	×1
0	1	×10
1	0	×m
1	1	×n

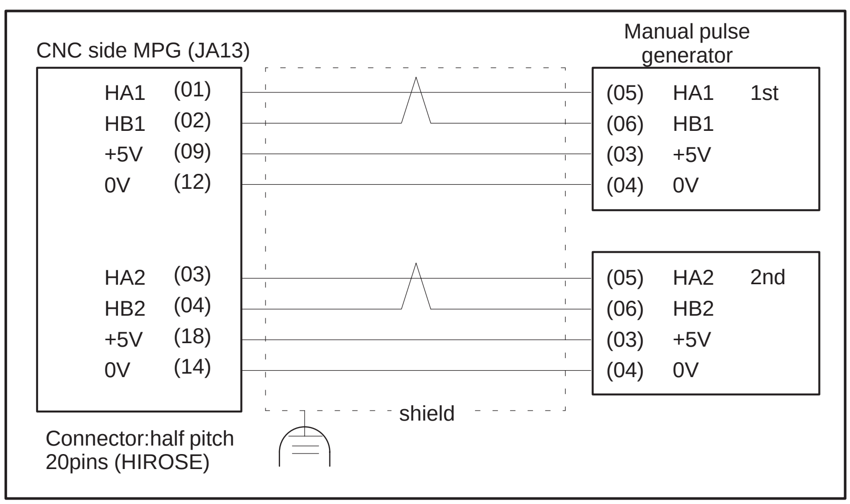
7110	Number of manual pulse generators used (1 to 2)
7113	Magnification of manual handle feed m(1 to 127)
7114	Magnification of manual handle feed n(1 to 1000)

(4) Checking manual pulse generator

(a) Incorrect of cable

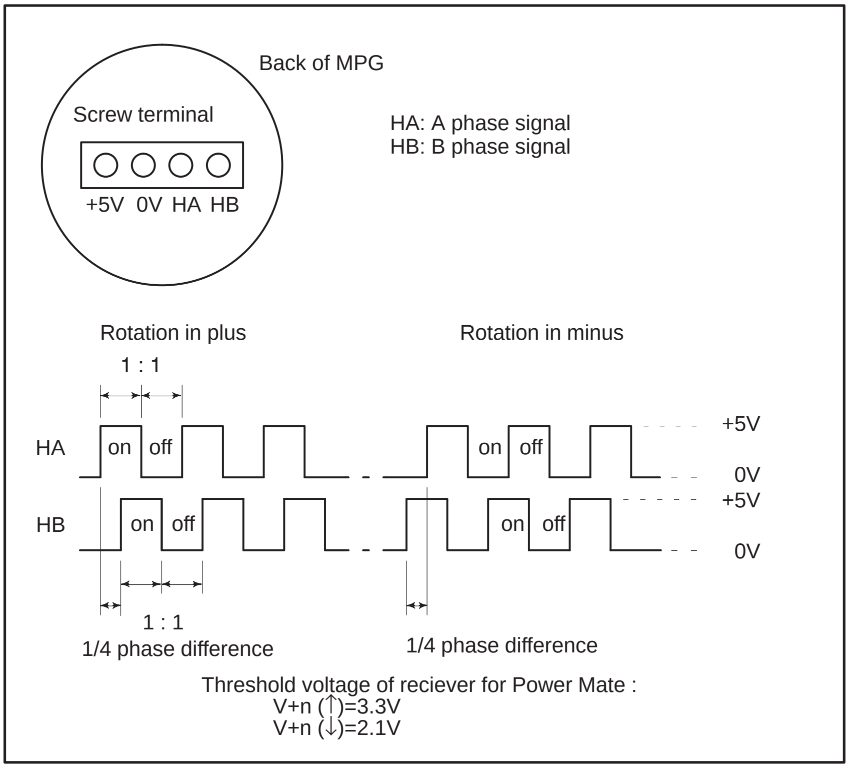
Check disconnection of cable or short circuit.





(b) Manual pulse generator is faulty

When you rotate the MPG, the following signal is output. Measure the signal with synchroscope at screw terminal on back of MPG. If no signal is output, measure +5V voltage.



Check on and off ratio and phase difference of HA and HB.

(5) Check of the torque limit

Check whether a torque limit is in effect.

8.6 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 Power Mate.

Causes and Remedies

When manual operation is either impossible, perform countermeasure, based on the previous item ”Jog operation cannot be done”.
Confirm that a correct mode is selected according to the mode select status of Power Mate 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 CRT.

(1) Mode select signal is not correct.

When the mode select signal is input correctly, following status display is done.
MDI :Manual data input mode (MDI)
AUTO :Automatic operation mode
RMT :Remote operation mode

If status display does not show a correct status, check the mode signal with following diagnosis function of PMC side (PMCDGN).

	#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 (MDI)
0	0	0	1	Memory operation mode (AUTO)
1	0	0	1	Remote operation mode

(2) Cycle start signal is not input

This signal turns 1 when cycle start button is pressed and turns 0 when it is released. The cycle start actuates when it changes from 1 to 0. Check the state of the signal using PMC's diagnostic function(PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0007						ST		

#2 (ST) : Cycle start signal

The cycle is allowed to start by setting of parameter (No.3001#1) when it changes from 1 to 0.

(3) Feed hold signal is input

Under normal state, the feed hold signal is 1 when the feed hold button is not pressed.
Check the state of this signal using the PMC's diagnostic function (PMCDGN) .

	#7	#6	#5	#4	#3	#2	#1	#0
G0008			*SP					

#5 (*SP) : Feed hold signal

2. When an automatic operation is in progress (Cycle start LED is lit)

Power Mate’s status display shows “STRT” on the CRT.

(1) Check the contents of diagnostic nos. 000 to 015.

	No.	Message	Display
a.	000	WAITING FOR FIN SIGNAL (Example)	: 1
b.	001	MOTION	: 0
c.	002	DWELL	: 0
d.	003	IN–POSITION CHECK	: 0
e.	004	FEEDRATE OVERRIDE 0%	: 0
f.	005	INTERLOCK	: 0
g.	006	SPINDLE SPEED ARRIVAL CHECK	: 0
	010	PUNCHING	: 0
	011	READING	: 0
	012	WAITING FOR (UN) CLAMP	: 0
h.	013	JOG FEEDRATE OVERRIDE 0%	: 0
i.	014	WAITING FOR RESET, ESP, RRW OFF	: 0
	015	EXTERNAL PROGRAM NUMBER SEARCH	: 0

Items with a to i relate with an automatic operation and their details are as follows :

a. An auxiliary function is being executed (waiting for FIN signal)

An auxiliary function (M/S/T) specified in a program is not ended.
Check according to the following procedure.
At first, confirm the kind of interface of an auxiliary function.

	#7	#6	#5	#4	#3	#2	#1	#0
3001	MHI							

#7(MHI) 0 : M/S/T is of normal interface.
1 : M/S/T is of high–speed interface.

1 Normal interface

When the auxiliary function finish signal turns from 1 to 0, the auxiliary function is supposed to be ended and the next block is read for operation. Confirm the status of this signal using PMC’s diagnostic function(PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0004					FIN			

#3 (FIN) : Auxiliary function finish signal

2 High–speed interface

The auxiliary function is supposed to be ended when the signals are in the following state. Confirm it using PMC’s diagnostic function (PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0005					TFIN	SFIN		MFIN

#0(MFIN) : M function finish signal
#2(SFIN) : S function finish signal
#3(TFIN) : T function finish signal

	#7	#6	#5	#4	#3	#2	#1	#0
F0007					TF	SF		MF

#0(MF) : M function strobe signal
#2(SF) : S function strobe signal
#3(TF) : T function strobe signal

Signal	End state	
Finish signal	0	1
store signal	0	1

b. Travel command is being executed

CNC is reading an axis command (X,Y,Z,...) in a program and giving the command to the axis.

c. A dwell command is being executed

CNC is reading a dwell command (G04) in a program and is executing the dwell command.

d. In–position check (confirming positioning) is being done

Positioning (G00) to a specified position of a specified axis is not completed.
Whether positioning is completed or not is checked as the servo position error amount. Check it CNC's diagnostic function as follows:

DGN no.300 $\boxed{\text{Position Error}}$ > PARAM 1826 $\boxed{\text{In–position width}}$

Position error amount almost becomes 0, when positioning of an axis completes and when the amount becomes within the in–posiiton width, it is assumed that positioning completes and the next block is exected.
If position error amount does not become within the in–position width, refer to servo alarm 400, 410 and 411.

e. 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 diagnostic function (PMCDGN).

<Normal 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	254%
:	:
1 0 0 1 1 0 1 1	100%
:	:
0 0 0 0 0 0 0 1	1%
0 0 0 0 0 0 0 0	0%

f. Interlock signal or start lock signal is input

There are a plural number of interlock functions. Parameters are set by machine tool builders for which interlock function is used.
Therefore, confirm the following parameters at first:

	#7	#6	#5	#4	#3	#2	#1	#0
3003					DIT	ITX	HITL	ITL

#0 (ITL) 0 : Interlock signal(*IT) is valid. To 1
#1 (HITL) 1 : shows interlock signal *RILK is effective. To 2
#2 (ITX) 0 : Interlock signal (*ITn) is valid. To 3
#3 (DIT) 0 : Interlock signal (± MITn) is valid. To 4

Confirm which interlock signal is activated by the PMC's diagnostic function (PMCDGN) .

1 Interlock signal (*IT) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0008								*IT

#0 (*IT) : When this bit is 0, interlock signal is input.

2 High–speed interlock signal (*RILK) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
X0000 or X1000		*RILK						

*RILK = 0 shows interlock signal is input.

3 Interlock signal per each axis (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130							*IT2	*IT1

***ITn** When the bit is 0, the corresponding axis's interlock signal is input.

4 Interlock signal per axis and direction(± MITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0132							+MIT2	+MIT1
G0134							–MIT2	–MIT1

± MITn Interlock signal is input to the corresponding axis and direction with the signal being 1.

5 Controlled axis detach function is running. A detached axis is specified for travelling.

*This function is valid when Power Mate parameter RMB No.1005#7=1. For whether this function is running or not, confirm the following signal using PMC's diagnostic function (PMCDGN). Check the axis concerned.

	#7	#6	#5	#4	#3	#2	#1	#0
F0110							MDTCH2	MDTCH1

When signal MDTHn is "1" ,the axis detach function is in valid.
The control axis detach function becomes valid by the following signal issued from the PMC or a Power Mate side parameter. Check as in the following procedure :

1) The control axis detach signal (DTCHn) is input.

	#7	#6	#5	#4	#3	#2	#1	#0
G0124							DTCH2	DTCH1

If it is 1, the corresponding axis is detached.

2) The following parameter enables the control axis detach function to the corresponding axis.

	#7	#6	#5	#4	#3	#2	#1	#0
0012	RMVx							

#7(RMVx) 0 : Controlled axis is connected
1 : Controlled axis is detached

g. 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 diagnostic function (PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0029				SAR				

#4(SAR) : When this signal is 0, spindle speed does not arrive at the specified speed.
This function is valid when PARAM SAR (3708#0)=1.

h. 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 auomatic 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							

#7(DRN) : Dry run signal is input with this signal being 1.

1410	Dry run rate for each axis	[mm/min]

The rate when the following override value is 100%.

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	+JV3	*JV2	*JV1	*JV0
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%

i. Power Mate is in a reset state

In this case, the CNC's status display shows RESET. Refer to item 1.

(1) Only rapid traverse in positioning (G00) does not function Confirm the following parameter and signals from the PMC.
(a) Setting value of rapid traverse rate

1420	Rapid traverse rate for each axis	[mm/min]

(b) Rapid traverse override signals

	#7	#6	#5	#4	#3	#2	#1	#0
G0014							ROV2	ROV1

ROV1	ROV2	Override
0	0	100%
1	0	50%
0	1	25%
1	1	Fo

1421	Rapid traverse override F0 rate	[mm/min]

(2) Only feed (other than G00) does not function

(a) Maximum feed rate set by parameter is incorrect.

1422	Maximum feedrate	[mm/min]

Feed rate is clamped at this upper feed rate.

(b) Feedrate is specified by feed per revolution (mm/rev)

1) Position coder does not rotate

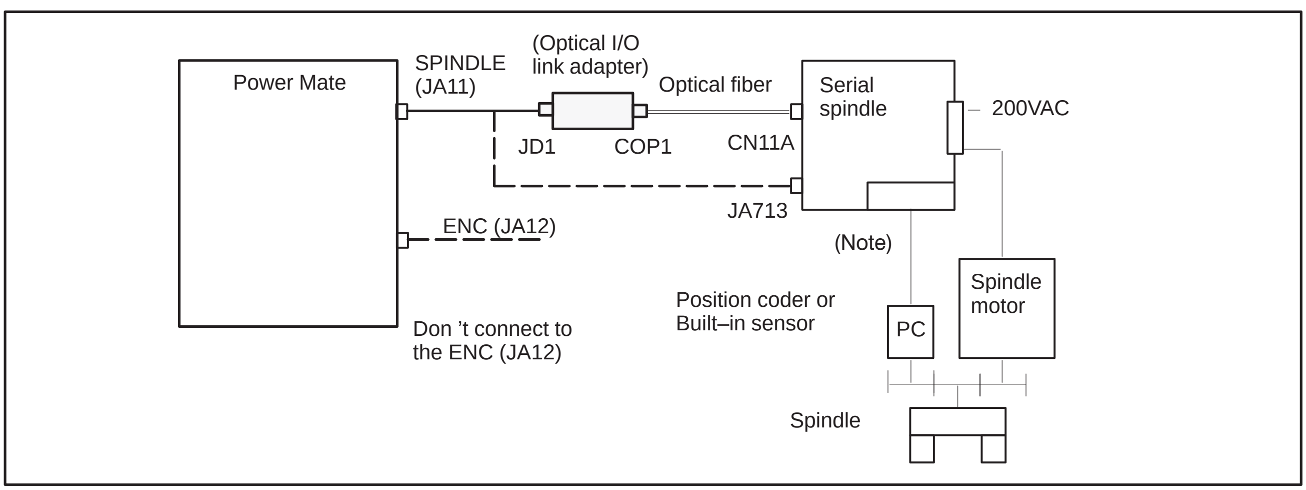
Check the connection between spindle and position coder
The following failure is considered:

- Timing belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened

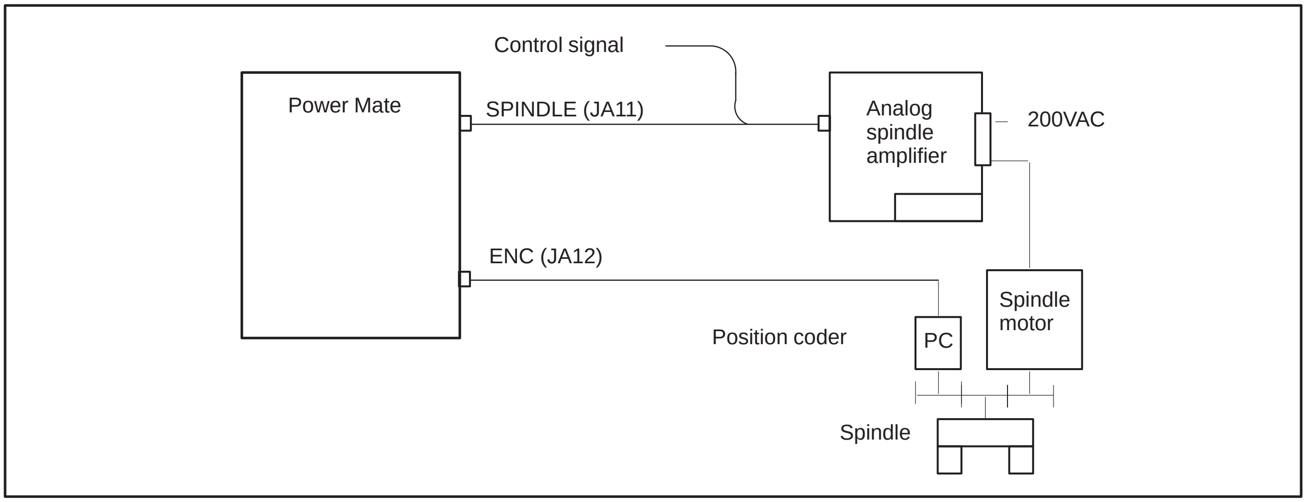
2) Position coder is faulty

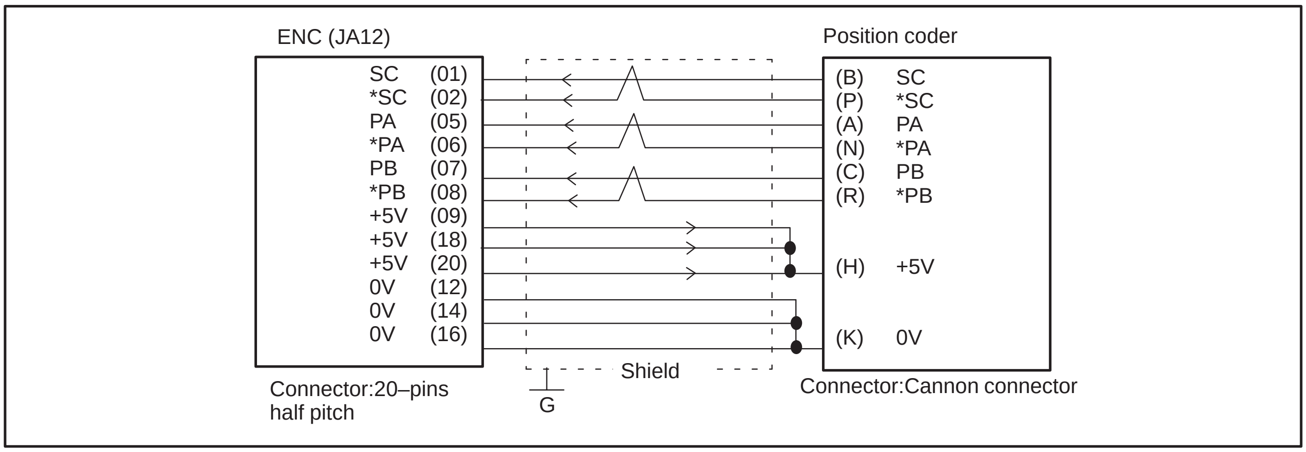
Position coder is connected to the spindle amplifier when serial interface spindle is used or connected to the CNC when analog interface spindle is used.
For details of connection, refer to the following.

<Serial interface spindle amplifier>



<Analog interface spindle amplifier>





8.7 CYCLE START LED SIGNAL HAS TURNED OFF

Points

(1) After cycle operation is started, then stopped, check as follows:

(2) Confirm cycle start LED on machine operator's panel.

(3) Confirm Power Mate's diagnostic function

Causes and Remedies

The reason why cycle start LED signal (STL) has turned off are displayed on Power Mate's diagnostic numbers 020 to 025 as follows:

		a	b	c	d	e	f	g
020	CUT SPEED UP/DOWN	1	0	0	0	1	0	0
021	RESET BUTTON ON	0	0	1	0	0	0	0
022	RESET AND REWIND ON	0	0	0	1	0	0	0
023	EMERGENCY STOP ON	1	0	0	0	0	0	0
024	RESET ON	1	1	1	1	0	0	0
025	STOP MOTION OR DWELL	1	1	1	1	1	1	0

a. Emergency stop signal
b. External reset signal
c. Reset button on MDI
d. Reset & rewind signal
e. Servo alarm
f. Feed hold by switching mode
g. Single block stop

Details of signals a to g are as follows:
Confirm the signals concerned using diagnostic function (PMCDGN).

a. Emergency stop is input

1 When Built–in I/O is used :

	#7	#6	#5	#4	#3	#2	#1	#0
X1000				*ESP				

	#7	#6	#5	#4	#3	#2	#1	#0
G0008				*ESP				

***ESP=0** : Emergency stop signal is input :

2 When input from Buit–in I/O card :

	#7	#6	#5	#4	#3	#2	#1	#0
X0000				*ESP				

	#7	#6	#5	#4	#3	#2	#1	#0
G0008				*ESP				

***ESP=0** : Emergency stop signal is input :

b. External reset signal is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0008	ERS							

#7(ERS) : When the bit is 1, external reset signal is input.
This signal is usually used for a confirmation signal of M02 when an M02 is specified in a program as the end of a program.
Therefore, when M02 is executed, this signal is input.

c. Reset button on the MDI is pressed

An automatic operation is put into a reset status when RESET key on the MDI panel is pressed.

d. Reset & rewind signal is input

	#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 is usually used for a confirmation signal of M30 when an M30 is specified in a program as the end of a program.
Therefore, when M30 is executed, this signal is input.

e. Servo alarm has generated

When any servo alarm has generated, cycle operation is put into the reset state and operation stop.

f. Cycle operation is in a feed hold state

The cycle operation becomes feed hold state in the following cases:

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

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	0
	Handle/Step	1	0	1
	TEACH IN STEP	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. It become single block stop during automatic operation

	#7	#6	#5	#4	#3	#2	#1	#0
G0046							SBK	

#1(SBK) When this signal is 1, the single block signal is input.

8.8 WHEN MANIPULATION IS NOT POSSIBLE WITH THE CRT/MDI

Points

Check whether it is a trouble of display or a trouble of the system.

Judgement of the point

Check the STATUS LED on the controller shows the following state.

EW (green)	ON
WD (red)	OFF
S0.SI	–

If the status shows the above state, the system is normal.
Therefore, display system may be faulty.
If you have a DPL/MDI, check whether it can be used to manipulate the system.
If the status shows other state, a hardware other than the display system may be troublesome.
If the message ”WAITING FOR CRT DATA” appears on the CRT/MDI unit, it indicates that the CRT/MDI unit has started normally.

Causes and remedies

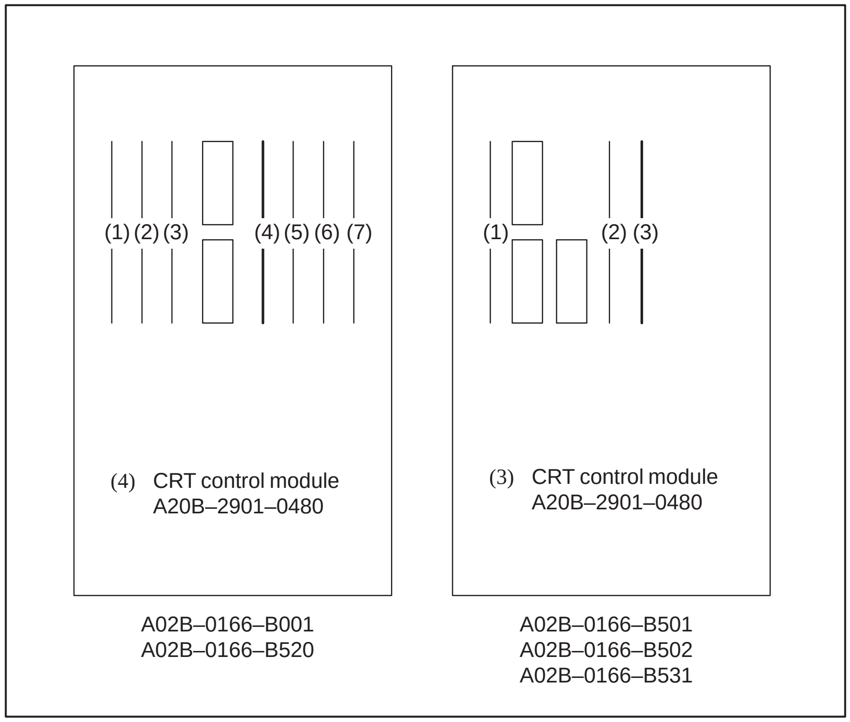
1. When the display system is in toruble

(1) Confirmation item
Determine which of the following problems are evident.

1. Nothing is displayed on the CRT/MDI unit.
2. Only the message ”WAITING FOR CRT DATA” appears on the CRT/MDI unit.
3. A position display appears on the CRT/MDI unit, and the keys are ineffective.

(2) Causes and remedies

1. If nothing is displayed on the CRT/MDI unit.
   - The power being supplied to the CRT/MDI unit is abnormal (check the power supply).
   - The CRT/MDI unit is defective (replace the CRT/MDI unit).
2. If only the message ”WAITING FOR CRT DATA” appears on the CRT/MDI unit.
   - Incorrect cable connection (correct)
   - Defective cable (repair or replace)
   - Defective CRT control module (replace)
   - No CRT control module installed (install)
   - Touch panel connection module or HSSB connection module installed in place of the CRT control module (install the CRT control module)
   - Incorrect setting of rotary switches RSW and MTSW (correct the setting)
3. A position display appears on the CRT/MDI unit, and the keys are ineffective.
   - DPL/MDI left connected (remove)
   - Defective cable (repair or replace)

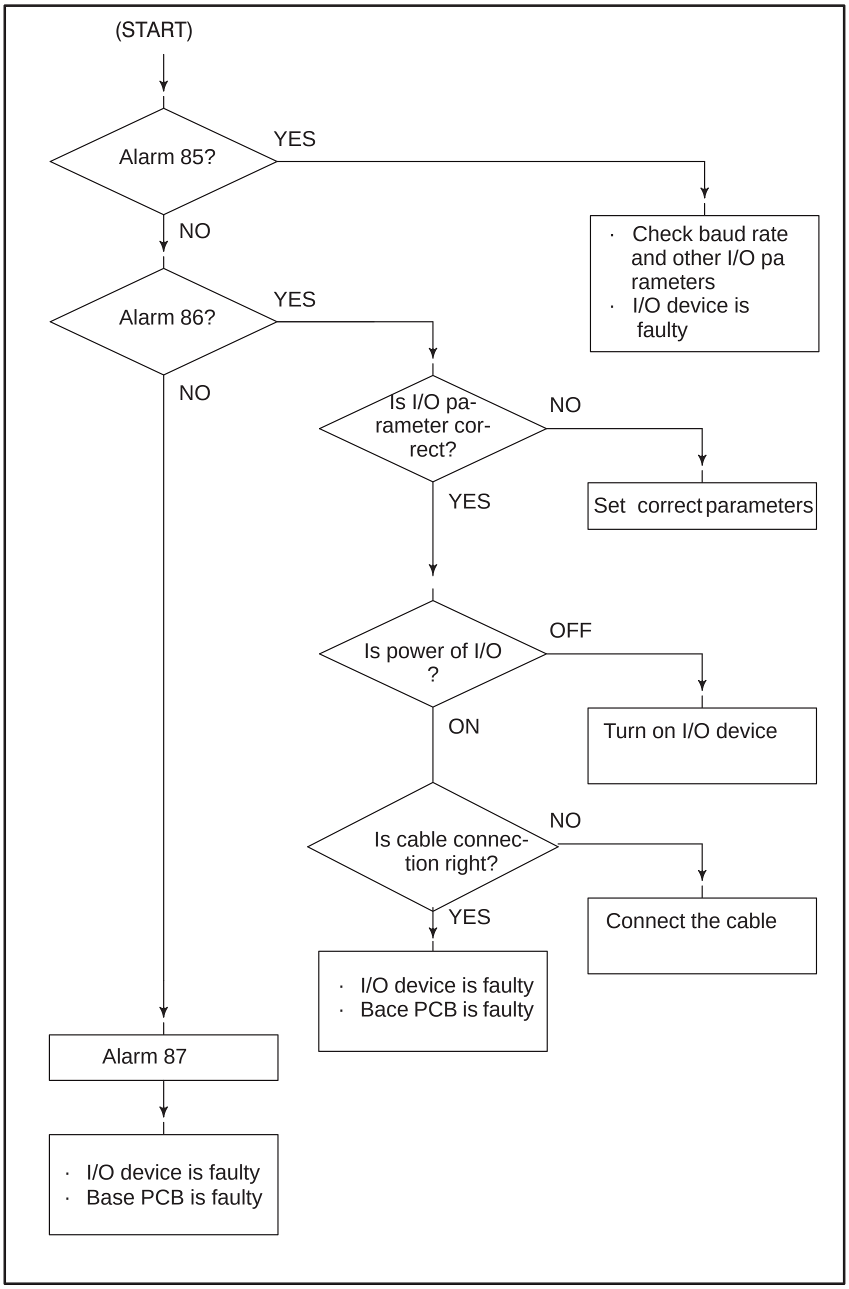


2. When system is in trouble

EN (green)	ON
WD (red)	OFF

When STATUS LED on the controller is other than above, check identify the trouble and make an appropriate action. See Sec. 2.4 for LED display.

8.9 ALARM 85 TO 87 (READER/PUNCHER INTERFACE ALARM)



Causes

(a) Parameters on reader/puncher interface are not correct.

(b) External I/O device or host computer is faulty.

(c) Cable between Power Mate and I/O device is faulty.

(d) Power Mate base PCB is faulty.

Countermeasures

(a) Parameters on reader/puncher interface are not correct.
Check the following setting data and parameters:
<Setting>
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 86 will generate.

Parameter

Function \ Value of parameter 0020	0	1
Feed	0101#7	0111#7
Data input code	0101#3	0111#3
Stop bit	0101#0	0111#0
Type of I/O device	102	112
Baud rate	103	113
Communication method	RS–232C	

Numbers in the table indicate parameters and bit numbers.
Example) 101#7:bit7 of parameter 101.

	#7	#6	#5	#4	#3	#2	#1	#0
0101 / 0111	NFD				ASI			SB2

#7(NFD) 0 : Feed is output before and after data in data output (FANUC PPR)
1 : Feed is not output (standard).

#3(ASI) 0 : Data input code is EIA or ISO (automatic recognition)
1 : Data input code is ASCII.

#0(SB2) 0 : No. of stop bits is 1.
1 : No. of stop bits is 2.

0102 / 0112	Type of I/O device

Value	TYPE OF I/O DEVICE
0	RS–232–C (control codes DC1 to DC4 are used)
1	Not used
2	FANUC CASSETTE F1 (Old type FLOPPY CASSETTE ADAPTOR)
3	FANUC PROGRAM FILE Mate, FANUC FLOPPY CASSETTE ADAPTOR, FANUC SYSTEM P–MODEL H, FANUC Handy File
4	Not used
5	Not used
6	FANUC SYSTEM P–MODEL G, FANUC SYSTEM P–MODEL H

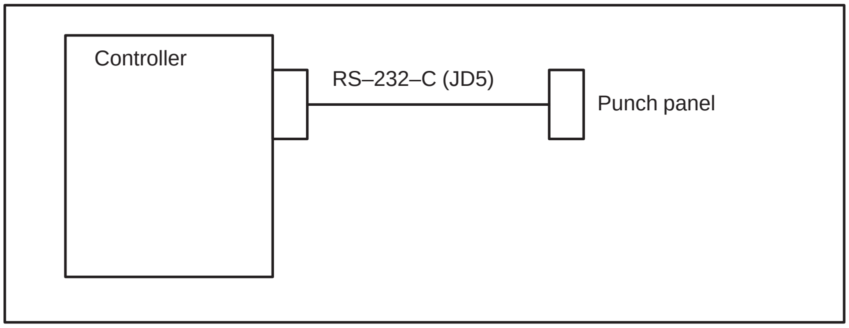
0103 / 0113	Baud rete

Value	Baud rate
7	600
8	1200
9	2400

10	4800
11	9600
12	19200

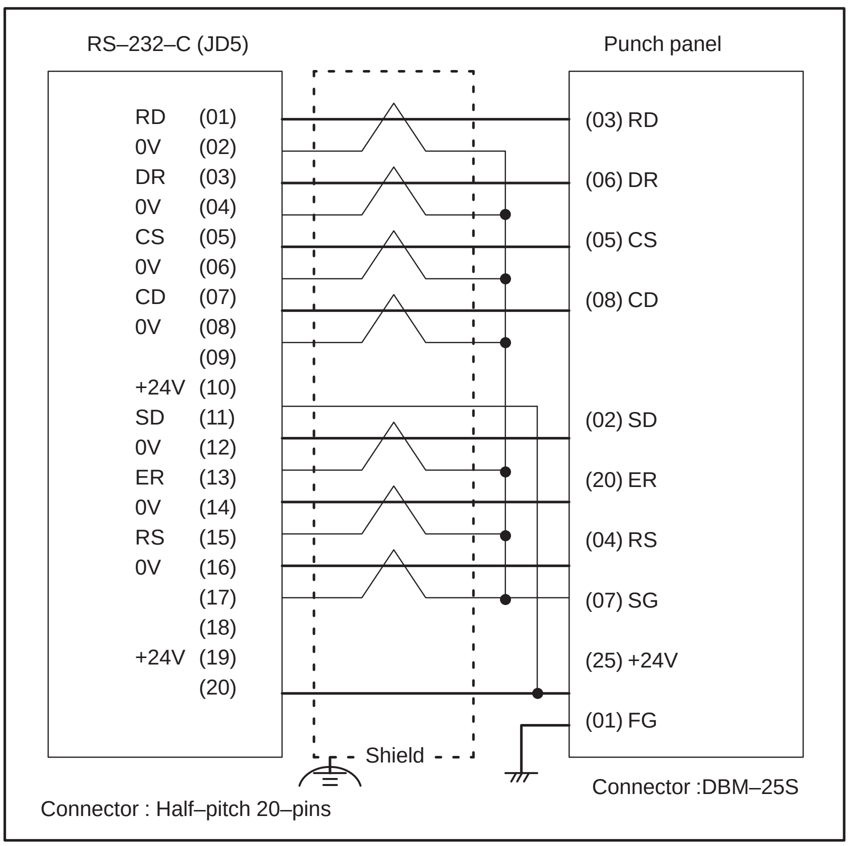
(b) External I/O device or Host computer is in trouble
   (i) Check whether the setting on communication of external I/O device or host computer is the same as that of the Power Mate. (baud rate, stop bits, etc.) If they are not the same, change the setting.
   (ii) When spare I/O device presents, check whether it is possible to realize communication using the spare I/O device.

(c) Cable between Power Mate and I/O device is faulty.
   Check the cable for disconnection or wrong connection.



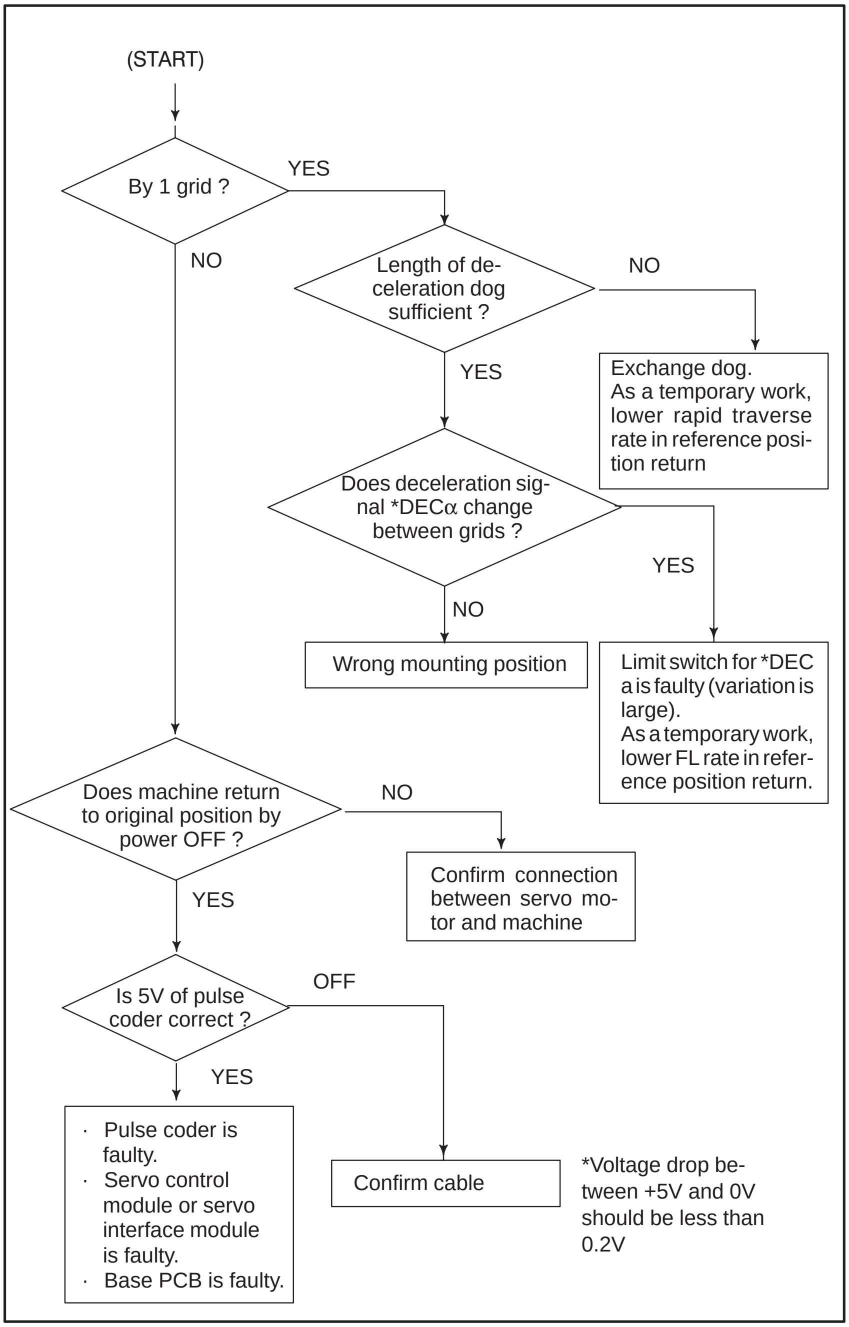
(d) Power Mate base PCB is faulty.
   Replace the power Mate unit.

< Cable connection>



NOTE
When CS is not used, connect it to RS.
Always use a twisted pair cable.

8.10 REFERENCE POSITION DEVIATES



8.11 ALARM 90 (REFERENCE POSITION RETURN IS ABNORMAL)

Contents

An attempt was made to return to the reference position without satisfying the condition that, when the tool is moving toward the reference position with a positional deviation (DGN. 300) of 128 or more pulses, at least a one–turn signal is received.
Moreover, for the α absolute pulse coder, a reference position return was attempted without first turning the power off then on again after rotating the motor one turn when the system is started, or when the battery is replaced in response to a battery zero alarm.

Countermeasures

(START)

α absolute pulse?

YES

Ensure that, after the occurrence of a battery alarm (306), the battery was restored to its normal state, the motor was rotated through at least one turn, and that the power was turned off then on again.

Was the motor rotated through at least one turn, and was the power turned off then on again?

YES

NO

Rotate the motor through at least one turn, then turn the power off then on again.

NO

Check whether position gain is greater than 128 pulses (DGN 300) before or during reference position return.

Position error amount : 300

128 or more

YES → (1) Next page

NO

Raise the speed

Check feed rate command:

PRM	1420	F :	Rapid traverse rate	(mm/min)
PRM	1424		Manual rapid traverse rate	(mm/min)
PRM	1825	G :	Servo loop gain	(0.01sec–1)

$$\text{Position error} = \frac{F \times 5000/3}{G \times \text{detection unit } [\mu m/\text{PLUSE}]}$$

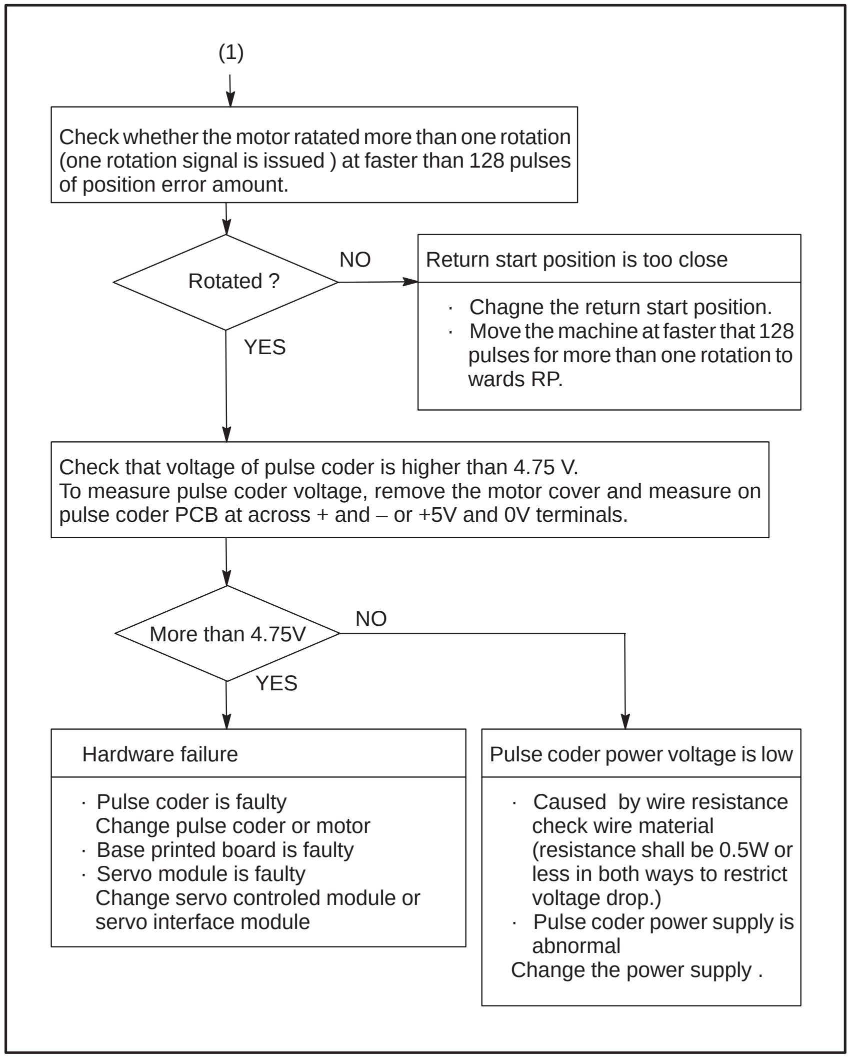
Detection unit : Move amount to a command pulse (usually 1µm)
In metric machine, if the no. of digits below decimal point is 4 on the position display screen, detection unit is 0.1 mm.

Check rapid traverse override signals :

ROV1	DGN	G14.0
ROV2	DGN	G14.1
PRM	1421	Fo rate

ROV1	ROV2	Override
0	0	100%
1	0	50%
0	1	25%
1	1	Fo rate

Check reference position return deceleration signal
DEC1 DEC2
DGN X000.5, X001.5 when a built–in I/O card is used
DGN X1000.5, X1001.5 when a built–in I/O card is not used
When reference position return is started from deceleration signal 0, feed rate becomes FL rate.
PRM 1425 FL rate



CAUTION

1 After the pulse coder or motor is exchanged, reference position or machine's standard point may be different from former one. Please set it correctly.

2 When the base printed board is exchanged, all the data stored in memory is lost. Reset all the data again, referring to the data input/output item.
The data includes reference position information. Reference position setting must also be performed, therefore.

- **Reference**

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.

8.12 ALARM 300 (REQUEST FOR REFERENCE POSITION RETURN)

Absolute position data in the serial pulse coder was lost.
[This alarm occurs if the serial pulse coder is replaced, the position feedback signal line is removed from the serial pulse coder, the battery or its cable is removed, or parameters are loaded into the Power Mate as a batch.]

Remedies

Machine position must be memorized using the following method:

If a battery alarm (306) occurs in the α pulse coder, recover the normal battery status, rotate the motor through at least one turn, then turn the power off then on again.

- **When dog reference position return function is present**

(1) Execute manual reference position return only for an axis for which this alarm was generated.

(2) Press RESET key at the end of reference position return to release the alarm.

- **When dog reference position return function is not present**

Execute dogless reference position setting to memorize the reference position.

- **When serial pulse coder is changed**

Since the reference position is different from the former one, change the grid shift value (PRM 1850) to correct the position.

Related parameters

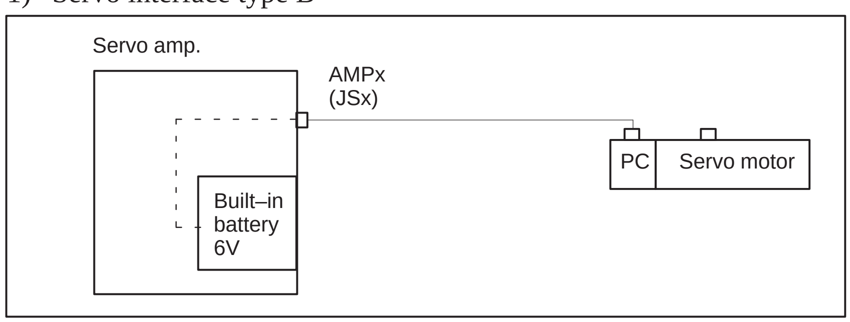
	#7	#6	#5	#4	#3	#2	#1	#0
1815			APC x	APZx				

#5(APCx) 0 : Position detector is incremental pulse coder.
1 : Position detector is absolute pulse coder.

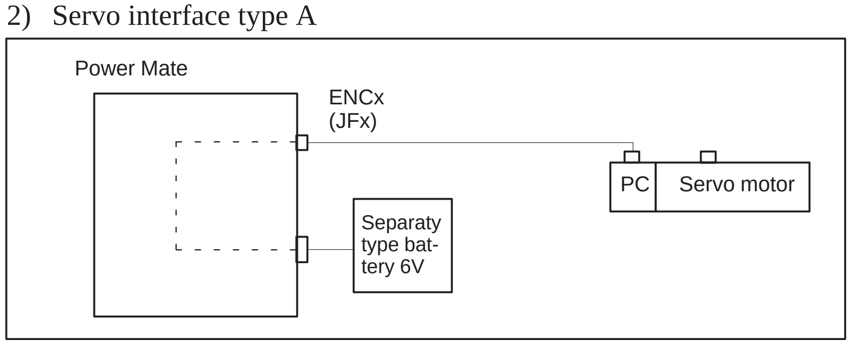
#4(APZx) Reference position of absolute pulse coder is :
0 : not established
1 : established

System configuration

1) Servo interface type B



2) Servo interface type A



8.13 ALARM 301 TO 305 (ABSOLUTE PULSE CODER IS FAULTY)

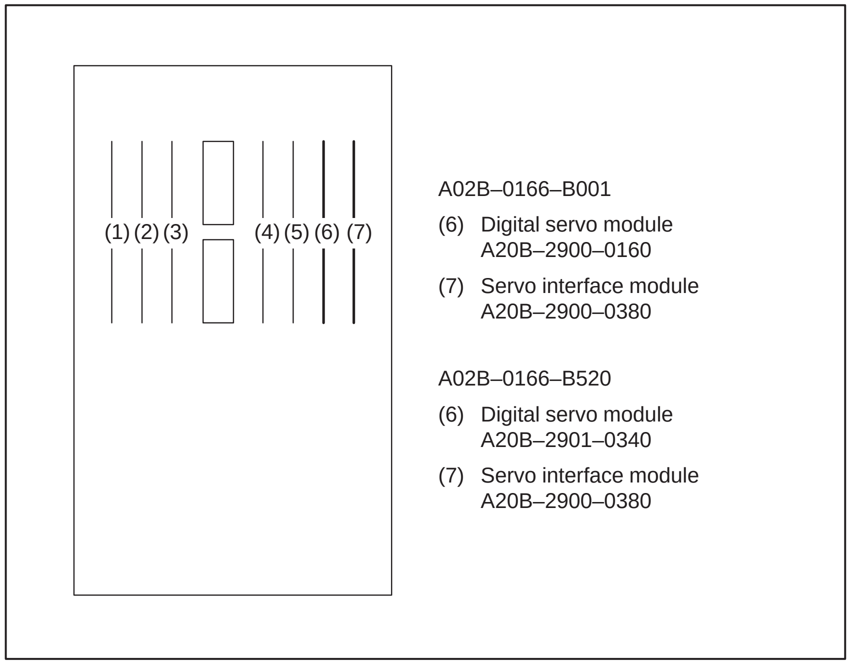
Absolute pulse coder, cable, servo module or base PCB is faulty.

Countermeasures

1 Agitate the cable connected to JSn of servo amplifier or JFn of controler. If an alarm is issued, replace the cable.

2 Replace the base PCB.
(Power Mate–D/B501, B502, B531, Power Mate–F)

3 Replace the servo module (servo controled module, servo interface module). (Power Mate–D/B001, B520)



8.14 ALARM 306 TO 308 (ABSOLUTE PULSE CODER BATTERY IS LOW)

This alarm is generated when absolute pulse coder battery becomes low. If alarm 306 occurs, the reference position has been lost. After replacing the battery, re–set the reference position.

Absolute pulse coder battery replacement

WARNING

When replacing the memory backup batteries, keep the power to the machine (CNC, servo amplifier) switched on, and hold the machine at an emergency stop. Because this work must be carried out while the power is kept switched on and the cabinet is open, only the personnel who have been trained for safety are allowed to engage in the work. When replacing the batteries, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover). If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

Procedure

Replace the batteries in the α series servo amplifier module, the β series servo amplifier, or the separate battery box.

CAUTION

1 When replacing the built–in batteries for the α series servo amplifier module or β series servo amplifier module, keep the power to the servo amplifier switched on.
2 When replacing the batteries in the separate type battery box, keep the power to the NC and servo amplifier switched on.
3 Note that we are not supposed to replace the batteries for the control unit (for memory backup).

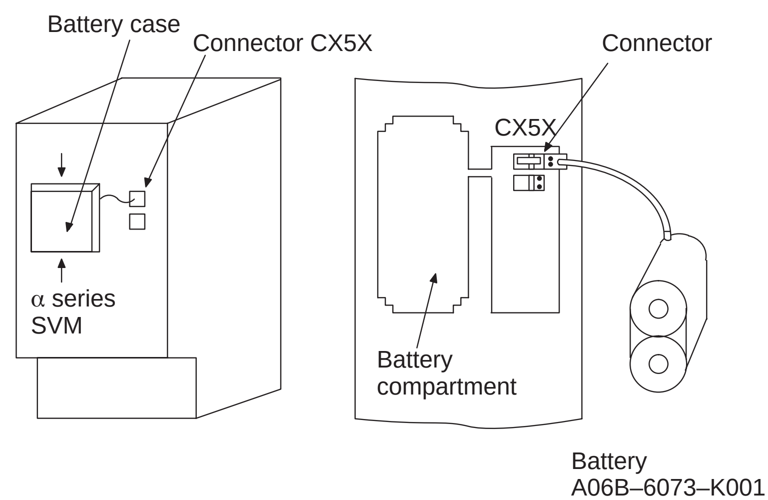
Procedure for replacing batteries for absolute pulse coder (α series servo amplifier module)

1 Prepare lithium battery A06B–6073–K001(*) in advance.

(*) FANUC specification : A98L–0001–0902

2 Turn machine (servo amplifier) power ON.

3 Remove the battery case on the front panel of α series Servo Amp Module (SVM).
The battery case can be removed by holding the top of the case and pulling the case towards you.



4 Remove the connector the battery.

5 Replace the battery , and connect the connector.

6 Attach the battery case.

7 Turn machine (servo amplifier) power OFF.

CAUTION
Replace the batteries for absolute pulse coder when machine (servo amplifier) power is ON.
Replacing the batteries with power OFF causes the absolute position stored in memory to be lost.

Procedure for replacing batteries for absolute pulse coder (β series servo amplifier)

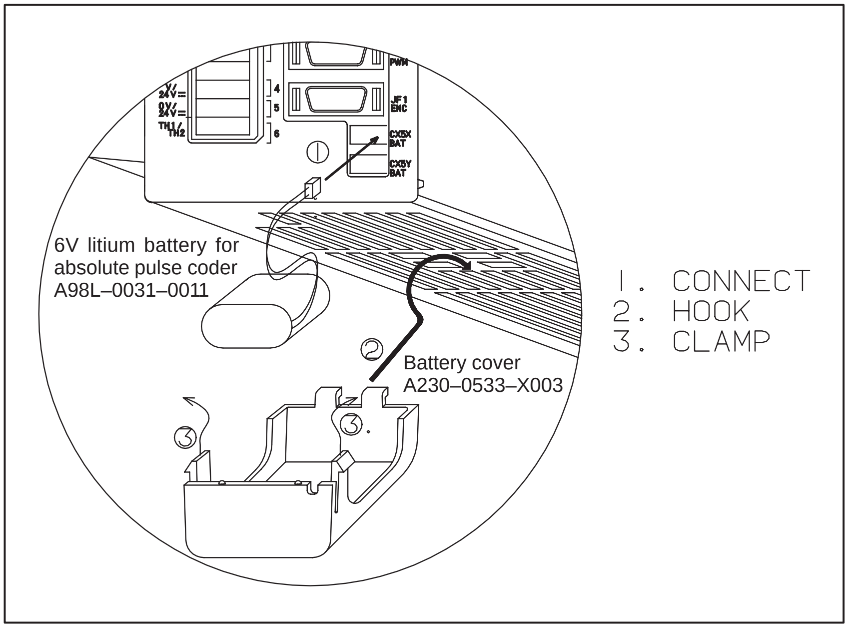
Prepare lithium battery A02B–0168–K111(*) in advance.

(*) FANUC specification: A98L–0031–0011

Procedure

1 Turn machine (servo amplifier) power ON.

2 Remove the battery case from under the β series servo amplifier module by holding the case at both sides and pulling downwards.



3 Remove the connector the battery.

4 Replace the battery, and connect the connector.

5 Attach the battery case.

6 Turn machine (servo amplifier) power OFF.

CAUTION

1 Replace the batteries for absolute pulse coder when machine (servo amplifier) power is ON.
Replacing the batteries with power OFF causes the absolute position stored in memory to be lost.

2 If your machine is equipped with a separate battery case, follow the instructions in 2.6.4

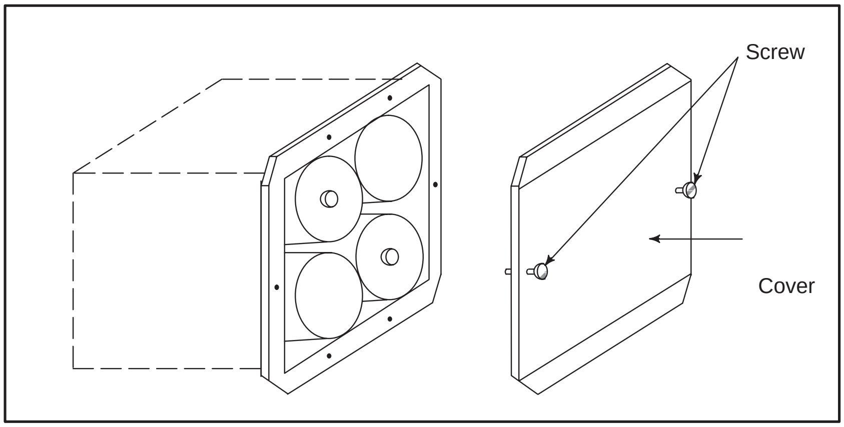
Procedure for replacing separate type batteries for absolute pulse coder

1 Prepare 4 alkaline batteries (UM–1type) commercially available in advance.

2 Turn machine (CNC, sevo amplifier) power ON.

3 Loosen screws on the battery case to remove the cover. For placement of the battery case, refer to the machine tool builder's manual.

4 Replace the batteries in the case. Insert 2 batteries each in the opposite direction as illustrated below.



5 After replacement, install the cover.

6 Turn machine (CNC, sevo amplifier) power OFF

CAUTION
Replace the batteries for absolute pulse coder when machine (CNC, servo amplifier) power is ON.
Replacing the batteries with power OFF causes the absolute position stored in memory to be lost.

8.15 ALARM 350 (SERIAL PULSE CODER IS ABNORMAL)

An error is generated in the control section of the serial pulse coder.

Points

1 Alarm No. 351 has also generated⇒Refer to alarm 351.

2 Only alarm No. 350 has generated⇒Refer to the following Confirm the details by diagnostic number 0202 and 0204.

● When diagnostic number 0202 shows 1

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0202		CSA		PHA	RCA		CKA	SPH

#6(CSA) Check sum alarm has generated.
#4(PHA) Phase data abnormal alarm has generated.
#3(RCA) Speed count abnormal alarm has generated.
#1(CKA) Clock alarm has generated.
#0(SPH) Soft phase data abnormal alarm has generated.

1 Check the contens using the above diagnostic function if the alarm generates repeatedly. If diagnostic data is the same, serial pulse coder may be faulty.⇒Refer to following Caution

2 When diagnostic result does not the same, or other abnormality is detected, an external noise may be generated.

● When diagnostic number 0204 shows 1

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0204				LDA	PMS			

#4(LDA) LED of serial pulse coder is abnormal
#3(PMS) Feedback pulses are not issued correctly.

(1) #4(LDA): LED in the serial pulse coder is abnormal.
Serial pulse coder is faulty⇒Refer to following Caution

(2) #3(PMS): Pulses are not issued correctly by abnormality of feedback cable.

1 Fault of serial pulse coder ⇒Refer to following Caution

2 Feedback cable is faulty.

> **CAUTION**
> Reference position and machine's standard position are different from the ones before, adjust and set them correctly.

8.16 ALARM 351 (SERIAL PULSE CODER COMMUNICATION IS ABNORMAL)

An error is generated in communication with serial pulse coder.

Points

Check the details by the diagnostic function of the Power Mate.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0203	DTE	CRC	STB					

#7(DTE) Data error has generated.
#6(CRC) Serial communication error has generated. (CRC check error)
#5(STB) Serial communication error has generated. (Stop bit error)

Causes

1) #7(DTE):Response from serial pulse coder is absent.
   1 Signal cable is disconnected
   2 Serial pulse coder is faulty. ⇒ See Caution 1.
   3 +5V to the serial pulse coder is lowered.
2) #6(CRC),#5(STB):Serial communication is in faulty
   1 Signal cable is disconnected.
   2 Serial pulse coder is faulty ⇒ See Caution 1.
   3 Base printed board or servo module is faulty ⇒ See Caution 2

CAUTION
1 After the serial pulse coder is changed, reference position or machine's standard point is different from the one before replacement. Therefore reset and adjust it again.
2 All the data stored in memory is lost when the base printed board is changed. Set NC data again, referring to "chapter 3 data input/output".
The data includes reference position information. Reference position setting must also be performed, therefore.

8.17 ALARM 400 (OVERLOAD)

Amplifier or overheat of motor is detected.

400 SERVO ALM :X OVERLOAD

⇐ Example of CRT display.
Axis name is also displayed.

Points

Confirm the detail by the diagnostic function of Power Mate.

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0200	OVL							

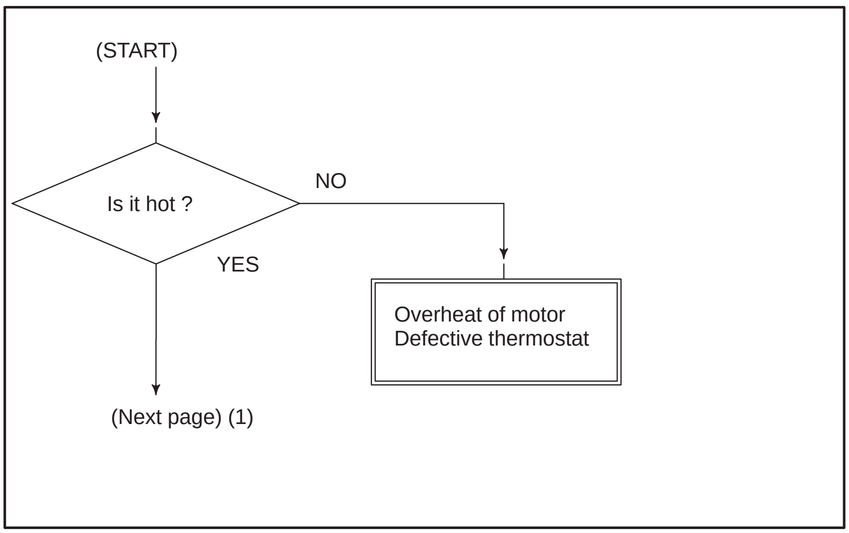
#7(OVL) : 1 OVERLOAD ALARM is displayed.

Check details of alarms by DGN 201.

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0201	ALD							

1	Overheat of servo motor
0	Overheat of servo amplifier

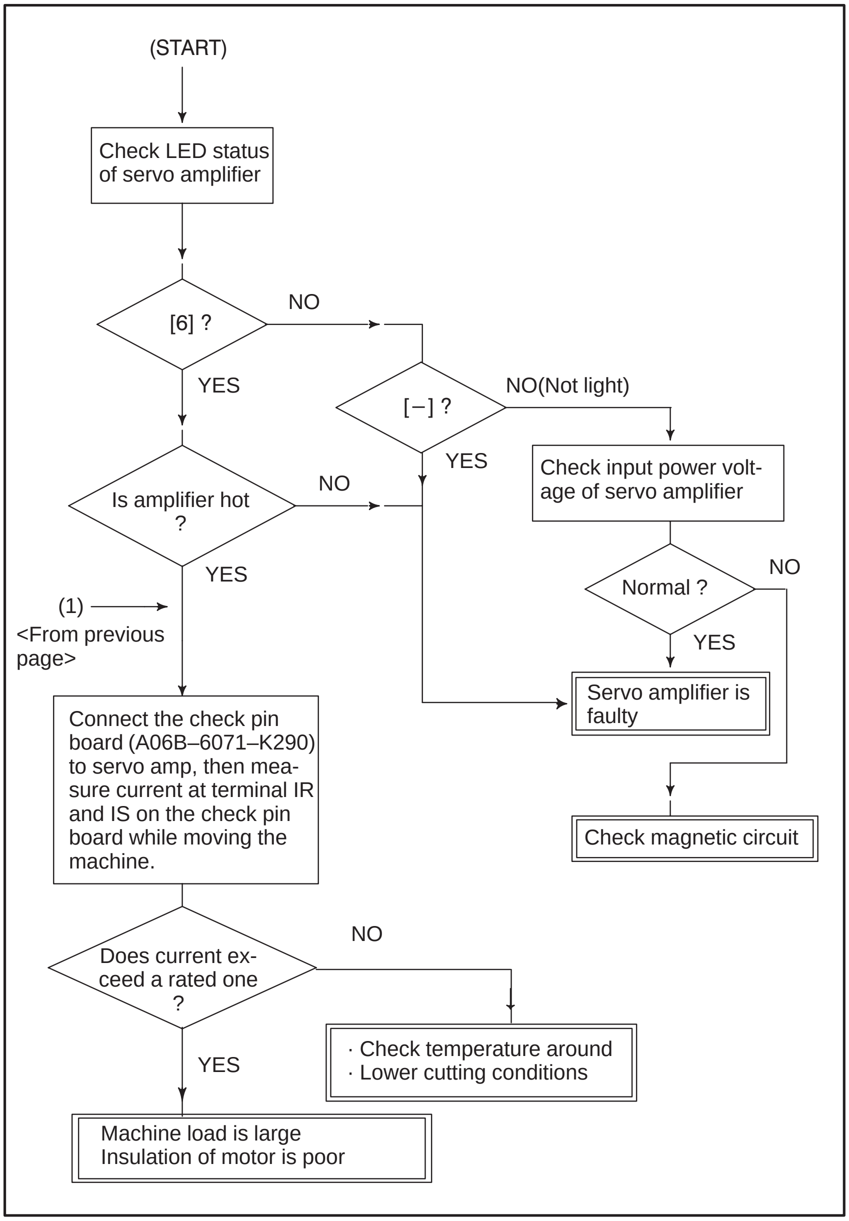
Overheat of servo motor



CAUTION
After the motor is changed, reference position or machine's reference point is different from the one before replace ment. Set it again.

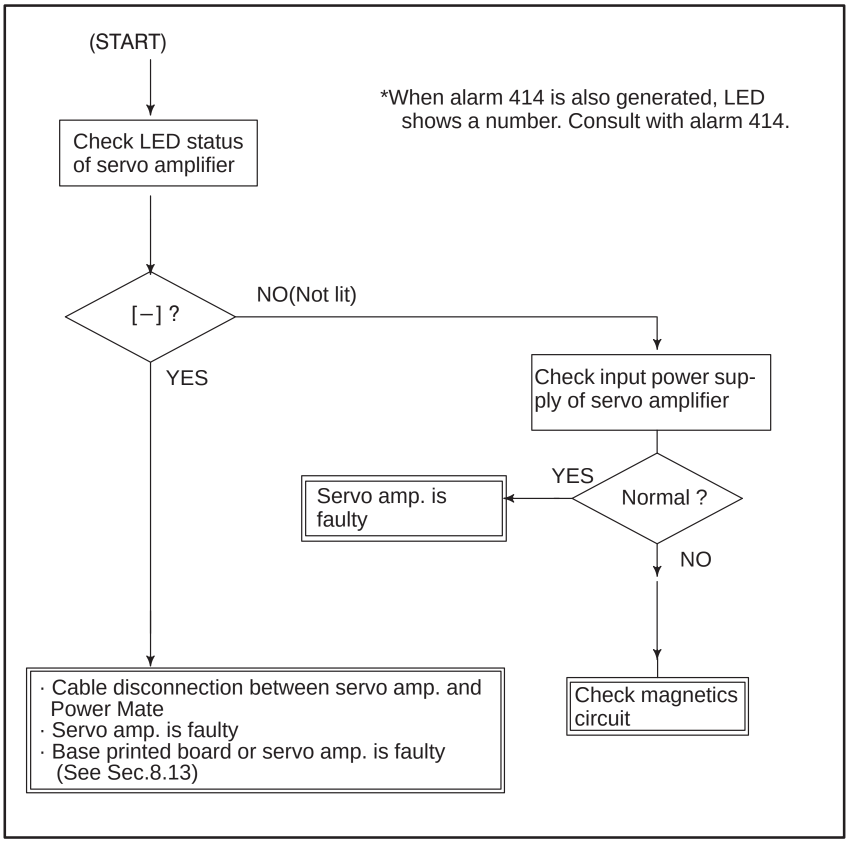
- **Overheat of servo amplifier**

LED 6 of servo amplifier is lit



8.18 ALARM 401 (*DRDY SIGNAL TURNED OFF)

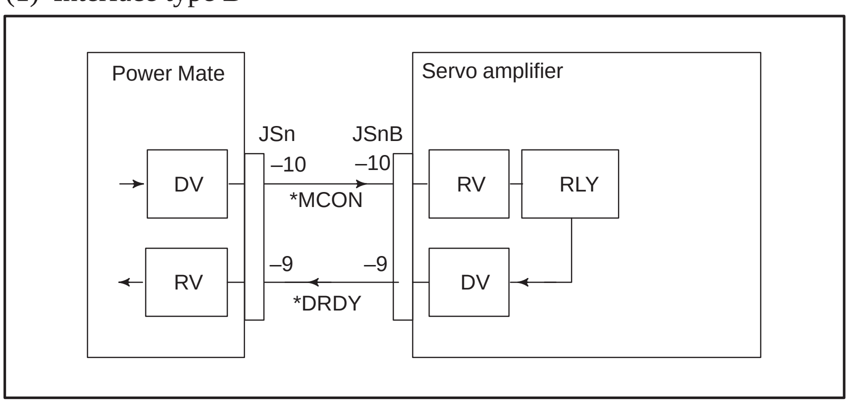
Ready signal (*DRDY) of servo amplifier is not turned on or turned off during operation.



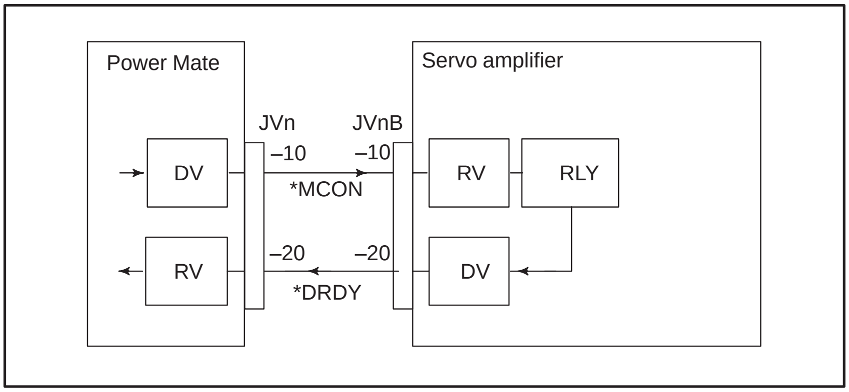
CAUTION

When the base printed board is replaced, all the data stored in memory is lost. Set data again, referring to chapter 3. “Data input/output” .

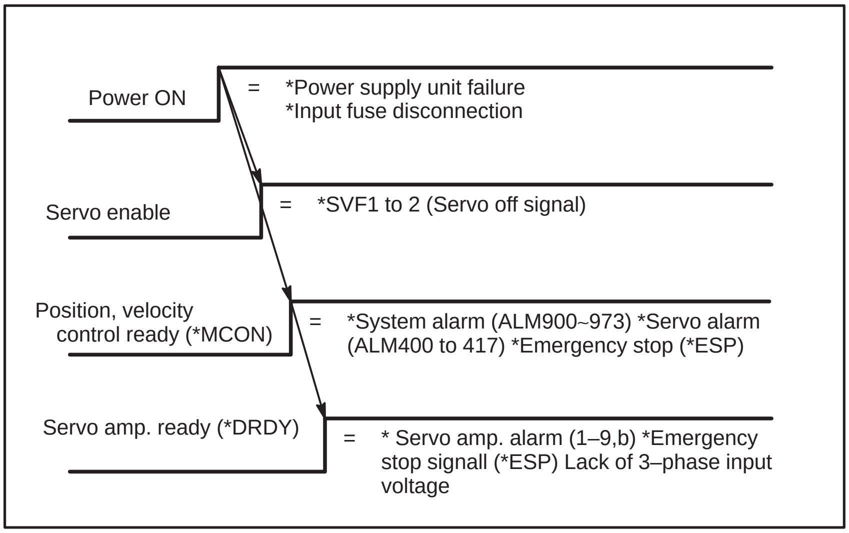
(1) Interface type B



(2) Interface type A



Power on sequence (Power Mate⇔Servo amplifier)



NOTE

1 When a servo amplifier is shared by more than one Power Mate, this alarm may occur in one of the Power Mate units if *MCON is not generated in another Power Mate unit. Set NOFVY (bit 2 of parameter No. 1803).
2 When a two–axis amplifier is used in a 2–path Power Mate–D, this alarm may occur in one path of the Power Mate–D unit if *MCON is not generated in the other path. Set NOFVY (bit 2 of parameter No. 1803).
3 The non–generation of *MCON in another Power Mate or another path of 2–path Power Mate may be due to an emergency stop signal being input, follow–up after the power is turned on, or the detach function being applied.

8.19 ALARM 404 AND 405 (*DRDY ON, REFERENCE POSITION RETURN ABNORMAL)

- **Alarm 404 (* DRDY ON)**

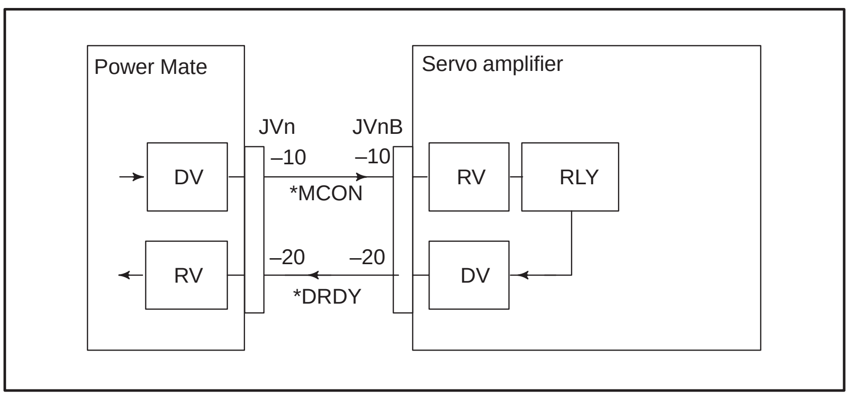
DRDY signal is turned on before *MCON signal is turned on, or DRDY is not turned off after *MCON signal is turned off.

- **Causes**

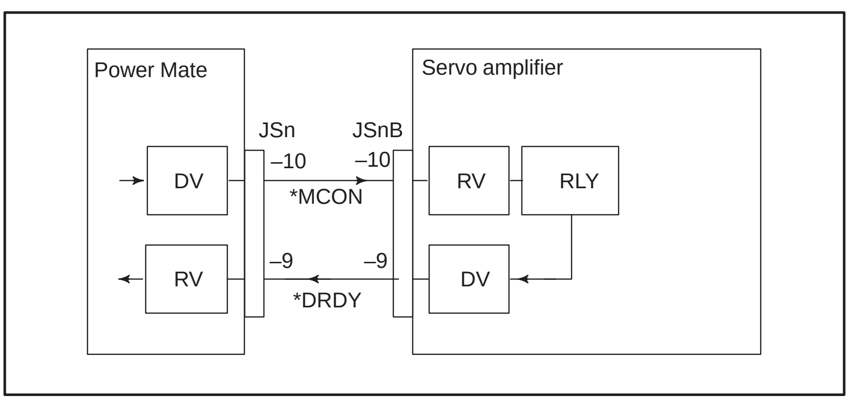
1 Servo amplifier is faulty.
2 Between servo amplifier and Power Mate is faulty.
3 Base printed board or servo module is faulty. (See Sec.8.13)

> **NOTE**
> When the base printed board is replaced, all the data stored in memory is lost. Set the NC data again, referring to chapter 3 “data input/output”.

1) TYPE B Interface



2) TYPE A Interface



- **Alarm 405 (Reference positin return is abnormal)**

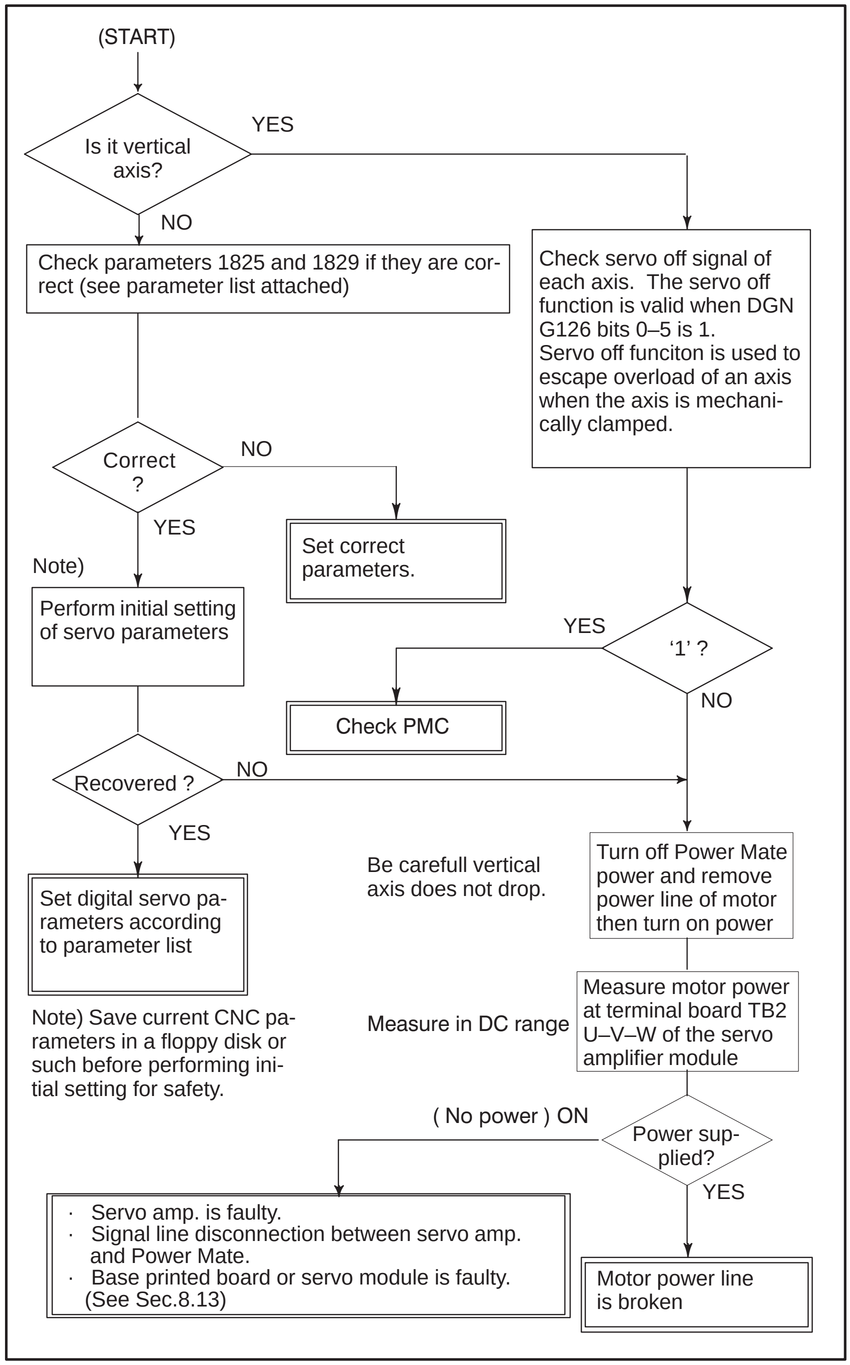
- **Causes**

Base printed board or servo module is faulty. (See Sec.8.13.)

> **CAUTION**
> When the base printed board is replaced, all the data stored in memory is lost. Set the NC data again, referring to chapter 3 “data input/output”.

8.20 ALARM 410 (EXCESSIVE POSITION ERROR AMOUNT DURING STOP)

Position error amount at stop (DGN 300) exceeds a value set by parameter No. 1829.

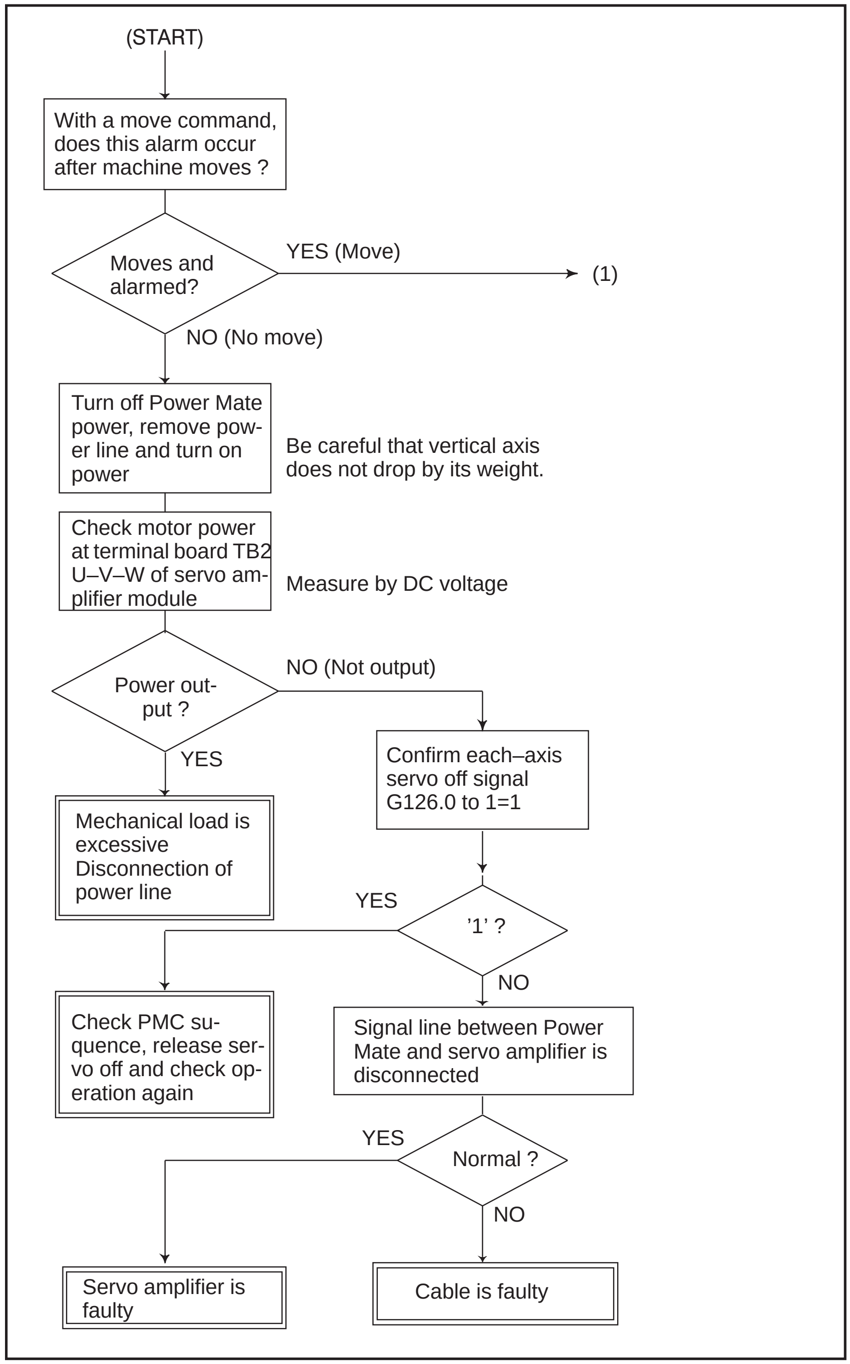


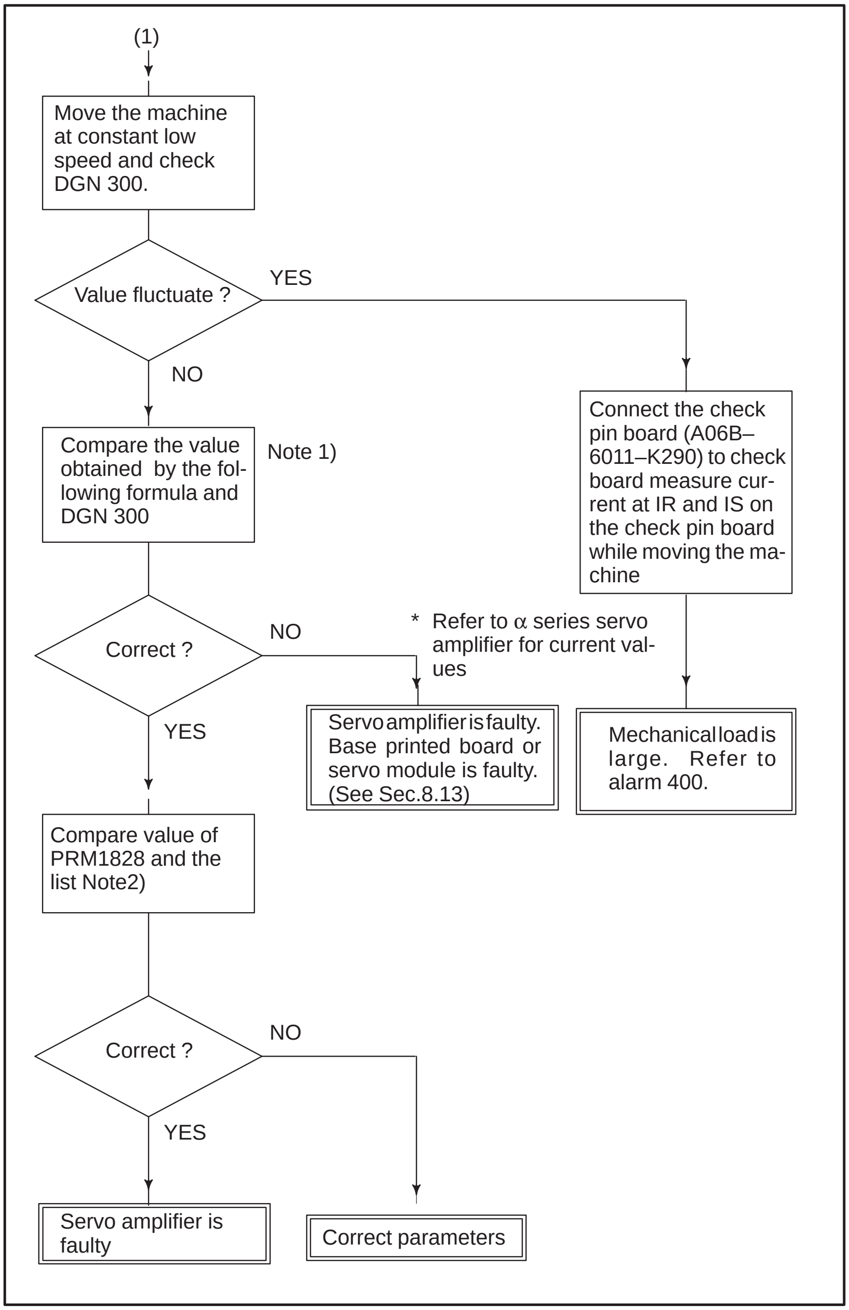
CAUTION

When the base printed board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 "data input/output".

8.21 ALARM 411 (EXCESSIVE POSITION ERROR DURING MOVE)

Position error amount during movement (DGN 300) execeeds a value set by parameter 1828.





CAUTION

When the base printed board is replaced, all the data in memory is lost. Reset NC data, referring to chapter 3 data input/output item.

NOTE

1 Position error= $\dfrac{\text{Feed rate (mm/min)}}{60 \times \text{PRM1825}} \times \dfrac{1}{\text{Detection unit}}$

2 Parameter 1828 $\geqq$ Position error at rapid traverse 1.2

8.22 ALARM 414 (DIGITAL SERVO SYSTEM IS ABNORMAL)

```
414 SERVO ALARM:X–AXIS
                DETECTION
                SYSTEM ERROR
```

EXAMPLE OF DISPLAY
AXIS NAME DETECTED
IS DISPLAYED

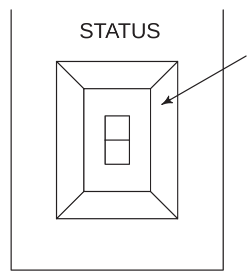
Points

Check details by Power Mate's diagnostic fucntion and LED display on the servo amplifier.

1

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0200		LV	OVC	HCA	HVA	DCA	FBA	OFA

2 LED display on the front panel of servo amplifier module and power supply module.



* An alarm detected on the servo amplifier is also displayed at DGN 200.

3

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0204		OFS	MCC					

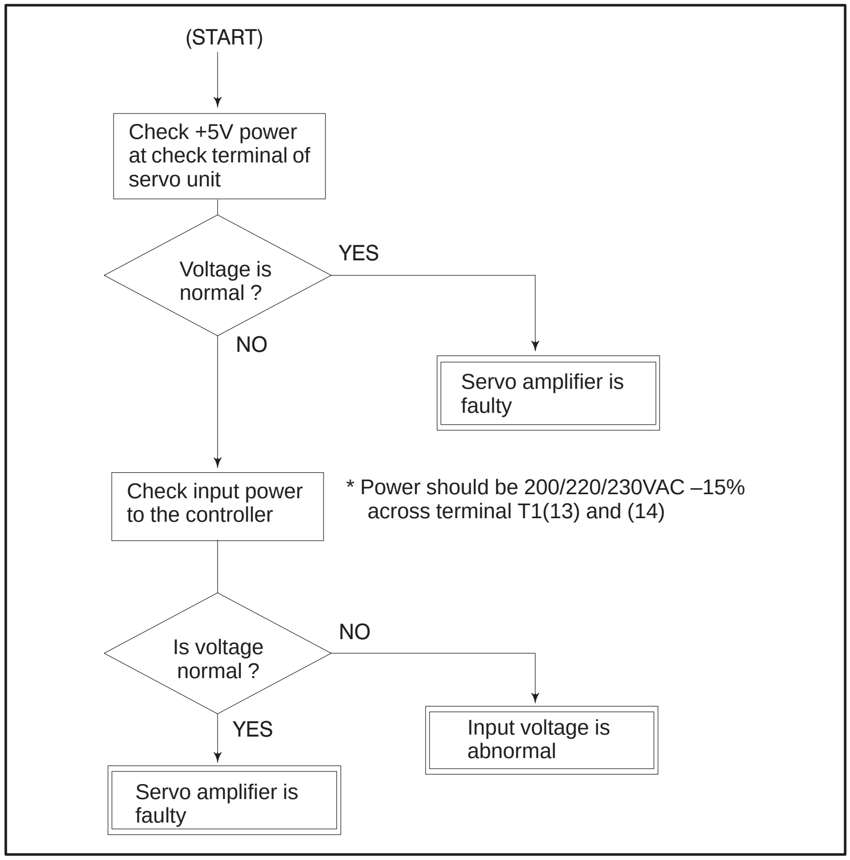
- **When DGN200 shows "1"**

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0200		LV	OVC	HCA	HVA	DCA	FBA	OFA

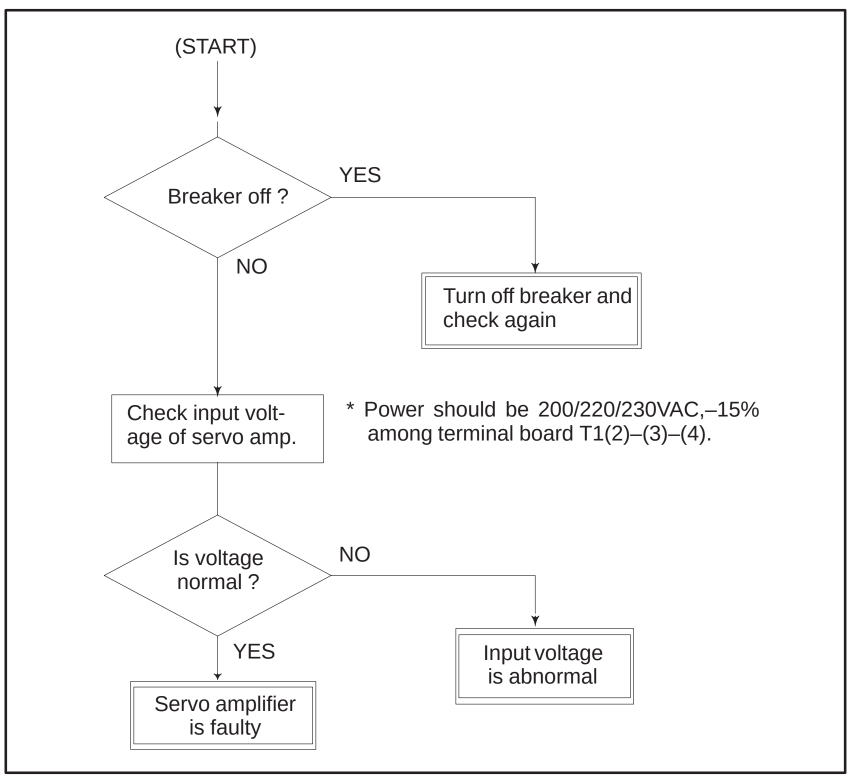
#6(LV) : Low voltage alarm → LED : "2" or "3" is lishted.
#5(OVC) : Over current alarm
#4(HCA) : Abnormal current alarm → LED : "8" is lishted.
#3(HVA) : Over current alarm → LED : "1" is lishted.
#2(DCA) : Discharge alarm → LED : "4" or "5" is lishted.
#1(FBA) : Disconnection alarm
#0(OFA) : Overflow alarm

- **#6(LV):Insufficient voltage alarm**

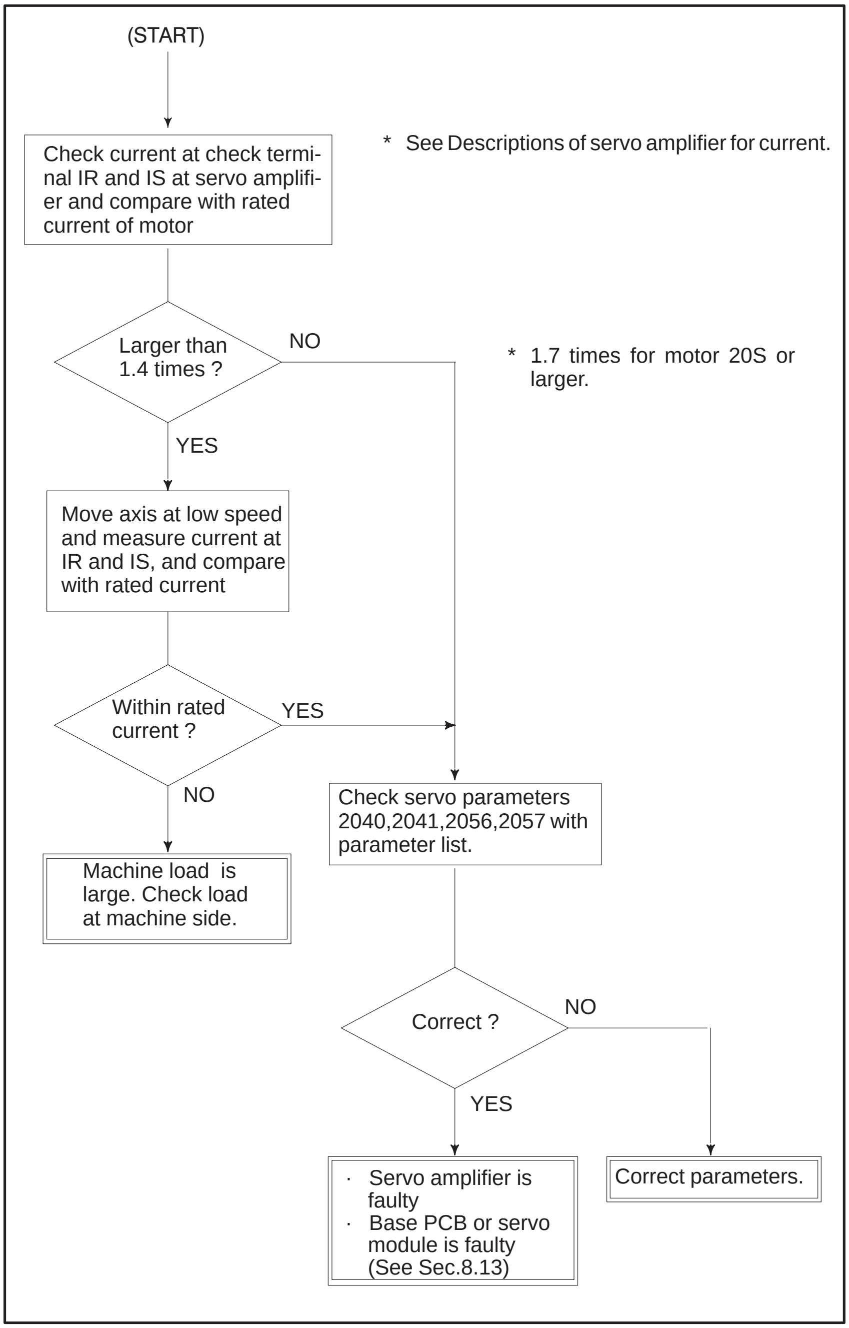
1) Servo amp LED [2] turns on (control power shortage)



2) Servo amp LED [3] turns on (DC power shortage)



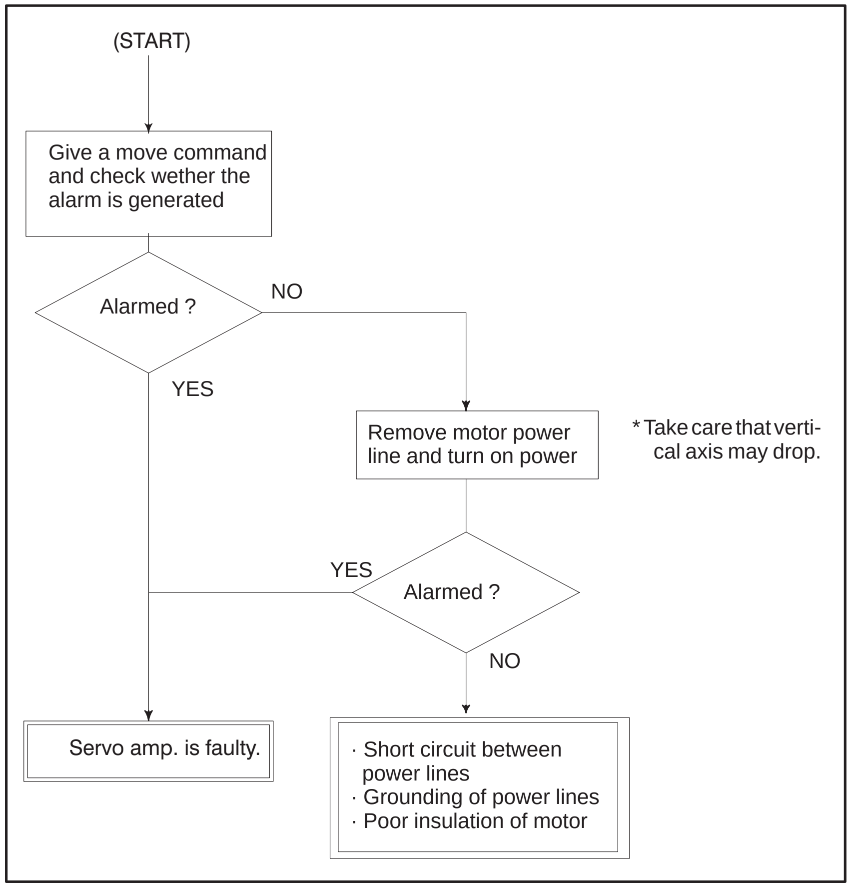
- **#5(OVC):Over current detection by software**



CAUTION

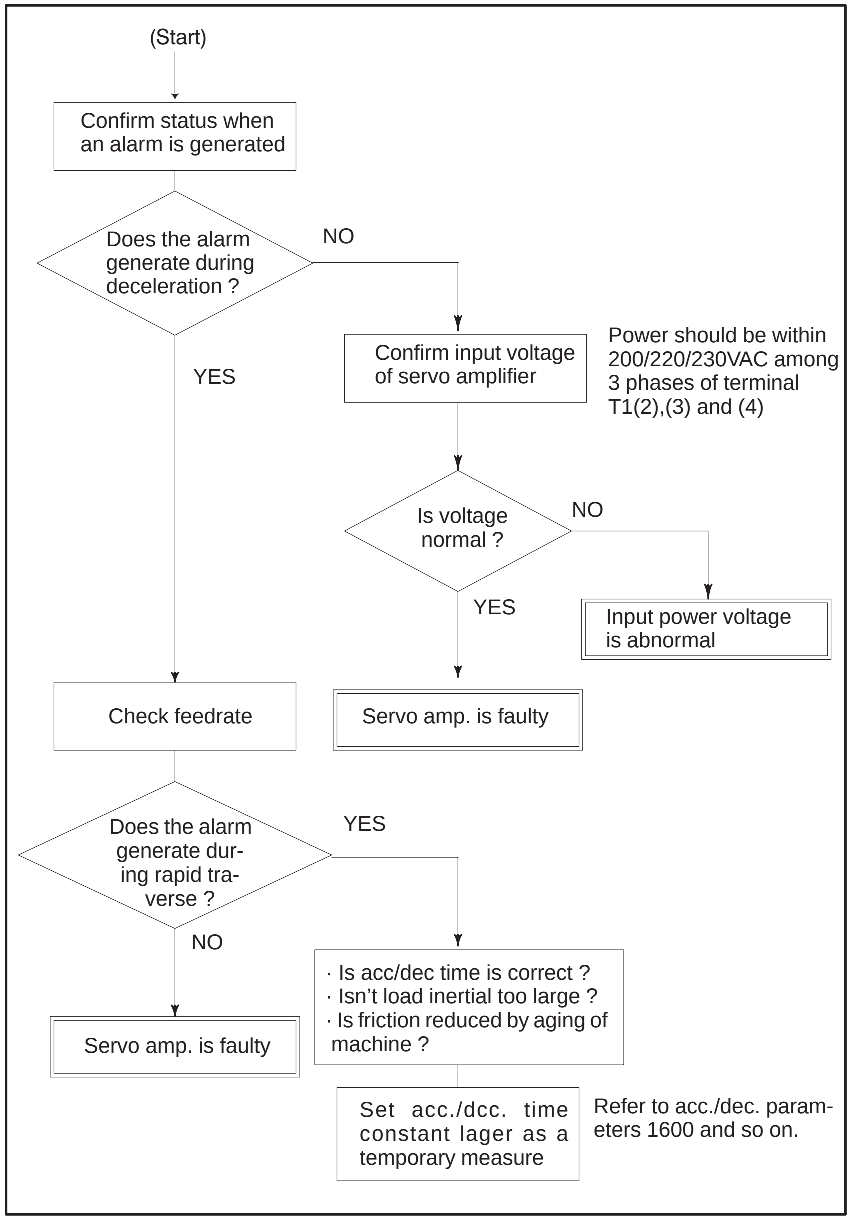
When the base PCB is replaced, all the data in memory is lost.Reset NC data, referring to chapter 3 “input/output of data” .

- **#4(HCA):Abnormal current alarm (Servo amp. LED:[8] lights)**



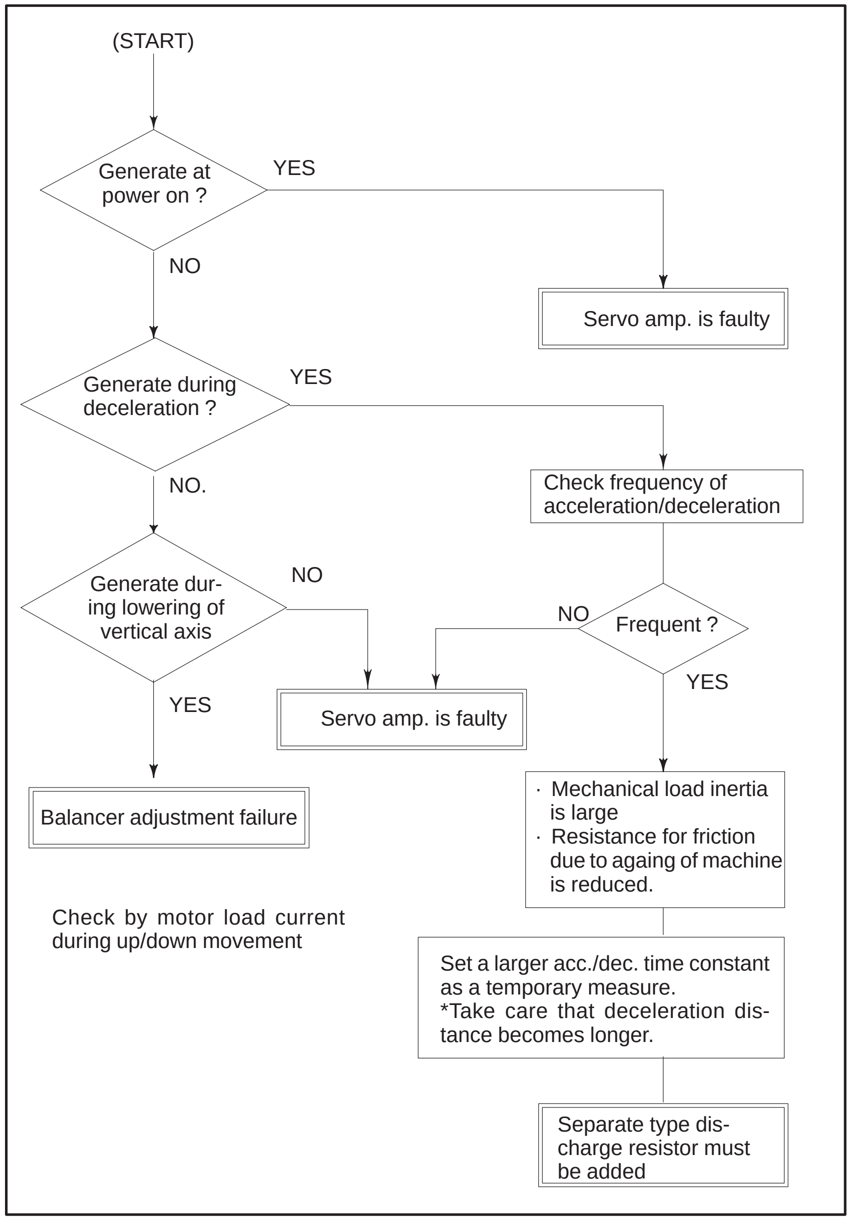
- **#3(HVA):Over voltage alarm (Servo amp.LED [1] lights)**

DC voltage in servo amp. is excessive.

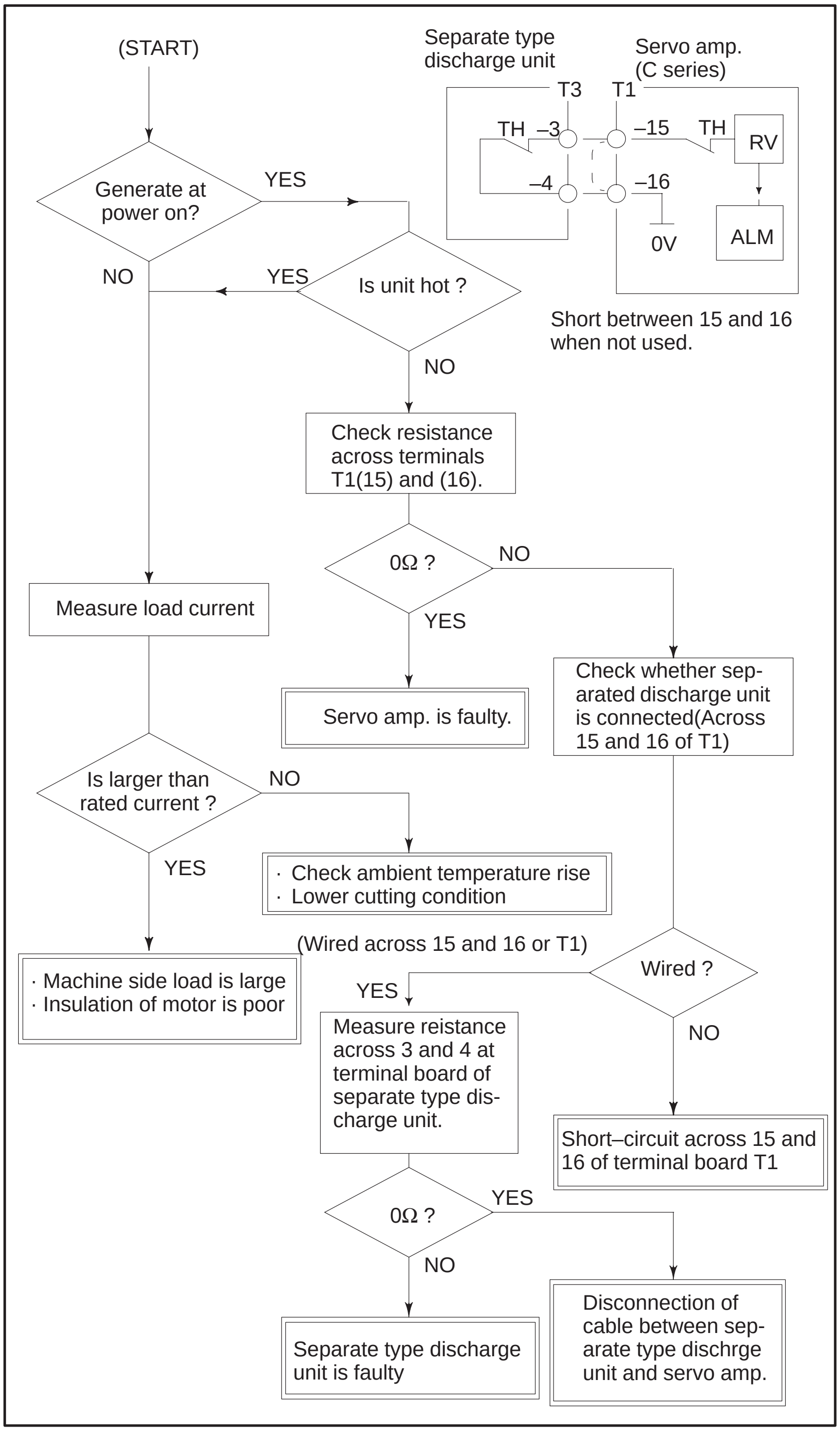


- **#2(DCA):Discharge alarm**

1 Servo amp LED 4 lights (discharge control circuit is abnormal)



2 Servo amp LED 5 lights (discharge circuit overheat)



- **#1(FBA):DISCONNECTION ALARM**

Position detection signal line is disconnected or short–circuited.

DGN	#7	#6	#5	#4	#3	#2	#1	#0
0201	ALD			EXP				

#7 (ALD)	#6	#5	#4 (EXP)	Description	
1	–	–	0	Built–in serial pulse coder disconnection	→JF_X
1	–	–	1	Separate type position detector connection	→JF2x
0	–	–	0	Pulse coder disconnection (software)	

- **Causes**

1 Signal cable is disconnected or short–circuited.

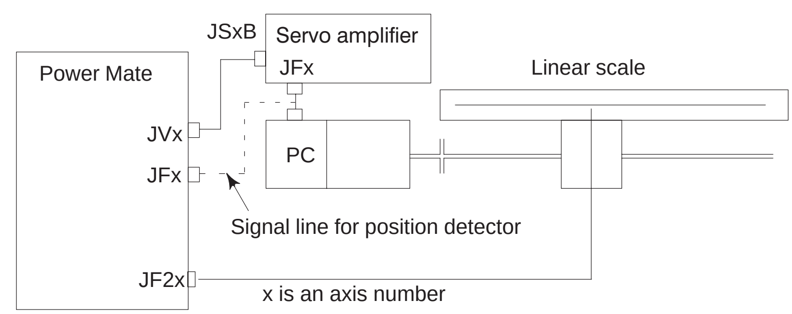
2 Serial pulse coder or position detector is faulty Refer to CAUTION 1.

3 Base PCB or servo module is faulty. (See Sec.8.13)
Refer to CAUTION 2.

CAUTION

1 After the pulse coder is replaced, reference position or machine's standard position is different from former one. Adjust and set it correctly.

2 When the base PCB is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 "input/output of data".



NOTE) In the case of the type A interface, the position detection signal line is connected to the Power Mate, while in the case of the type B interface, it is connected to the servo amplifier.

- **#0(OFA):Overflow alarm**

causes

1 Wrong setting of servo parameters 1800s.

2 Base PCB or servo module is faulty. (See Sec.8.13)

CAUTION
When the base PCB is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 “input/output of data”.

When 1 is displayed at DGN 204

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0204		OFS	MCC					

#6(OFS): A/D converter used for current feedback in the digital servo is abnormal.

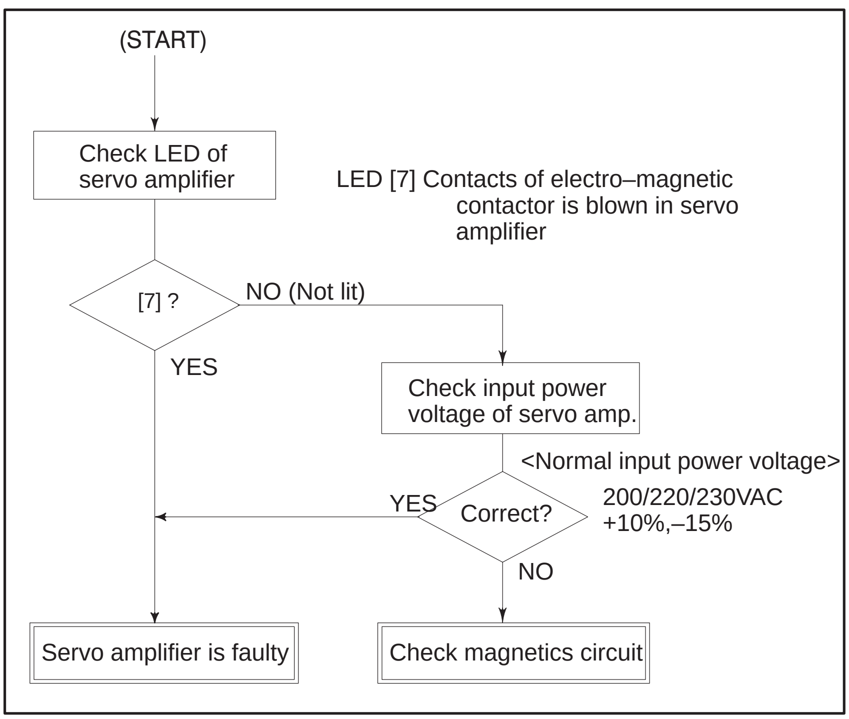
#5(MCC): Contacts of electromagnetic contactor in the servo amp. is blown.→LED 7 lights.

- **#6(OFS):A/D converter is abnormal**

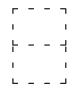
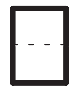
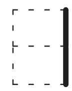
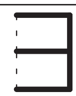
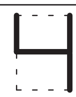
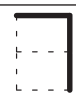
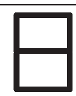
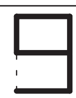
Base PCB or servo module is faulty. (See Sec.8.13.)

CAUTION
When the base PCB is replaced, all the data stored in memory is lost.
Set NC data again, referring to chapter 3 “input/output of data”.

- **#5(MCC):Contacts of electro–magnetic contactor is blown within servo amp.**



• LED display

Display	Meaning	Explanation
	Power off	Power to the servo converter is not supplied.
	NOT READY	Internal MMC (electro–magnetic contactor) is not turned on.
	READY	Internal MMC is turned on and the motor becomes ready.
	HV Excessive voltage alarm	DC voltage for driving main circuit is considerabley high.
	LV5V Control power low alarm	+5V of control power is abnormally low.
	LVDC DC link voltage low alarm	DC voltage for main circuit is extremely low.
	DCSW Abnormal regenerative control circuit	Regenerative discharge energy in short time is large or regenerative discharge circuit is faulty.
	DCOH Excessive regenerative discharge	Average regenerative discharge energy is large or frequency of acc./dec. is large.
	OH Servo amplifier overheat	Lights when thermostat in the servo amplifier functions.
	MCC Electromagnetic contactor	Contacts of electro–magnetic contactor is blown.
	HCL L axis excess current	Lights when a large current flows through the main circuit of L axis.
	HCM M axis excess current	Lights when a large current flows through the main circuit of M axis.
	HCLM Excess current	Lights when a large current flows throught the main circuit of L axis and M axis.

NOTE
1st axis is L, 2nd axis is M.

• LVDC alarm

When the electro–magnetic contactor is turned on in the servo amp. or DC voltage for the main circuit becomes low, this LED is lit.
Causes are;

1) Input voltage is insufficient.
2) Contacts of electro–magnetic contactor in servo amp. is poor.
3) Power circuit in servo amp. is abnormal.

- **DCSW alarm**

This alarm is lit when the transistor for regenerative discharging turns on more than 1 second.
Its causes are;

1) Mulfunction of servo amplifier such as regenerative discharge circuit.
2) Regenerative discharge energy is excessive due to cutting conditions.

- **DCOH alarm**

This alarm is lit when regenerative discharge registance is overheated and the thermost operates.
Its causes are ;

1) Average discharge energy is excessive due to frequent acc./dec. or no use of balancer in vertical axis
2) Functioning of a thermostat in the power transformer when thermostat signal TH1 and TH2 are connected.

- **MCC alarm**

When turning on MCC, if the contacts are already on.

- **Check terminals on servo amp.**

When you open the cover of the terminal board, you can see the check terminal below LED.

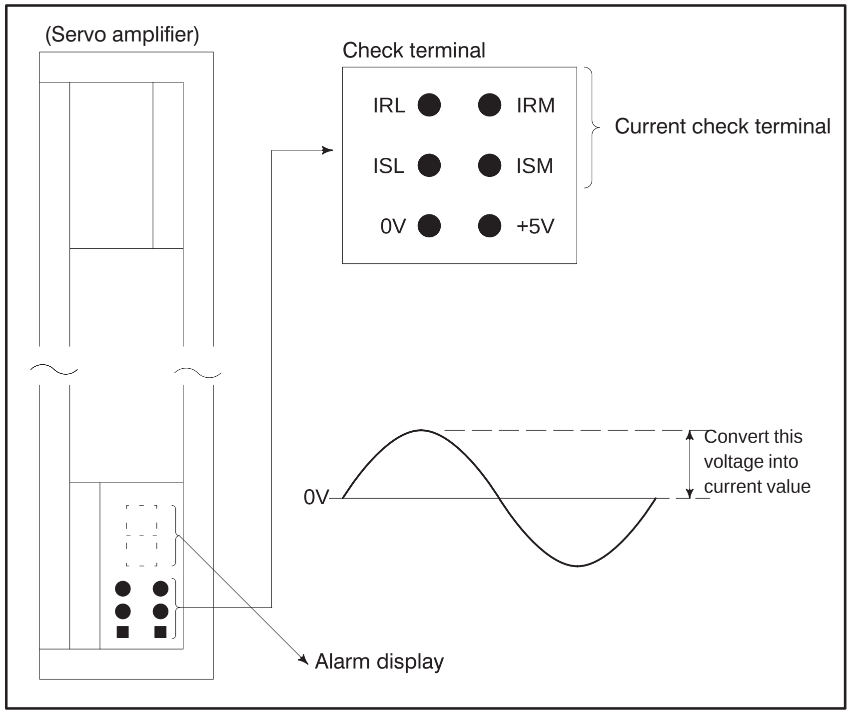
- **Terminal name and meaning**

Terminal name	Meaning
0V	0V
5V	Control power +5V(+5 ± 0.25)
IRL	R–phase motor current of L axis
ISL	S–phase motor current of L axis
IRM	R–phase motor current of M axis
ISM	S–phase motor current of M axis

- **Current/volt**

Type of unit	A/V	Type of unit	(A/V)	
A06B–6066–H002	1	A06B–6066–H222	1/1	Left side L axis/Right side M axis
A06B–6066–H003	3	A06B–6066–H223	1/3	
A06B–6066–H004	10	A06B–6066–H224	1/10	
A06B–6066–H006	20	A06B–6066–H233	3/3	
		A06B–6066–H234	3/10	
		A06B–6066–H244	10/10	

- **Current waveform**



8.23 ALARM 416 (DISCONNECTION ALARM)

Position detection signal line is disconnected or short–circuited.

Point

Check the details using the Power Mate’s diagnostic fucntion.

DGN	#7	#6	#5	#4	#3	#2	#1	#0
0201	ALD			EXP				

#7	#6	#5	#4		
1	–	–	0	Built–in serial pulse coder disconnection	→JF_X
1	–	–	1	Separate type position detector connection	→$JF2_X$
1	–	–	0	Pulse coder disconnec-tion (software)	

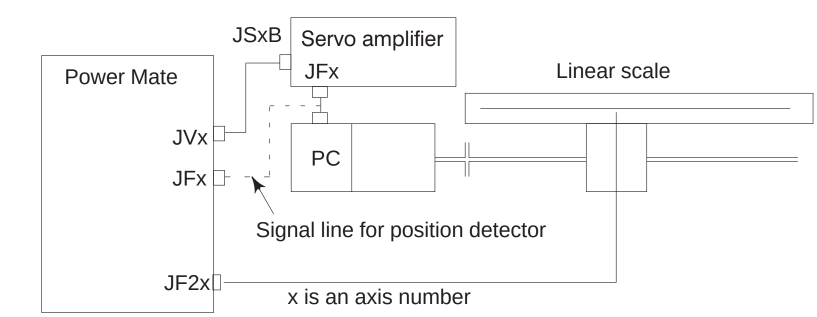
Causes

1 Signal cable is disconnected or short–circuitted.

2 Serial pulse coder or position detector is faulty. Refer to Note 1

3 Base printed board or servo module is faulty. (See Sec.8.13.) Refer to Caution 2

> **CAUTION**
> 1 After the pulse coder is replaced, reference position or machine’s standard position is different from former one. Adjust and set it correctly.
> 2 When the base printed board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 ” Data input/output” .



NOTE) In the case of the type A interface, the position detection signal line is connected to the Power Mate, while in the case of the type B interface, it is connected to the servo amplifier.

8.24 ALARM 417 (DIGITAL SERVO SYSTEM IS ABNORMAL)

Digital servo parameters are abnormal.
(Digital servo parameters are set incorrectly.)
When alarm 315 is occured at the same time, check the cause of alarm 351 of Sec. 8.16.

- **Causes**

1 Confirm the setting value of the following parameters:
PRM 2020 : Motor format number
PRM 2022 : Motor rotation direction
PRM 2023 : Number of pulses of velocity feedbacks
PRM 2024 : Number of pulses of position feedback
PRM 1023 : Servo axis number
PRM 2084 : Flexible feed gear ratio
PRM 2085 : Flexible feed gear ratio
Confirm the details with diagnosis function of CNC side.

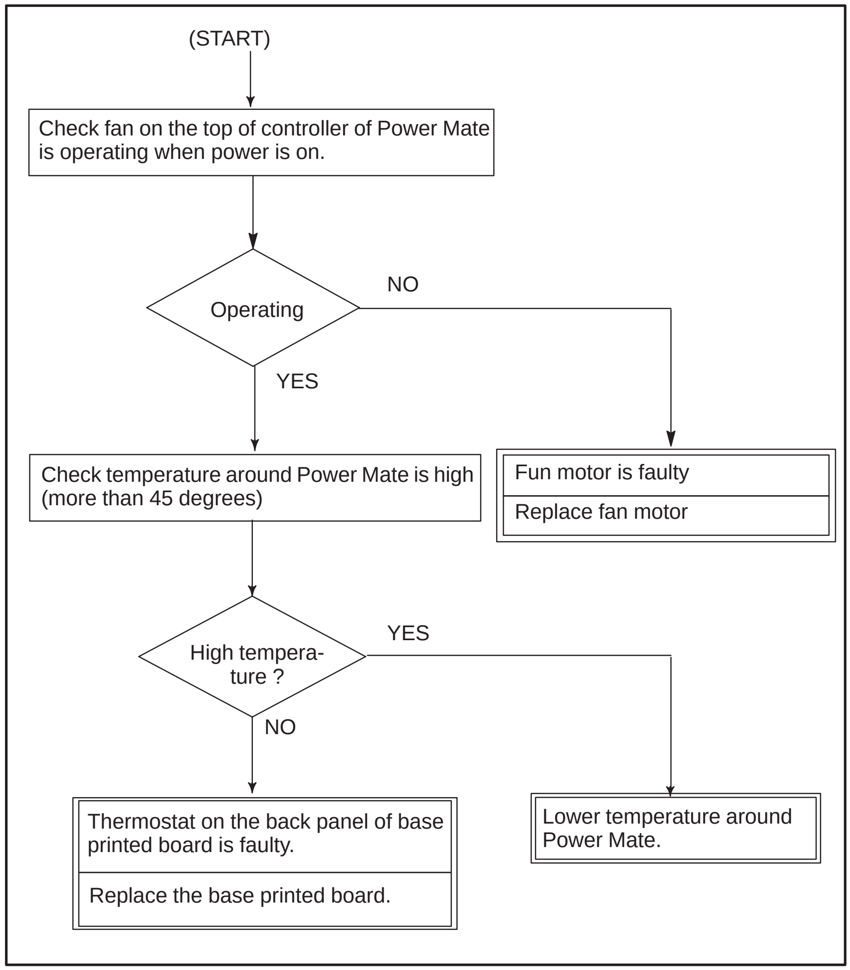
2 Change the setting of this parameter to 0.
PRM 2047 : Observer parameter

3 Perform initial setting of digital servo parameters.
”Refer to setcion 5.1 ”initial setting of servo parameters” .

8.25 ALARM 700 (OVERHEAT AT CONTROL SIDE)

Because an ambient temperature of Power Mate becomes high, a thermostat mounted on Power Mate and informs an alarm.

Remedies

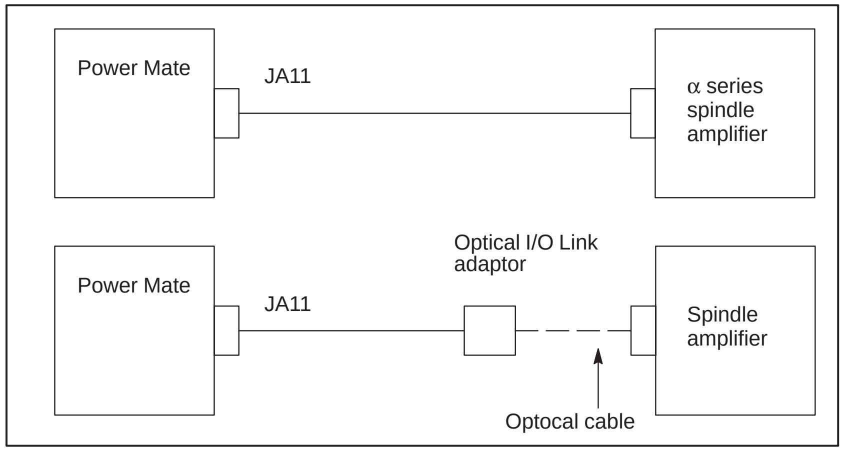


8.26 ALARM 749 (SERIAL SPINDLE COMMUNICATION ERROR)

Communication error has generated in serial spindle

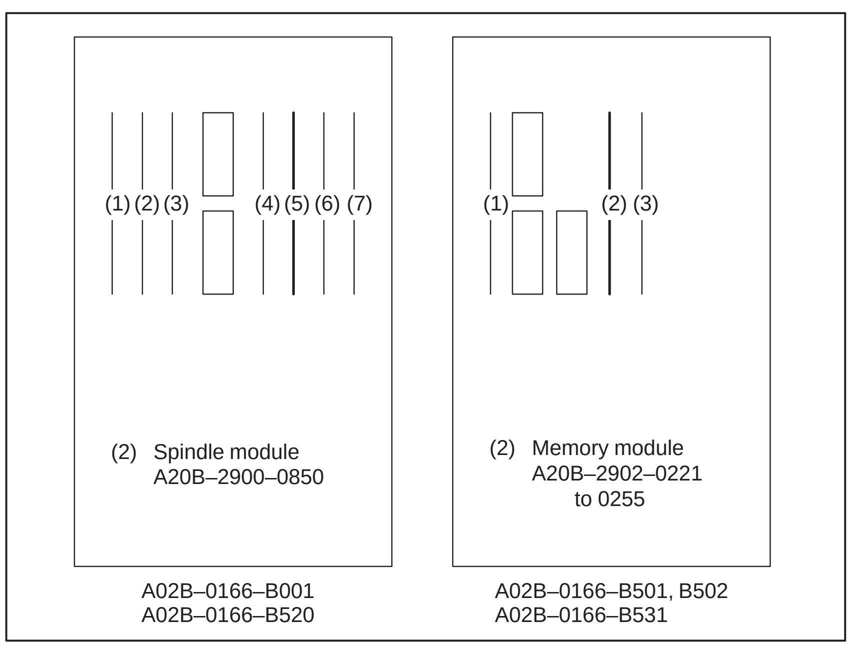
Causes and Remedies

Improper connection between the control unit and the serial spindle. The following reason is considered.

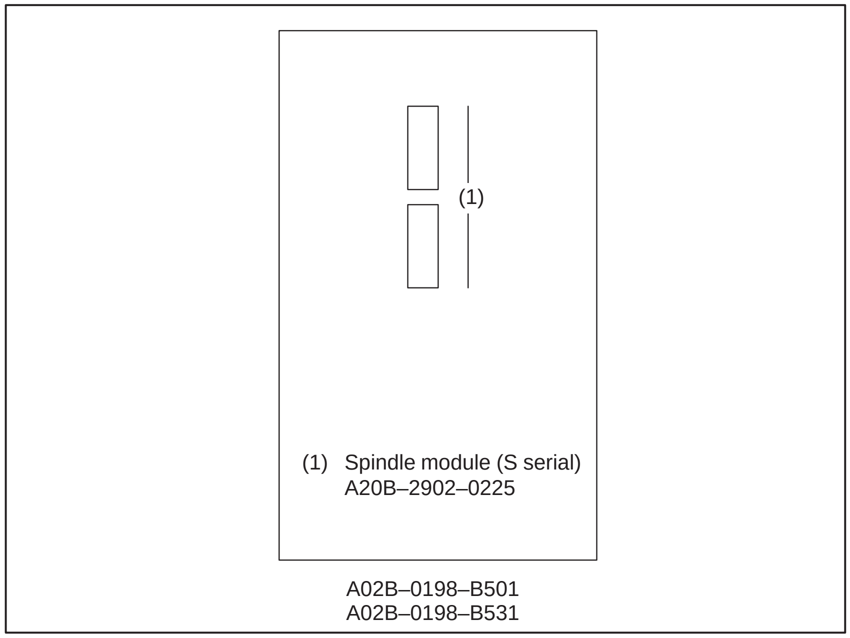


- Spindle module is faulty. (Bold line in the figure below indicates module mounting position.)
- The cable between the control unit and spindle amplifier is broken or disconnected.
- A cable between the control unit and optical I/O link adapter is disconnected or short–circuited.
- Optical I/O link adapter is faulty.
- Optical cable is disconnected.
- Serial spindle amplifier is faulty.

<Location of spindle module> Power Mate–D



<Location of spindle module> Power Mate–F



8.27 ALARM 750 (SPINDLE SERIAL LINK CANNOT BE STARTED)

When the spindle amplifier does not become normal state immediately after power is turned on in the serial spindle system, this alarm is informed.

Points

This alarm does not occur once the system becomes ready including the spindle system .
This alarm occurs during power on sequence before the system becomes ready.
After the system becomes ready, serial spindle alarm is issued by alarm 749.

Causes

(1) Cable is in poor contact or spindle amplifier power is off.

(2) When display of spindle amplifier shows SU–01 or an alarm other than AL–24 is displayed, power to the CNC is turned on.
In this case, this alarm usually occurs when the CNC's power is turned off while the serial spindle is operating. Turn off the power of serial spindle once, then turn it on and starts the system.

Details of Alarms

Confirm the details of troubles on diagnostic 409.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0409					SPE		S1E	SHE

#3(SPE) 0 : In spindle serial control, the serial spindle parameters satisfies the starting conditions for spindle amplifier.
1 : In spindle serial control, the serial spindle parameters do not satisfy the starting conditions for spindle amplifier.

#1(S1E) 0 : The serial communication module of the CNC side is normal.
1 : The serial communication module of the CNC side is abnormal.

#0(SHE) 0 : Serial spindle module on the CNC side is normal.
1 : Serial spindle module was detected to be abnormal on the CNC side.

Remedies

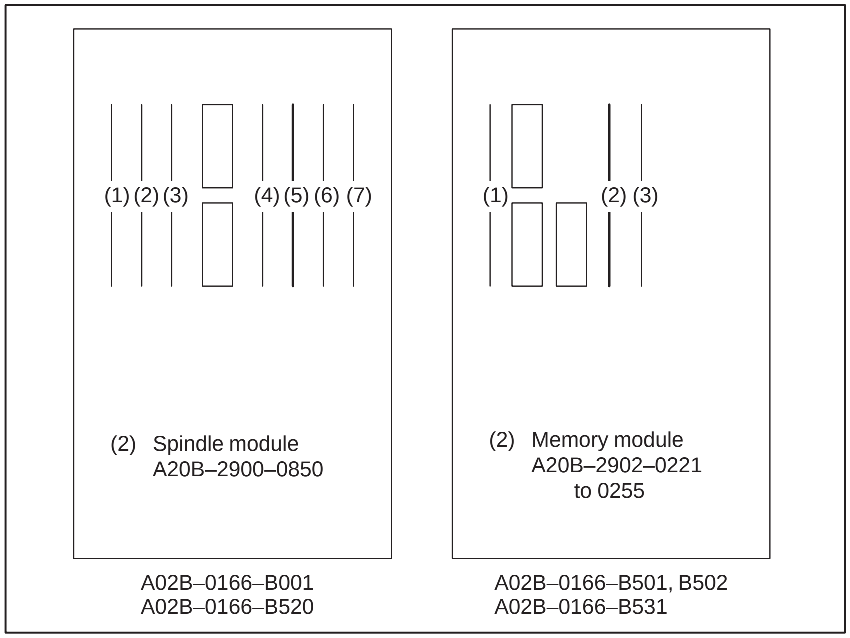
Reform the following countermeasures based on the above configurations:

(1) #3(SPE)1: In spindle serial control, the serial spindle parameters does not satisfy the starting conditions for spindle amplifier.
↓
Confirm the settings of parameters 4000s.
Especially checks the parameters those are changed from the standard parameters.

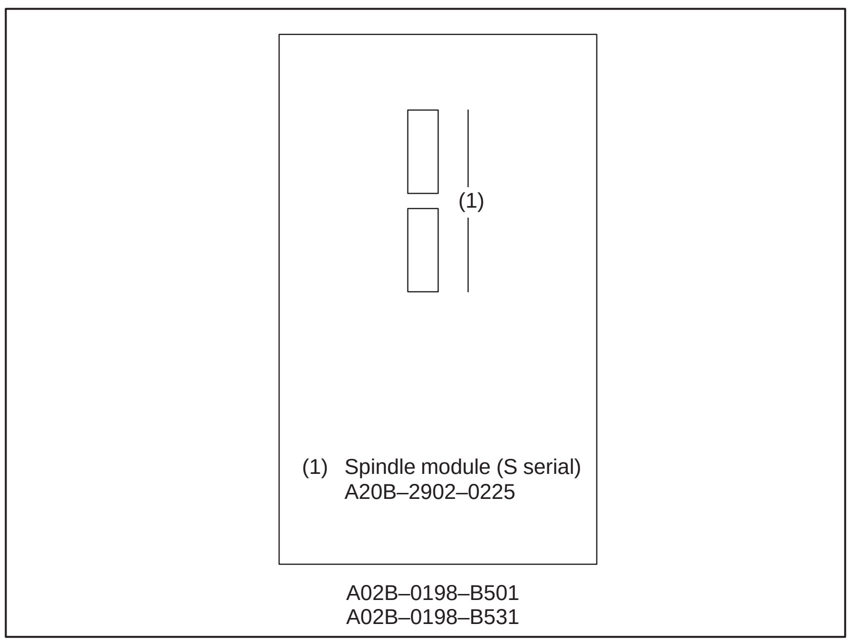
(2) #1(SIE)1: When an abnormality is found in the 1st spindle at the start of serial spindle control, exchange the unit if the following check items are not concerned.
↓
Check the parameters and connections at the 1st spindle to see whether the 1st spindle is mechanically and electrically connected.
↓
If the parameters and connections are correct, the system control module shown below or the spindle amplifier itself is faulty.

(3) #0(SPE)1: The serial spindle module is detected to be abnormal.
Exchange the following module :

<Location of spindle module> Power Mate–D



<Location of spindle module> Power Mate–F



8.28 ALARM 751 (SPINDLE ALARM)

With serial spindle system, an alarm on the spindle unit is informed to the CNC.
751 (Alarm detection by 1st spindle)
The alarm contents is displayed by AL–xx on the display of spindle amp. Refer to appendix B for the contents.
The CNC holds an alarm number display (AL–xx).

- **Point**

This alarm informs of trouble of spindle control unit.
Repair the spindle side by the method of remedy for each alarm.

- **Causes and Remedies**

Refer to Appendix B for details.

8.29 ALARM 900 (ROM PARITY ERROR)

ROM parity error occurred.

Causes

(1) ROM on the base printed board is defective.

```
SYSTEM ALARM                                   8834–06

900    ROM PARITY

                         Defective file
                         or ROM is displayed
```

Confirm the series and versions of control software those are displayed on upper right of the screen.

Remedies

Replace the ROM.

8.30 ALARM 910 TO 911 (RAM PARITY)

Parity error of SRAM that stores part programs.

Points

A parity bit is prepared for writing data in memory correctly. There are odd–number parity and even–number parity.

#7	#6	#5	#4	#3	#2	#1	#0	#P	
1	0	1	1	0	1	1	1	0	(Parity bit) (Even–number parity)

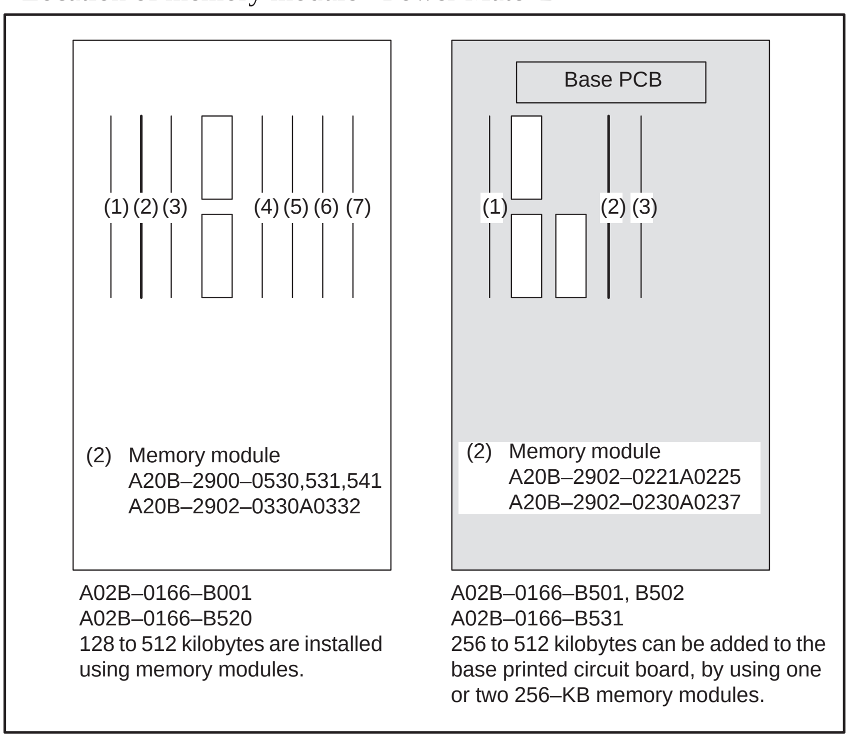
Causes and Remedies

(1) Defective base printed–circuit board or memory module, or incorrect data in the base printed–circuit board or memory module
When this alarm occurs immediately after power is turned on, once turn off power, then turn on power while pushing RESET and DELETE key to perform memory all clear
If parity error is not released by clearing all memory, RAM or backup circuit of RAM may be faulty. Change memory module or base printed board.

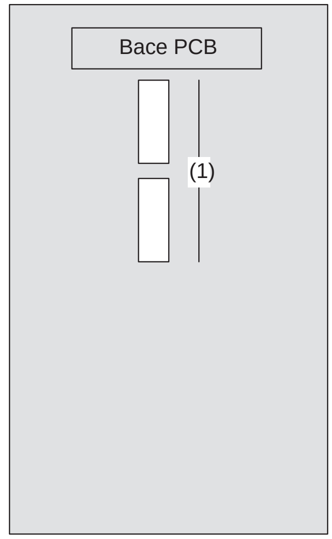
> **CAUTION**
> When the base printed board or memory module is replaced, all the data stored in memory is lost. Set data again, referring to chapter 3 ” Data input/output” .

- **Memory module mounting position**

<Location of memory module> Power Mate–D



<Location of memory module> Power Mate–F



A02B–0166–B501
A02B–0166–B531
256 kilobytes are installed on the base printed circuit board.

(2) Low voltage of memory back up battery.
A battery alarm occurs if a voltage rated at 3.0 V drops to 2.5 V typical (2.3 to 2.7 V).

When the memory back up battery voltage is lowered, BAT is displayed at lower part of the screen.

When battery alarm is lit, replace with new lithium batteries as soon as possible.

Refer to 2.6 battery replacing item and change the batteries.

(3) Power supply printed board is faulty
When alarm turns off by an operation of clearing all the memory, power supply printed board may also be faulty.

8.31 ALARM 920 (WATCH DOG OR RAM PARITY)

920: Watch dog alarm or local RAM of servo has occurred

points

- **Watch dog timer alarm**

The timer used to monitor the operation of CPU is called the watch dog timer. The CPU resets timer time every time a constant time has passed. When an error occurs in CPU or peripheral device, timer is not reset but the alarm is informed.

- **RAM parity error**

Refer to alarm 910 to 911. Local RAM or module has been checked.

Causes and Remedies

- **Servo module is faulty**

In the Power Mate–D (A02B–0166–B001, –B520), the servo module includes servo RAM, watch dog timer circuit, etc. Defectiveness of hardware, abnormality or malfunctioning of detection circuit or the like is considered. Therefore, replace servo module.

- **Base printed board is faulty**

In the Power Mate–D (A02B–0166–B501, –B502, –B531) and Power Mate–F the Base PCB includes servo RAM, watch dog timer circuit, etc. Defectiveness of hardware, abnormality or malfunctioning of detection circuit or the like is considered. Therefore, replace base PCB.

- **Memory is faulty**

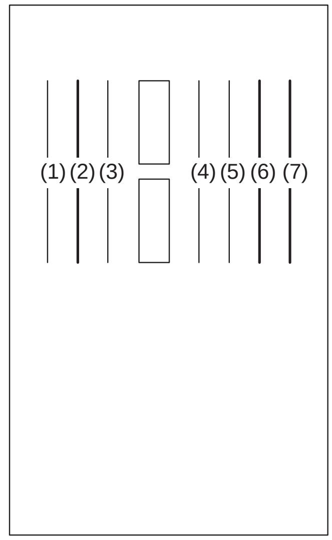
In the Power Mate, software may not workpiece properly due to failure of memory. Change memory. (See Sec.8.31)

- **Power supply printed board is faulty**

DC output voltage of power supply printed board may be faulty. Replace the power supply printed board.

Location of PCB

1) Power Mate–D(A02B–0166–B001)

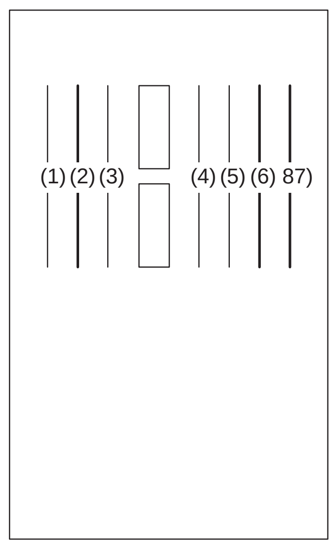


(2) Memory module
A20B–2900–0530,531,541
A20B–2902–0330 to 0332

(6) Digital servo module
A20B–2900–0160

(7) Servo interface module
A20B–2900–0380

2) Power Mate–D(A02B–0166–B520)

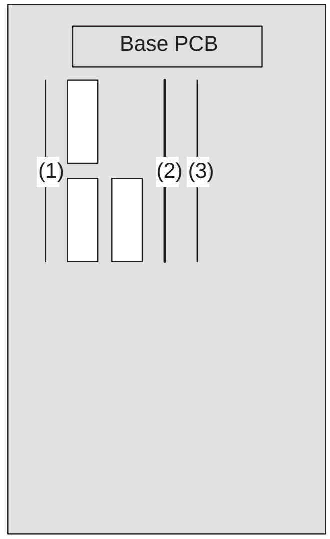


(2) Memory module
A20B–2900–0530,531,541
A20B–2902–0330 to 0332

(6) Digital servo module
A20B–2901–0340

(7) Servo interface module
A20B–2900–0380

3) Power Mate–D(A02B–0166–B501, B502, B531)

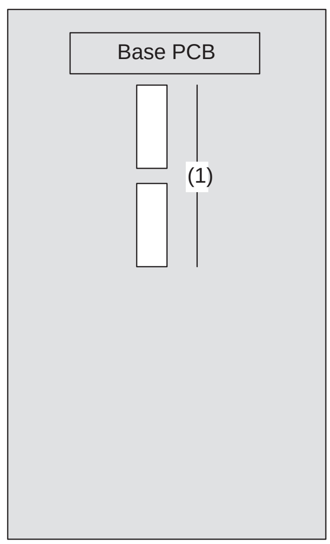


The base printed–circuit board provides the servo module functions.

(2) Memory modules
A20B–2902–0221 to –0225
A20B–2902–0230 to –0237

The base printed–circuit board has 256 KB of memory installed.

4) Power Mate–F(A02B–0198–B501, B531)



The base printed–circuit board provides both servo module functions and memory.

CAUTION

When the base printed board and memory module are replaced, all the data stroed in memory is lost. Set data again, referring to chapter 3 " Data input/output" .

8.32 ALARM 924 (SERVO MODULE MOUNTING ERROR)

In the Power Mate–D (A02B–0166–B001, –B520) the servo module is not mounted.

> **NOTE**
> This alarm may not occur during normal operaion.
> This alarm may be generated when a PCB is changed for maintenance.

Causes and Remedies

Check installation servo module on base printed board.

Unless these boards are mounted correctly, if this alarm still generates, change servo module.

- **Module location**

See Sec. 8.13.

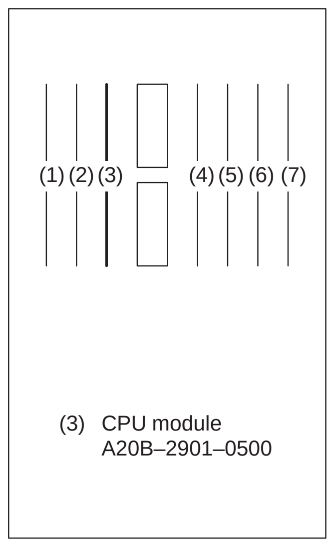
> **NOTE**
> The base printed–circuit boards of both the Power Mate–D (A02B–0166–B501, –B502, –B531) and Power Mate–F provide a servo module function. If this alarm occurs, replace the base printed–circuit board.

8.33 ALARM 930 (CPU ERROR)

CPU error (illeagal interrupt) has generated.

Causes and Remedies

1) Base printed board is faulty
   An interrupt which will not occur during usual operation has generated.
   Peripheral circuit of the CPU may be abnormal. Change the base printed board. If operation is performed normally by power off and on, noise may be a cause. Refer to Subsec.2.2.3. Suppressing Noise.
2) Memory is faulty
   Replace PCB including the memory. For location of memory see the section of alarm 910 to 911.
3) Defective CPU module
   Replace the CPU module. (Power Mate–D/B001, B520)
   When replacing the CPU module, the memory module must be removed then re–mounted. Observe the following precaution.



CAUTION
If the base printed–circuit board is replaced, or the memory module is removed then remounted, all data in memory will be lost. Set data again, referring to chapter 3 ” Data input/output”.

8.34 ALARM 950 OR 951 (PMC SYSTEM ALARM)

An error occurred when RAM used for PMC test is being executed.

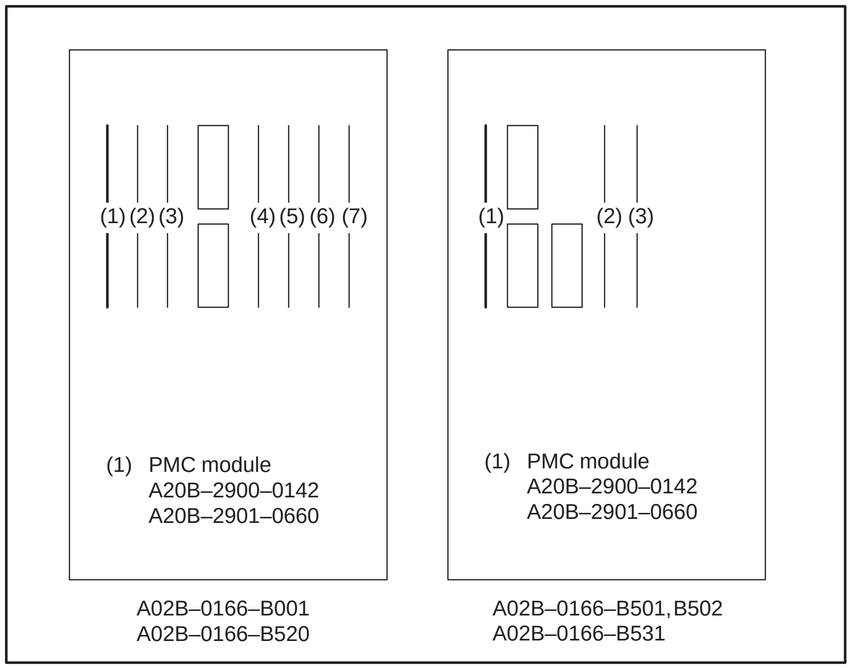
Causes and Remedies

The following causes are considered :

- PMC module (1) is faulty. (Power Mate–D)
- Base printed board is faulty. (Power Mate–F)

Module mounting position

<Location of module> Power mate–D



8.35 ALARM 970 (NMI ALARM IN PMC MODULE)

RAM parity error or NMI has occurred in the PMC module.

Causes and Remedies

Same as alarm 950

Module mounting position

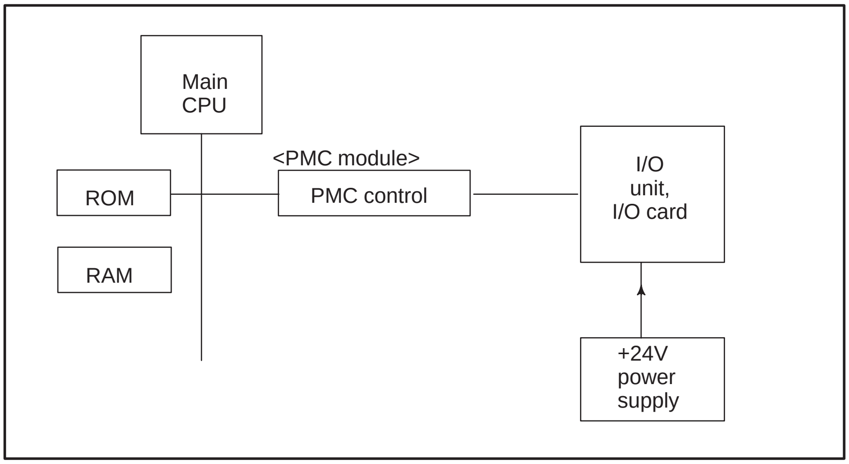
See alarm 950.

8.36 ALARM 971 (NMI ALARM IN SLC)

A communication error is detected between Power Mate and I/O unit I/O card at SLC in the PMC module. (Power Mate–D)

Causes and Remedies

Fault of PMC module or fault of I/O unit or I/O card.



- PMC control module (1) is faulty.
  Refer to ALARM 950 for the module mounting position.
- I/O unit or I/O card is faulty.
- +24V power to the I/O unit is faulty.

Interface module
AF01A/AF01B

CP32

1	+24V
2	GND
3	Unused

Disconnection or broken of cable.

8.37 ALARM 973 (NMI ALARM BY UNKNOWN CAUSE)

An unknown NMI has generated.
This alarm may also occur due to an I/O Link communication error when the Power Mate is used as a slave of the FANUC I/O Link.

Causes and Remedies

Possible causes are as follows. Replace the corresponding printed circuit board.

- Defective base printed–circuit board
- Defective memory
  See the description of alarms 910 to 911 for details of the memory location.
- Defective CPU module (Power Mate–D/B001, B520)
  See alarm 930 for the location of the CPU module.
- Defective power supply printed–circuit board

NOTE

If the base printed–circuit board is replaced, or if the memory module is removed then remounted, all data in memory will be lost. Re–set the data as explained in Chapter 3.

9 TROUBLESHOOTING (SERIAL INTERFACE SPINDLE)

This chapter describes a troubleshooting of the serial interface spindle amplifier.

9.1 LIST OF SERIAL INTERFACE SPINDLE AMPLIFIER ALARMS

For troubleshooting the listed alarms, refer to 9.2 “TROUBLE SHOOTING FOR EACH ALARM”.

Alarm No.	Meanings	Description	Remedy
AL–01	Motor overheat	Detects internal motor temperature : exceeding specified temperature.	Check load status. Cool motor, then reset alarm.
AL–02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load status. Reset alarm.
AL–03	DC link section fuse blown	Detects that fuse F4 in DC link section is blown (models 30S and 40S).	Check power transistors, and so forth. Replace fuse.
AL–04	Input fuse blown. Input power open phase.	Detects blown fuse (F1 to F3), open phase or momentary failure of power (models 30S and 40S).	Replace fuse. Check open phase and power supply regenerative circuit operation.
AL–05	Control power supply fuse blown	Detects that control power supply fuse AF2 or AF3 is blown (models 30S and 40S).	Check for control power supply short circuit. Replace fuse.
AL–07	Excessive speed	Detects that motor rotation has exceeded 115% of its rated speed.	Reset alarm.
AL–08	High input voltage	Detects that switch is set to 200 VAC when input voltage is 230 VAC or higher (models 30S and 40S).	Set switch to 230 VAC.
AL–09	Excessive load on main circuit section	Detects abnormal temperature rise of power transistor radiator.	Cool radiator, then reset alarm.
AL–10	Low input voltage	Detects drop in input power supply voltage.	Correct cause, then reset alarm.
AL–11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Correct cause, then reset alarm.
AL–12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power circuit.	Correct cause, then reset alarm.
AL–13	CPU internal data memory abnormality	Detects abnormality in CPU internal data memory. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL–15	Spindle switch/output switch alarm	Detects incorrect switch sequence in spindle switch/output switch operation.	Check sequence.
AL–16	RAM abnormality	Detects abnormality in RAM for external data. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL–18	Program ROM sum check error	Detects program ROM data error. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL–19	Excessive U phase current detection circuit offset	Detects excessive U phase current detection circuit offset. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL–20	Excessive V phase current detection circuit offset	Detects excessive V phase current detection circuit offset. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL–24	Serial transfer data error	Detects serial transfer data error (such as NC power supply turned off, etc.)	Correct cause, then reset alarm.
AL–25	Serial data transfer stopped	Detects that serial data transfer has stopped.	Correct cause, then reset alarm.
AL–27	Position coder signal disconnection	Detects abnormality in position coder signal (such as unconnected cable and parameter setting error).	Correct cause, then reset alarm.
AL–29	Short-time overload	Detects that overload has been continuously applied for some period of time (such as restraining motor shaft in positioning).	Correct cause, then reset alarm.
AL–30	Input circuit overcurrent	Detects overcurrent flowing in input circuit.	Correct cause, then reset alarm.

Alarm No.	Meanings	Description	Remedy
AL–31	Speed detection signal disconnection motor restraint alarm	Detects that motor cannot rotate at specified speed (but rotates at very slow speed or has stopped). (This includes checking of speed detection signal cable.)	Correct cause, then reset alarm.
AL–32	Abnormality in RAM internal to LSI for serial data transfer	Detects abnormality in RAM internal to LSI for serial data transfer. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL–33	Insufficient DC link section charging	Detects insufficient charging of direct current power supply voltage in power circuit section when magnetic contactor in amplifier is turned on (such as open phase and defective charging resistor).	Correct cause, then reset alarm.
AL–34	Parameter data setting beyond allowable range of values	Detects parameter data set beyond allowable range of values.	Set correct data.
AL–35	Excessive gear ratio data setting	Detects gear ratio data set beyond allowable range of values.	Set correct data.
AL–36	Error counter over flow	Detects error counter overflow.	Correct cause, then reset alarm.
AL–37	Speed detector parameter setting error	Detects incorrect setting of parameter for number of speed detection pulses.	Set correct data.
AL–41	Alarm for indicating failure in detecting position coder 1-rotation signal.	Detects failure in detecting position coder 1-rotation signal.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL–42	Alarm for indicating position coder 1-rotation signal not detected	Detects that position coder 1-rotation signal has not occurred.	Make 1-rotation signal adjustment for signal conversion circuit.
AL–43	Alarm for indicating disconnection of position coder signal for differential speed mode	Detects that main spindle position coder signal used for differential speed mode is not connected yet (or is disconnected).	Check that main spindle position coder signal is connected to connector CN12.
AL–46	Alarm for indicating failure in detecting position coder 1-rotation signal in thread cutting operation.	Detects failure in detecting position coder 1-rotation signal in thread cutting operation.	Make 1-rotation signal adjustment for signal conversion circuit. Check cable shield status.
AL–47	Position coder signal abnormality	Detects incorrect position coder signal count operation.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL–48	Position coder 1-rotation signal abnormality	Detects that occurrence of position coder 1-rotation signal has stopped.	Make 1-rotation signal adjustment for signal conversion circuit.
AL–49	The converted differential speed is too high.	Detects that difference between a spindle speed and another spindle speed has exceeded allowable limit in differential speed mode.	Calculate differential speed by multiplying speed of other spindle by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL–50	Excessive speed command calculation value in spindle synchronization control	Detects that speed command calculation value exceeded allowable range in spindle synchronization control.	Calculate motor speed by multiplying specified spindle speed by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL–51	Undervoltage at DC link section	Detects that DC power supply voltage of power circuit has dropped (due to momentary power failure or loose contact of magnetic contactor).	Correct cause, then reset alarm.
AL–52	ITP signal abnormality I	Detects abnormality in synchronization signal (ITP signal) with CNC (such as loss of ITP signal).	Correct cause, then reset alarm.
AL–53	ITP signal abnormality II	Detects abnormality in synchronization signal (ITP signal) with CNC (such as loss of ITP signal).	Correct cause, then reset alarm.
AL–54	Overload current alarm	Detects that excessive current flowed in motor for long time.	Check if overload operation or frequent acceleration/deceleration is performed.
AL–55	Power line abnormality in spindle switching/output switching	Detects that switch request signal does not match power line status check signal.	Check operation of magnetic contractor for power line switching. Check if power line status check signal is processed normally.

9.2 TROUBLESHOOTING FOR EACH ALARM

AL–01 Motor overheat

Item	Cause of trouble	Check procedure	Remedy
1	Defective fan motor of motor	Check if fan motor is rotating.	Replace fan motor.
2	Overload operation	Check cutting conditions and how tools are worn. Check load meter for cutting.	Review cutting conditions and tools.
3	Dirty motor cooling system	Check motor cooling system for dirt.	Clean motor cooling system with an air gun or vacuum cleaner.
4	Disconnection or loose contact of motor overheat signal line	Check signal line connection status.	Connect signal line correctly.

AL–02 Excessive speed deviation

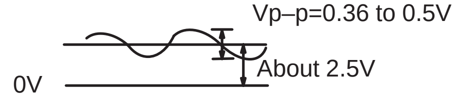
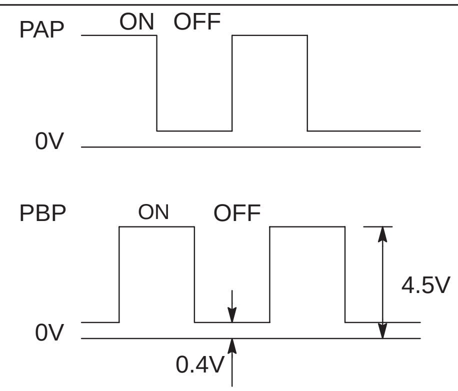
Item	Cause of trouble	Check procedure	Remedy
1	Overload operation (overload)	Check with load meter.	Review cutting conditions and tools.
2	Defective transistor module	Check if transistor collector-emitter is open.	Replace transistor module.
3	Fuse for protecting driver on PCB blown or not inserted correctly (disconnection, loose contact, etc.)	Check if fuses F3A to F3M (models 1S to 26S) or FA to FG (models 30S and 40S) are blown or removed.	Insert fuses firmly. Replace any blown fuse.
4	Speed feedback signal abnormality	Check level of speed feedback signal.	Check motor speed detector and signal cable connection.
5	Wiring failure (disconnection, loose contact, etc.)	Check that cables are connected correctly.	

NOTE

How to check the speed feedback signal

Observe the speed feedback signal with an osciloscope after turning on power and setting the rotation command off (motor stopped and drive power set off).

Observe the test points indicated below, while turning the motor slowly by hand.

Test point	Normal wave form
PA–0V	
PB–0V	Same as above
RA–0V	2.5VDC±0.2V
RB–0V	Same as above
PAA–0V PBA–0V (CW rotation)	 Check that the ON/OFF duty cycle is 50%. (The PAP and PBP signals are inverted in CCW direction.)

AL–03 Blown fuse in DC link section

This alarm indicates that the fuse (F4) in the DC link section is blown. In this case, the transistor module may have failed.

AL–04 Input fuse blown Input power open phase

Item	Cause of trouble	Check procedure	Remedy
1	High impedance on AC power supply side. Example: Two transformers are connected in series, or variable autotransformer is connected.	Alarm No. 04 is on only at time of deceleration from high speed operation. Alarm No. 04 can be on when F1 to F3 are not blown.	Change power supply to one with low impedance. There may be loose connection of input power cable Example: Open phase due to screws not tightened firmly
2	Defective transistor module		Replace transistor module and fuse.
3	Defective diode module or thyristor module	Disconnect diode modules DM1 to DM3 and thyristor modules SM1 to SM3, then check A-K connection with multimeter. (Defective modules are usually short-circuited.)	Replace defective part. Replace blown fuse.
4	Defective surge absorber or capacitor	Check surge absorbers Z1 to Z3 and capacitors C4 to C6.	Replace defective part. Replace blown fuse.
5	When input fuse is not blown	Check if Item 1 is applicable.	When Item 1 is not applicable, replace PCB.

AL–05 Control power supply fuse blown

Item	Cause of trouble	Check procedure	Remedy
1	Defective PCB	Check AC input voltage. See (5) above.	Replace PCB.
2	Abnormal power supply voltage		

AL–07 Excessive speed (Detection by digital value)

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of speed feedback pulses (No. 6511)	Check if number of speed feedback pulses matches parameter setting.	Set correct value in parameter.

NOTE
See Chapter 6.

AL–08 High input voltage

Item	Cause of trouble	Check procedure	Remedy
1	AC power supply voltage 10% higher than rated voltage.	Check power supply voltage.	
2	Incorrect setting of toggle switch for voltage switching.	Check power supply voltage.	Change setting from 200V to 230V.

AL–09 Heat sink is overheated

Item	Cause of trouble	Check procedure	Remedy
1	Cooling fan is defective.	Check if fan is rotating.	Replace fan.
2	Overload operation.	Check load by using a load meter.	Re-examine the cutting condition.
3	Dusty and dirty.		Clean using compressed air or vacuum cleaner.

AL–10 Input power voltage drops

This alarm indicates abnormally low AC power voltage (–15% or less). This alarm may be generated even during momentary power failures.

AL–11 Overvoltage of DC link circuit (Regenerative circuit is faulty…Regeneration failure)

Item	Cause of trouble	Check procedure	Remedy
1	High power impedance.		Examine AC power specification.
2	PCB is defective.		Replace PCB.
3	Defective transistor module (TM1).		Replace transistor module.

AL–12 Overcurrent flows to DC link circuit

Item	Cause of trouble	Check procedure	Remedy
1	Output terminals or internal circuit of motor is shorted.	Check connections.	
2	Transistor module is defective.	Check the transistor module.	Replace transistor module.
3	PCB is defective.		Replace PCB.

AL–13 CPU internal data memory alarm

Replace PCB .

AL–16 RAM abnormality

Item	Cause of trouble	Check procedure	Remedy
1	External data memory (RAM) defective		Replace memory (RAM).
2	PCB defective		Replace PCB.

AL–18 Program ROM sum check error

Item	Cause of trouble	Check procedure	Remedy
1	Program memory data (ROM) defective	Compare data displayed when power is turned ON with ROM labels.	Replace program memory (ROM).

AL–19 Excessive U phase current detection circuit offset

Item	Cause of trouble	Check procedure	Remedy
1	A/D converter defective		Replace A/D converter.
2	U-phase current detector circuit defective	After power is turned on, check if offset voltage on check terminal IU is beyond range of about ±100 mV.	Replace PCB.
3	Loose contact of connectors between PCB and power circuit	Check connector connection between PCB and power circuit.	Ensure that PCB and power circuit are securely connected with each other.

AL–20 Excessive V phase current detection circuit offset

Item	Cause of trouble	Check procedure	Remedy
1	V-phase current detector circuit defective	After power is turned on, check if offset voltage on check terminal IV is beyond range of about ±100 mV.	Replace PCB.
2	Loose contact of connectors between PCB and power circuit	Check connector connection between PCB and power circuit.	Ensure that PCB and power circuit are securely connected with each other.

AL–24 Serial transfer data error

AL–25 Serial data transfer stopped

Item	Cause of trouble	Check procedure	Remedy
1	CNC power supply is OFF	Check that CNC power is ON.	Turn CNC power ON.
2	Defective optical cable for serial data transmission	Check that optical cable is fitted securely to the connector. Check that the cable is not broken. Check that transmission/reception surfaces of the cable are clean.	Connect securely. Replace optical cable. Clean optical cable transmission/reception surfaces.
3	Defective data transmission/reception elements in LSI used in serial data transmission		Replace LSI. Replace PCB.

AL–27 Position coder signal disconnection

Item	Cause of trouble	Check procedure	Remedy
1	Position coder signal line defective	Check that signal cable is connected securely to connector. Check that signal cable is not broken.	Connect signal cable securely. Replace signal cable.
2	Incorrect parameter setting	Check that the parameter setting does not indicate that the position coder signal is used when actually it is not.	Parameter MRDY2 = 0 No. 4001#2

AL–29 Short–time overload

Item	Cause of trouble	Check procedure	Remedy
1	Overloaded operation (Overload)	Use loadmeter to check that a load close to the load resistance limit is not imposed continuously for 30 seconds or more.	Re-examine cutting conditions and tools.

AL–30 Input circuit overcurrent

Item	Cause of trouble	Check procedure	Remedy
1	Defective of power transistor used for power	Check power transistor.	Replace power transistor.
2	Defective of power regeneration circuit		Replace PCB.

AL–31 Speed detection signal disconnection motor restraint alarm

Item	Cause of trouble	Check procedure	Remedy
1	Motor constrained	Check that nothing is preventing the motor from accelerating.	Remove cause.
2	Defective motor speed feedback signal	Check signal waveform. (Alarm No. 2)	Remove cause.
3	Defective motor speed feedback signal cable	Check that cable is connected securely to connector. Check that cable is not broken.	Connect cable securely. Replace cable.

AL–32 Abnormality in RAM internal to LSI for serial data transfer

Item	Cause of trouble	Check procedure	Remedy
1	Defective LSI used in serial data transmission		Replace LSI. Replace PCB.

AL–33 Insufficient DC link section charging

Item	Cause of trouble	Check procedure	Remedy
1	Defective relay used in DC link recharging.Disconnection of resistor used in limiting re-charge current	Check relevant parts.	Replace amp.

AL–34 Parameter data setting beyond allowable range of values

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect parameter setting	Check if specified parameter value is beyond allowable range of values.	Specify value within allowable range.

AL–34 and F–XXX are alternately displayed in the spindle amplifier indicator section if an AL–34 alarm is raised.
"XXX" indicates the data number internal to the spindle for a parameter where a value beyond the allowable range is specified.

AL–35 Excessive gear ratio data setting

Item	Cause of trouble	Check procedure	Remedy
1	Parameter data of gear ratio and position gain are too large.	Check gear ratio and position gain data.	Change to suitable values.

AL–37 Speed detector parameter setting error

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of speed feedback pulses (No. 6511)	Check if number of speed feedback pulses matches parameter setting.	Set correct value in parameter.

AL–41 Alarm for indicating failure in detecting position coder 1–rotation signal

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of position coder signal pulses (No. 4003#4,6,7).	Check number of position coder signal pulses and parameter setting.	Set correct value in parameter.
2	Incorrect amplitude and offset of position coder feedback signal, or noise on same feedback signal.	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

AL–47 Position coder signal abnormality

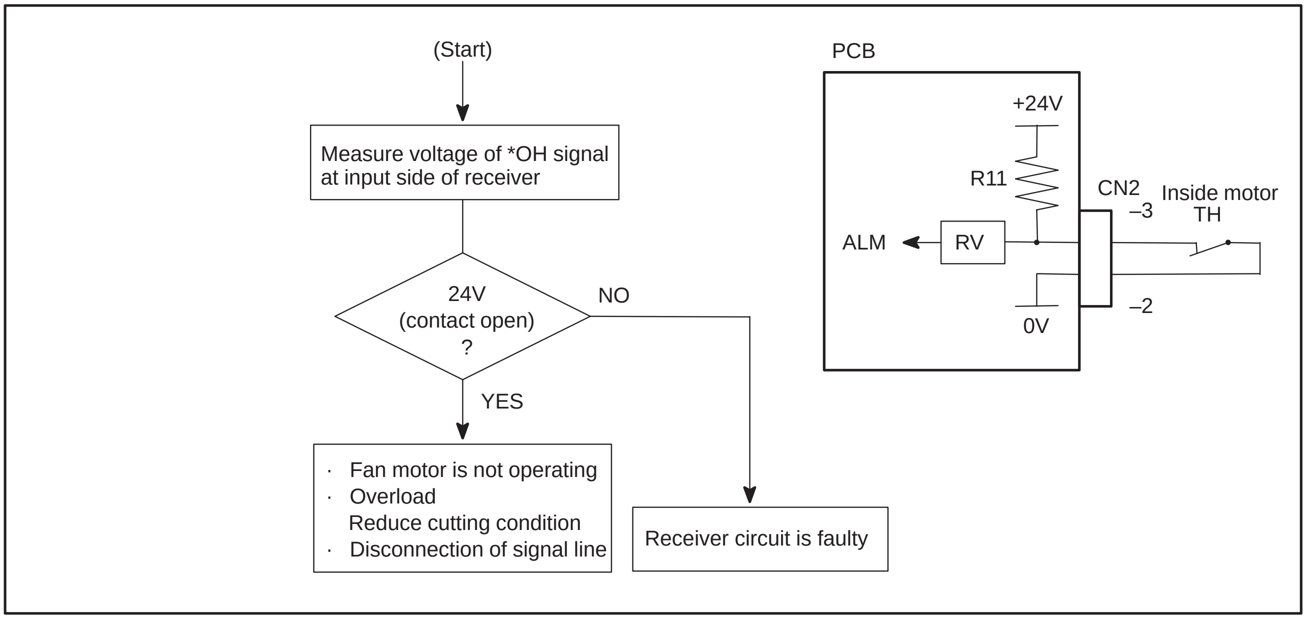
Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of position coder signal pulses (No. 4003#4,6,7).	Check number of position coder signal pulses and parameter setting.	Set correct value in parameter.
2	Incorrect amplitude and offset of position coder feedback signal, or noise on same feedback signal.	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

10 TROUBLESHOOTING (ANALOG INTERFACE SPINDLE)

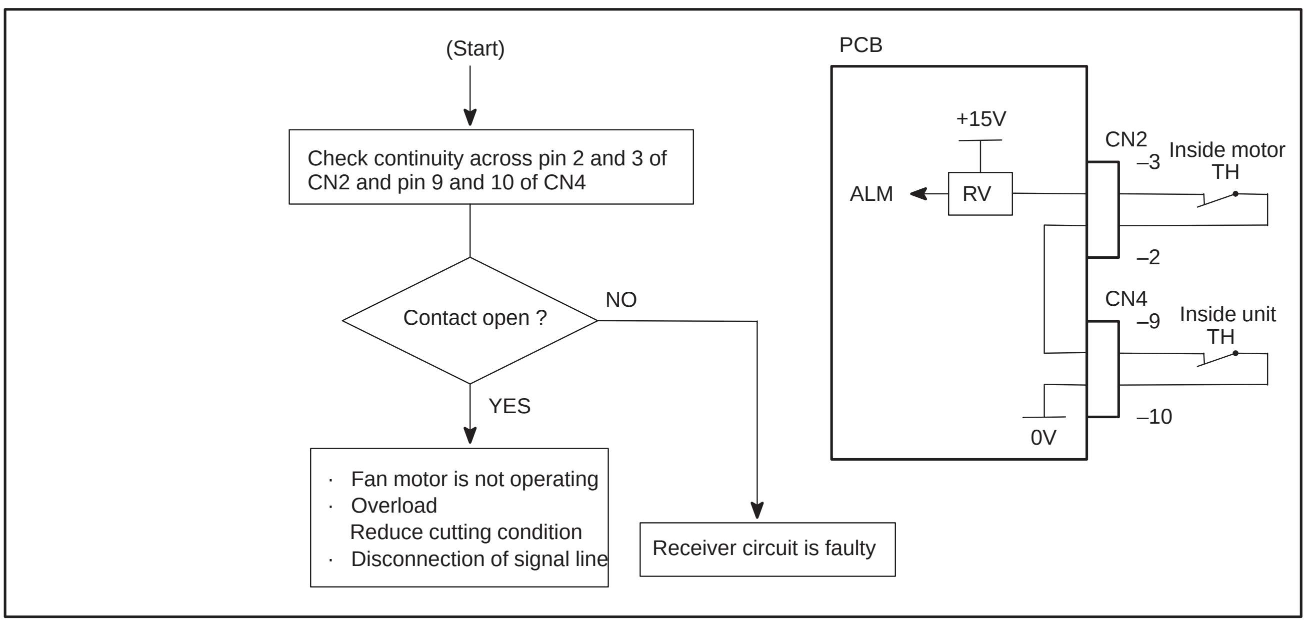
This chapter describes troubleshooting of the analog interface spindle.

10.1 AL–01 (MOTOR OVERHEAT)

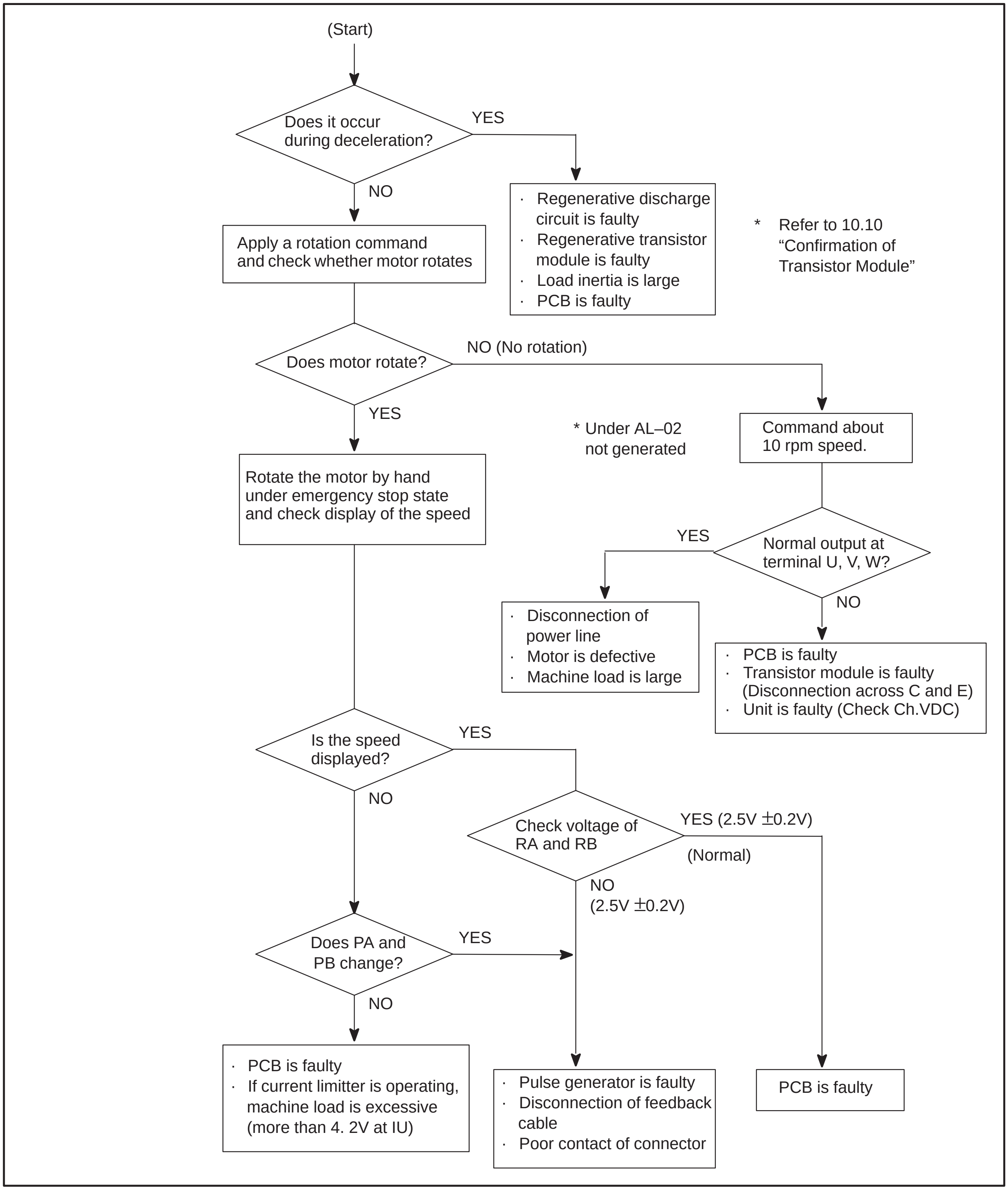
Model 6S to 22S (A20B–1003–0010)



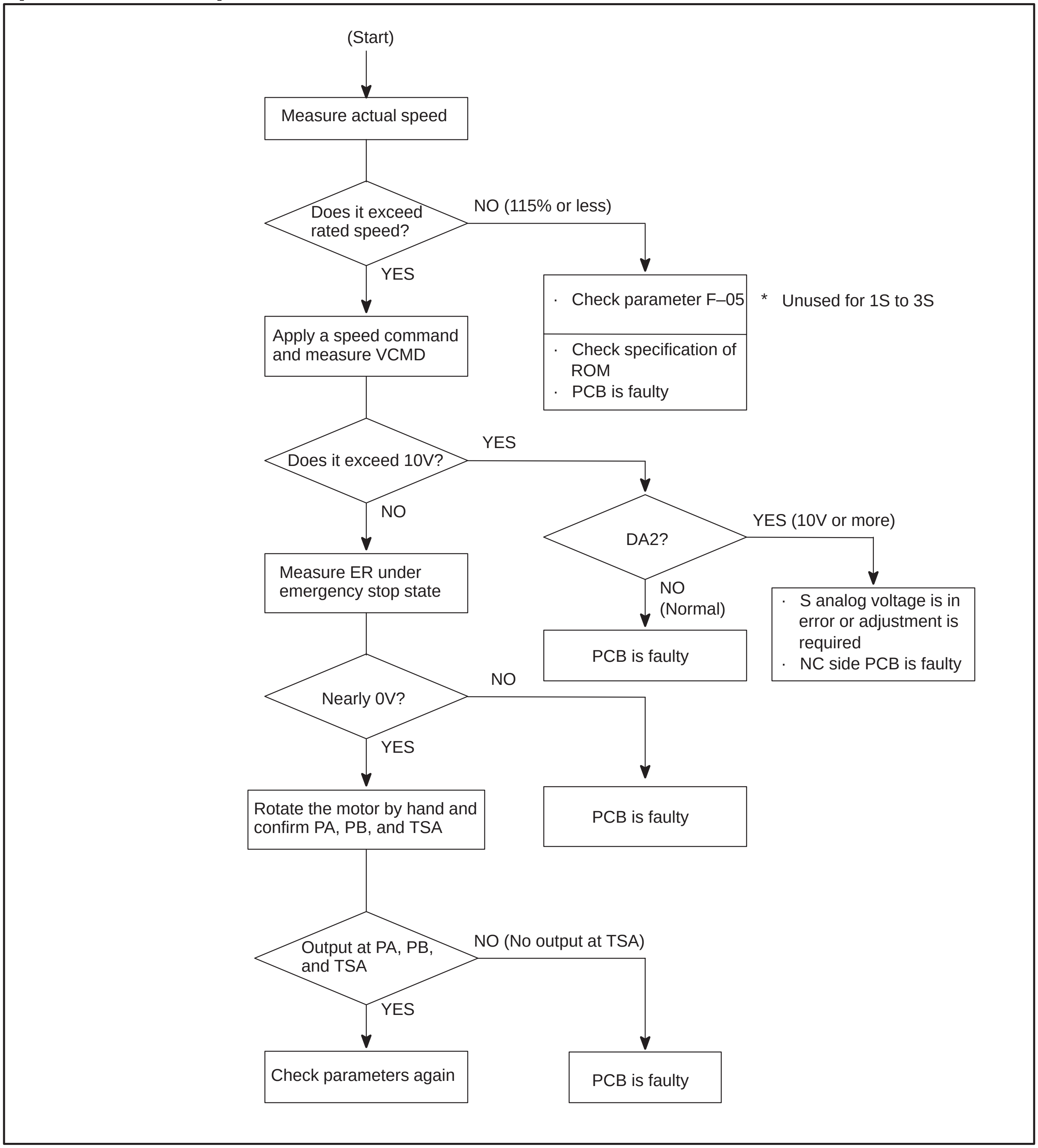
Model 1S to 3S (A16B–1100–0200)



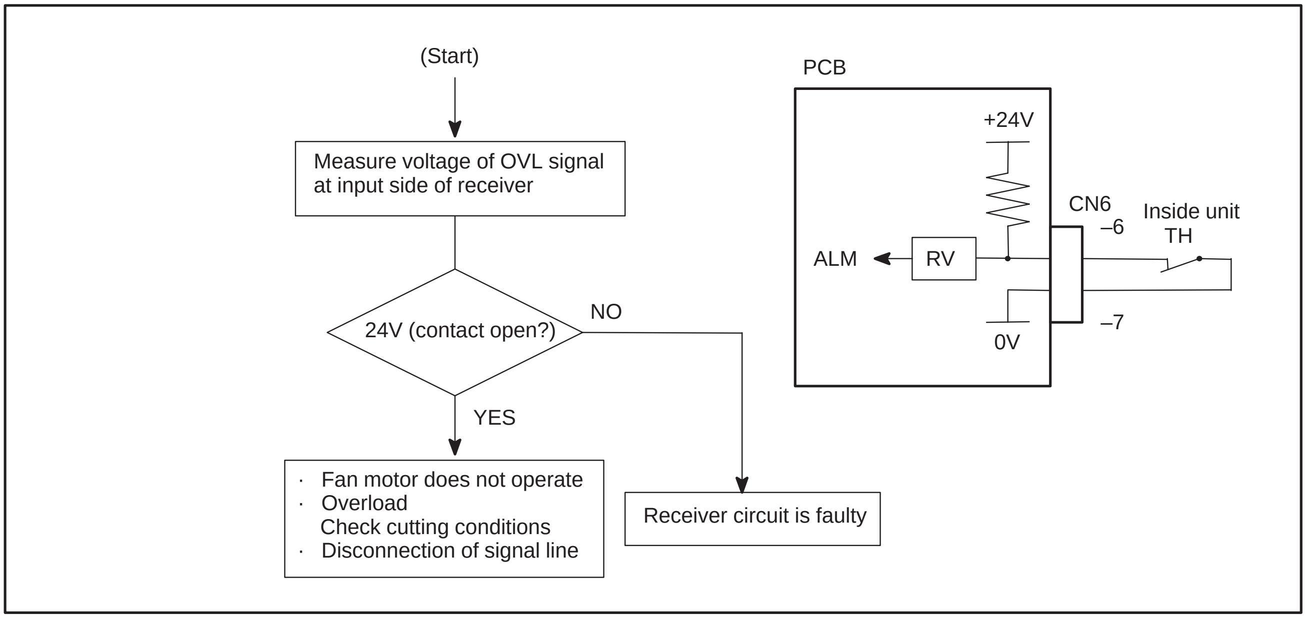
10.2 AL–02 (EXCESSIVE DEVIATION OF SPEED)



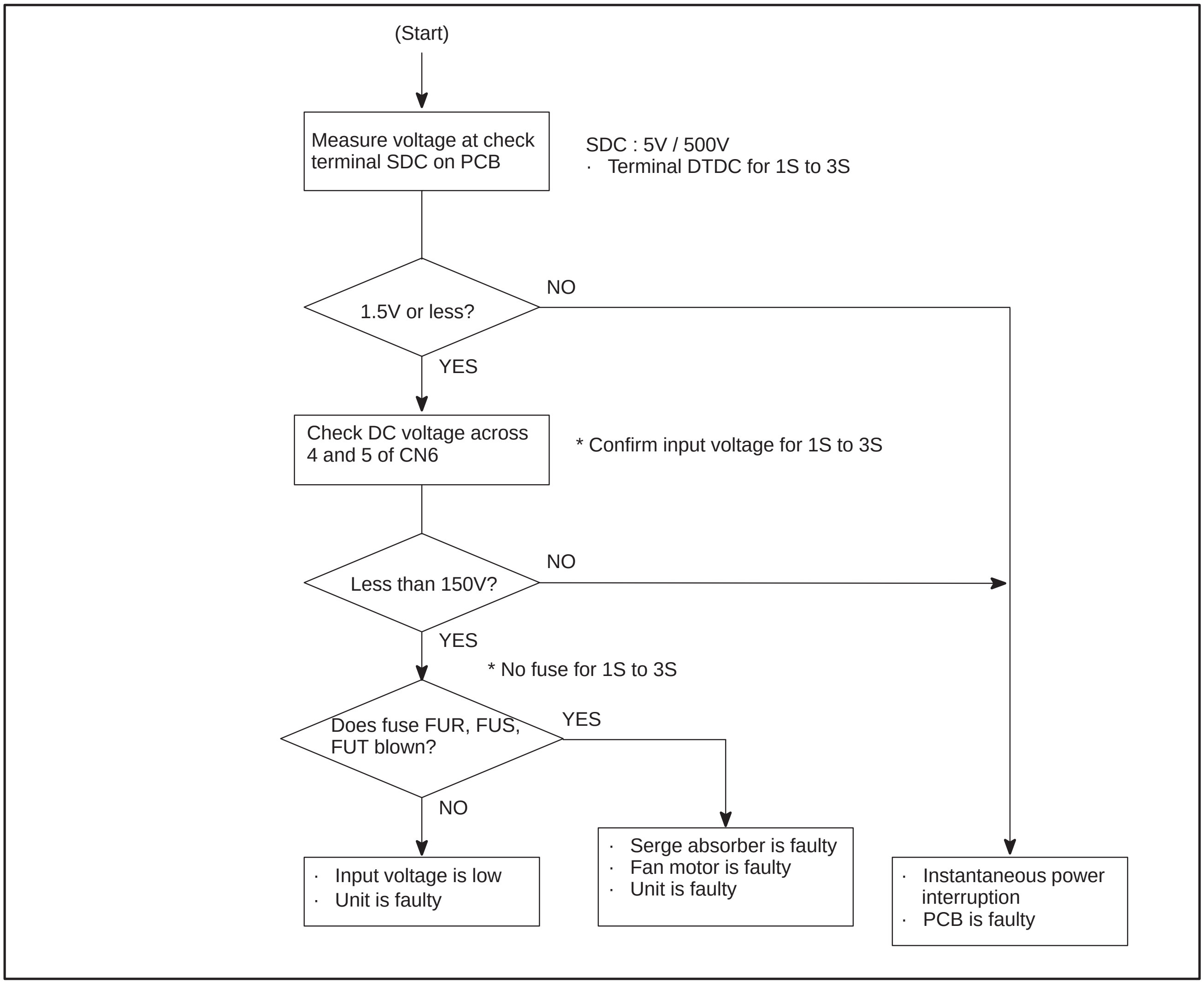
10.3 AL–06, 07 (OVER SPEED)



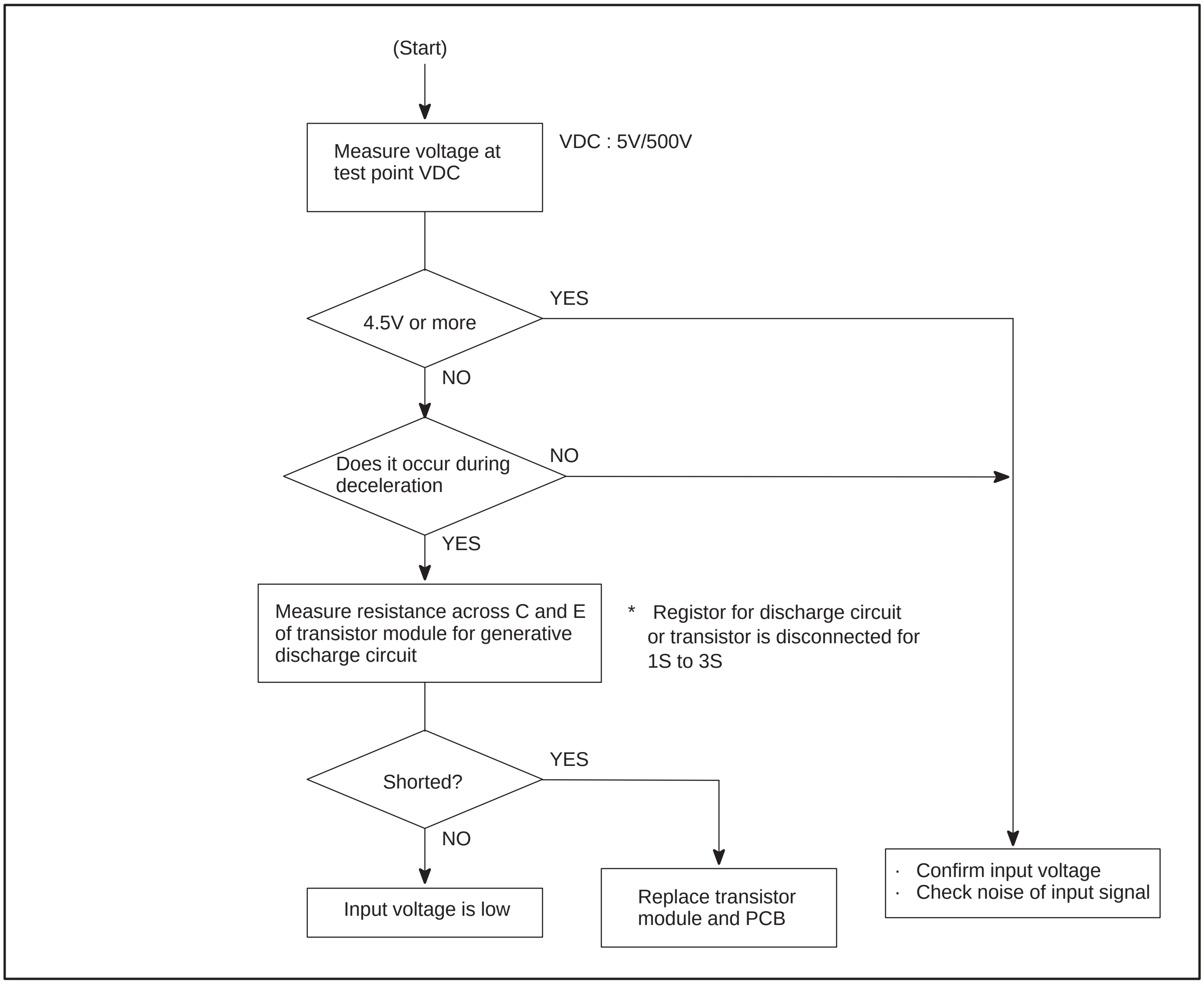
10.4 AL–09 (UNIT OVERHEAT / 6S TO 26S ONLY)



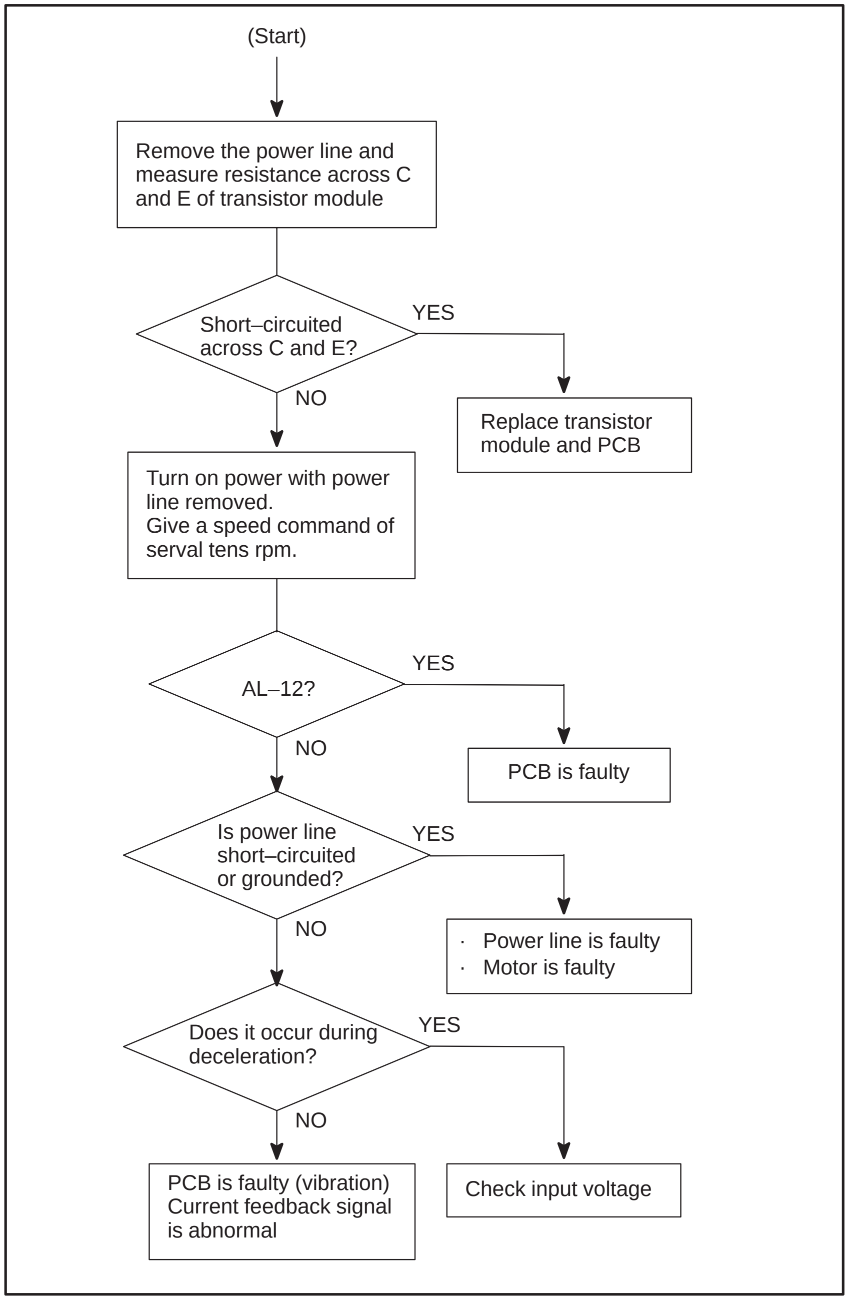
10.5 AL–10 (LOW INPUT VOLTAGE)



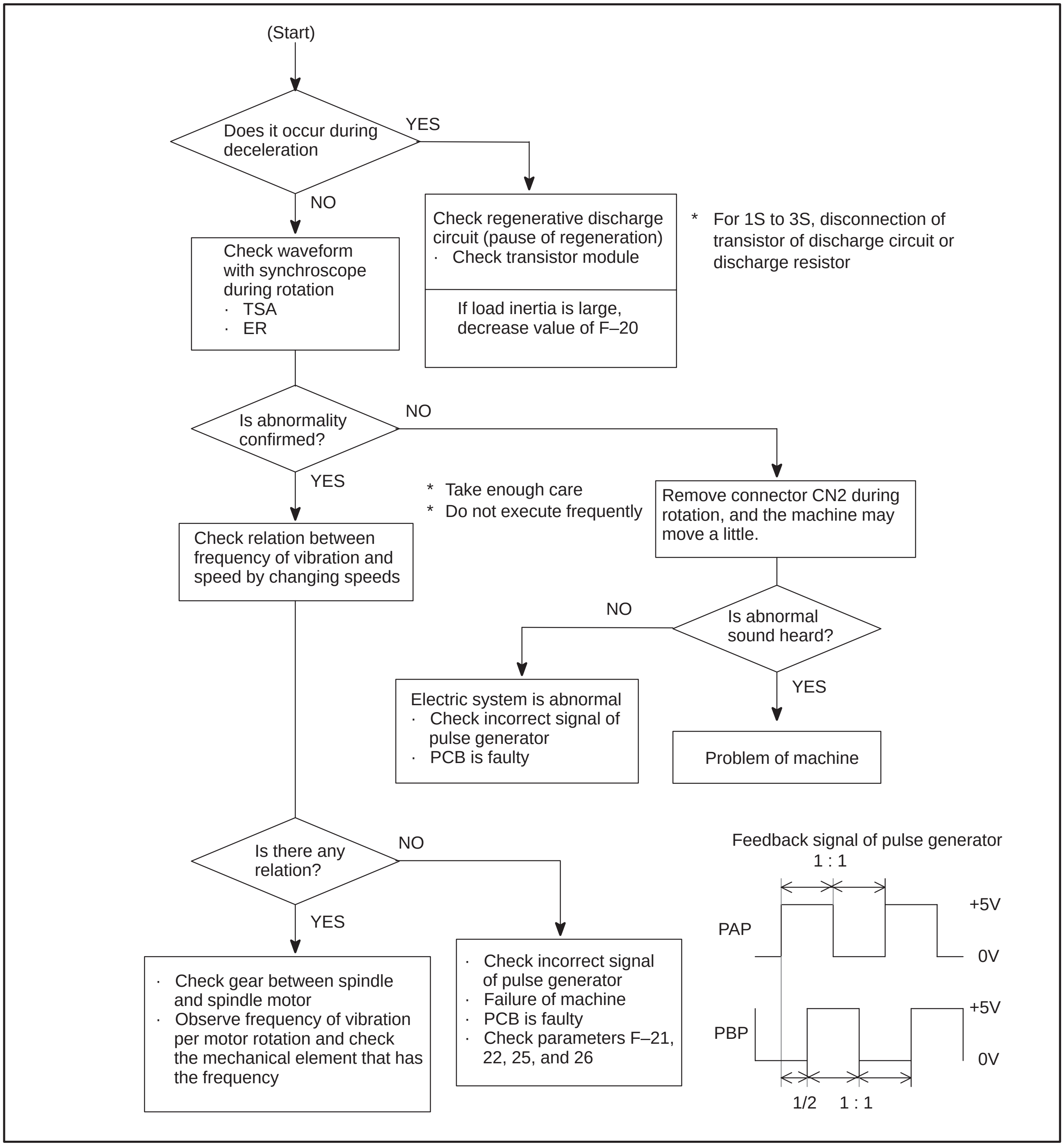
10.6 AL–11 (DC LINK EXCESSIVE VOLTAGE)



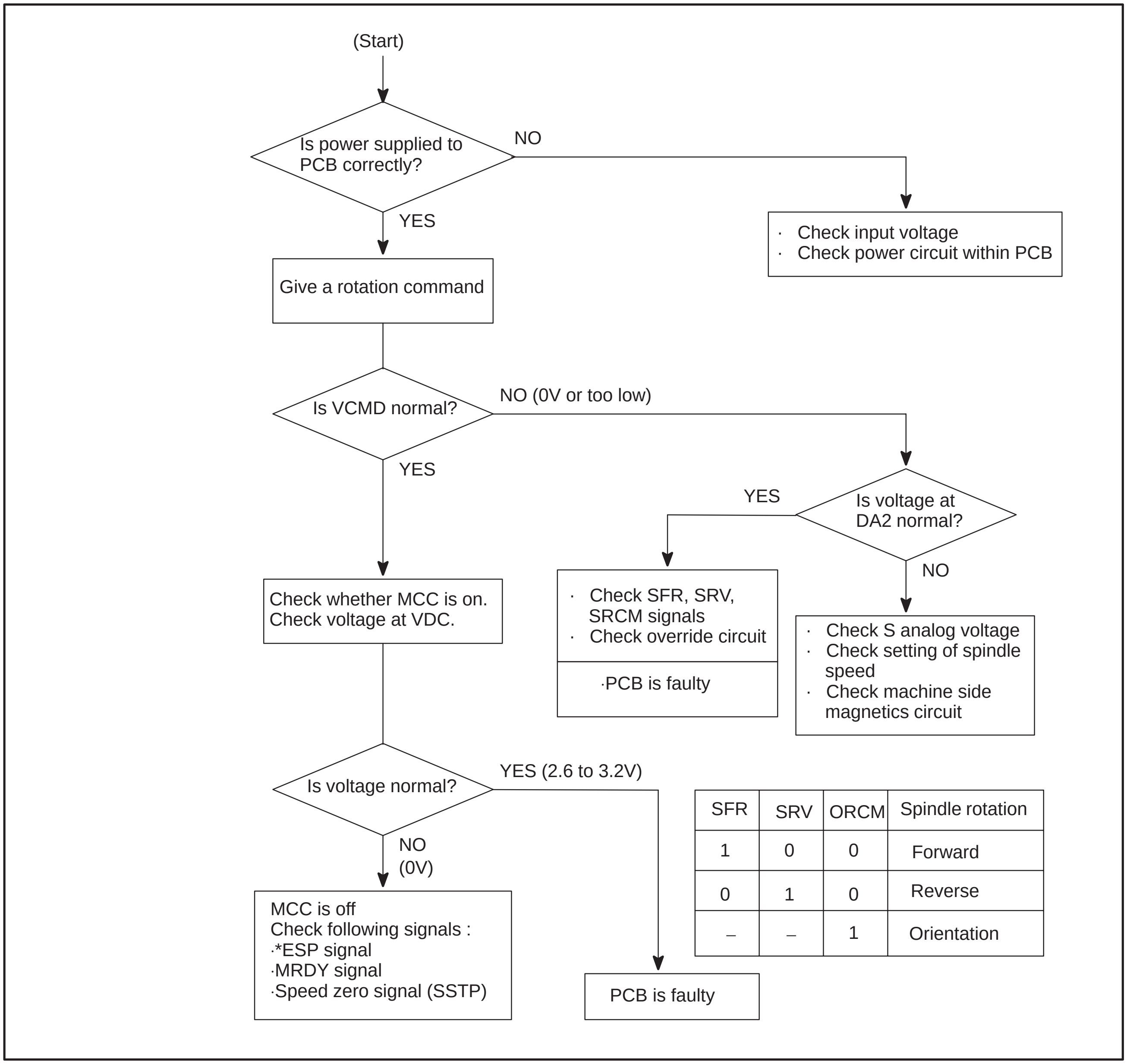
10.7 AL–12 (DC LINK EXCESSIVE CURRENT)



10.8 ABNORMAL SOUND AND VIBRATION DURING ROTATION



10.9 NO ROTATION OR INCORRECT SPEED



SFR	SRV	ORCM	Spindle rotation
1	0	0	Forward
0	1	0	Reverse
–	–	1	Orientation

WARNING

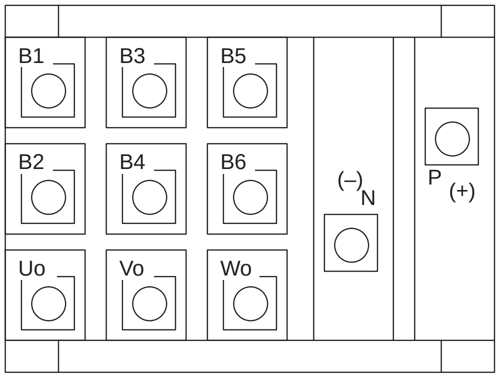
Whille you are checking above items, if the system may recover, the spindle may suddenly start its rotation. Therefore, take enough care when you access the spindle or its peripherals.

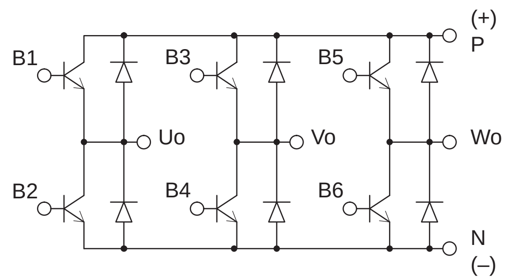
10.10 CONFIRMATION OF TRANSISTOR MODULE

(1) Remove PCB–1 on the spindle amplifier.

(2) Turn off power of main power supply of machine side and remove the motor power line.

(3) Measure resistance across the following terminals of the transistor module on the circuit board shown below with a tester.

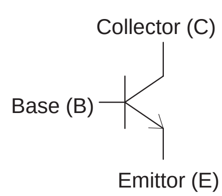




Judgement (Range of tester : x10 ohm)

Terminal	Tester	Normal	Abnormal
C – E	C : +	100 ohms	Short, infinity
	C : –	Infinity	Short, 100 ohms
C – B	C : +	100 ohms	Short, infinity
	C : –	Infinity	Short, 100 ohms
B – E	B : +	100 ohms	Short, infinity
	B : –	100 ohms	Short, infinity

* When a transistor is defective, terminals across collector and emitter, and across collector and base are short–circuited.

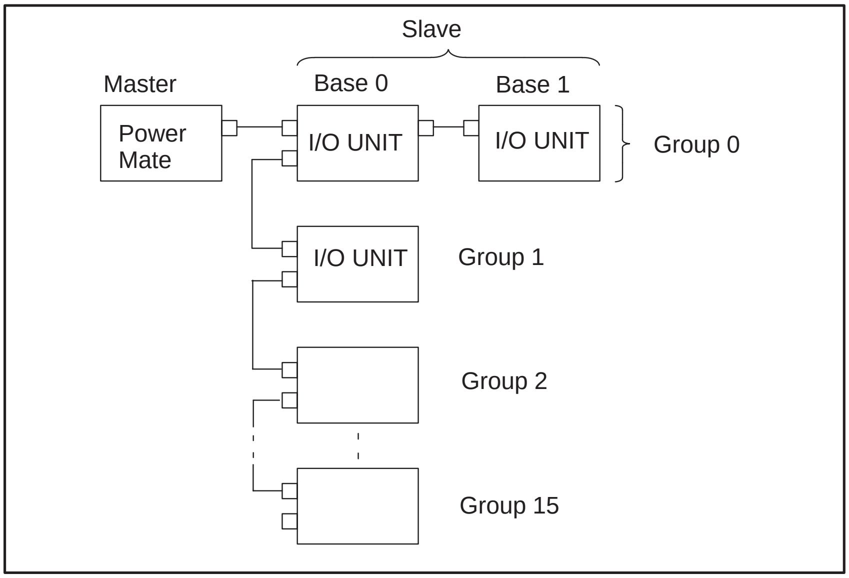


APPENDIX

A I/O UNIT MODEL A

A.1 SYSTEM CONFIGURATION

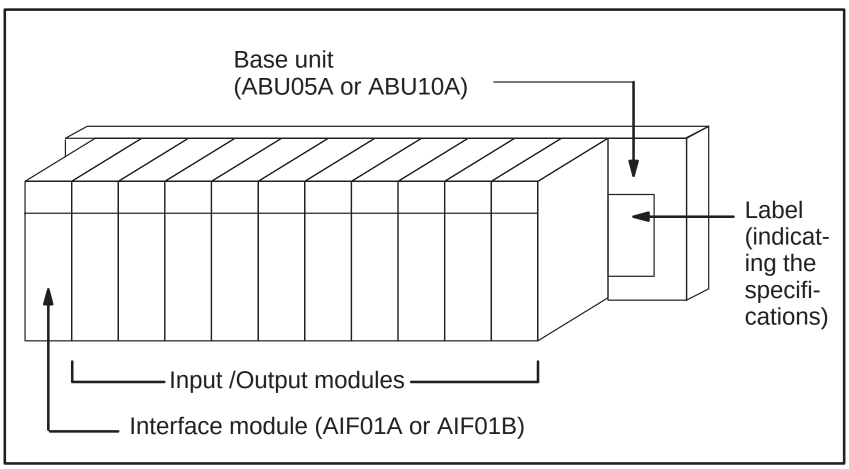
Up to 16 FANUC I/O Unit–MODEL A groups can be connected to a Power Mate through the FANUC I/O Link high–speed serial interface.



* The number and types of slave units that can be connected for each group are as follows :

- Up to two I/O Units
- One Power Mate
- One I/O card

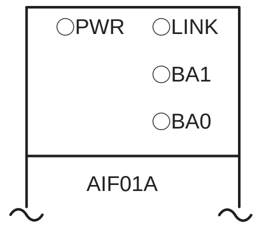
A.2 HARDWARE CONFIGURATION



A.3 LED INDICATION

Modules having up to 16 input/output points are provided with LEDs to indicate their statuses.
Use these LED's to assist you with troubleshooting.

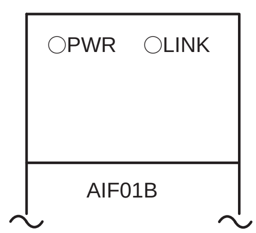
AIF01A



<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>PWR</td><td>Indicates that the internal 24 VDC power supply is operating normally.</td></tr>
<tr><td>LINK</td><td>Indicates that the I/O Link is operating normally.</td></tr>
<tr><td>BA0
BA1</td><td>Indicates the number of the base from which data is being transferred.
<table>
<tr><th>BA1</th><th>BA0</th><th>Base number</th></tr>
<tr><td>○</td><td>○</td><td>Base #0</td></tr>
<tr><td>○</td><td>●</td><td>Base #1</td></tr>
<tr><td>●</td><td>○</td><td>Base #2</td></tr>
<tr><td>●</td><td>●</td><td>Base #3</td></tr>
</table>
●'On
○'Off

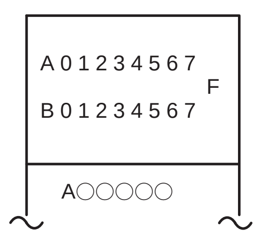
If the LINK went on once, but then falled, these LEDs indicate the number of the base that was transferring data when the error occurred.</td></tr>
</table>

AIF01B



Symbol	Description
PWR	Indicates that the internal 24 VDC power supply is operating normally.
LINK	Indicates that the I/O Link is operating normally.

Input / Output modules (with up to 16 input / output points)



Symbol	Description
A0 to 7 B0 to 7	Indicate the state of an input / output signal (LED on : signal on, LED off : signal off)
F	Indicates that the internal fuse has blown

A.4 FUSES

The following modules provide the corresponding protection fuses. If a fuse blows for any reason , such as the short–circuiting of a cable connected to a load, first remove the cause of the problem, then replace the fuse.

Module	Indication of whether a fuse has blown	Parts number of fuse	Rated current
AIF01A Interface module	PWR off	A60L–0001–0290#LM32	3.2A
AIF01B Interface module	PWR off	A60L–0001–0290#LM32	3.2A
A0D08C Output module (8 DC points)	F on	A60L–0001–0260#5R00	5A
A0D08D Output module (8 DC points)	F on	A60L–0001–0260#5R00	5A
A0A05E Output module (5 AC points)	F on	A60L–0001–0276#3.15	3.15A
A0A08E Output module (8 AC points)	F on	A60L–0001–0276#3.15	3.15A
A0A12F Output module (12 AC points)	F on	A60L–0001–0276#3.15	3.15A

WARNING

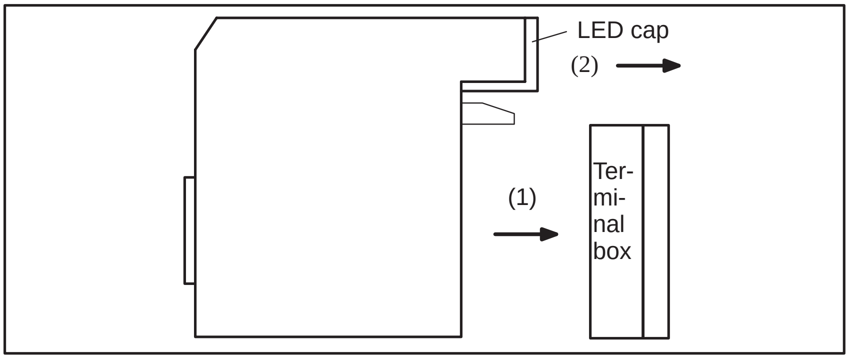
Before replacing a blown fuse, it is necessary to remove the cause of the blown fuse. For this reason, only the personnel who have a working knowledge of maintenance and safety are allowed to carry out this work. When replacing a fuse with the cabinet open, be careful not to touch the high–voltage circuit section (marked ⚠ and shielded with a shock hazard prevention cover). If you touch the high–voltage circuit section when it is uncovered, you will get an electric shock.

A.5 REMOVING A PRINTED CIRCUIT BOARD

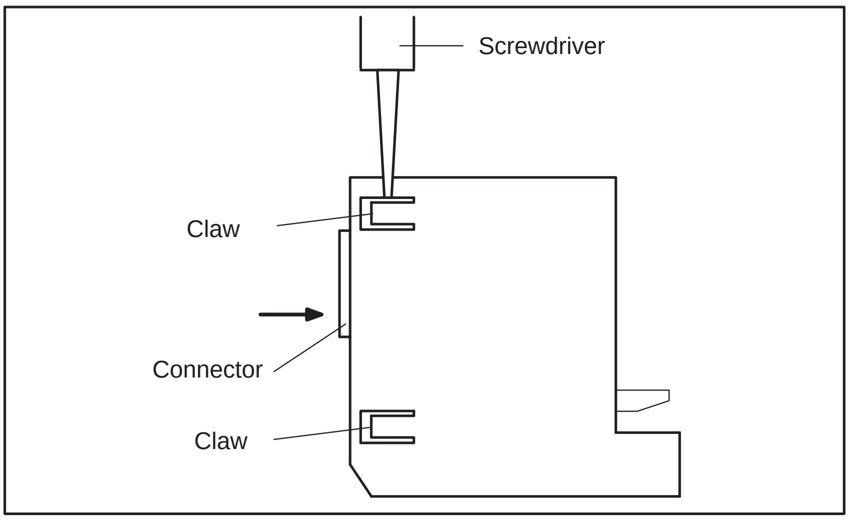
- **Removing a terminal–box–type input/output module**

1 Remove the terminal box, if necessary.

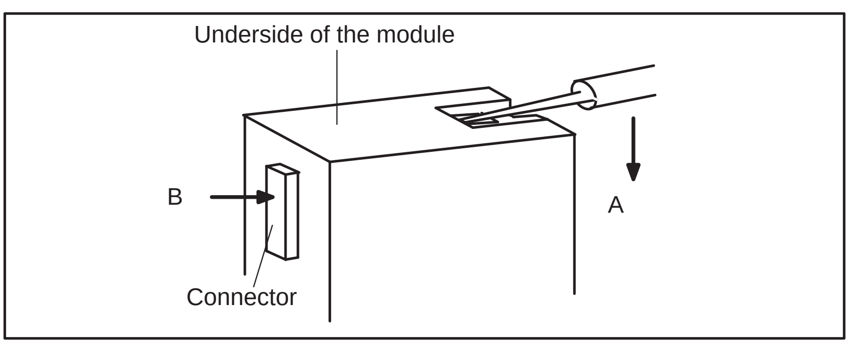
2 Remove the LED cap by pulling it in the direction indicated by the arrow.



3 While pushing the connector in the direction indicated by the arrow, use a screwdriver to release the two claws on the module case.

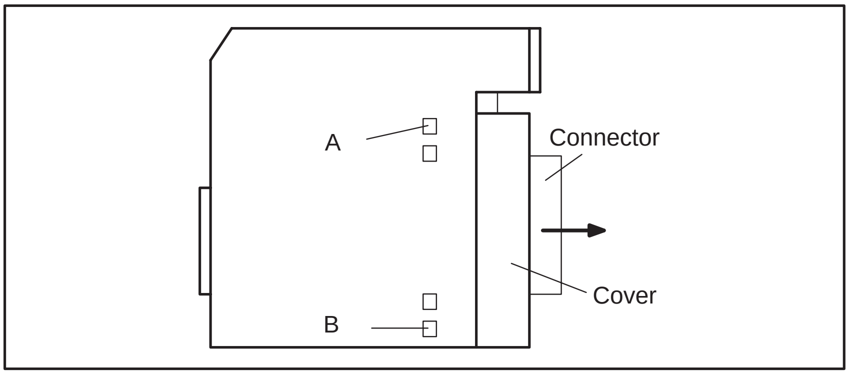


4 As shown on the right, insert a screwdriver into the gap between the module case and the connector of the terminal box. To remove the printed circuit board, push the connector in the direction indicated by arrow B while pushing the screwdriver in the direction indicated by arrow A

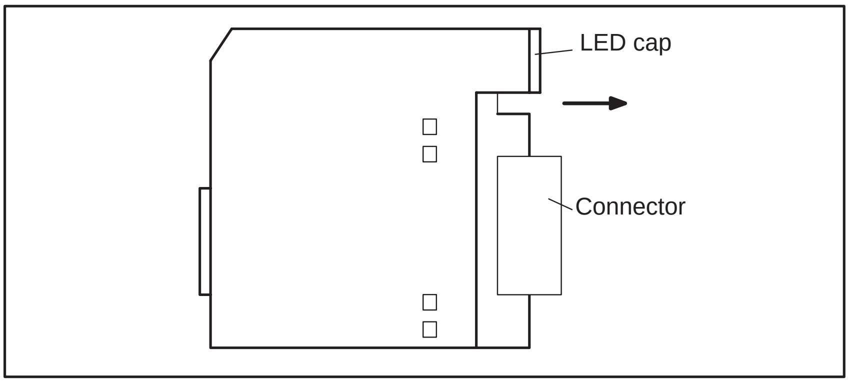


- **Removing a connector–type input/output module**

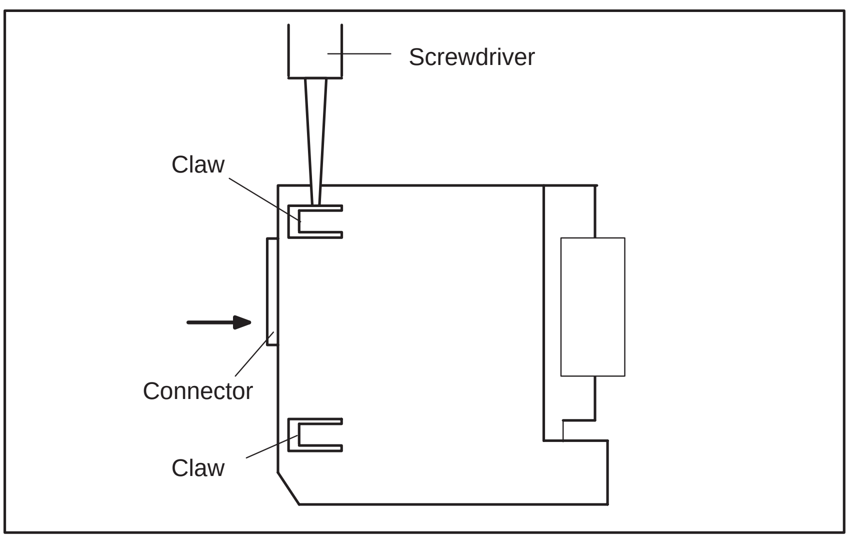
1 To remove the cover, pull it in the direction indicated by the arrow, while using a screwdriver to release claws A and B on both sides.



2 To remove the LED cap, pull it in the direction indicated by the arrow.



3 While pushing the connector in the direction indicated by the arrow, use a screwdriver to release the two or four claws on the module case. Then, remove the printed circuit board by pushing the connector in the direction indicated by the arrow.



B ALARM LIST

1) Program errors (P/S alarm)

Number	Message	Contents
000	PLEASE TURN OFF POWER	A parameter which requires the power off was input, turn off power.
001	TH PARITY ALARM	TH alarm (A character with incorrect parity was input). Correct the tape.
002	TV PARITY ALARM	TV alarm (The number of characters in a block is odd). This alarm will be generated only when the TV check is effective. Correct the tape.
003	TOO MANY DIGITS	Data exceeding the maximum allowable number of digits was input. (Refer to the item of max. programmable dimensions.)
004	ADDRESS NOT FOUND	A numeral or the sign “ – ” was input without an address at the beginning of a block. Modify the program .
005	NO DATA AFTER ADDRESS	The address was not followed by the appropriate data but was followed by another address or EOB code. Modify the program.
006	ILLEGAL USE OF NEGATIVE SIGN	Sign “ – ” input error (Sign “ – ” was input after an address with which it cannot be used. Or two or more “ – ” signs were input.) Modify the program.
007	ILLEGAL USE OF DECIMAL POINT	Decimal point “ .” input error (A decimal point was input after an address with which it can not be used. Or two decimal points were input.) Modify the program.
009	ILLEGAL ADDRESS INPUT	Unusable character was input in significant area. Modify the program.
010	IMPROPER G–CODE	An unusable G code or G code corresponding to the function not provided is specified. Modify the program.
011	NO FEEDRATE COMMANDED	Feedrate was not commanded to a cutting feed or the feedrate was inadequate. Modify the program.
020	OVER TOLERANCE OF RADIUS	In circular interpolation (G02 or G03), difference of the distance between the start point and the center of an arc and that between the end point and the center of the arc exceeded the value specified in parameter No. 3410. Modify the program.
021	ILLEGAL PLANE AXIS COMMANDED	An axis not included in the selected plane (by using G17, G18, G19) was commanded in circular interpolation. Modify the program.
027	NO AXES COMMANDED IN G43/G44	No axis is specified in G43 and G44 blocks for the tool length offset. Offset is not canceled but another axis is offset for the tool length offset. Modify the program.
028	ILLEGAL PLANE SELECT	In the plane selection command, two or more axes in the same direction are commanded. Modify the program.
029	ILLEGAL OFFSET VALUE	The offset values specified by H code is too large. Modify the program.
030	ILLEGAL OFFSET NUMBER	The offset number specified by H code for tool length offset is too large. Modify the program.
031	ILLEGAL P COMMAND IN G10	In setting an offset amount by G10, the offset number following address P was excessive or it was not specified. Modify the program.
032	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. Correct the offset value.

Number	Message	Contents
044	G27–G30 NOT ALLOWED IN FIXED CYC	One of G27 to G30 is commanded in canned cycle mode. Modify the program.
046	ILLEGAL REFERENCE RETURN COMMAND	Other than P2 and P3 are commanded for 2nd and 3rd reference position return command.
059	PROGRAM NUMBER NOT FOUND	In an external workpiece number search, a specified program number was not found. Otherwise, a program specified for searching is being edited in background processing. Check the program number and external signal. Or discontinue the background eiting.
060	SEQUENCE NUMBER NOT FOUND	Commanded sequence number was not found in the sequence number search. Check the sequence number.
070	NO PROGRAM SPACE IN MEMORY	The tape memory area is insufficient. An attempt to input a ladder program using the DPL/MDI failed because the program was too big. Delete any unnecessary programs, then retry.
071	DATA NOT FOUND	The address to be searched was not found. Or the program with specified program number was not found in program number search. Check the data.
072	TOO MANY PROGRAMS	The number of programs to be stored exceeded 63 (basic), 125 (option), 200 (option), or 400 (option). Delete unnecessary programs and execute program registeration again.
073	PROGRAM NUMBER ALREADY IN USE	The commanded program number has already been used. Change the program number or delete unnecessary programs and execute program registeration again.
074	ILLEGAL PROGRAM NUMBER	The program number is other than 1 to 9999. Modify the program number.
075	PROTECT	An attempt was made to register a program whose number was protected.
076	ADDRESS P NOT DEFINED	Address P (program number) was not commanded in the block which includes an M98, G65, or G66 command. Modify the program.
077	SUB PROGRAM NESTING ERROR	The subprogram was called in five folds. Modify the program.
078	NUMBER NOT FOUND	A program number or a sequence number which was specified by address P in the block which includes an M98, M99, M65 or G66 was not found. The sequence number specified by a GOTO statement was not found. Otherwise, a called program is being edited in background processing. Correct the program, or discontinue the background editing.
079	PROGRAM VERIFY ERROR	In memory or program collation,a program in memory does not agree with that read from an external I/O device. Check both the programs in memory and those from the external device.
085	COMMUNICATION ERROR	When entering data in the memory by using Reader / Puncher interface, an overrun, parity or framing error was generated. The number of bits of input data or setting of baud rate or specification No. of I/O unit is incorrect.
086	DR SIGNAL OFF	When entering data in the memory by using Reader / Puncher interface, the ready signal (DR) of reader / puncher was off. Power supply of I/O unit is off or cable is not connected or a P.C.B. is defective.
087	BUFFER OVERFLOW	When entering data in the memory by using Reader / Puncher interface, though the read terminate command is specified, input is not interrupted after 10 characters read. I/O unit or base P.C.B. is defective.
090	REFERENCE RETURN INCOMPLETE	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.

Number	Message	Contents
091	REFERENCE RETORN INCOMPLETE	An attempt was made to return to the reference position during feed hold. If it becomes necessary to return to the reference position during feed hold, reset the system to release the feed hold state before returning to the reference position.
092	AXES NOT ON THE REFERENCE POINT	The commanded axis by G27 (Reference position return check) did not return to the reference position.
093	EXTERNAL SETTING INCOMPLETE	The reference position external setting cannot be performed because the reference position external setting signal is set to 1 in the following status. 1) When the jog feed mode (JOG) is not selected. 2) When the jog feed mode (JOG) is selected, however the signal ZRN is 0. 3) When the emergency stop signal ESP is 0. 4) When the parameter APC No.1815 bit 5 is 0.
100	PARAMETER WRITE ENABLE	On the PARAMETER(SETTING) screen, PWE(parameter writing enabled) is set to 1. Set it to 0, then reset the system.
101	PLEASE CLEAR MEMORY	The power turned off while rewriting the memory by program edit operation. If this alarm has occurred, press <RESET> while pressing <PROG>, and only the program being edited will be deleted. Register the deleted program.
110	DATA OVERFLOW	The absolute value of fixed decimal point display data exceeds the allowable range. Modify the program.
111	CALCULATED DATA OVERFLOW	The result of calculation result is out of the allowable range. (-10^{47} to -10^{-29}, 0, and 10^{-29} to 10^{47}). Check the calculated data.
112	DIVIDED BY ZERO	Division by zero was specified. (including tan 90°) Check the calculated data.
113	IMPROPER COMMAND	A function which cannot be used in custom macro is commanded. Modify the program.
114	FORMAT ERROR IN MACRO	There is an error in other formats than <Formula>. Modify the program.
115	ILLEGAL VARIABLE NUMBER	A value not defined as a variable number is designated in the custom macro. Modify the program.
116	WRITE PROTECTED VARIABLE	The left side of substitution statement is a variable whose substitution is inhibited. Modify the program.
118	PARENTHESIS NESTING ERROR	The nesting of bracket exceeds the upper limit (quintuple). Modify the program.
119	ILLEGAL ARGUMENT	The SQRT argument is negative, BCD argument is negative, or other values than 0 to 9 are present on each line of BIN argument. Modify the program.
122	DUPLICATE MACRO MODAL–CALL	The macro modal call is specified in double. Modify the program.
123	CAN NOT USE MACRO COMMAND IN DNC	Macro control command is used during DNC operation. Modify the program.
124	MISSING END STATEMENT	DO – END does not correspond to 1 : 1. Modify the program.
125	FORMAT ERROR IN MACRO	<Formula> format is erroneous. Modify the program.
126	ILLEGAL LOOP NUMBER	In DOn, $1 \leqq n \leqq 3$ is not established. Modify the program.
127	NC, MACRO STATEMENT IN SAME BLOCK	NC and custom macro commands coexist. Modify the program.
128	ILLEGAL MACRO SEQUENCE NUMBER	The sequence number specified in the branch command was not 0 to 9999. Or, it cannot be searched. Modify the program.
129	ILLEGAL ARGUMENT ADDRESS	An address which is not allowed in <Argument Designation > is used. Modify the program.

Number	Message	Contents
130	ILLEGAL AXIS OPERATION	An axis control command was given by PMC to an axis controlled by CNC. Or an axis control command was given by CNC to an axis controlled by PMC. Modify the program.
131	TOO MANY EXTERNAL ALARM MESSAGES	Five or more alarms have generated in external alarm message. Consult the PMC ladder to find the cause.
132	ALARM NUMBER NOT FOUND	No alarm No. concerned exists in external alarm message clear. Check the PMC ladder.
133	ILLEGAL DATA IN EXT. ALARM MSG	Small section data is erroneous in external alarm message or external operator message. Check the PMC ladder.
139	CAN NOT CHANGE PMC CONTROL AXIS	An axis is selected in commanding by PMC axis control. Modify the program.
145	ILEGAL CONDITIONS IN POLAR COORDINATE INTERPOLATION	A condition for starting or canceling polar coordinate interpolation was incorrect. There is an error at plane selection (parameter No. 5460 or 5461 error). Correct the program or parameter setting.
190	ILLEGAL AXIS SELECT	In the constant surface speed control, the axis specification is wrong. (See parameter No. 3770.) The specified axis command (P) contains an illegal value. Correct the program.
199	MACRO WORD UNDEFINED	Undefined macro word was used. Modify the custom macro.
200	ILLEGAL S CODE COMMAND	In the rigid tap, an S value is out of the range or is not specified. The maximum value for S which can be specified in rigid tapping is set in parameter (No.5241 to 5243). Change the setting in the parameter or modify the program.
201	FEEDRATE NOT FOUND IN RIGID TAP	In the rigid tapping, no F value is specified. Correct the program.
202	POSITION LSI OVERFLOW	In the rigid tapping, spindle distribution value is too large.
203	PROGRAM MISS AT RIGID TAPPING	In the rigid tapping, position for a rigid M code (M29) or an S command is incorrect. Modify the program.
204	ILLEGAL AXIS OPERATION	In the rigid tapping, an axis movement is specified between the rigid M code (M29) block and G84 (G74) block. Modify the program.
205	RIGID MODE DI SIGNAL OFF	Rigid tapping signal (DGNG 061#1) is not 1 when G84 (G74) is executed though the rigid M code (M29) is specified.Consult the PMC ladder to find the reason the DI signal is not turned on. Modify the program.
206	CAN NOT CHANGE PLANE (RIGID TAP)	Plane changeover was instructed in the rigid mode. Correct the program.
207	RIGID DATA MISMATCH	The specified distance was too short or too long in rigid tapping.
224	RETURN TO REFERENCE POINT	Reference position return has not been performed before the automatic operation starts. Perform reference position return only when bit 0 of parameter 1005 ZRN_X is 0.
231	ILLEGAL FORMAT IN G10 OR L50	Any of the following errors occurred in the specified format at the programmable–parameter input. 1) Address N or R was not entered. 2) A number not specified for a parameter was entered. 3) The axis number was too large. 4) An axis number was not specified in the axis–type parameter. 5) An axis number was specified in the parameter which is not an axis type.
233	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.
239	BP/S ALARM	While punching was being performed with the function for controlling external I/O units ,background editing was performed.
240	BP/S ALARM	Background editing was performed during MDI operation.

Number	Message	Contents
5010	END OF RECORD	The end of record (%) was specified.
5011	PARAMETER ZERO (CUT MAX)	The parameter (No. 1422) for the maximum cutting feedrate is set to 0.

2) Background edit alarm

Number	Message	Contents
???	BP/S alarm	BP/S alarm occurs in the same number as the P/S alarm that occurs in ordinary program edit. (070, 071, 072, 073, 074 085,086,087 etc.)
140	BP/S alarm	It was attempted to select or delete in the background a program being selected in the foreground. **(Note)** Use background editing correctly.

NOTE
Alarm in background edit is displayed in the key input line of the background edit screen instead of the ordinary alarm screen and is resettable by any of the MDI key operation.

3) Absolute pulse coder (APC) alarm

Number	Message	Contents
300	nth–axis origin return	Manual reference position return is required for the nth–axis (n=1 – 2).
301	APC alarm: nth–axis communication	nth–axis (n=1 – 2) APC communication error. Failure in data transmission Possible causes include a faulty APC, cable, or servo interface module.
302	APC alarm: nth–axis over time	nth–axis (n=1 – 2) APC overtime error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
303	APC alarm: nth–axis framing	nth–axis (n=1 – 2) APC framing error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
304	APC alarm: nth–axis parity	nth–axis (n=1 – 2) APC parity error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
305	APC alarm: nth–axis pulse error	nth–axis (n=1 – 2) APC pulse error alarm. APC alarm.APC or cable may be faulty.
306	APC alarm: nth–axis battery voltage 0	nth–axis (n=1 – 2) APC battery voltage has decreased to a low level so that the data cannot be held. APC alarm. Battery or cable may be faulty.
307	APC alarm: nth–axis battery low 1	nth–axis (n=1 – 2) axis APC battery voltage reaches a level where the battery must be renewed. APC alarm. Replace the battery.
308	APC alarm: nth–axis battery low 2	nth–axis (n=1 – 2) APC battery voltage has reached a level where the battery must be renewed (including when power is OFF). APC alarm .Replace battery.
309	APC alarm: nth–axis Ern impossible	An attempt was made to return to the reference position without rotating the motor. First rotate the motor through at least one turn, then turn the power off, before returning to the reference position.

4) Serial pulse coder (SPC) alarms

When either of the following alarms is issued, a possible cause is a faulty serial pulse coder or cable.

Number	Message	Contents
350	SPC ALARM: n AXIS PULSE CODER	The n axis (axis 1–2) pulse coder has a fault. Refer to diagnosis display No. 202 for details.
351	SPC ALARM: n AXIS COMMUNICATION	n axis (axis 1–2) serial pulse coder communication error (data transmission fault) Refer to diagnosis display No. 203 for details.

- **The details of serial pulse coder alarm No.350**

The details of serial pulse coder alarm No. 350 (pulse coder alarm) are displayed in the diagnosis display (No. 202 or 204) as shown below.

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

CSA : The serial pulse coder is defective. Replace it.
BLA : The battery voltage is low. Replace the batteries. This alarm has nothing to do with alarm 350 (serial pulse coder alarm).
SPH : The serial pulse coder or feedback cable is defective. Replace the serial pulse coder or cable.
RCA : The serial pulse coder is defective. Replace it.
BZA : The pulse coder was supplied with power for the first time.
Make sure that the batteries are connected.
Turn the power off, then turn it on again and perform a reference position return. This alarm has nothing to do with alarm 350 (serial pulse coder alarm).
CKA : The serial pulse coder is defective. Replace it.
PHA : The serial pulse coder or feedback cable is defective. Replace the serial pulse coder or cable.

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

OFS : A current conversion error has occured in the digital servo.
MCC : A magnetic contactor contact in the servo amplifier has welded.
LDA : The LED indicates that serial pulse coder C is defective
PMS : A feedback pulse error has occured because the feedback cable is defective.

- **The details of serial pulse coder alarm No.351**

The details of serial pulse coder alarm No. 351 (communication alarm) are displayed in the diagnosis display (No. 203) as shown below.

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

DTE : The serial pulse coder encountered a communication error.
The pulse coder, feedbak cable, or feedback receiver circuit is defective. Replace the pulse coder, feedback cable, base PCB, or servo module.
The servo interface type (A or B) is incorrect.

CRC : The serial pulse coder encountered a communication error.
The pulse coder, feedback cable, or feedback receiver circuit is defective. Replace the pulse coder, feedback cable, base PCB, or servo module.

STB : The serial pulse coder encountered a communication error.
The pulse coder, feedback cable, or feedback receiver circuit is defective.
Replace the pulse coder, feedback cable, base PCB, or servo module.

PRM: An invalid parameter was found. Alarm 417 (invalid servo parameter) is also issued.

5) Servo alarms

Number	Message	Contents
400	SERVO ALARM: n–th AXIS OVERLOAD	The n–th axis (axis 1–2) overload signal is on. Refer to diagnosis display No. 201 for details.
401	SERVO ALARM: n–th AXIS VRDY OFF	1) The n–th (axis 1 or 2) servo amplifier ready signal (DRDY) went off. Check the servo amplifier. 2) This alarm may occur if a servo amplifier is shared by several NC units, or if a two–axis servo amplifier is used in a dual Power Mate–D system. Set NOFVY (bit 2 of parameter No. 1803).
404	SERVO ALARM: n–th AXIS VRDY ON	Even though the n–th axis (axis 1–2) READY signal (*MCON) went off, the servo amplifier READY signal (*DRDY) is still on. Or, when the power was turned on, *DRDY went on even though *MCON was off.
405	SERVO ALARM: (ZERO POINT RETURN FAULT)	Position control system fault. Due to an NC or servo system fault in the reference position return, there is the possibility that reference position return could not be executed correctly. Try again from the manual reference position return.
409	SERVO ALARM: n–th AXIS TORQUE ALM	An abnormal servo motor load was detected, or an abnormal spindle motor load was detected during rigid tapping.
410	SERVO ALARM: n–th AXIS – EXCESS ERROR	The position deviation value when the n–th axis (axis 1–2) stops is larger than the set value. Note) Limit value must be set to parameter No.1829 for each axis.
411	SERVO ALARM: n–th AXIS – EXCESS ERROR	The position deviation value when the n–th axis (axis 1–2) moves is larger than the set value. Note) Limit value must be set to parameter No.1828 for each axis.
413	SERVO ALARM: n–th AXIS – LSI OVERFLOW	The contents of the error register for the n–th axis (axis 1–2) and beyond the range of -2^{31} to 2^{31}. This error usually occurs as the result of an improperly set parameters.
414	SERVO ALARM: n–th AXIS – DETECTION RELATED ERROR	N–th axis (axis 1–2) digital servo system fault. Refer to diagnosis display No. 200 and No.204 for details.
415	SERVO ALARM: n–th AXIS – EXCESS SHIFT	A speed higher than 511875 units/s was attempted to be set in the n–th axis (axis 1–2). This error occurs as the result of improperly set CMR.
416	SERVO ALARM: n–th AXIS – DISCONNECTION	Position detection system fault in the n–th axis (axis 1–2) pulse coder (disconnection alarm). Refer to diagnosis display No. 201 for details.
417	SERVO ALARM: n–th AXIS – PARAMETER INCORRECT	This alarm occurs when the n–th axis (axis 1–2) is in one of the conditions listed below. (Digital servo system alarm) 1) The value set in Parameter No. 2020 (motor form) is out of the specified limit. 2) A proper value (111 or –111) is not set in parameter No.2022 (motor revolution direction). 3) Illegal data (a value below 0, etc.) was set in parameter No. 2023 (number of speed feedback pulses per motor revolution). 4) Illegal data (a value below 0, etc.) was set in parameter No. 2024 (number of position feedback pulses per motor revolution). 5) Parameters No. 2084 and No. 2085 (flexible field gear rate) have not been set. 6) A value outside the limit of {1 to the number of control axes} or a non–continuous value (Parameter 1023 (servo axis number) contains a value out of the range from 1 to the number of axes, or an isolated value (for example, 3 not prceded by 2).was set in parameter No. 1023 (servo axisnumber).
421	SERVO ALARM: n–th AXIS EXCESS ER (D)	The difference between the semi–closed side error and the fully closed side error became large when the dual position feedback function was being used. Check the setting of the dual position conversion factor (parameter Nos. 2078 and 2079).

6) Over travel alarms

If this alarm occurs, move the machine manually in the direction opposite to that in which it was moving when the alarm occurred, then reset the alarm.

Number	Message	Contents
500	OVER TRAVEL : +n	Exceeded the n–th axis (axis 1–2) + side stored stroke limit I. (Parameter No.1320)
501	OVER TRAVEL : –n	Exceeded the n–th axis (axis 1–2) – side stored stroke limit I. (Parameter No.1321)

7) Overheat alarms

Number	Message	Contents
700	OVERHEAT: CONTROL UNIT	Control unit overheat Check that the fan motor operates normally, and clean the air filter.
701	OVERHEAT: FAN MOTOR	The fan motor on the top of the contorl unit is overheated. Check the operation of the fan motor and replace the motor if necessary.

8) Spindle alarms

Number	Message	Contents
749	S–SPINDLE LSI ERROR	A communication error occurred for the serial spindle. The cause may be the disconnection of an optical cable or the interruption of the power to the spindle amplifier. (Note) Unlike alarm No. 750, this alarm occurs when a serial communication alarm is detected after the spindle amplifier is normally activated.
750	SPINDLE SERIAL LINK START FAULT	This alarm is generated when the spindle control unit is not ready for starting correctly when the power is turned on in the system with the serial spindle. The four reasons can be considered as follows: 1) An improperly connected optic cable, or the spindle control unit's power is OFF. 2) When the NC power was turned on under alarm conditions other than SU–01 or AL–24 which are shown on the LED display of the spindle control unit. In this case, turn the spindle amplifier power off once and perform startup again. 3) Other reasons (improper combination of hardware) This alarm does not occur after the system including the spindle control unit is activated. 4) The second spindle (when SP2, bit 4 of parameter No. 3701, is 1) is in one of the above conditions 1) to 3). See diagnostic display No. 409 for details. For serial spindle operation, the position coder should be connected to the serial spindle amplifier. Determine whether it has been connected to the JA12 connector of the Power Mate by mistake.
751	FIRST SPINDLE ALARM DETECTION (AL–XX)	This alarm indicates in the NC that an alarm is generated in the spindle unit of the system with the serial spindle. The alarm is displayed in form AL–XX (XX is a number). Refer to Sec.9.1.The alarm number XX is the number indicated on the spindle amplifier. The CNC holds this number and displays on the screen.
752	FIRST SPINDLE MODE CHANGE FAULT	This alarm is generated if the system does not properly terminate a mode change. The modes include the spindle positioning, 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.
754	SPINDLE–1 ABNORMAL TORQUE ALM	An abnormal spindle motor load was detected.

- **The details of spindle alarm No.750**

The details of spindle alarm No. 750 are displayed in the diagnosis display (No. 409) as shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
409					SPE		S1E	SHE

SPE **0 :** In the spindle serial control, the serial spindle parameters fulfill the spindle unit startup conditions.
1 : In the spindle serial control, the serial spindle parameters do not fulfill the spindle unit startup conditions.

S1E **0 :** The first spindle is normal during the spindle serial control startup.
1 : The first spindle was detected to have a fault during the spindle axis serial control startup.

SHE **0 :** The serial communications module in the CNC is normal.
1 : The serial communications module in the CNC was detected to have a fault.

9) System alarms

(These alarms cannot be reset with reset key.)

Number	Message	Contents
900	ROM PARITY	ROM parity error Replace the ROM.
910	SRAM PARITY: (4N)	RAM parity error. Clear the memory or replace the base PCB or memory module. After this operation, reset all data including the parameters.
911	SRAM PARITY : (4N+1)	RAM parity error. Clear the memory or replace the base PCB or memory module. After this operation, reset all data including the parameters.
920	SERVO ALARM (1/2 AXIS)	Servo alarm (1st or 2nd axis). A watchdog alarm or a local RAM parity error of the servo occured. Replace the servo control module on the main CPU board.
924	SERVO MODULE SETTING ERROR	The servo module is not installed. Check that the servo control module or servo interface module on the base PCB is mounted securely.
930	CPU INTERRUPUT	CPU error (abnormal interrupt) The base PCB, memory module, or CPU module is faulty.
950	PMC SYSTEM ALARM	Fault occurred in the PMC. The base PCB or PMC module may be faulty.
951	PMC–PA WATCH DOG ALARM	Fault occurred in the PMC–PA3 module (watchdog alarm). Defective base printed–circuit board or PMC control module
970	NMI OCCURRED IN BOC	A RAM parity error or NMI occurred in the PMC–PA3 module. It is likely that the base printed–circuit board or PMC module is defective.
971	NMI OCCURRED IN SLC	An alarm occurred in the FANUC I/O link master function. Check the connection between the controller and the I/O unit or I/O card. Also check whether the I/O unit and I/O card are supplied with power and whether the interface module or the I/O card is faulty. Or, check the PMC module.
973	NON MASK INTERRUPT	NMI occurred for an unknown reason. Or, a communication error occurred in the FANUC I/O link slave function.
980	SYNC ERROR	The ITP period of the master became asynchronous with that of the slave. Replace the base printed–circuit board.

10) ALARM OF M–NET

Number	Message	Contents
5051	M–NET CODE ERROR	Abnormal character received (other than code used for transmission).
5052	M–NET ETX ERROR	Abnormal ETX code.
5053	M–NET CONNECT TIMEOUT	Connection time monitoring error (parameter No. 175).
5054	M–NET RECEIVE TIMEOUT	Polling time monitoring error (parameter No. 176).
5055	M–NET PRT/FRM ERROR	Vertical parity or framing error.
5056	M–NET OVERRUN ERROR	Overrun error is detected.
5057	M–NET TRANSFER TIMEOUT	Transmission timeout error (parameter No. 178).
5058	M–NET ROM PARITY ERROR	ROM parity error is detected.
5059	M–NET BOARD SYSTEM ERROR	Unjust interruption is occured.

11) MEMORY CARD ALARM

Number	Message	Contents and solution
5101	MEMORY CARD NOT CONNECTED	No memory card is inserted. Insert a memory card before attempting input/output.
5102	MEMORY CARD WRITE PROTECTED	The memory card is write–protected. Write–enable the memory card before attempting to write data to it.
5103	MEMORY CARD DATA ERROR	(During restoration) The memory card contains invalid data. (During saving) Data cannot be written to the memory card. The memory card may be defective. Use another memory card.
5104	EMERGENCY STOP RELEASE	The emergency stop state was released during input/output to or from the memory card. Place the system in emergency stop state, then retry input/output.
5105	LADDER READ ERROR	An alarm was issued during the input of ladder programs from the memory card. Reinput the ladder programs.
5106	MEMORY CARD SIZE ERROR	The capacity of the memory card is less than the size of the data to be saved. Use a memory card having a capacity greater than the size of the data to be saved.
5107	MEMORY CARD DATA TYPE ILLEGAL	The data stored on the memory card is not supported by the system. Retry using a memory card containing data that is compatible with the system.
5109	MEMORY CARD BATTERY ALARM	A PMC communication error occurred during input/output to or from the memory card. Retry input/output.
5110	MEMORY CARD READ ERROR	An attempt was made to simultaneously read data for the two Power Mate–D units of a dual Power Mate–D system from the memory card, but reading of the data for the Power Mate–D unit that is not currently displayed failed. Re–set the input condition correctly, then re–enter the data for the two Power Mate–D units. (This error occurs only for a dual Power Mate–D system.)
5111	READ DATA MISSING IN PART	An attempt was made to read the micro library for the first Power Mate–D unit from the memory card and load it into the second Power Mate–D unit, or to read the micro library for the second Power Mate–D unit from the memory card and load it into the first Power Mate–D unit. (This error occurs only for a dual Power Mate–D system.)

NOTE

For the 8830 series Version 12 and earlier (A02B–0166–B001), alarm 5103 or 5106 may occur because the use of the latest memory card is not supported. Upgrade the ROM.

12) ALARM

Number	Message	Contents	Counter plan	Reference
1000 to 1999	A message created by the user or machine tool builder, using the PMC alarm message function, is displayed. **NOTE**) On the DPL/MDI, only the number is displayed.	Alarm generated by the user or machine tool builder using the PMC	Apply appropriate countermeasures as explained in the manual provided by the machine tool builder.	Manual provided by machine tool builder
3000 to 3200	A message created by the user or machine tool builder, using a custom macro, is displayed. **NOTE**) On the DPL/MDI, only the number is displayed.	Alarm generated by the user or machine tool builder, using a custom macro	Apply appropriate countermeasures as explained in the manual provided by the machine tool builder.	Manual provided by machine tool builder
3000 to 3099	P/S ALARM	Alarm generated by the user or machine tool builder, using the PMC alarm display function	Manual provided by machine tool builder	Manual provided by machine tool builder
5010	END OF RECORD	EOR was read without specifying a program end command.		

13) Alarm messages (PMC)

This list contains alarms which do not occur in the Power Mate–D/F.

Message	Contents and solution
ALARM NOTHING	Normal status
ER00 PROGRAM DATA ERROR(ROM)	The ladder program is not written correctly. (solution) Write the ladder program again.
ER03 PROGRAM SIZE ERROR(OPTION)	The size of ladder program exceeds the option specification size. (solution) Please increase the option specification size. Or, reduce the size of ladder program.
ER04 PMC TYPE UNMATCH	The PMC model setting of the ladder program is not corresponding to an actual model. (solution) Please change the PMC model setting by the offline programmer.
ER05 PMC MODULE TYPE ERROR	The module type of the PMC engine is not correct. (solution) Please exchange the module of PMC engine for a correct one.
ER07 NO OPTION (LADDER STEP)	There is no step number option of LADDER.
ER17 PROGRAM PARITY	A parity error occurred in RAM containing a ladder program. (solution) Please edit the sequence program once on PMC. Check the operation. Still the error occurs, exchange the RAM.
ER18 PROGRAM DATA ERROR BY I/O	Transferring the ladder program from offline programmer was interrupted by the power off etc. (solution) Please clear the ladder program and transfer the ladder program again.
ER19 LADDER DATA ERROR	Editing the LADDER was interrupted by the power off or by the switch to the CNC screen by the function key etc. (solution) Please edit LADDER once on PMC. Or, please input LADDER again.
ER20 SYMBOL/COMMENT DATA ERROR	Editing the symbol and comment was interrupted by the power off or by the switch to the CNC screen by the function key etc. (solution) Please edit symbol and comment once on PMC. Or, please input symbol and comment again.
ER21 MESSAGE DATA ERROR	Editing the message data was interrupted by the power off or the switch to the CNC screen by the function key etc. (solution) Please edit message data once on PMC. Or, please input message data again.

Message	Contents and solution
ER22 PROGRAM NOTHING	There is no sequence program
ER23 PLEASE TURN OFF POWER	There is a change in setting LADDER MAX AREA SIZE etc. (solution) Please restart the system to make the change effective.
ER32 NO I/O DEVICE	Any DI/DO unit of I/O Unit or the connection unit etc. is not connected. (solution) When I/O Link is used: Please confirm whether the DI/DO units turning on. Or please confirm the connection of the cable.
ER33 SLC ERROR	The LSI for I/O Link is defective. (solution) Please exchange the module of PMC engine.
ER34 SLC ERROR(xx)	The communication with the DI/DO units of the xx group failed. (solution) Please confirm the connection of the cable connected to the DI/DO units of the xx group. Please confirm whether the DI/DO units turned on earlier than Power Mate. Or, please exchange the module of PMC engine on the DI/DO units of the xx group
ER35 TOO MUCH OUTPUT DATA IN GROUP(xx)	The number of the output data in the xx group exceeded the max. The data, which exceed 32 bytes, become ineffective. (solution) Please refer to the following for the number of the data for each group. “FANUC I/O Unit–MODEL A connecting and maintenance manual” (B–61813E) “FANUC I/O Unit–MODEL B connecting manual”(B–62163E)
ER36 TOO MUCH INPUT DATA IN GROUP(xx)	The number of the input data in the xx group exceeded the max. The data, which exceed 32 bytes, become ineffective. (solution) Please refer to the following for the number of the data for each group. “FANUC I/O Unit–MODEL A connecting and maintenance manual” (B–61813E) “FANUC I/O Unit–MODEL B connecting manual”(B–62163E)
ER38 MAX SETTING OUTPUT DATA OVER(xx)	The assignment data for a group exceeds 128 bytes. (The assignment data of output side of xx group or later become ineffective.) (solution) Please reduce the assignment data to 128 bytes or less for the number of the output data of each group.
ER39 MAX SETTING INPUT DATA OVER(xx)	The assignment data for a group exceeds 128 bytes. (The assignment data of input side of xx group or later become infective.) (Solution) Please reduce the assignment data to 128 bytes or less for the number of the input data of each goup.
WN01 LADDER MAX SIZE ERROR	The MAX LADDER AREA SIZE in the system parameter is illegal. (solution) Set the correct value to MAX LADDER AREA SIZE and restart the system.
WN03 ABORT NC–WINDOW/EXIN	LADDER was stopped while CNC and PMC were communicating. The functional instruction WINDR, WINDW, EXIN, DISPB, and etc. may not work normally. (solution) When restarting the system, this alarm will be released. Execute the sequence program(Press RUN key) after confirming whether there is a problem in LADDER or not.
WN07 LADDER SP ERROR (STACK)	When functional instruction CALL(SUB65) or CALLU(SUB66) was executed, the stack of the LADDER overflowed. (solution) Please reduce the nesting of the subprogram to 8 or less.

*When ER00 to ER23 occur, sequence program is not available.

Alarm messages (For EDIT 1)

Message	Contents and solution
ADDRESS BIT NOTHING	The address of the relay/coil is not set.
FUNCTION NOT FOUND	There is no functional instruction of the input number.
COM FUNCTION MISSING	The funcitonal instruction COM (SUB29) is not correctly dealt with. Correspondence of COM and COME (SUB29) is incorrect. Or, the number of coil controlled by COM is specified by the model which the number cannot be specified.
EDIT BUFFER OVER	There in no empty area of the buffer for the editing. (solution) Please reduce NET under editing.
END FUNCTION MISSING	Functional instruction END1,END2,END3 and END do not exist. Or, there are error net in END1,END2,END3,END. Or, order of END1,END2,END3, and END is not correct.
ERROR NET FOUND	There is an error net.
ILLEGAL FUNCTION NO.	The wrong number of the functional instruction is searched.
FUNCTION LINE ILLEGAL	The functional instruction is not correctly connected.
HORIZONTAL LINE ILLEGAL	The horizontal line of the net is not connected.
ILLEGAL NET CLEARED	Because the power had been turn off while editing LADDER, some net under editing was cleared.
ILLEGAL OPERATION	Operation is not correct. The value is not specified and only INPUT key was pushed. The address data is not correctly inputted. Because the space to display the instruction on screen is not enough, the functional instruction cannot be made.
SYMBOL UNDEFINED	The symbol which was inputted is not defined.
INPUT INVALID	There is an incorrect input data. Non–numerical value was inputted with COPY, INSLIN,C–UP,C–DOWN etc. The input address was specified for write coil. An illegal character was specified for the data table.
NET TOO LARGE	The input net is larger than the editing buffer. (solution) Please reduce the net under editing.
JUMP FUNCTION MISSING	The functional instruction JMP(SUB10) is not correctly dealt with. Correspondence of JMP and JMPE(SUB30) is incorrect. The number of coil to jump is specified by the model which the number of coil cannot specified. (It is possible to specify the coil number only on PMC–RB/RC.)
LADDER BROKEN	LADDER is broken.
LADDER ILLEGAL	There is an incorrect LADDER.
OBJECT BUFFER OVER	The sequence program area was filled. (solution) Please reduce the LADDER.
PARAMETER NOTHING	There is no parameter of the functional instruction.
PLEASE COMPLETE NET	The error net was found in LADDER. (solution) After correcting the error net, please continue operating.
PLEASE KEY IN SUB NO.	Please input the number of the functional instruction. (solution) If you do not input the functional instruction, please push soft key “FUNC” again.
RELAY COIL FORBIT	There is an unnecessary relay or coil.
RELAY OR COIL NOTHING	The relay or the coil does not suffice.
PLEASE CLEAR ALL	It is impossible to recover the sequence program. (solution) Please clear the all data.
SYMBOL DATA DUPLICATE	The same symbol name is defined in other place.
COMMENT DATA OVERFLOW	The comment data area was filled. (solution) Please reduce the number of the commnet.

Message	Contents and solution
SYMBOL DATA OVERFLOW	The symbol data area was filled. (solution) Please reduce the number of the symbol.
VERTICAL LINE ILLEGAL	There is an incorrect vertical line of the net.
MESSAGE DATA OVERFLOW	The message data area was filled. (solution) Please reduce the number of the message.
1ST LEVEL EXECUTE TIME OVER	The 1st level of LADDER is too large to complete execution in time. (solution) Please reduce the 1st level of LADDER.

14) SPINDLE ALARMS (SERIAL SPINDLE)

NOTE
Er–xx is not displayed on crt.
This list contains alarms which do not occur in the Power Mate–D/F.

Message	Contents	Countermeasure
Er–01	*Although ESP (there are 2 types : connection signal and PMC→CNC) and MRDY (machine ready signal) are not input, SFR/SRV is input. However, regarding MRDY, pay attention to the setting of use/not use spindle parameter MRDY.	*Confirm the sequence of ESP and MRDY.
Er–02	If spindle motor is not integrated with spindle in system with high–resolution magnetic pulse coder, speed detector of spindle motor is set to 128 p/rev. Attempt to excite motor fails if value other than 128 p/rev is set.	Set the spindle motor speed detector parameter to 128 p/rev.
Er–03	Parameter for high–resolution magnetic pulse coder is not set, but Cs contouring control command is entered. In this case, motor is not excited.	Check parameter setting for high–resolution magnetic pulse coder.
Er–04	Although parameter setting for using position coder was not performed, commands for servo mode and synchronous control are input. In this case, the motor will not be excited.	Confirm the parameter setting of the position coder.
Er–05	Although option parameter for orientation is not set, the orientation command (ORCM) is input.	Confirm the parameter setting of orientation.
Er–06	Although option parameter for output switchover is not set, LOW winding is selected.	Confirm the parameter setting for output switching and power line status signal.
Er–07	Although Cs contouring control command was entered, SFR/SRV is not entered.	Confirm the sequence.
Er–08	Although servo mode control command was input, SFR/SRV is not input.	Confirm the sequence.
Er–09	Although synchronous control command was input, SFR/SRV is not input.	Confirm the sequence.
Er–10	Cs control command was entered, but another mode (servo mode, synchronous control, orientation) is specified.	Never set another mode when Cs contouring control command is being processed. Before changing to another mode, clear Cs contouring contorl command.
Er–11	Servo mode command was entered, but another mode (Cs contouring control, synchronous control, orientation)is specified.	Do not command other modes during servo mode command. When moving to other modes, perform after releasing the servo mode command.
Er–12	Synchronous control command was entered, but another mode (Cs contouringt control, servo mode, orientation) is specified.	Do not command other modes during synchronous control command. When moving to other modes, perform after releasing the synchronous control command.

Message	Contents	Countermeasure
Er–13	Orientation command was entered, but another mode (Cs contouring control, servo mode, synchronous control) is specified.	Do not command other modes during orientation command. When moving to other modes, perform after releasing the orientation command.
Er–14	SFR/SRV are simultaneously commanded.	Command one or the other.
Er–15	Cs contouring control command is entered when differential speed control function is enabled by parameter setting (No.6500#5=1).	Check parameter setting and control input signal.
Er–16	Differential mode command (DEFMDA) is entered when differential speed function is disabled by parameter setting (No.6500#5=1).	Check parameter setting and control input signal.
Er–17	Parameter setting (No.6511#0,1,2) for speed detector is incorrect. (Specified speed detector is not present.)	Check parameter setting.
Er–18	Spindle orientation command of position coder type is entered when use of position coder signal is disabled by parameter setting(No.6501#2=0).	Check parameter setting and control input signal.
Er–19	Although the command for orienting the magnetic sensor system was entered, another mode was issued.	Do not issue another mode while the orientation command is executed. Before issuing another mode, cancel the orientation command.
Er–20	Both the slave mode and the high–resolution magnetic pulse coder were enabled.	These two settings are incompatible. Check the parameter settings.
Er–21	The slave mode command (SLV=1) was entered under position control (servo mode, orientation,etc.).	Enter the slave mode command in the normal operation mode.
Er–22	The position control command (servo mode, orientation,etc.) was entered in the slave operation mode (SLV=1).	Enter the position control command in the normal operation mode.
Er–23	A slave mode command was entered when the slave mode is disabled.	Enable the slave mode.
Er–24	To perform continuous indexing in the mode for orienting the position coder system, incremental operation(INCMD=1) was first performed, then the absolute position command (INCMD=0) was entered.	Check the control input signal (INCMD). To execute the absolute position command continuously, be sure to perform orientation with the absolute position command first.
Contact signal of *ESP	Between ESP1 and ESP2 of spindle control printed circuit board	Contact is open : emergency stop Contact is closed : general operation

Alarm No.	Meaning	Description	Remedy
“A” display	Program ROM abnormality (not installed)	Detects that control program is not started (due to program ROM not installed, etc.)	Install normal program ROM
AL–01	Motor overheat	Detects motor speed exceeding specified speed excessively.	Check load status. Cool motor then reset alarm.
AL–02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load status. Reset alarm.
AL–03	DC link section fuse blown	Detects that fuse F4 in DC link section is blown (models 30S and 40S).	Check power transistors, and so forth. Replace fuse.
AL–04	Input fuse blown. Input power open phase.	Detects blown fuse (F1 to F3), open phase or momentary failure of power (models 30S and 40S).	Replace fuse. Check open phase and power supply regenerative circuit operation.
AL–05	Control power supply fuse blown	Detects that control power supply fuse AF2 or AF3 is blown (models 30S and 40S).	Check for control power supply short circuit . Replace fuse.
AL–07	Excessive speed	Detects that motor rotation has exceeded 115% of its rated speed.	Reset alarm.

Alarm No.	Meaning	Description	Remedy
AL–08	High input voltage	Detects that switch is flipped to 200 VAC when input voltage is 230 VAC or higher (models 30S and 40S).	Flip switch to 230 VAC.
AL–09	Excessive load on main circuit section	Detects abnormal temperature rise of power transistor radiator.	Cool radiator then reset alarm.
AL–10	Low input voltage	Detects drop in input power supply voltage.	Remove cause, then reset alarm.
AL–11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Remove cause, then reset alarm.
AL–12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power cirtcuit	Remove cause, then reset alarm.
AL–13	CPU internal data memory abnormality	Detects abnormality in CPU internal data memory. This check is made only when power is turned on.	Remove cause, then reset alarm.
AL–15	Spindle switch/output switch alarm	Detects incorrect switch sequence in spindle switch/ output switch operation.	Check sequence.
AL–16	RAM abnormality	Detects abnormality in RAM for external data. This check is made only when power is turned on.	Remove cause, then reset alarm.
AL–18	Program ROM sum check error	Detects program ROM data error.This check is made only when power is turned on.	Remove cause, then reset alarm.
AL–19	Excessive U phase current detection circuit offset	Detects excessive U phase current detection ciucuit offset. This check is made only when power is turned on.	Remove cause, then reset alarm.
AL–20	Excessive V phase current detection circuit offset	Detects excessive V phase current detection circuit offset. This check is made only when power is turned on.	Remove cause, then reset alarm.
AL–24	Serial transfer data error	Detects serial transfer data error (such as NC power supply turned off, etc.)	Remove cause, then reset alarm.
AL–25	Serial data transfer stopped	Detects that serial data transfer has stopped.	Remove cause, then reset alarm.
AL–26	Disconnection of speed detection signal for Cs contouring control	Detects abnormality in position coder signal(such as unconnected cable and parameter setting error).	Remove cause, then reset alarm.
AL–27	Position coder signal disconnection	Detects abnormality in position coder signal (such as unconnected cable and adjustment error).	Remove cause, then reset alarm.
AL–28	Disconnection of position detection signal for Cs contouring control	Detects abnormality in position detection signal for Cs contouring control (such as unconnected cable and adjustment error).	Remove cause, then reset alarm.
AL–29	Short–time overload	Detects that overload has been continuously applied for some period of time (such as restraining motor shaft in positioning).	Remove cause, then reset alarm.
AL–30	Input circuit overcurrent	Detects overcurrent flowing in input circuit.	Remove cause, then reset alarm.
AL–31	Speed detection signal disconnection motor restraint alarm or motor is clamped.	Detects that motor cannot rotate at specified speed or it is detected that the motor is clamped. (but rotates at very slow speed or has stopped). (This includes checking of speed detection signal cable.)	Remove cause, then reset alarm.
AL–32	Abnormality in RAM inside the LSI used for serial data transfer. This check is made only when power is turned on.	Detects abnormality in RAM inside the LSI used for serial data transfer. This check is made only when power is turned on.	Remove cause, then reset alarm.
AL–33	Insufficient DC link section charging	Detects insufficient charging of direct current power supply voltage in power circuit section when magnetic contactor in amplifier is turned on (such as open phase and defectifve charging resistor).	Remove cause, then reset alarm.

Alarm No.	Meaning	Description	Remedy
AL–34	Parameter data setting beyond allowable range of values	Detects parameter data set beyond allowable range of values.	Set correct data.
AL–35	Excessive gear ratio data setting	Detects gear ratio data set beyond allowable range of values.	Set correct data.
AL–36	Error counter overflow	Detects error counter overflow.	Correct cause, then reset alarm.
AL–37	Speed detector parameter setting error	Detects incorrect setting of parameter for number of speed detection pulses.	Set correct data.
AL–39	Alarm for indicating failure in detecting 1–rotation signal for Cs contouring control	Detects 1–rotaion signal detection failure in Cs contouring contorl.	Make 1–rotaion signal adjustment. Check cable shield status.
AL–40	Alarm for indicating 1–rotation signal for Cs contouring control not detected	Detects that 1–rotation signal has not occurred in Cs contouring control.	Make 1–rotaion signal adjustment.
AL–41	Alarm for indicating failure in detecting position coder 1–rotaion signal.	Detects failure in detecting position coder 1–rotation signal.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL–42	Alarm for indicating position coder 1–rotation signal not detected	Detects that position coder 1–rotation signal has not issued.	Make 1–rotation signal adjustment for signal conversion circuit.
AL–43	Alarm for indicating disconnection of position coder signal for differential speed mode	Detects that main spindle position coder signal used for differential speed mode is not connected yet (or is disconnected).	Check that main spindle position coder signal is connected to connector CN12.
AL–46	Alarm for indicating failure in detecting position coder 1–rotation signal in thread cutting operation.	Detects failure in detecting position coder 1–rotation signasl in thread cutting operation.	Make 1–rotation signal adjustment for signal conversion circuit. Check cable shield status.
AL–47	Position coder signal abnormality	Detects incorrect position coder signal count operation.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL–49	The converted differential speed is too high.	Detects that speed of other spindle converted to speed of local spindle has exceeded allowable limit in differential mode.	Calculate differential speed by multiplying speed of other spindle by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL–50	Excessive speed command calculation value in spindle synchronization control	Detects that speed command calculation value exceeded allowable range in spindle synchronization control.	Calculate motor speed by multiplying specified spindle speed by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL–51	Undervoltage at DC link section	Detects that DC power supply voltage of power circuit has dropped (due to momentary power failure or loose contact of magnetic contactor).	Remove cause, then reset alarm.
AL–52	ITP signal abnormality I	Detects abnormality in synchronization signal (ITP signal) used in software.	Replace servo amp. PCB.
AL–53	ITP signal abnormality II	Detects abnormality in synchronization signal (ITP signal) used in hardware.	Replace servo amp. PCB.
AL–54	Overload current alarm	Detects that excessive current flowed in motor for long time.	Remove overload of motor and reset the alarm.
AL–55	Power line abnormality in spindle switching/output switching	Detects that switch request signal does not match power line status check signal.	Check if power line status, check signal is processed normally.

15) SPINDLE ALARMS (ANALOG INTERFACE) (S SERIES ACSPINDLE)

Spindle alarms of Model 1S to 3S

Alarm No.	Meaning	Description	Remedy
"A" display	Program ROM abnormality (not installed)	Detects abnormality in ROM.	Exchange ROM
AL–01	Motor overheat	Detects motor speed exceeding specified speed excessively.	Check load status. Cool motor then reset alarm.
AL–02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load status. Reset alarm.
AL–03	Defective regenerative current	Detects that regenerative current has flown longer than the allowable time.	Reset alarm after checking cutting condition etc.
AL–04	Not used		
AL–05	Not used		
AL–06	Excessive speed (Analog)	Detects that motot rotation has exceeded 115% of its rated speed.	Reset alarm.
AL–07	Excessive speed (Digital)	Detects that motor rotation has exceeded 115% of its rated speed.	Reset alarm.
AL–08	High input voltage	Detects that input voltage is 230 VAC or higher .	Flip switch to 230 VAC.
AL–09	Not used		
AL–10	Low input voltage	Detects drop in +15V power supply or input power supply voltage.	Remove cause, then reset alarm.
AL–11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Remove cause, then reset alarm.
AL–12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power circtcuit	Check transistor and motor coils for their grounding, remove cause, then reset alarm.
AL–13	Defectives CPU and peripherals	Detects abnormal transmission between CPU and peripherals	Exchange PCB.
AL–14	ROM abnormality	Detects abnormality in ROM.	Exchange ROM or PCB.
AL–15	Not used		
AL–16 AL–17	NVRAM abnormality	Detects abnormality in NVRAM for external data.	Exchange NVRAM or PCB.
AL–18 to AL–23	Defectives CPU and peripherals	Detects abnormal transmission between CPU and peripherals	Exchange PCB.

Spindle alarms of Model 6S to 26S

Alarm No.	Meaning	Description	Remedy
"A" display	Program ROM abnormality (not installed)	Detects abnormality in ROM.	Exchange ROM
AL–01	Motor overheat	Detects motor speed exceeding specified speed excessively.	Check load status. Cool motor then reset alarm.
AL–02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load or other status on the motor, correct failure, then reset the alarm.
AL–03 *	+24V fuse is blown.	+24V fuse of the control power is blown	Check control power if it is shorted and replace fuses.
AL–04	Blown of input fuse Lack of phase of input power supply	One of fuse F1 to F3 is flown or lack of phase or momentary power failure was detected.	Check lack of phase of power supply and power regenerative circuit and replace fuse if required.
AL–05	Not used		
AL–06	Excessive speed (Analog)	Detects that motot rotation has exceeded 115% of its rated speed.	Remove cause, then reset alarm.
AL–07	Excessive speed (Digital)	Detects that motor rotation has exceeded 115% of its rated speed.	Remove cause, then reset alarm.
AL–08	High input voltage	Detects that input voltage is 230 VAC or higher .	Flip switch to 230 VAC.
AL–09	Overheat of radiator	Temperature of radiator used for transistor is extremely high.	Cool radiator then reset alarm.
AL–10	Low input voltage	Detects drop in +15V power supply or input power supply voltage.	Remove cause, then reset alarm.
AL–11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Remove cause, then reset alarm.
AL–12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power cirtcuit	Remove cause, then reset alarm.
AL–13	Defectives CPU and peripherals	Detects abnormal transmission between CPU and peripherals	Exchange PCB.
AL–14	ROM abnormality	Detects abnormality in ROM.	Exchange ROM or PCB.
AL–15	Defective optional circuit	Detects defective optional circuit (switch sequence in spindle switch/output switch operation) and erroneous connection to optional circuit.	Check sequence ,then exchange PCB.
AL–16 AL–17	NVRAM abnormality	Detects abnormality in NVRAM for external data.	Exchange NVRAM or PCB.
AL–18 to AL–23	Defectives CPU and peripherals	Detects abnormal transmission between CPU and peripherals	Exchange PCB.

* Not displayed in PCB version number 10B and later.

- **Method of resetting alarm**

Press MODE and DATA SET key at the same time.

> **WARNING**
> There is a possibility that the spindle may rotate immediately after an alarm is released. Therefore, reset an alarm under the emergency stop state and the rotation command being off.

Alarm is not released if the cause of the alarm is not removed.

C LIST OF MAINTENANCE PARTS

C.1 MAINTENANCE PARTS

C.1 MAINTENANCE PARTS

Maintenance Parts (Consumable)

Consumables here refer to the parts which are not reused after replacement. Rank : A>B>C

Name	Drawing number	Vender	Remarks	Rank
Fan motor	A90L-0001-0385	SANYO		A
Battery	A98L-0031-0006	SANYO		A
Fuse	A60L-0001-0046#5.0R	DAITO	5. 0A Contorol unit	B
	A60L-0001-0175#3.2R		3. 2A CRT/ MDI, I/O card	B
	A60L-0001-0290#LM50		5. 0A I/O card	B
	A60L-0001-0290#LM10		1. 0A LCD	B
key board	A86L-0001-0171#SM2	FUJITSU	A02B-0166-C001	B
	A86L-0001-0171#SM2R		A02B-0166-C201#R	B
	A86L-0001-0171#SM2S		A02B-0120-C201#S	B
	A20B-1003-0170	FANUC	A02B-0168-C010 to C013 A02B-0118-C030 to C033 A02B-0118-C130#R to C133#R A02B-0118-C130#S to C133#S	B
	A16B-2600-0070		A02B-0211-C020#R, #S	B
Key sheet	A98L-0001-0741	FUJI POLY-MERTECH	A02B-0168-C010 to C013 A02B-0118-C030 to C033	B
	A98L-0001-0741#R		A02B-0118-C130#R to C133#R	B
	A98L-0005-0022		A02B-0118-C130#S to C133#S	B
	A98L-0005-0035#PMGE1		A02B-0211-C020#R	B
	A98L-0005-0035#PMGS1		A02B-0211-C020#S	B
	A98L-0005-0036#PMGE1		A02B-0211-C020#R LED	B
	A98L-0005-0036#PMGS1		A02B-0211-C020#S LED	B
Plastic case	A230-0476-T001	FANUC	A02B-0166-B001, B520, B501, B502	C
	A230-0476-T006		A02B-0166-B531	C
	A230-0476-T003		A02B-0198-B501	C
	A230-0476-T007		A02B-0198-B531	C

Maintenance Parts (Parts to be repaired by us)

Name	Drawing number	Vender	Remarks	Rank
Built-in I/O card	A20B-1004-0960	FANUC		B
Power Mate-D base PCB	A16B-2201-0630	FANUC	TYPE A For B001, B520	B
	A20B-2001-0610	FANUC	TYPE A,corresponding to 2-path For B501	B
	A16B-2100-0030	FANUC	TYPE A,corresponding to 2-path For B501	B
	A16B-2100-0031	FANUC	TYPE A,corresponding to 2-path For B502	B
	A16B-2100-0160	FANUC	TYPE B,corresponding to 2-path For B531	B
Power Mate-F base PCB	A20B-2001-0620	FANUC	TYPE A For B501	B
	A20B-2002-0370	FANUC	TYPE B For B531	B
Built-in I/O card (Powr Mate-D)	A20B-2000-0670	FANUC	DI:32, DO:24(Sink type)	B
Built-in I/O card C (Power Mate-D)	A20B-2001-0902	FANUC	DI:32, DO:24(Source type)	B
Built-in I/O card A (Power Mate-F)	A20B-2001-0631	FANUC	DI:32, DO:24(Sink type)	B
Built-in I/O card B (Power Mate-F)	A20B-2001-0630	FANUC	DI:48, DO:32(Sink type)	B
Built-in I/O card D1 (Power Mate-F)	A20B-2001-0901	FANUC	DI:32, DO:24(Source type)	B
Built-in I/O card D2 (Power Mate-F)	A20B-2001-0900	FANUC	DI:48, DO:32(Source type)	B
M–NET card	A20B-2001-0370	FANUC		B
I/O Link- II card	A20B-2100-0040	FANUC		B
Genius card	A20B-8100-0060	FANUC		B
Profibus card1	A20B-2100-0120	FANUC		B
Profibus card2	A20B-8001-0500	FANUC		B
Memory module A	A20B-2900-0531	FANUC	RAM 128KB, Replaceable with the following	B
	A20B-2902-0332	FANUC	RAM 128KB	B
Memory module B	A20B-2900-0530	FANUC	RAM 256KB, Replaceable with the following	B
	A20B-2902-0331	FANUC	RAM 256KB	B
Memory module C	A20B-2900-0541	FANUC	RAM 512KB, Replaceable with the following	B
	A20B-2902-0330	FANUC	RAM 512KB	B
CPU module	A20B-2901-0500	FANUC		B
Spindle module	A20B-2900-0851	FANUC	Analog spindle	B
	A20B-2900-0850	FANUC	Serial spindle	B
	A20B-2901-0210	FANUC	Analog input + Serial spindle	B
Digital servo module	A20B-2900-0160	FANUC	Corresponding tp S series servo	B
	A20B-2901-0340	FANUC	Corresponding tp E, α series servo	B
Digital servo interface module	A20B-2900-0380	FANUC		B
Memory module CSA	A20B-2902-0230	FANUC	RAM addition 512KB Analog spindle X 2	B

Maintenance Parts (Parts to be repaired by us)

Name	Drawing number	Vender	Remarks	Rank
Memory module BSA	A20B-2902-0231	FANUC	RAM addition 256KB Analog spindle X 2	B
	A20B-2902-0234		RAM addition 256KB Analog spindle	
Memory module ASA	A20B-2902-0232	FANUC	Analog spindle X 2	B
Memory module ASA Spindle module S analog	A20B-2902-0235	FANUC	Analog spindle	B
memory module C	A20B-2902-0236	FANUC	RAM addition 512KB	B
Memory module B	A20B-2902-0237	FANUC	RAM addition 256KB	B
Memory module BSSA	A20B-2902-0221	FANUC	RAM addition 256KB Serial spindle Analog input	B
Memory module ASSA	A20B-2902-0222	FANUC	Serial spindle Analog input	B
Memory module CSS	A20B-2902-0223	FANUC	RAM addition 512KB Serial spindle	B
Memory module BSS	A20B-2902-0224	FANUC	RAM addition 256KB Serial spindle	B
Memory module ASS Spindle module S serial	A20B-2902-0225	FANUC	Serial spindle	B
PMC control module A	A20B-2900-0142	FANUC	PMC-PA1	B
CRT control module	A20B-2901-0480	FANUC		B
Touch panel control module	A20B-2902-0470	FANUC		B
HSSB module	A20B-2902-0540	FANUC		B
PMC control module B	A20B-2901-0660	FANUC	PMC-PA3	B
	A20B-2901-0662	FANUC	Replaceable with A20B-2901-0660	B
CRT control P.C.B	A20B-2000-0840	FANUC		B
	A20B-2000-0841	FANUC	In-line connection type	B
	A20B-2100-0061	FANUC	Picture display 32 screen	B
	A16B-2100-0060	FANUC	Picture display 64 screen	B
I/O card A	A16B-2201-0071	FANUC	DI:48, DO:32(Sink type)	B
I/O card B	A16B-2201-0070	FANUC	DI:96, DO:64(Sink type)	B
I/O card D	A16B-2202-0733	FANUC	DI:48DO:32 (Source type)	B
I/O card E	A16B-2202-0732	FANUC	DI:96DO:64 (Source type)	B
DPL/MDI P.C.B.	A20B-8000-0141	FANUC		B
DPL/MDI P.C.B.	A20B-8000-0490	FANUC	Long direction type	B
DPL/MDI P.C.B.	A20B-8001-0310	FANUC	Dust protected type	B
DPL/MDI Switch circuit	A16B-2600-0080	FANUC		B
Handy operator’s panel control P.C.B.	A20B-2002-0200	FANUC		B
HSSB adapter P.C.B.	A20B-8001-0510	FANUC		B
Position display unit P.C.B	A20B-1004-0360	FANUC		B
	A20B-1004-0370	FANUC		B

Maintenance Parts (Parts to be repaired by us)

Name	Drawing number	Vender	Remarks	Rank
CRT/MDI Unit	A02B-0166-C001	FANUC		B
	A02B-0166-C003	FANUC	In–line connection type	B
	A02B-0166-C201#R	FANUC	For CE marking	B
	A02B-0166-C203#R	FANUC	For CE marking, in–line connection type	B
	A02B-0166-C201#S	FANUC	For CE marking	B
	A02B-0166-C203#S	FANUC	For CE marking, in–line connection type	B
CRT/MDI Unit (Picture display)	A02B-0166-C221#R	FANUC	Graphic 32 screen	B
	A02B-0166-C221#S	FANUC	Graphic 32 screen	B
	A02B-0166-C222#R	FANUC	Graphic 64 screen	B
	A02B-0166-C222#S	FANUC	Graphic 64 screen	B
Separate type CRT	A02B-0120-C111	FANUC		B
Separata type PDP	A02B-0120-C113	FANUC	200VAC input	B
	A02B-0200-C100	FANUC	24VDC input, For CE marking	B
Separate type MDI unit	A02B-0166-C010	FANUC		B
	A02B-0166-C210#R	FANUC	For CE marking	B
	A02B-0166-C213#R	FANUC	For CE marking, In-line connection type	B
	A02B-0166-C210#S	FANUC	For CE marking	B
	A02B-0166-C213#S	FANUC	For CE marking, In-line connection type	B
Separate type MDI unit (Picture display)	A02B-0166-C231#R	FANUC	Graphic 32 screen	B
	A02B-0166-C232#S	FANUC	Graphic 32 screen	B
	A02B-0166-C232#R	FANUC	Graphic 64 screen	B
	A02B-0166-C231#S	FANUC	Graphic 64 screen	B
Separate type LCD unit	A02B-0166-C251	FANUC		B
Detachable LCD/MDI unit	A02B-0166-C271#R	FANUC		B
	A02B-0166-C271#S	FANUC		B
CRT display device	A61L-0001-0093	MATSUSHITA	Usable unit A02B-0166-C001 A02B-0166-C201#R A02B-0166-C201#S A02B-0120-C111	B
Plasma display device	A61L-0001-0116	FUJITSU	Usable unit A02B-0120-C113	B
	A61L-0001-0116#S	FUJITSU	Usable unit A02B-0200-C100	B
LCD disply device	A61L-0001-0142	HITACHI	Usable unit A02B-0166-C251	B
Handy operator’s panel	A02B-0211-020#R	FANUC		B
	A02B-0211-020#S	FANUC		B
LCD	A61L-0001-0119	EPSON	Usable unit A02B-0211-C020#R, #S	B
HSSB adapter	A02B-0211-C220	FANUC		B
I/O link-II terminal board	A08B-0048-C331	FANUC		B
Display unit	A02B-0118-C020	FANUC		B
CRT link intermediate unit	A02B-0124-D002	FANUC		B

Maintenance Parts (Parts to be repaired by us)

Name		Drawing number	Vender	Remarks		Rank
DPL/MDI	FANUC, Table mount	A02B-0168-C010	FANUC			B
	FANUC, Wall mount	A02B-0168-C011	FANUC			B
	GEFanuc, Table mount	A02B-0168-C012	FANUC			B
	GEFanuc, Wall mount	A02B-0168-C013	FANUC			B
Long direction type DPL/MDI	FANUC, Table mount	A02B-0118-C030	FANUC		A02B-0118-C131, C132, C133	B
	FANUC, Wall mount	A02B-0118-C031	FANUC		A02B-0118-C130, C132, C133	B
	GEFanuc, Table mount	A02B-0118-C032	FANUC		A02B-0118-C130, C131, C133	B
	GEFanuc, Wall mount	A02B-0118-C033	FANUC		A02B-0118-C130, C131, C132	B
Dust protected type DPL/MDI	FANUC, Table mount	A02B-0118-C130#R	FANUC	For CE marking	A02B-0118-C131#R, C132#R, C133#R	B
		A02B-0118-C130#S	FANUC	For CE marking	A02B-0118-C131#S, C132#S, C133#S	B
	FANUC, Wall mount	A02B-0118-C131#R	FANUC	For CE marking	A02B-0118-C130#R, C132#R, C133#R	B
		A02B-0118-C131#S	FANUC	For CE marking	A02B-0118-C130#S, C132#S, C133#S	B
	GEFanuc, Table mount	A02B-0118-C132#R	FANUC	For CE marking	A02B-0118-C130#R, C131#R, C133#R	B
		A02B-0118-C132#S	FANUC	For CE marking	A02B-0118-C130#S, C131#S, C133#S	B
	GEFanuc, Wall mount	A02B-0118-C133#R	FANUC	For CE marking	A02B-0118-C130#R, C131#R, C132#R	B
		A02B-0118-C133#S	FANUC	For CE marking	A02B-0118-C130#S, C131#S, C132#S	B
LCD		A61L-0001-0110#A	HITACHI	Usable uint A02B-0168-C010 to C013 A02B-0118-C030 to C033 A02B-0118-C130#R to C133#R A02B-0118-C130#S to C133#S		B

D DATA INPUT/OUTPUT TO AND FROM A MEMORY CARD

D.1 OVERVIEW

Data stored in memory of the Power Mate can be output to a single memory card at one time. Moreover, programs, parameters, variables, PMC data can be input to the CNC.

Use the flash type memory card specified by FANUC.

D.2 FUNCTION DESCRIPTION

D.2.1 Conditions for Enabling This Function

Before this function can be enabled, the Power Mate and a memory card to be used must meet the conditions explained following.

❑ Conditions of the Power Mate

(1) For input, the Power Mate is in either EDIT or MDI mode, while for output, it is in EDIT mode.

(2) The Power Mate must be placed in the emergency stop state.

(3) The program display screen must be selected.

(4) To input data, setting parameter <parameter write> must be set to 1. (For the DPL/MDI, <PWE> must be set to 1.)

❑ Conditions of the memory card

(1) The capacity of the memory card must be greater than the storage capacity of the Power Mate.

(2) To output data, the write protect switch must be set off.

(3) The memory card must have attribute information.
*This function cannot be used with memory cards having no attribute information. So, use memory cards version 4.0 or later.

D.2.2 Output to a Memory Card

The contents of the entire memory area of the Power Mate are output to a memory card. The size of the output data is recorded in the memory card. If the capacity of the memory card is smaller than the memory size of the Power Mate, alarm 5106 is issued. The Power Mate memory cannot be divided in order to be output to two or more memory cards.

D.2.3 Input from a Memory Card

Data can be input from a memory card to the Power Mate only when the memory size recorded in the memory card matches the memory size of the Power Mate. If they do not match, alarm 5107 is issued.

> **NOTE**
> In the case of a 1–path Power Mate–D and the Power Mate–F, parameters, some variable data (#001 to #033, #100 to #149, #500 to #531), and tool length compensation data can be input regardless of the system's storage capacity, provided their data types are specified when individual data items are input.

❑ Inputting all data

(1) With the CRT/MDI

M →[READ]→[EXEC]

(2) With the DPL/MDI

M →[READ]

❑ Inputting data individually

(1) With the CRT/MDI

M n7 n6 n5 n4 n3 n2 n1 →[READ]→[EXEC]

(2) With the DPL/MDI

M n7 n6 n5 n4 n3 n2 n1 →[READ]

n1 : Program
n2 : Parameter, Pitch error compensation data
n3 : Variable, tool length compensation data
n4 : Ladder program
n5 : PMC data
*n6: Operation history data (usable with a 256–K, 512–K, or 768–K 1–path Power Mate–D) (usable with a 512–K or 768–K 2–path Power Mate–D)
*n7: Macro executor (usable with a 512–K or 768–K 1–path Power Mate–D) (usable with a 768–K 2–path Power Mate–D)

Specifying 1 causes the corresponding data to be read.
Specifying 0 causes the corresponding data to be skipped.

(Example) When variable number and program are read.

M 0 0 0 0 1 0 1 →[READ]→[EXEC]

D.3 OPERATION

D.3.1 Outputting Data to a Memory Card

Data stored in Power Mate memory can be output to a memory card by following the procedure below.

(1) Place the Power Mate in EDIT mode.

(2) Place the system in the emergency stop state.

(3) Press the <PRGRM> display button to display the program display screen.

(4) Insert the memory card in the CNC.

(5) Enter address <M>.

(6) Select the [OPERATION], [→], and [PUNCH] soft keys, then press [EXEC].
(When the DPL/MDI is used, press the <WRITE> key.)

All data in the Power Mate memory is then output.

NOTE
1 The output data varies with the storage capacity of the Power Mate.
2 For a 2–path Power Mate–D, place both paths in the emergency stop state.

D.3.2 Inputting Data from a Memory Card

Data can be input from a memory card to Power Mate memory by following the procedure below.

❑ Inputting all data

(1) Place the Power Mate in either EDIT or MDI mode.

(2) Place the system in the emergency stop state.

(3) For both paths, set setting parameter [parameter write enable] to 1.
(When the DPL/MDI is used, set [PWE] to 1.)

(4) Press the <PRGRM> display boutton to display the program display screen.

(5) Insert the memory card in the Power Mate.

(6) Enter address <M>.

(7) Select the [OPERATION] [→] and [READ] soft keys, then press [EXEC].
(When the DPL/MDI is used, press the <READ> key.)

All data is then read into the CNC memory.

NOTE
1 The output data varies with the storage capacity of the Power Mate.
2 For a 2–path Power Mate–D, read all data related to the path currently being displayed. To read all data for both paths, key in <#> after address <M> in step (5).

❑ Inputting specific data

(1) Place the Power Mate in either EDIT or MDI mode.

(2) Place the system in the emergency stop state.

(3) Set setting parameter [parameter write] to 1.
(When the DPL/MDI is used, set [PWE] to 1.)

(4) Press the <PRGRM> display button to display the program display screen.

(5) Insert the memory card in the Power Mate.

(6) Enter address <M>.

(7) Specify the types of data to be input by using numeric characters in the form <n7n6n5n4n3n2n1>.

n1 : Program
n2 : Parameter, Pitch error compensation
n3 : Variable, tool length compensation data
n4 : Ladder program
n5 : PMC data
n6 : Operation history data
n7 : Macro executor

Specifying 1 causes the corresponding data to be read. Specifying 0 causes the corresponding data to be skipped.

(8) Select [OPERATION], [→] and [READ], then press [EXEC].
(When the DPL/MDI is used, press the [READ] key.)

The specified data is then read into the Power Mate memory.

NOTE
1 The operation history data can be read for a 256–K, 512–K, or 768–K 1–path Power Mate–D or 512–K or 768–K 2–path Power Mate–D.
2 The macro executer can be read for a 512–K or 768–K 1–path Power Mate–D or 768–K 2–path Power Mate–D system.
3 For a 2–path Power Mate–D, data for currently displayed path is read.

D.4 DATA INPUT/OUTPUT TO AND FROM A MEMORY CARD

The data that can be input/output to and from a memory card varies according to the memory size of the power Mate.

Table D.4 (a) Valid Data for Different Memory sizes of the 1–path Power Mate–D

Data type	Power Mate–D memory size (bytes)			
	128K	256K	512K	768K
Program	○	○	○	○
Parameter Pitch error compensation data	○	○	○	○
Variable data Tool offset data	○	○	○	○
Ladder	○	○	○	○
PMC data	○	○	○	○
Operation history data	×	○	○	○
Macro executor	×	×	○	○

○ : Valid data, × : Invalid data

Table D.4 (b) Valid Data for Different Memory sizes of the 2–path Power Mate–D

Data type	Power Mate–D memory size (bytes)		
	256K	512K	768K
Program	○	○	○
Parameter Pitch error compensation data	○	○	○
Variable data Tool offset data	○	○	○
Ladder	○	○	○
PMC data	○	○	○
Operation history data	×	○	○
Macro executor	×	×	○

○ : Valid data, × : Invalid data

Table D.4 (c) Valid Data for Different Memory sizes of the Power Mate–F

Data type	Power Mate–F memory size
Program	○
Parameter Pitch error compensation data	○
Variable data Tool offset data	○
Ladder	○
PMC data	○

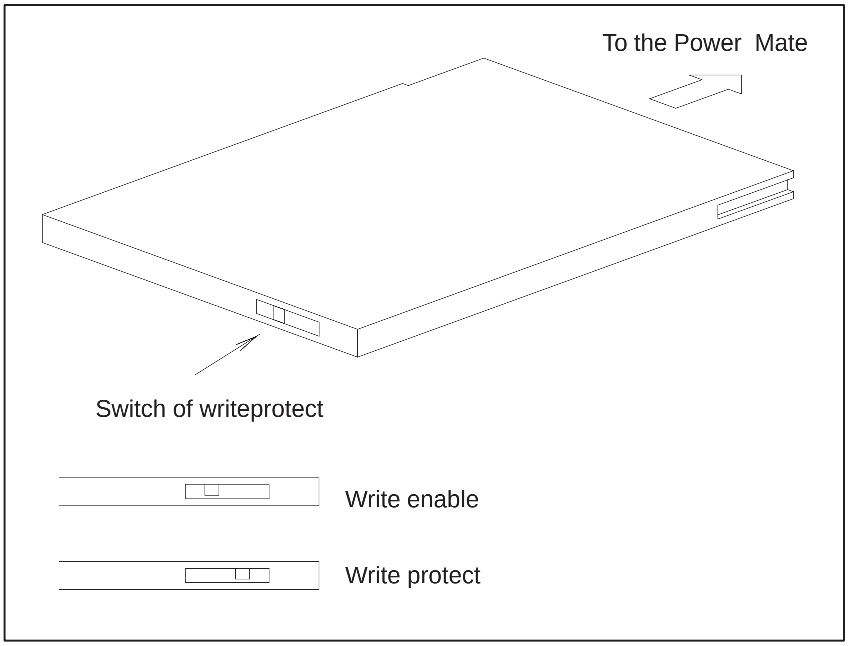
○ : Valid data, × : Invalid data

D.5 ERROR CODES

No.	Message	Explanation
5101	MEMORY CARD NOT CONNECTED	No memory card is connected to the unit. Before performing input/output, a memory card.
5102	WRITE PROTECTED	The memory card is write-protected. Before writing data to the card, release write protection.
5103	MEMORY CARD READ/WRITE ERROR	(Seve) Data cannot be written to the memory card. (Restoration) The memory card does not contain correct data. The card may be damaged. Retry input/output with another memory card.
5104	EMERGENCY STOP RELEASED	Emergency stop was released during input/output to or from a memory card. Place the system in the emergency stop state, then retry input/output.
5105	LADDER READ ERROR	An alarm was issued during input of ladder data from a memory card. Retry input of ladder data.
5106	INSUFFICIENT MEMORY CARD CAPACITY	The capacity of the memory card is insufficient to save the data. Insert a memory card with sufficient memory, then retry.
5107	IMPROPER MEMORY	The data stored in a memory card is not appropriate for the unit. Insert a memory card holding appropriate data, then retry.
5109	PMC COMMUNICATION ERROR	A PMC communication error occurred during input/output to or from a memory card. Retry input/output.
5110	MEMORY CARD READ ERROR	An attempt was made to read data for both paths from the memory card at a time, but data reading for the path whose data is not currently displayed was abnormal. Corrent the input conditions, and try data writing for both paths again. (This applies to the Power Mate–D2 only.)
5111	READ DATA MISSING IN PART	An attempt was made to read the path 1 macro library from the memory card into path 2, or vice versa. (This applies to the Power Mate–D2 only.)

D.6 MEMORY CARD WRITE PROTECT SWITCH

The write protect switch is used to protect the data recorded on the card. Important data can be kept safely by setting the write protect switch as shown in the figure below. The switch prevents data from being inadvertently rewritten.



E MEMORY CARD OPERATOR'S MANUAL

E.1 OUTLINE

FANUC–specified flash memory cards can be used as a data exchanging media for CNC unit, and are based on following standards.

- JEIDA "IC Memory Card Guideline Ver. 4.0"
- PCMCIA "PC Card Standard R.2.0"

The memory card is easy to use and a data exchanging media which can be input and output data with high speed, and you should take care of operation for the memory card.

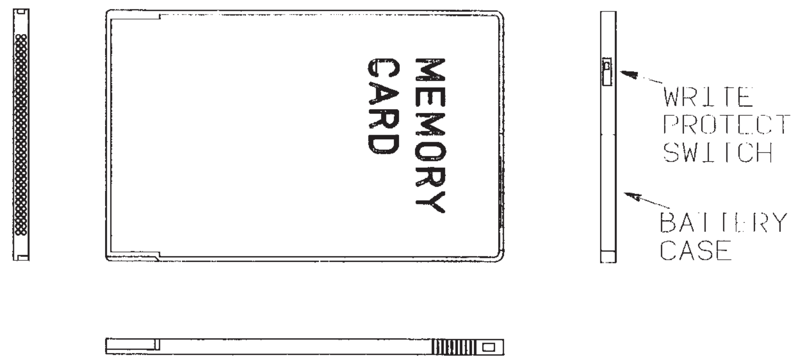
This manual describes operating procedure and advice for the memory card.

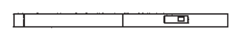
Some software of CNC unit may restrict a kind of useful memory card, input/output file function.
For detail, refer to the manual of each CNC unit.

FANUC–specified flash memory cards are listed below.

	Fujitsu Ltd.	Fuji Electrochemical Co., Ltd.
256KB	MB98A80813–20–G–S	SC–9027–22H14
512KB	MB98A80913–20–G–S	SC–9027–42H14
1MB	MB98A801013–20–G–S	SC–9027–82H14

E.2 NAMES AND FUNCTION OF MEMORY COMPONENTS



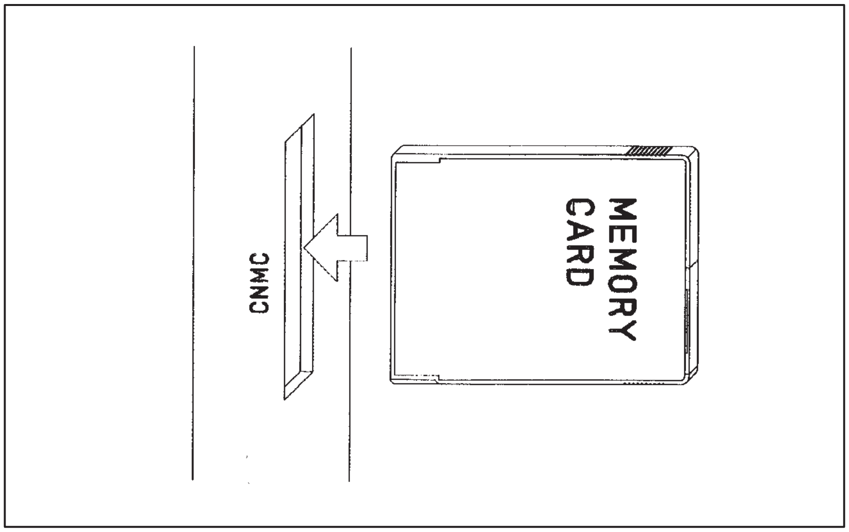
	Name	Function
1	Write Protect Switch	The memory card can be protected from writing data into the memory card by setting of the write protect switch. Non Write Protect  Write protect 
2	Battery Case	Incase of the SRAM memory card, the battery case includes the battery for data backup. The flash memory card has no battery case.

E.3 OPERATING OF MEMORY CARD

E.3.1 Connection of Memory Card

(1) Insert the memory card in the direction shown in the figure through the memory card insertion slot.

(2) The memory card cannot be inserted with wrong side, because the memory card has insertion guides.
Take care the direction of the memory card.

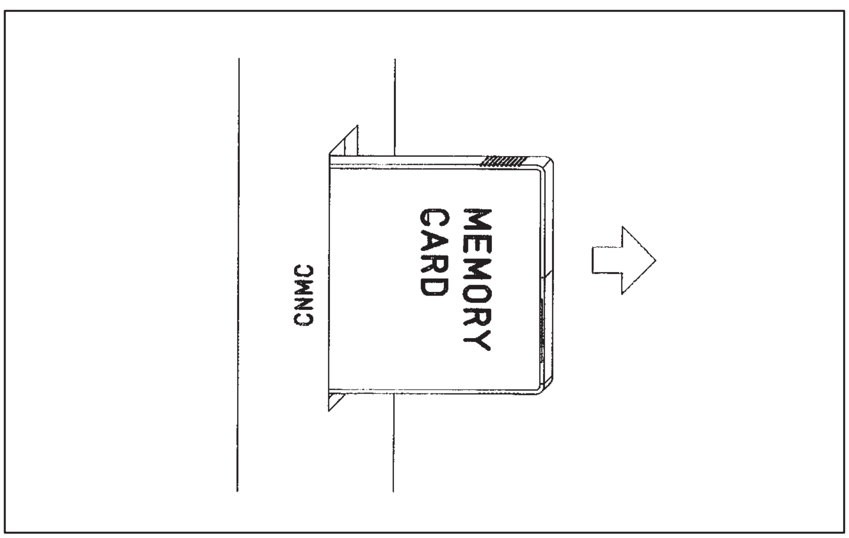


E.3.2 Operation

(1) For the read/write operation, refer to Appendix D.

E.3.3 Disconnection of Memory Card

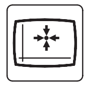
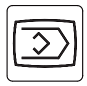
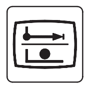
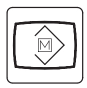
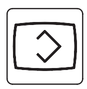
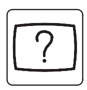
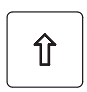
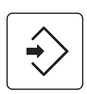
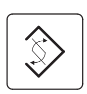
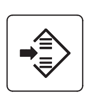
(1) Pull the memory card out in the direction shown in the figure.

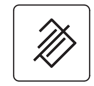
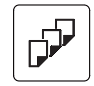
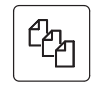
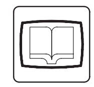
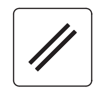
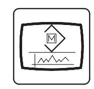


F NOTATION OF MDI KEYS

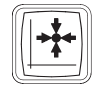
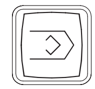
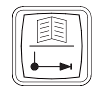
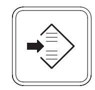
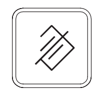
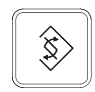
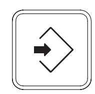
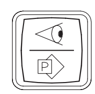
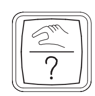
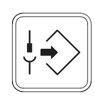
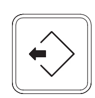
FANUC Power Mate has two types of MDI keypads : English type and Symbolic type.
The table below shows correspondence between English keys and Symbolic keys.
This manual uses English type in the text.
Therefore when a user uses Symbolic type MDI keypads and encounters an English key in the text, please refer to the correspondence table shown below.

MDI keys for CRT

Name	English key	Symbolic key
CANCEL key	CAN	
POSITION key	POS	
PROGRAM key	PROG	
OFFSET/ SETTING key	OFFSET SETTING	
CUSTOM key	CUSTOM	
SYSTEM key	SYSTEM	
MESSAGE key	MESSAGE	
GRAPH key	GRAPH	
CNC/MMC key	CNC/MMC	
SHIFT key	SHIFT	
INPUT key	INPUT	
ALTER key	ALTER	
INSERT key	INSERT	

Name	English key	Symbolic key
DELETE key	DELETE	
PAGE UP key	↑ PAGE	
PAGE DOWN key	PAGE ↓	
HELP key	HELP	
RESET key	RESET	
CUSTOM/ GRAPH key	CUSTOM GRAPH	

MDI keys for DPL

Name	English key	Symbolic key
POSITION key	POS	
PROGRAM key	PRGRM	
MENU/VAR key	MENU VAR	
INSERT key	INSRT	
DELETE key	DELET	
ALTER key	ALTER	
INPUT key	INPUT	
DIAGNOSE/PARAMETER key	DGNOS PARAM	
OPERATION/ALARM key	OPR ALARM	
READ key	READ	
WRITE key	WRITE	
CANCEL key	CAN	

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Revision Record

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Edition	Date	Contents	Edition	Date	Contents
01	Oct., ’96				