GE Fanuc Automation

Computer Numerical Control Products

Series 16-LB

Maintenance Manual

GFZ-62595EN/01 *May 1995*

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.

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PREFACE

Description of this manual

1. CRT/MDI display and operation

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

2. Hardware

This chapter covers hardware–related items, including the hardware configuration, connection, and NC 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, and tool compensation data, as well as the input/output procedures.

4. Interface between the NC 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. 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 manual operation cannot be performed. Countermeasures to be applied in the event of alarms being output are also described.

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 separate PARAMETER MANUAL (B–62600EN) .
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 can be used with the following models. The abbreviated names may be used.

Pruduct name	Abbreviation	
FANUC Series 16–LB	16–LB	Series 16

Related manuals

The table below lists manuals related to Series 16–LB.
In the table, this manual is marked with an asterisk(*).

Table 1 Manuals Related

Manual name	Specification number	
FANUC Series 16–MODEL B DESCRIPTIONS	B–62442E	
FANUC Seires 16–LB DESCRIPTIONS	B–62592EN	
FANUC Series 16–MODEL B CONNECTION MANUAL (HARDWARE)	B–62443E	
FANUC Series 16–MODEL B CONNECTION MANUAL (FUNCTION)	B–62443E–1	
FANUC Series 16–LB CONNECTION MANUAL	B–62593EN	
FANUC Series 16–LB OPERATOR'S MANUAL	B–62594EN	
FANUC Series 16–LB MAINTENANCE MANUAL	B–62595EN	*
FANUC Series 16–MODEL B PARAMETER MANUAL	B–62450E	
FANUC Series 16–LB PARAMETER MANUAL	B–62600EN	
PROGRAMMING MANUAL (Macro Compiler/ Macro Executer)	B–61803E–1	
FAPT MACRO COMPILER PROGRAMMING MANUAL	B–66102E	

Table of Contents

APPENDIX

1 DISPLAY AND OPERATION OF CRT/MDI

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, 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 :

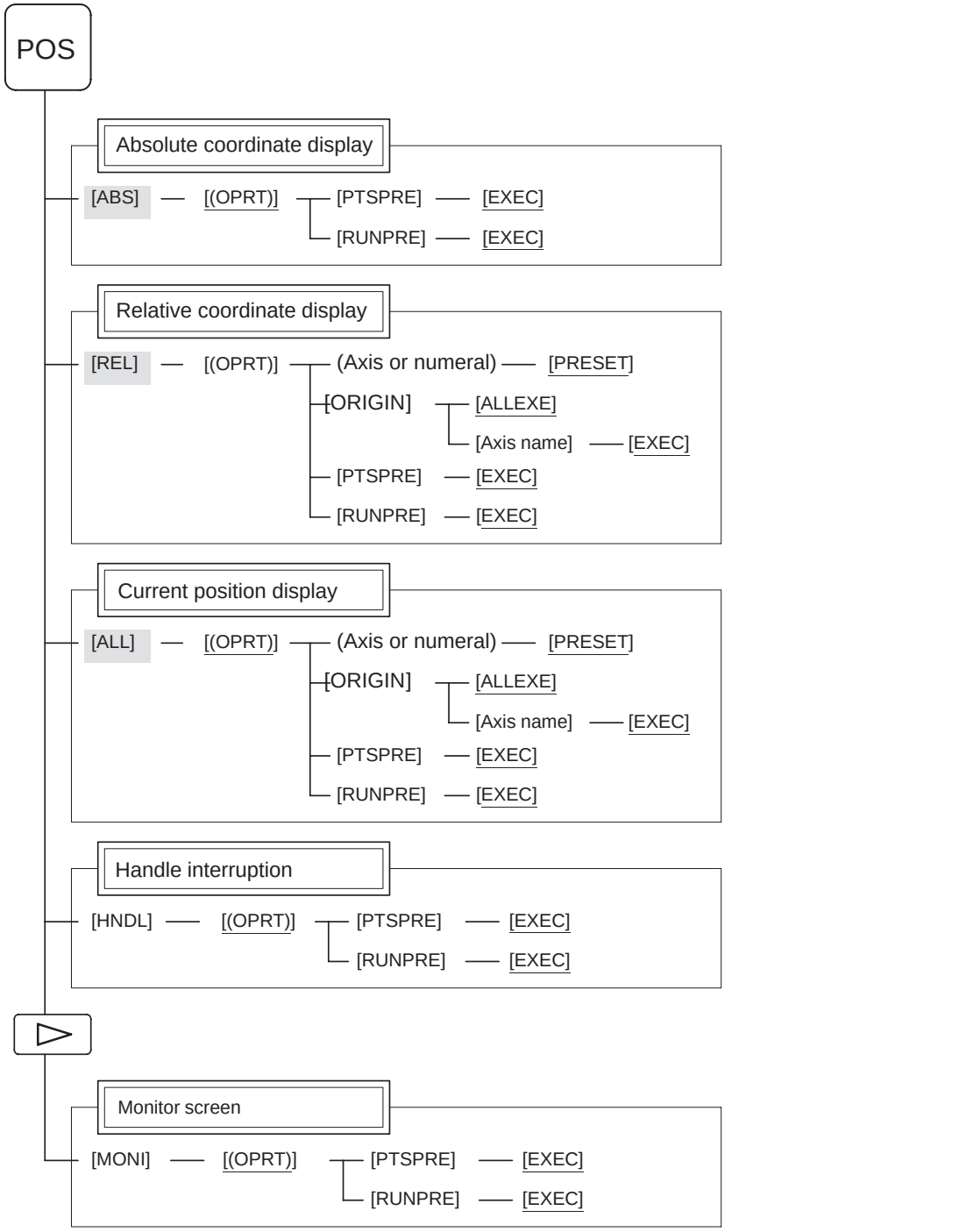
	:	Indicates screens
	:	Indicates a screen that can be displayed by pressing a function key(*1)
[ ]	:	Indicates a soft key(*2)
( )	:	Indicates input from the MDI panel.
[__]	:	Indicates a soft key displayed in green (or highlighted).
	:	Indicates the continuous menu key (rightmost soft key)(*3).

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

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

*3 In some cases, the continuous menu key is omitted when the 14″ CRT display or 10″/LCD is used.

POSITION SCREEN Soft key transition triggered by the function key [POS]

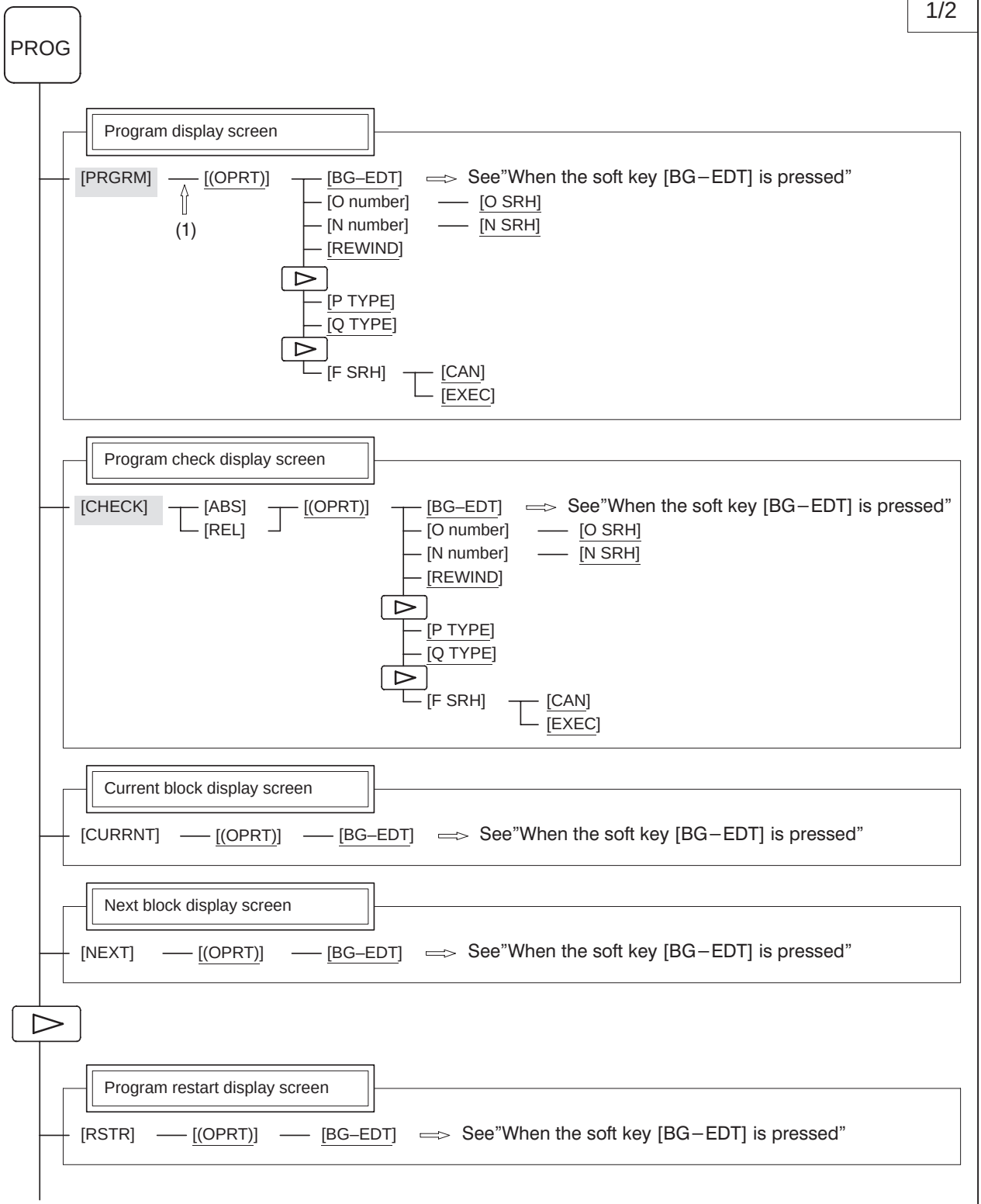


PROGRAM SCREEN

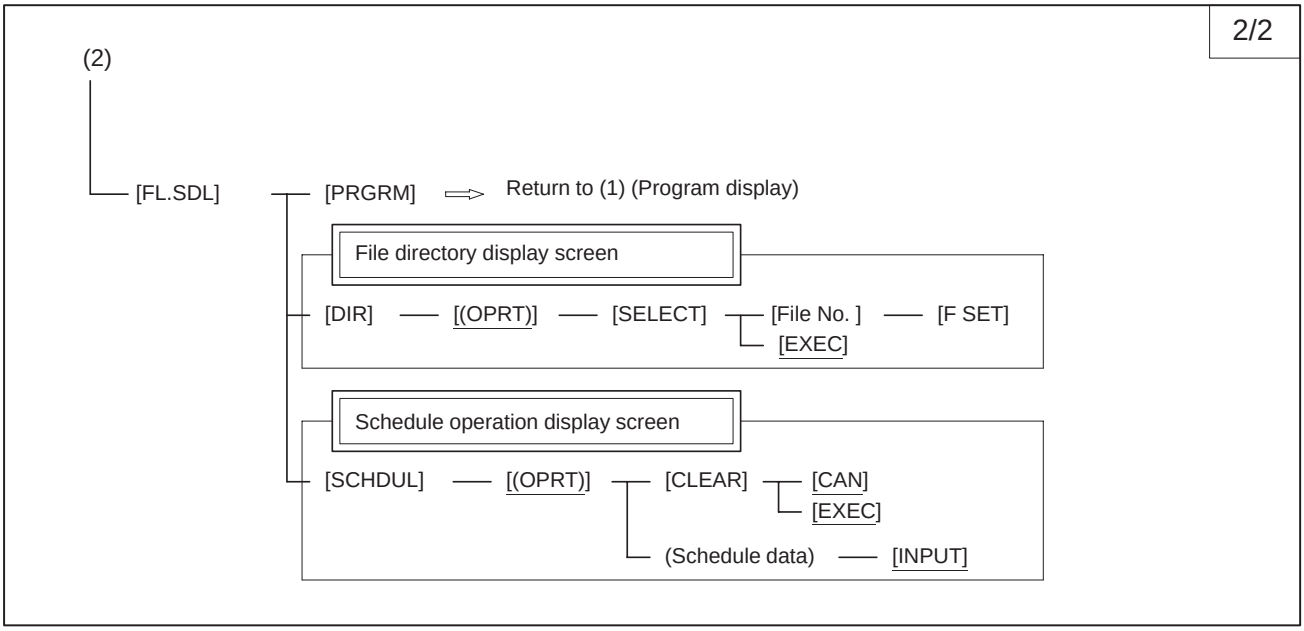
Soft key transition triggered by the function key in the MEM mode

PROG

1/2



(2)(Continued on the next page)

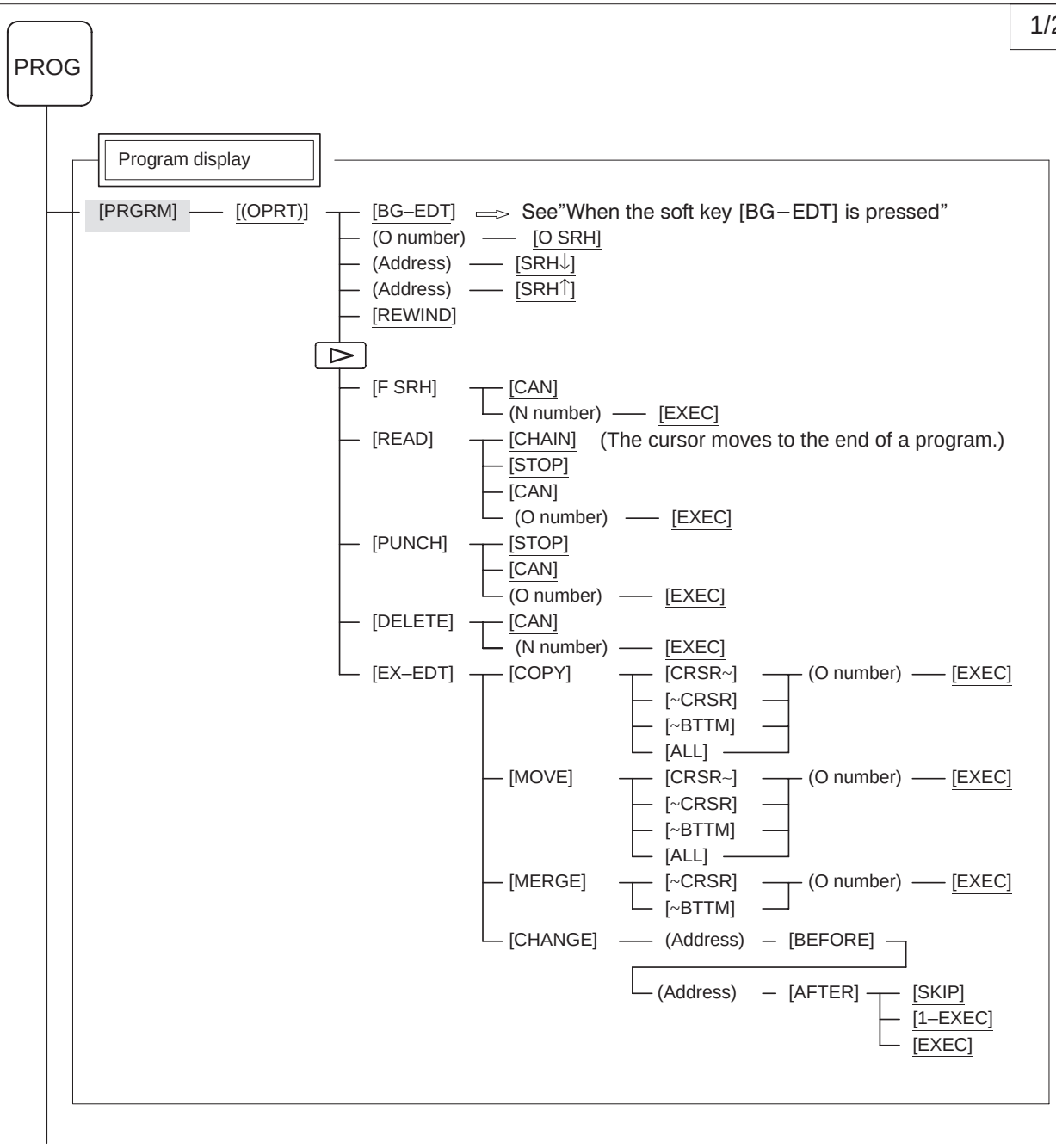

2/2
(2)
[FL.SDL]
[PRGRM]
Return to (1) (Program display)
File directory display screen
[DIR]
[(OPRT)]
[SELECT]
[File No.]
[F SET]
[EXEC]
Schedule operation display screen
[SCHDUL]
[(OPRT)]
[CLEAR]
[CAN]
[EXEC]
(Schedule data)
[INPUT]

PROGRAM SCREEN

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

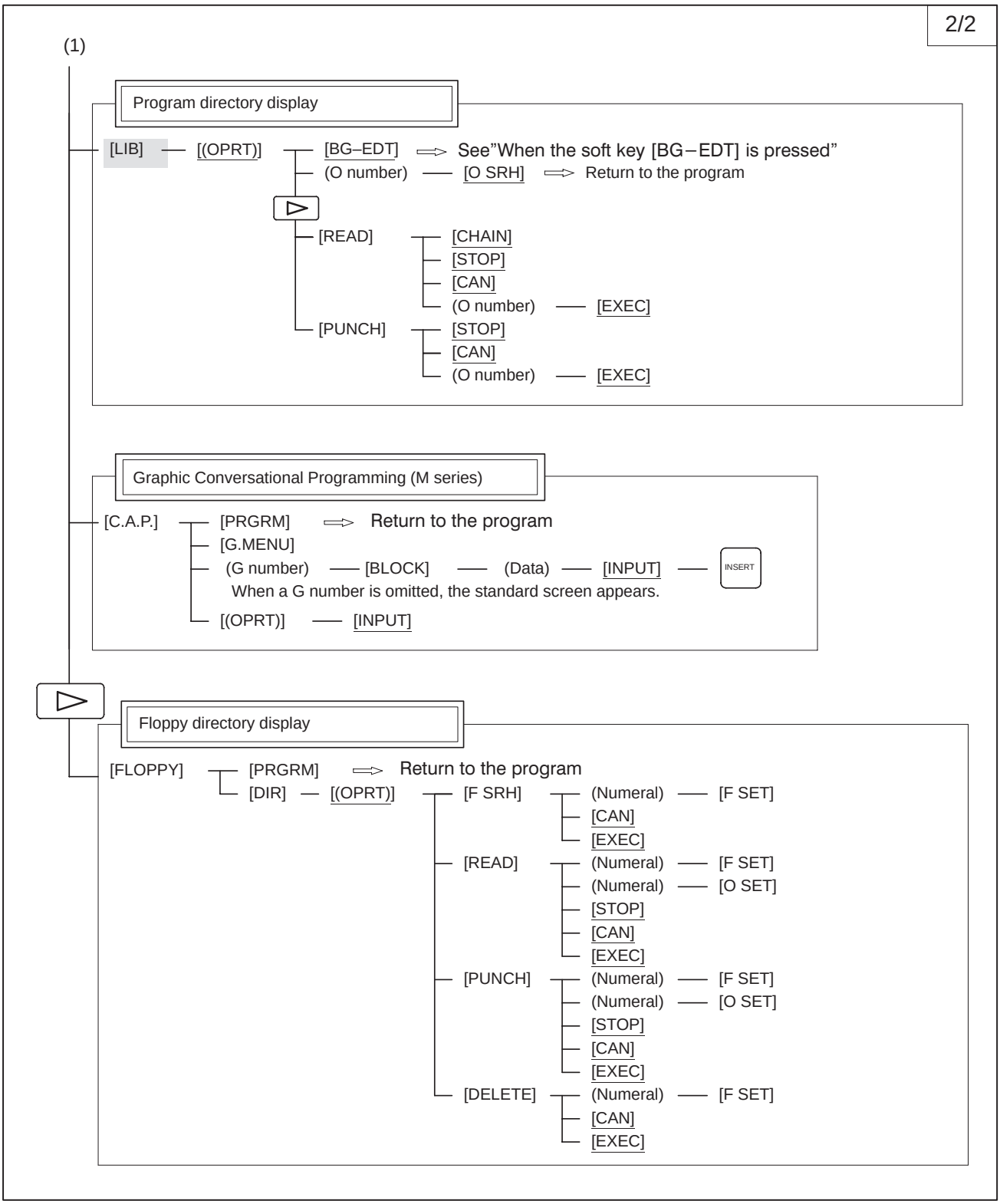
PROG

1/2



(1)(Continued on the next page)

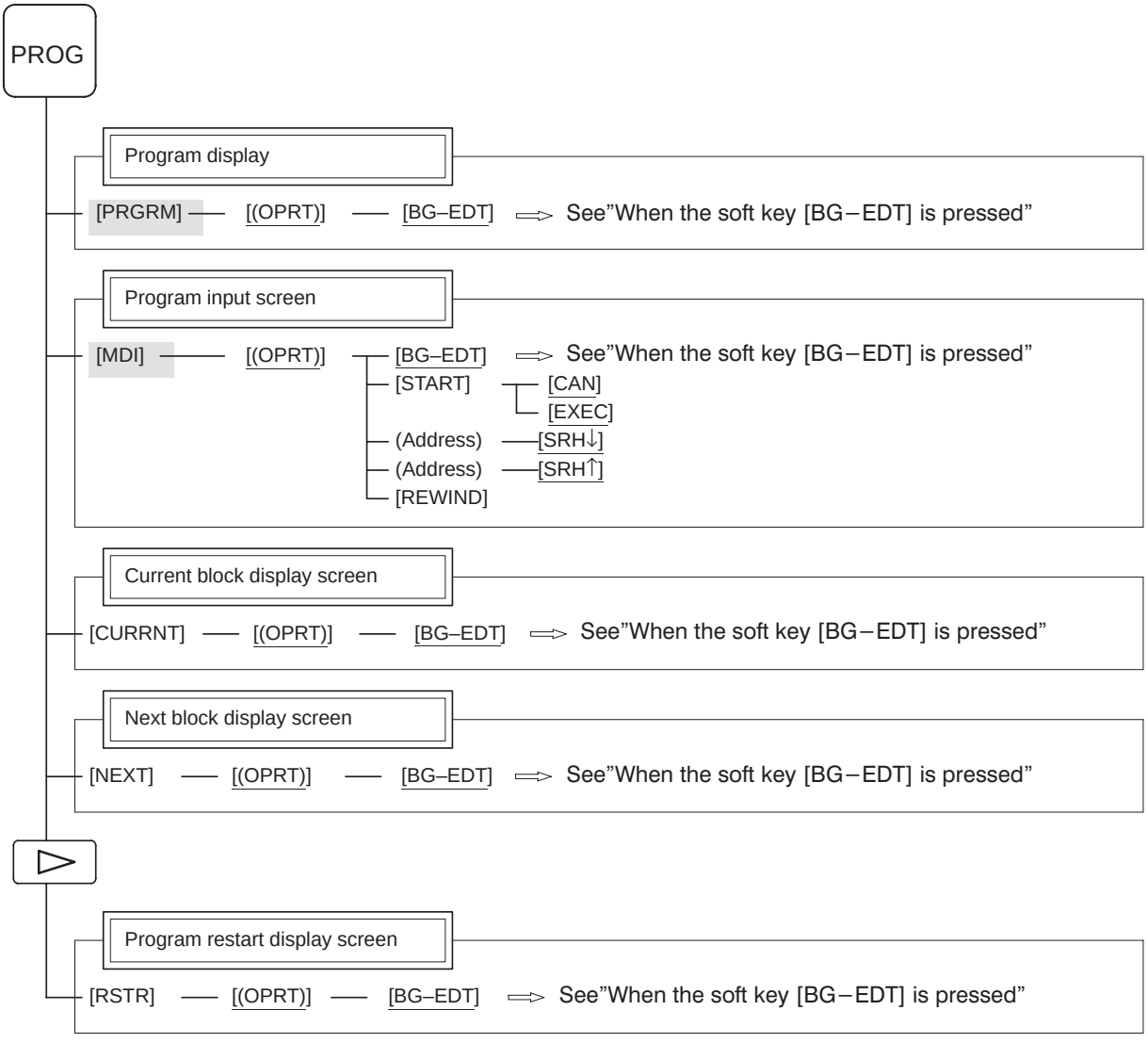
2/2


(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]
Graphic Conversational Programming (M series)
[C.A.P.]
[PRGRM]
Return to the program
[G.MENU]
(G number)
[BLOCK]
(Data)
[INPUT]
INSERT
When a G number is omitted, the standard screen appears.
[(OPRT)]
[INPUT]
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

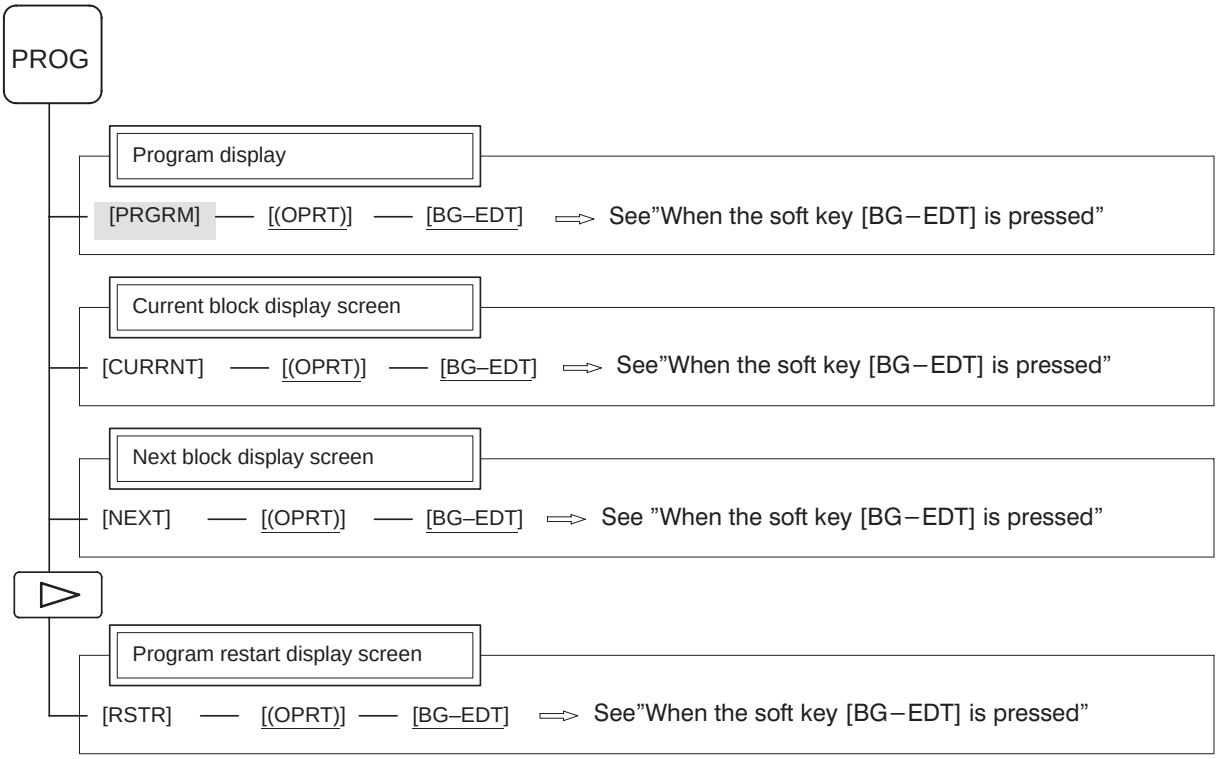
Soft key transition triggered by the function key in the MDI mode

PROG



PROGRAM SCREEN

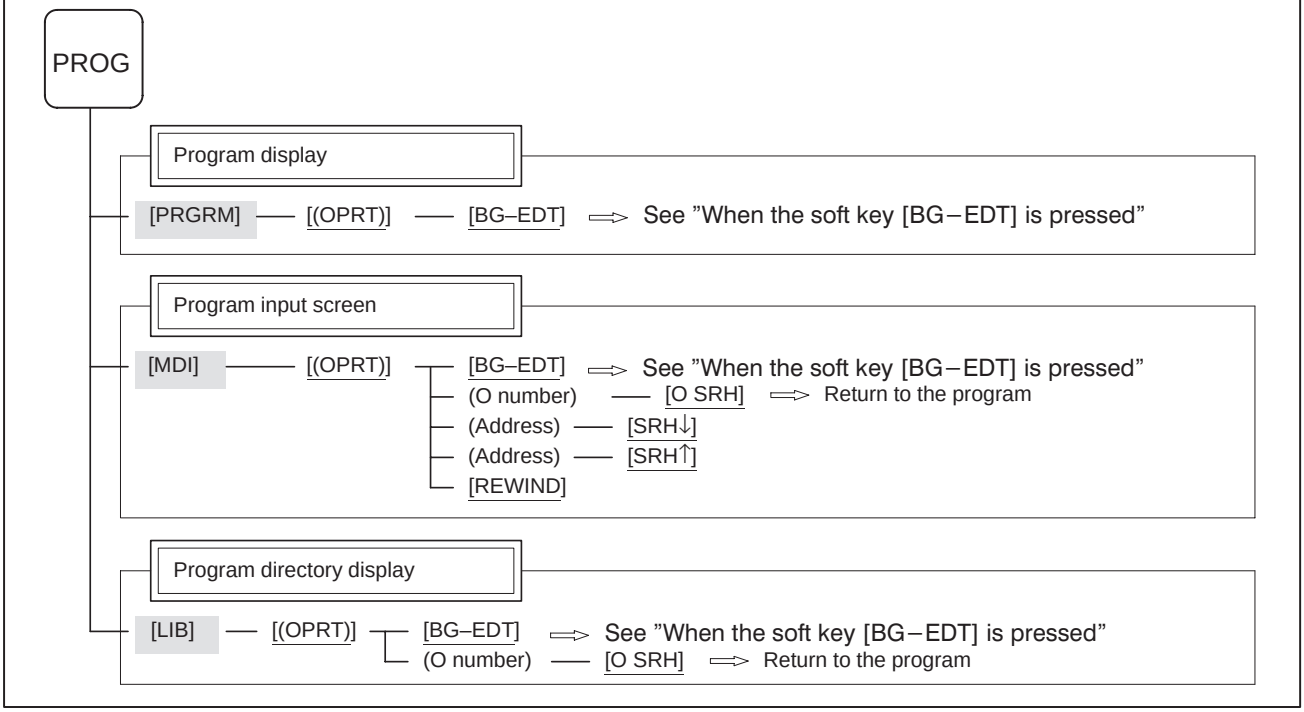
Soft key transition triggered by the function key in the HNDL, JOG, or REF mode



PROGRAM SCREEN

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

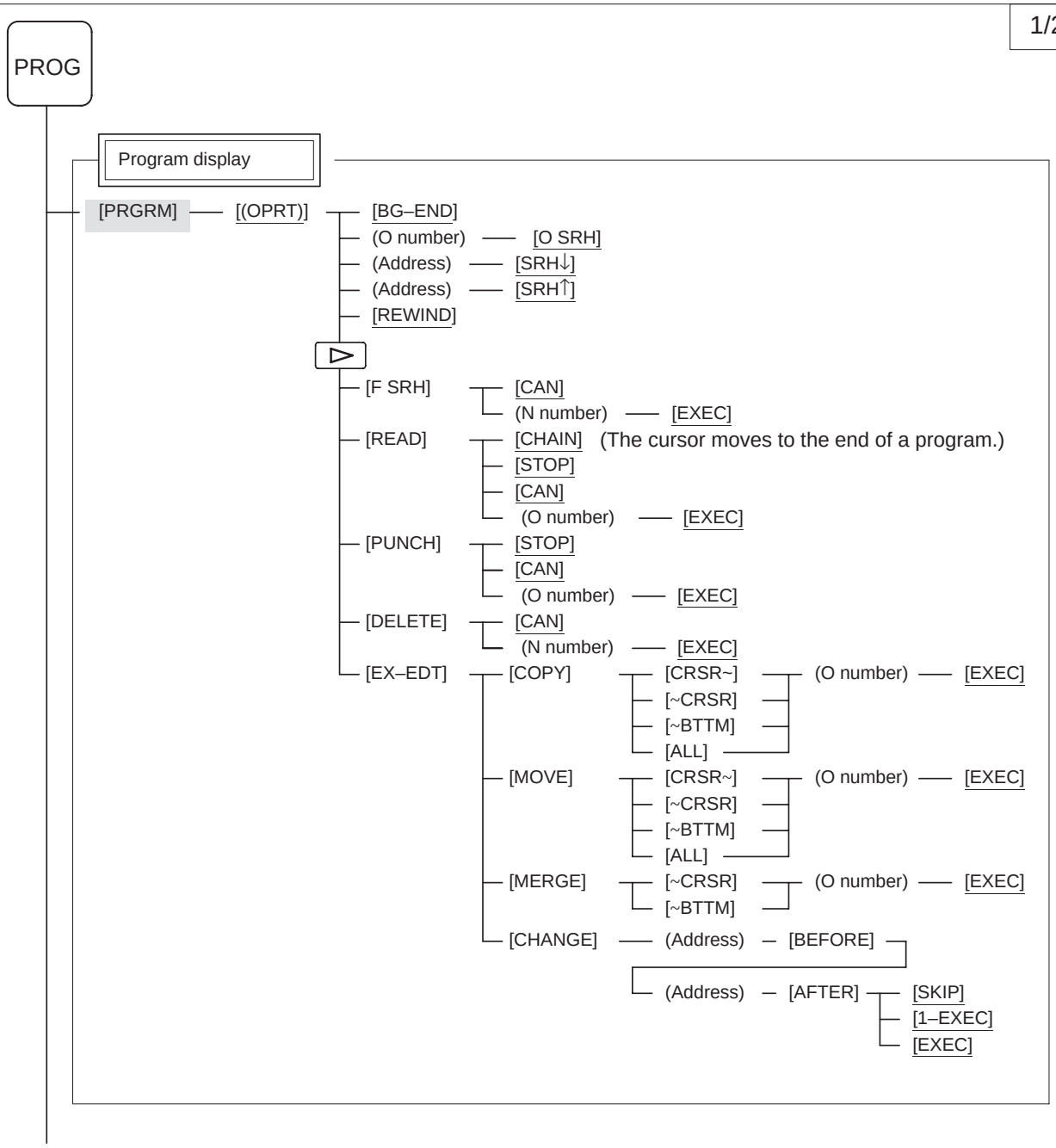
PROG



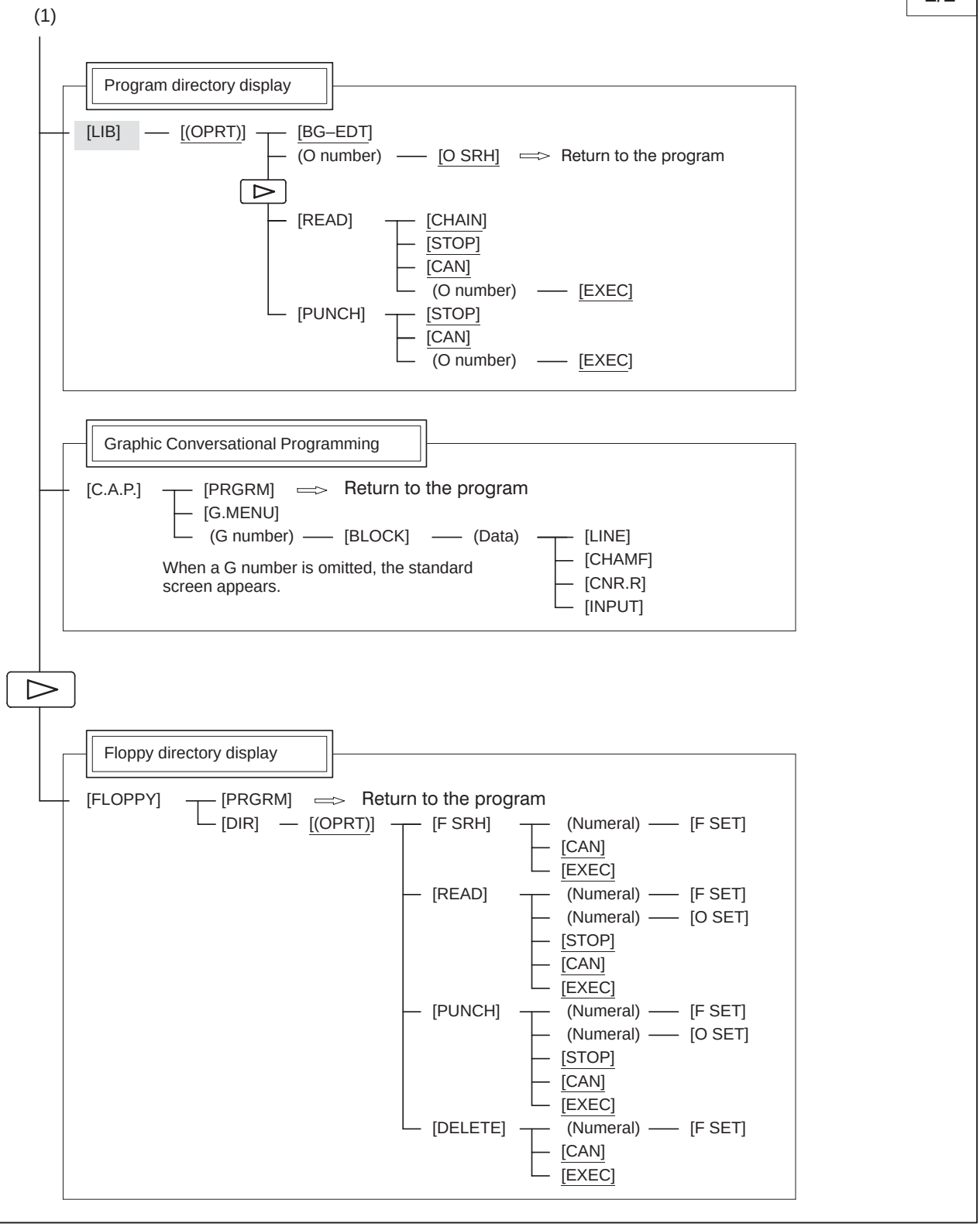
PROGRAM SCREEN

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

1/2

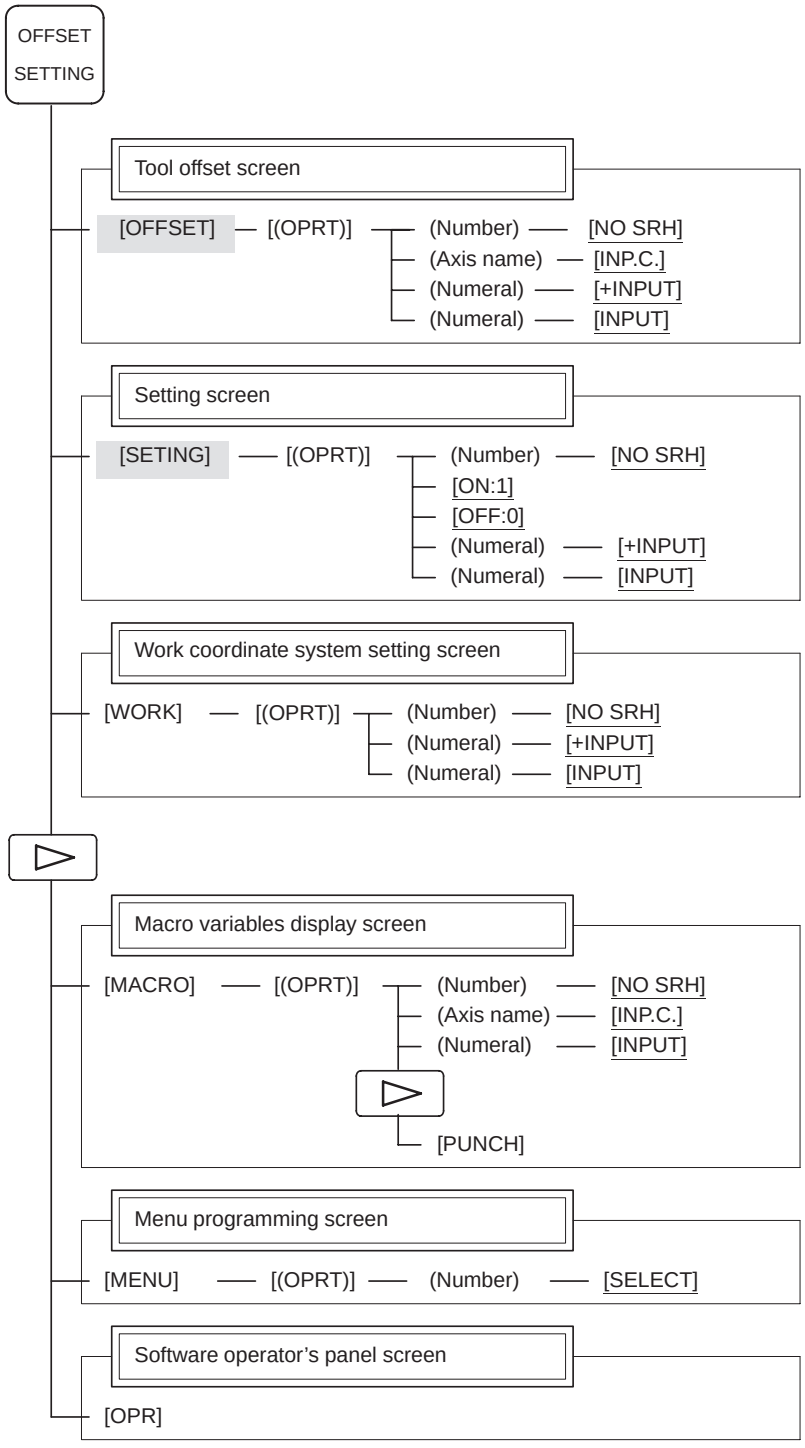


(1)(Continued on the next page)


(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]
Graphic Conversational Programming
[C.A.P.]
[PRGRM]
Return to the program
[G.MENU]
(G number)
[BLOCK]
(Data)
[LINE]
[CHAMF]
[CNR.R]
[INPUT]
When a G number is omitted, the standard screen appears.
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]

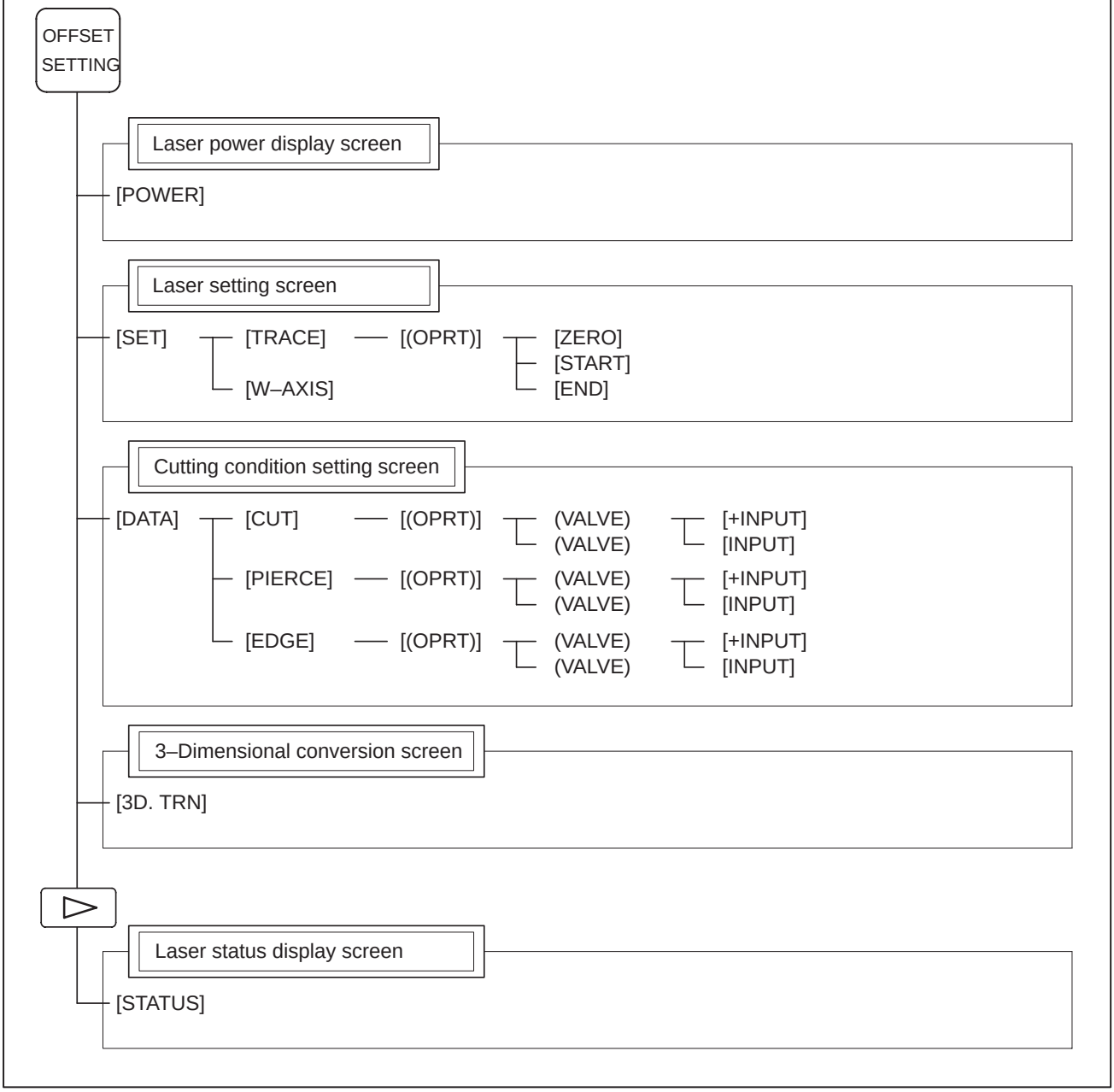
OFFSET/SETTING SCREEN

Soft key transition triggered by the function key OFFSET SETTING (1)



LASER SETTING SCREEN

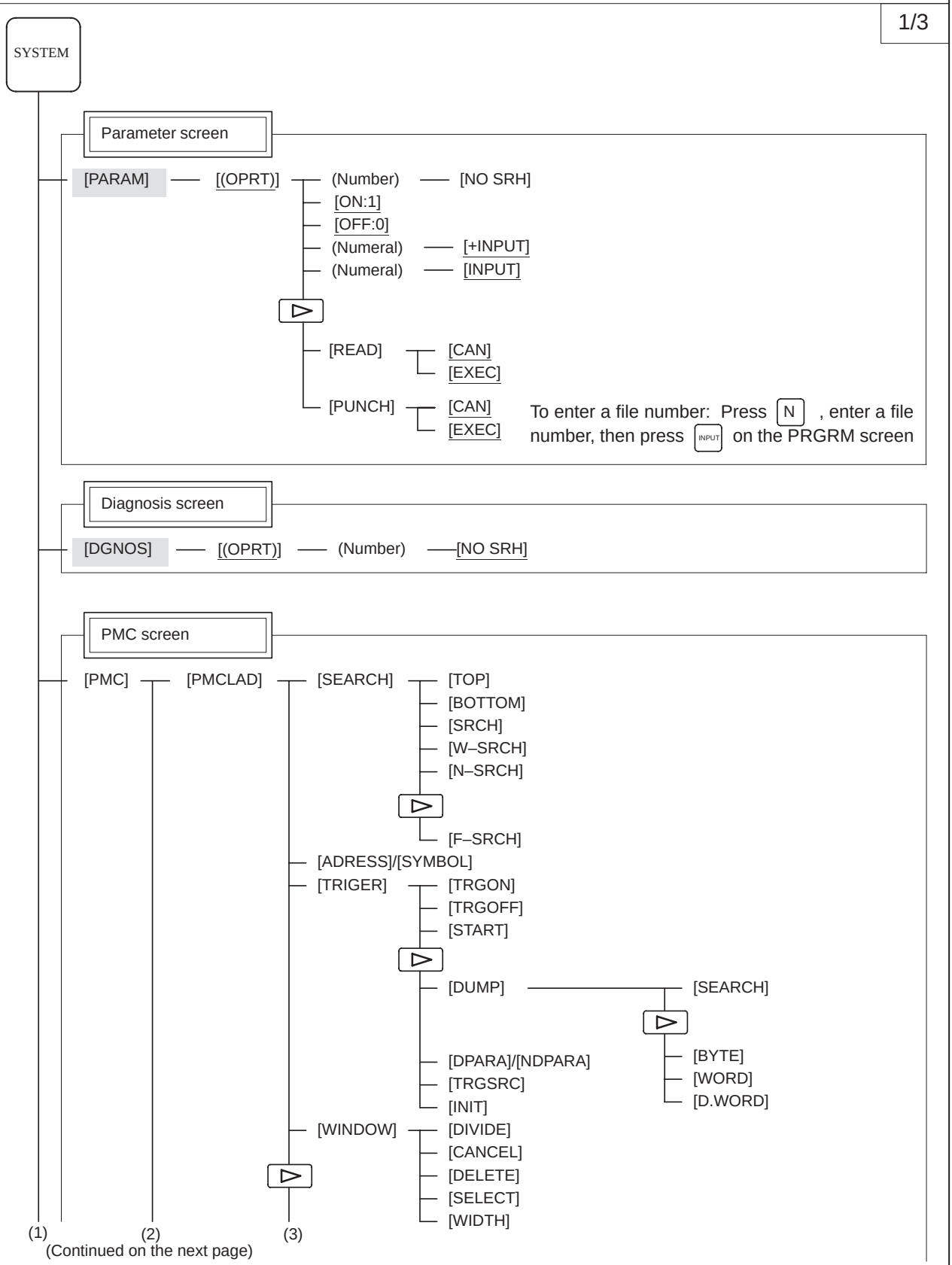
Soft key transition triggered by the function key OFFSET SETTING (2)



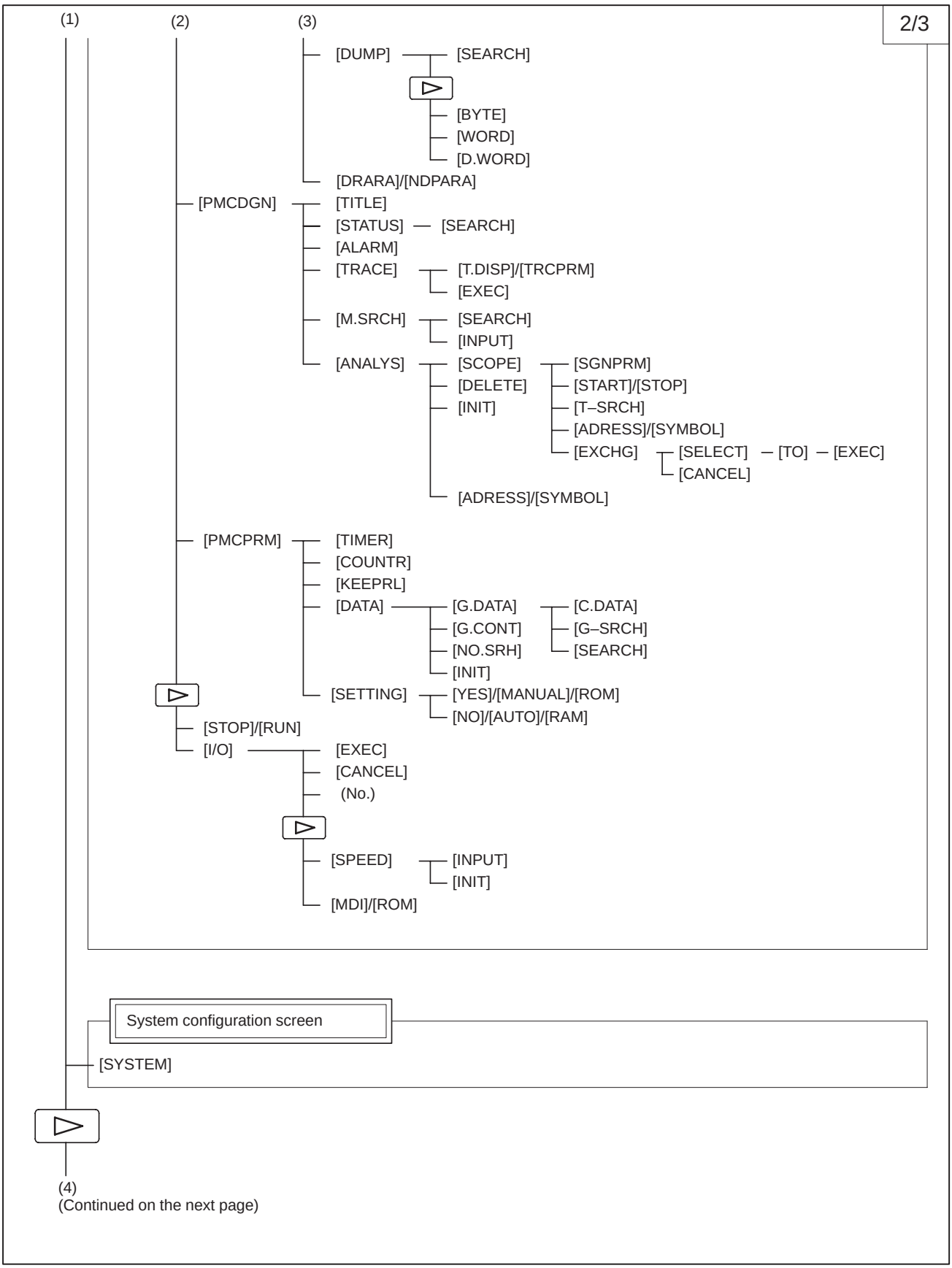
SYSTEM SCREEN

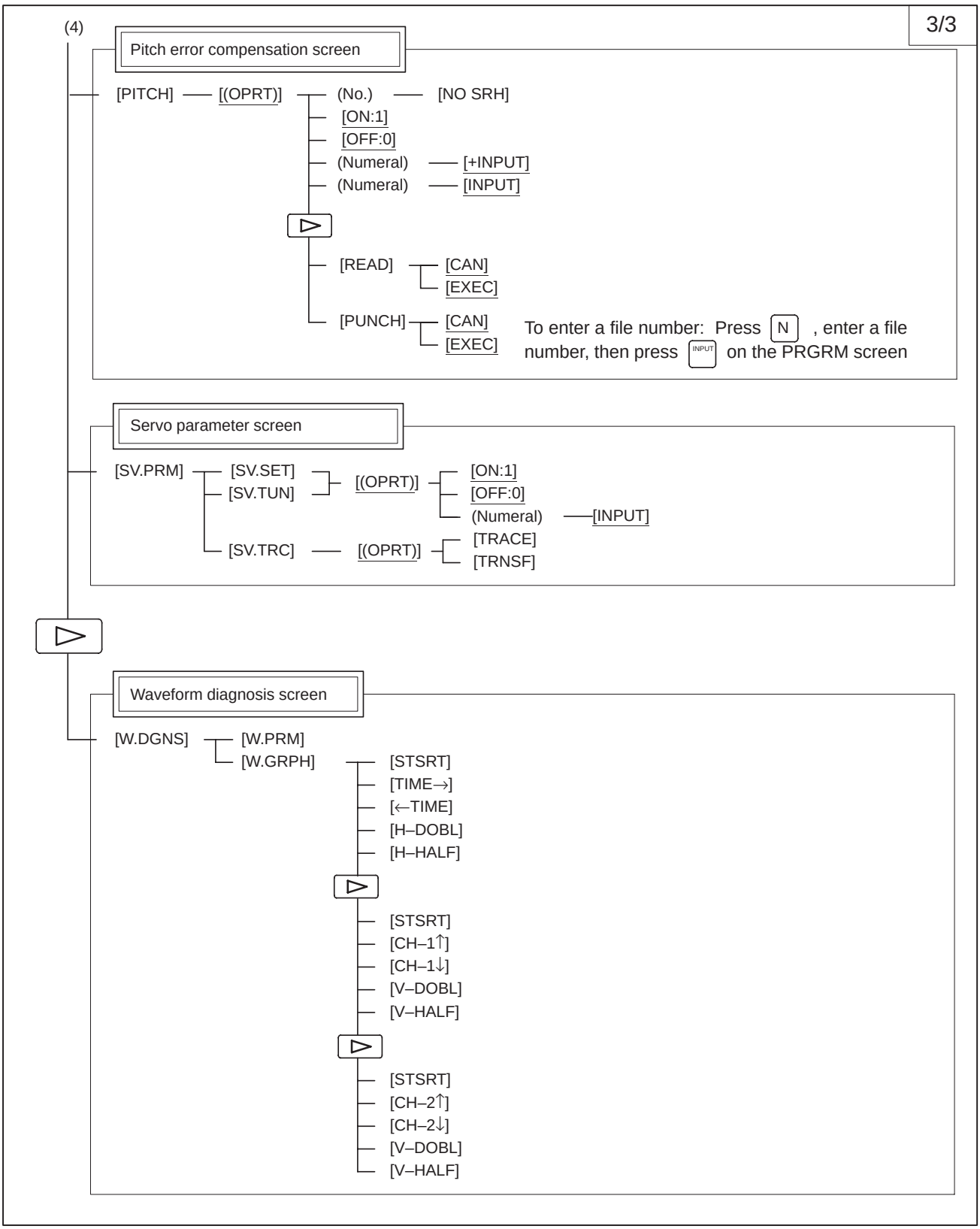
Soft key transition triggered by the function key SYSTEM

1/3



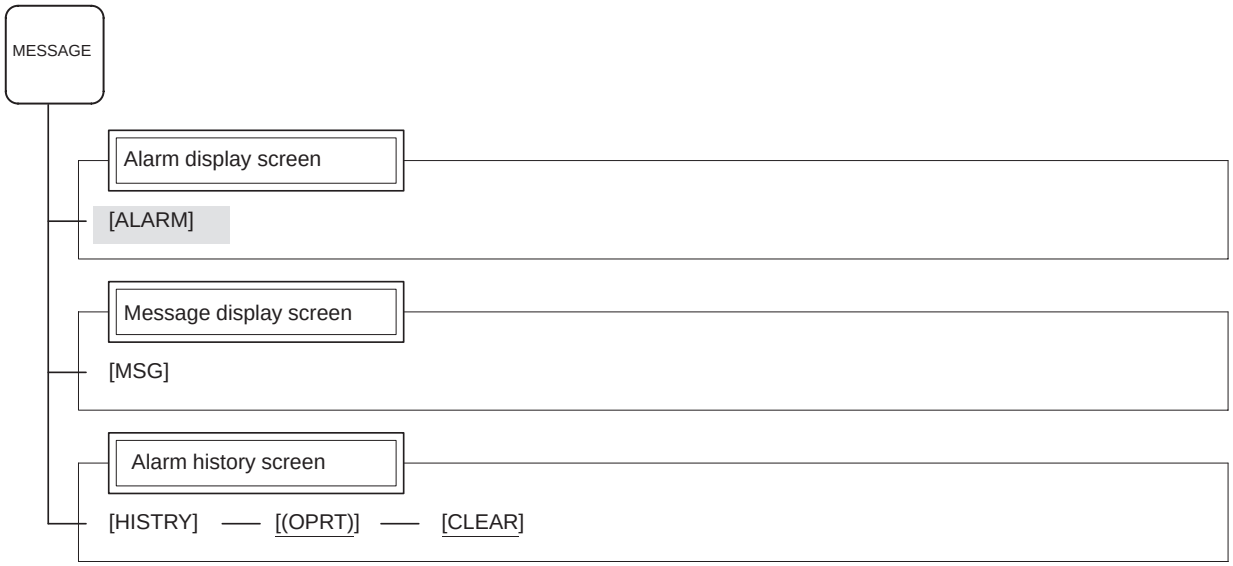
(Continued on the next page)


2/3
(1)
(2)
(3)
[DUMP]
[SEARCH]
[BYTE]
[WORD]
[D.WORD]
[DRARA]/[NDPARA]
[PMCDGN]
[TITLE]
[STATUS]
[SEARCH]
[ALARM]
[TRACE]
[T.DISP]/[TRCPRM]
[EXEC]
[M.SRCH]
[SEARCH]
[INPUT]
[ANALYS]
[SCOPE]
[SGNPRM]
[DELETE]
[START]/[STOP]
[INIT]
[T–SRCH]
[ADRESS]/[SYMBOL]
[EXCHG]
[SELECT]
[TO]
[EXEC]
[CANCEL]
[ADRESS]/[SYMBOL]
[PMCPRM]
[TIMER]
[COUNTR]
[KEEPRL]
[DATA]
[G.DATA]
[C.DATA]
[G.CONT]
[G–SRCH]
[NO.SRH]
[SEARCH]
[INIT]
[SETTING]
[YES]/[MANUAL]/[ROM]
[NO]/[AUTO]/[RAM]
[STOP]/[RUN]
[I/O]
[EXEC]
[CANCEL]
(No.)
[SPEED]
[INPUT]
[INIT]
[MDI]/[ROM]
System configuration screen
[SYSTEM]
(4)
(Continued on the next page)


3/3
(4)
Pitch error compensation screen
[PITCH]
[(OPRT)]
(No.)
[NO SRH]
[ON:1]
[OFF:0]
(Numeral)
[+INPUT]
(Numeral)
[INPUT]
[READ]
[CAN]
[EXEC]
[PUNCH]
[CAN]
[EXEC]
To enter a file number: Press N , enter a file number, then press INPUT on the PRGRM screen
Servo parameter screen
[SV.PRM]
[SV.SET]
[SV.TUN]
[(OPRT)]
[ON:1]
[OFF:0]
(Numeral)
[INPUT]
[SV.TRC]
[(OPRT)]
[TRACE]
[TRNSF]
Waveform diagnosis screen
[W.DGNS]
[W.PRM]
[W.GRPH]
[STSRT]
[TIME→]
[←TIME]
[H–DOBL]
[H–HALF]
[STSRT]
[CH–1↑]
[CH–1↓]
[V–DOBL]
[V–HALF]
[STSRT]
[CH–2↑]
[CH–2↓]
[V–DOBL]
[V–HALF]

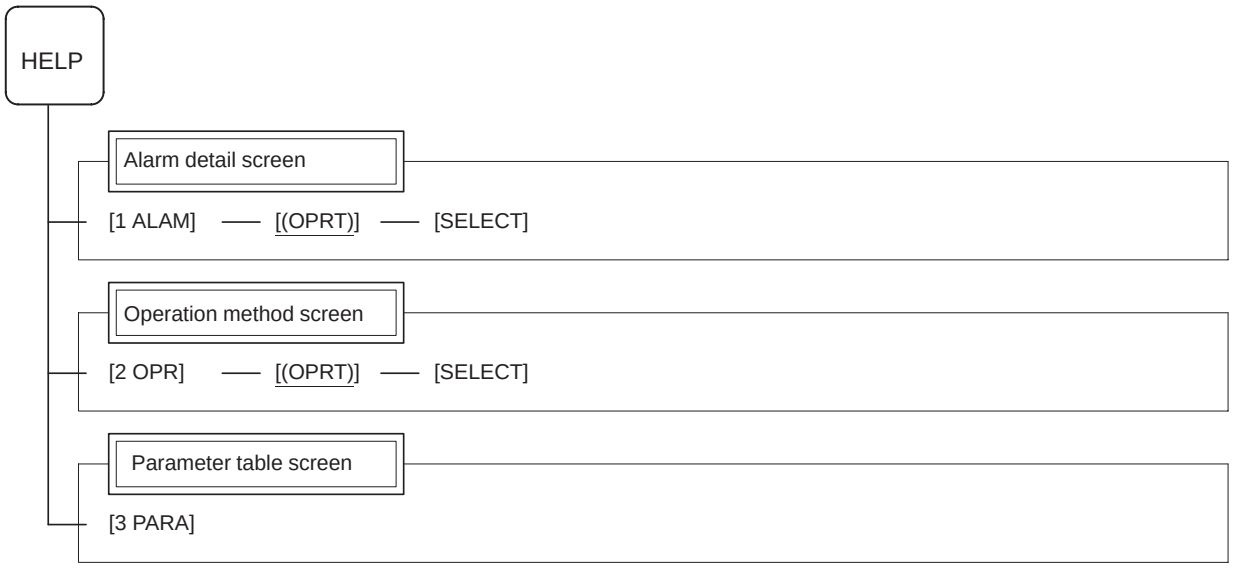
MESSAGE SCREEN

Soft key transition triggered by the function key [MESSAGE]



HELP SCREEN

Soft key transition triggered by the function key [HELP]

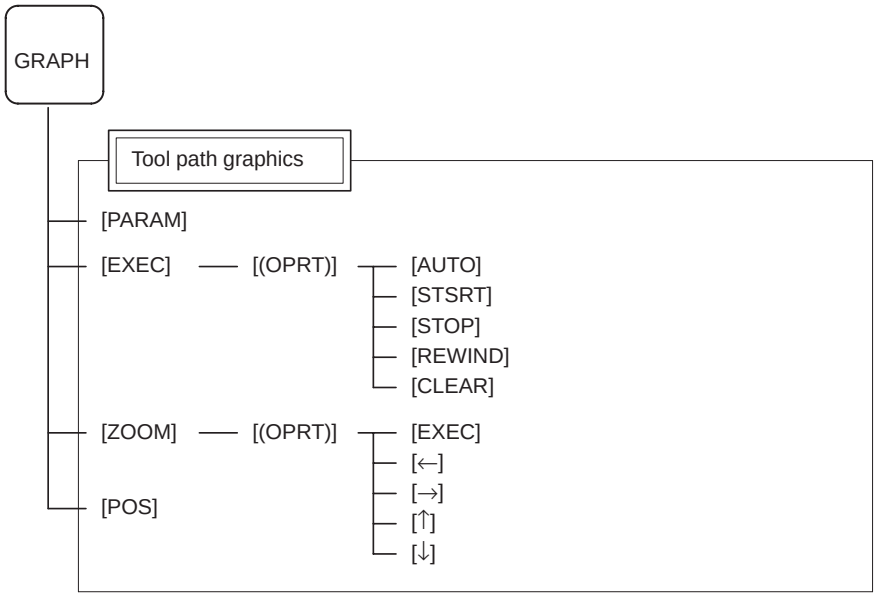


GRAPHIC SCREEN (M series)

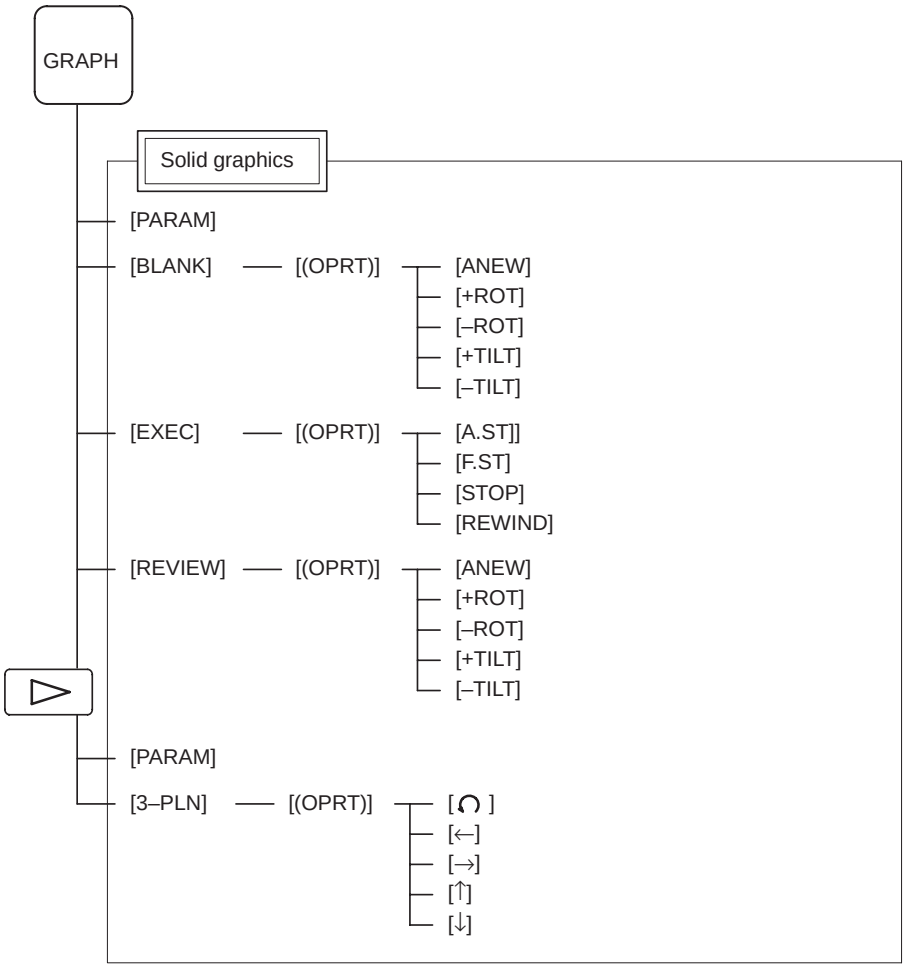
Soft key transition triggered by the function key

GRAPH

Tool path graphics



Solid graphics

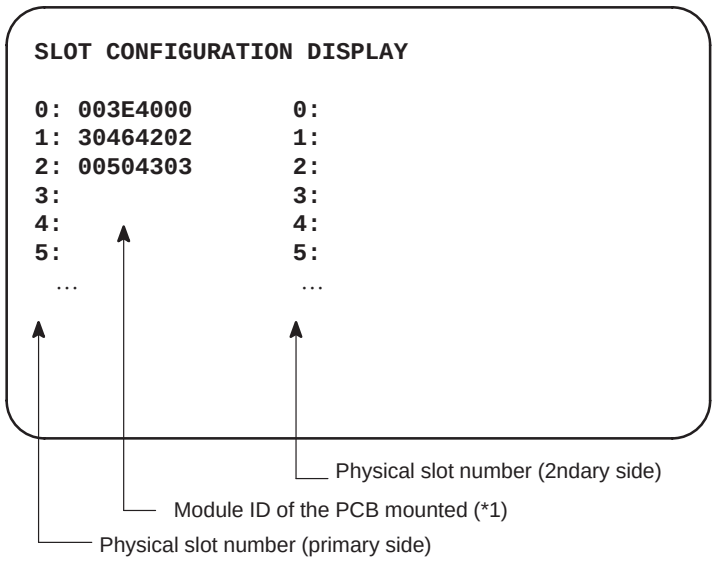


1.2 SCREEN DISPLAYED IMMEDIATELY AFTER POWER IS TURNED ON

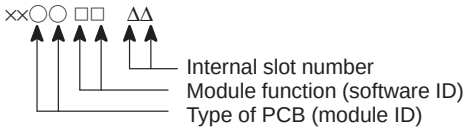
1.2.1 Slot Status Display

Types of PCBs mounted on the slots are displayed.
If a hardware trouble or an incorrect mounting is found, this screen is displayed.

- **Slot state screen**



*1) Module ID of PCB



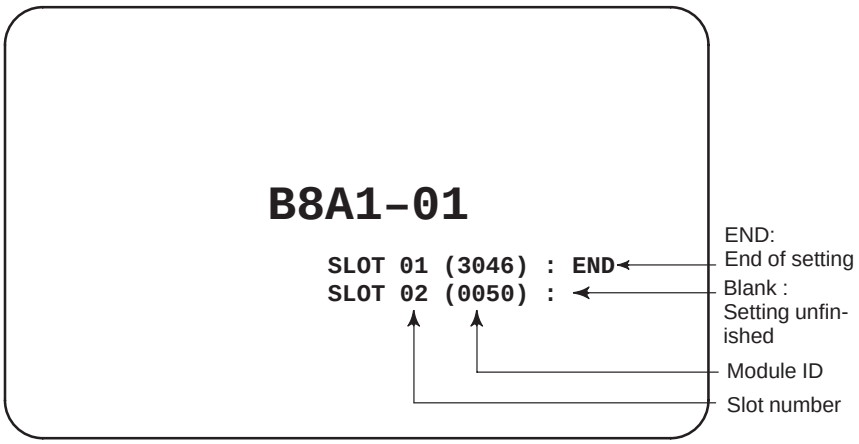
- **Module ID**

90 : Series 16 main CPU (For 4–axis)
3F : Remote buffer DNC1
9D : PMC–RC
46 : Built–in I/O card
9A : Graphic

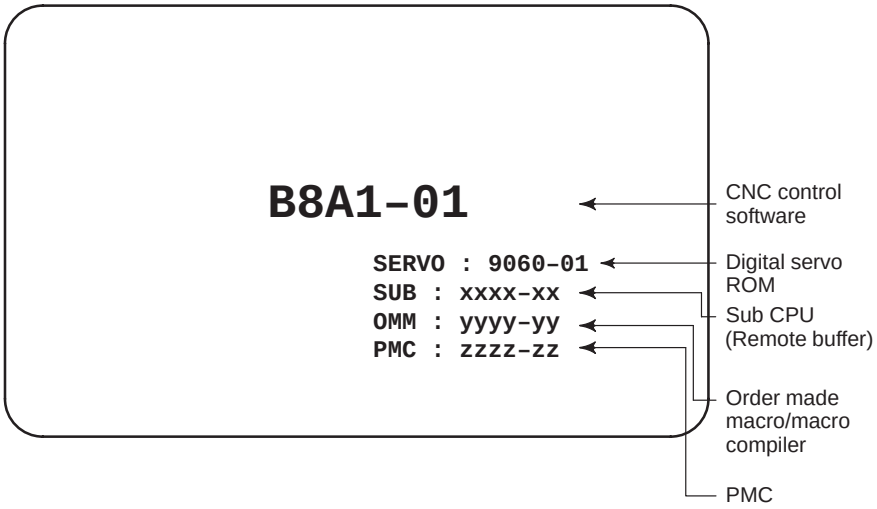
- **Software ID**

40 : Main CPU
41 : Option 3 board
42 : Built–in I/O card
4E :
45 : Graphic
50 : Additional 4–axis control (FS16 option 2)
4A : Remote buffer
4F :

1.2.2 Setting Module Screen



1.2.3 Configuration Display of Software



1.3 SYSTEM CONFIGURATION SCREEN

After the system has been installed correctly, you can find the PCBs installed and the softwares integrated on the system configuration screen.

1.3.1 Display Method

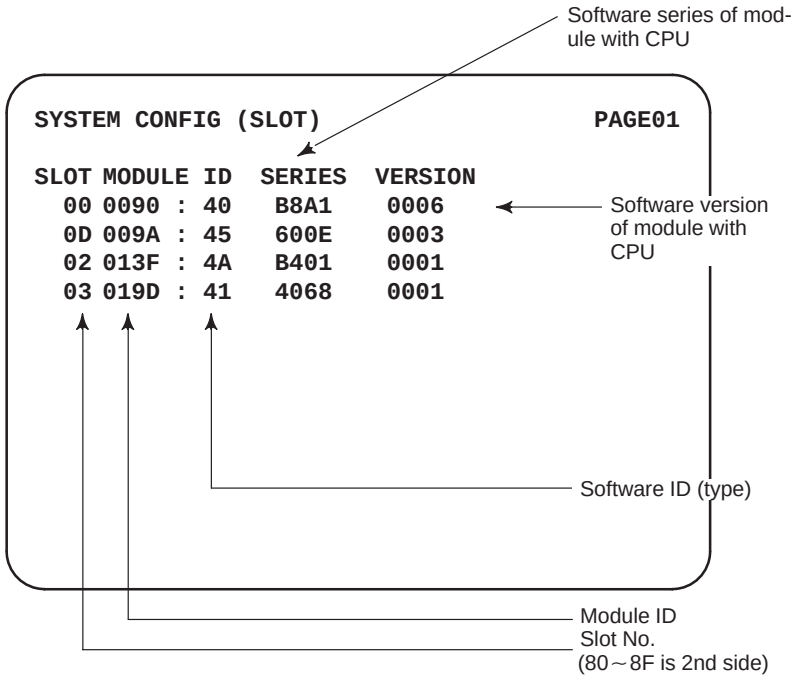
(1) Press [SYSTEM] key.

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

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

1.3.2 Configuration of PCBs

- **Screen**



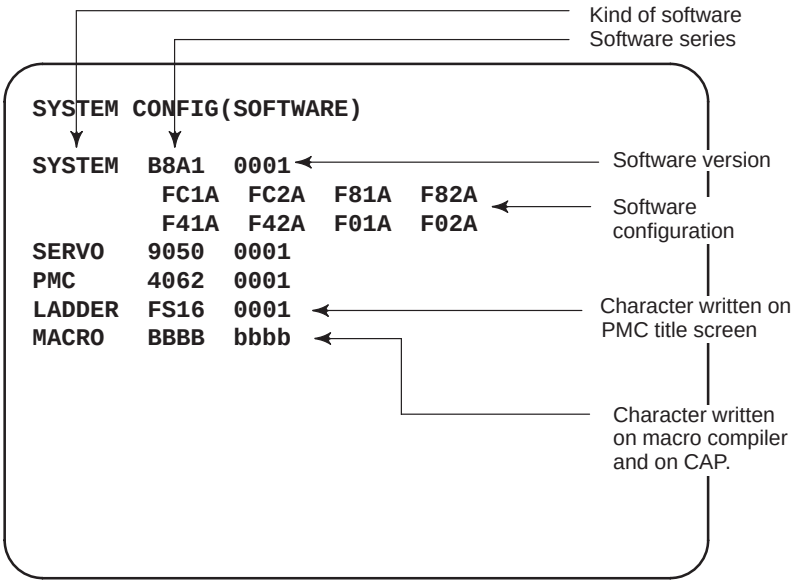
- **Module ID**

90 : Series 16 main CPU
3F : Remote buffer DNC1
9D : PMC–RC
9A : Graphic
46 : Built–in I/O card (Sink type)

- **Software ID**

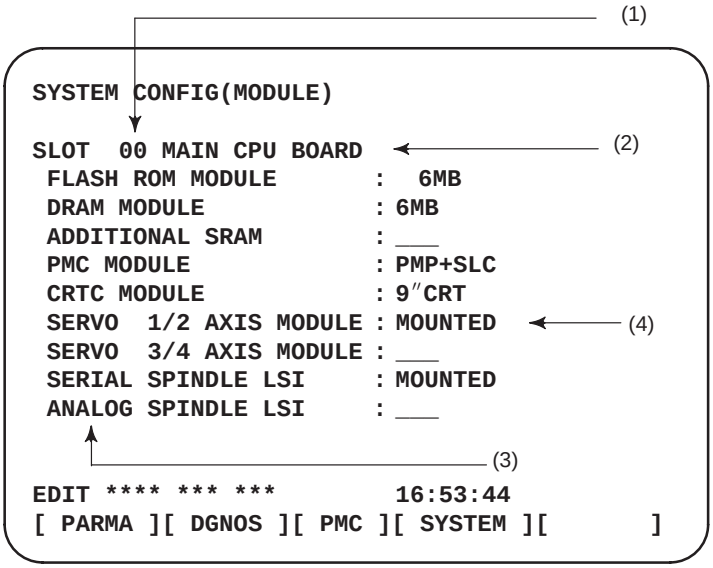
40 : Main CPU
41 : Option 3 board
42 : Built–in I/O card
4E : MAP
45 : Graphic
50 : Additional 4–axis control (FS16 option 2)
4A : Remote buffer
4F :

1.3.3 Software Configuration Screen



1.3.4 Module Configuration Screen

Configuration of the modules displayed on PCB.



Contents of display

(1) Slot number (The number is corresponding to PCB configuration screen)

(2) Type of PCB mounted

(3) Type of mounted module or hardware

(4) Mounted or not, or type of module

Pressing the PAGE key displays the system configuration screen of other PCBs.

*Refer to “Construction of Control Unit PCB” for correspondence with each module and display.

1.4 ALARM HISTORY SCREEN

1.4.1 General

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

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                          O1234 N12345

91/04/18 20:56:26
 506 OVERTRAVEL :  +X
91/04/18 19:58:11
 000 TURN OFF POWER
91/04/18 19:52:45
 000 TURN OFF POWER
91/04/18 19:48:43
 300 APC ALARM  : X–AXIS ZERO RETURN REQUEST
91/04/18 18:10:10
 507 OVERTRAVEL :  +B



[ ALARM ][ MSG ][ HISTRY ][       ][ (OPE) ]
```

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(ERROR1)⇒“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.

1.5.2 Display Method

Press HELP key on any screen other than PMC screen, then a help screen appears.
(However, it is not available when PMC screen is displaying)

- **Display of help screen**

```
HELP (INITIAL MENU)            O1234 N12345

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









[1 ALAM]  [2 OPE]  [3 PARA]  [     ]  [     ]
```

- **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




[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




[1 ALARM]  [2 OPR]  [3 PARA]  [ OPRT ]
```

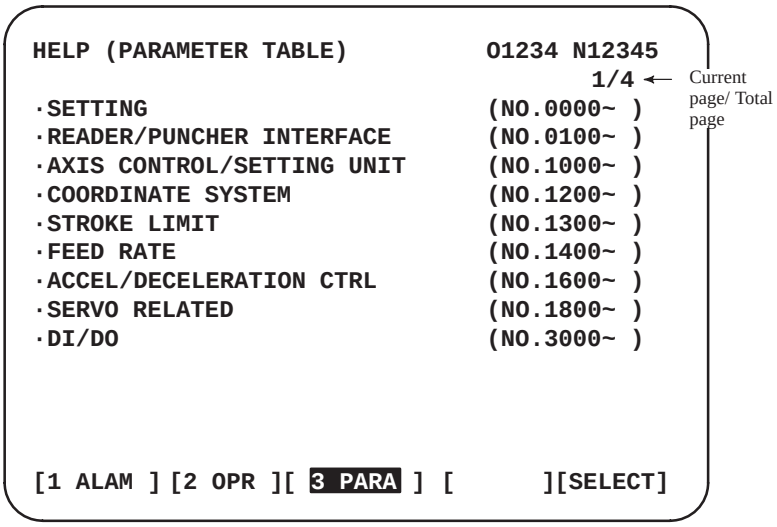
2 Press **[OPRT]**, (an item number) and soft key **[SELECT]**, then an operation method of the item is displayed.

Pressing PAGE key  or  displays another pages.

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

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




[    ]  [    ]  [    ]  [    ]  [SELECT]
```

- **Parameter table**

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



Another screen can be selected by the PAGE key  or  .

1.6 DISPLAYING DIAGNOSTIC PAGE

1.6.1 Displaying Diagnostic Page

(1) Press SYSTEM key.

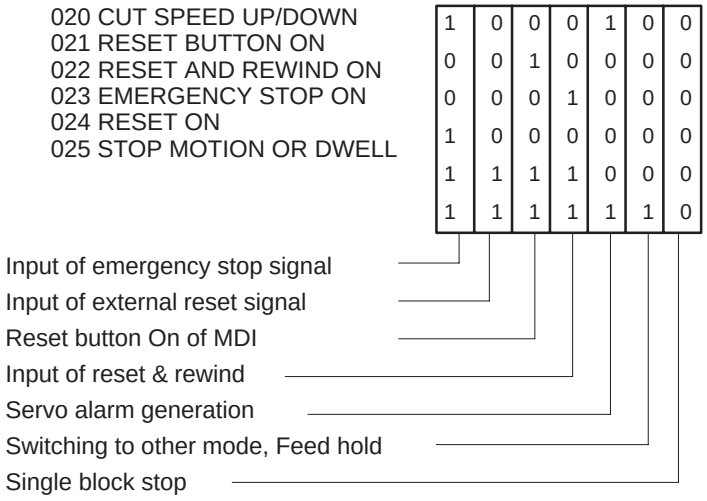
(2) Press soft key **[DGN]**, then a diagnostic screen is displayed.

1.6.2 Contents Displayed

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

000 WAITING FOR FIN SIGNAL	An auxiliary function is being executed.
001 MOTION	Travel command of cycle operation is being executed.
002 DWELL	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 or start lock is input.
006 SPINDLE SPEED ARRIVAL CHECK	Waiting for spindle speed arrival signal.
010 PUNCHING	Data is being output through reader/puncher interface.
011 READING	Data is being input through reader/puncher interface.
012 WAITING FOR (UN) CLAMP	Waiting for the end of index table indexing.
013 JOG FEEDRATE OVERRIDE 0%	Manual feedrate override is 0%.
014 WAITING FOR RESET, ESP,RRW OFF	NC is in reset state.
015 EXTERNAL PROGRAM NUMBER SEARCH	External Program Number Search External program number search is being done.

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



- **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**

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	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 block 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**

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	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**

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

#7(OVL): Overload alarm

#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

#0(OFA): Overflow alarm

	#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 (hand)
	1	–	–	1	Disconnection of separated type pulse coder (hard)
	0	–	–	0	Disconnection of pulse coder (software)

	#7	#6	#5	#4	#3	#2	#1	#0
DGN 0204	RAM	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**

DGN 0300	Position error of an axis in detection unit

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

- **Machine position**

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

- **State of remote buffer (protocol A)**

DGN 0500 Send command

1: SYN 2: RDY 3: RST 4: ALM
5: SAT 6: GTD 7: RTY 8: SDI

DGN 0501 Receive command

1: SYN 2: RDY 3: ARS 4: AAL
5: CLB 6: SET 7: DAT 8: EOD
9: WAT 10: RTY 11:RDI 12: SDO

DGN 0502 State of remote buffer

0 : Not ready
1 : Reset state
2 : Operation state
3 : Alarm state
4 : Circuit disconnection

- **Laser oscillator state C series (series B8A1)**

DOIML0A [88,89]
900 Laser power command

DOIML08 [90,91]
901 Laser bias command

R@LSPON [850,851]
902 Pulse on time

R@LSPOF [852,853]
903 Pulse off time

DOIML06 [92,93]
904 Gas pres. control

R@LSPRS [860]
905 Laser tube pres.

R@POWER [878]
906 Laser power

R@EIN
907 Trace data

R@LSEFCY
908 Laser sequence

[861]
909 RF voltage 1

[862]
910 RF current 1

[863]
911 RF voltage 2

[864]
912 RF current 2

[865]
913 RF voltage 3

[866]
914 RF current 3

[867]
915 RF voltage 4

[868]
916 RF current 4

[869]
917 RF voltage 5

[870]
918 RF current 5

[871]
919 RF voltage 6

[872]
920 RF current 6

[873]
921 RF voltage 7

[874]
922 RF current 7

[875]
923 RF voltage 8

[876]
924 RF current 8

925 RF voltage 9

926 RF current 9

927 RF voltage 10

928 RF current 10

929 RF voltage 11

930 RF current 11

931 RF voltage 12

932 RF current 12

933 RF voltage 13

934	RF current 13
935	RF voltage 14
936	RF current 14
937	RF voltage 15
938	RF current 15
939	RF voltage 16
940	RF current 16

DIIML00	#7	#6	#5	#4	#3	#2	#1	#0
960	*SFI	*RBT	*MGP	*AP		FRQ	*ESAL	*ENB

***ENB [841.0]** Intra–IF enable signal
0 : Disabled
1 : Enabled

***ESAL** Emergency stop signal
0 : Emergency stop
1 : Normal processing

FRQ Power frequency detection
0 : 50Hz
1 : 60Hz

***AP [840.0]** Air pressure sensor
0 : Lower than air pressure
1 : Same as air pressure

***MGP [840.4]** Laser gas pressure
0 : Low
1 : Normal

***RBT [840.5]** Blower temperature
0 : Abnormal
1 : Normal

***SFI** Safety interlock
0 : Interlocked
1 : Normal

DIIML01	#7	#6	#5	#4	#3	#2	#1	#0
961	*ABT	*SHT	SHOF	SHON	*RPAL	*WT1	*CAT	*MVW

***MVW [840.1]** Water amount sensor
0 : Abnormal
1 : Normal

***CAT [841.7]** Chamber temperature sensor
0 : Abnormal
1 : Normal

***WT1 [840.6]** Condensation sensor
0 : Abnormal
1 : Normal

***RPAL** Vacuum pump alarm

0 : Abnormal
1 : Normal

SHON [841.5] Open shutter sensor
The shutter is open when this bit is set to 1.

SHOF [841.6] Closed shutter sensor
The shutter is closed when this bit is set to 1.

***SHT [841.2]** Shutter temperature sensor

0 : Abnormal
1 : Normal

***ABT [841.3]** Absorber temperature sensor

0 : Abnormal
1 : Normal

DIIML02	#7	#6	#5	#4	#3	#2	#1	#0
962			*OH1	*TCA1	*REV1	*VIB1	*AR1	*IAL1

***IAL1** Inverter alarm 1

0 : Abnormal
1 : Normal

***AR1** Frequency signal 1

0 : Mismatch
1 : Match

***VIB1** Vibration sensor 1

0 : Abnormal
1 : Normal

***REV1** Rotation sensor 1

0 : 8000 rpm or more
1 : Less than 8000 rpm

***TCA1** Turbo current sensor 1

0 : Abnormal
1 : Normal

***OH1** Abnormal turbo temperature 1

0 : Abnormal
1 : Normal

DIIML03	#7	#6	#5	#4	#3	#2	#1	#0
963			*OH2	*TCA2	*REV2	*VIB2	*AR2	*IAL2

***IAL2** Inverter alarm 2

0 : Abnormal
1 : Normal

***AR2** Frequency signal 2

0 : Mismatch
1 : Match

***VIB2** Vibration sensor 2

0 : Abnormal
1 : Normal

***REV2** Rotation sensor 2

0 : 8000 rpm or more
1 : Less than 8000 rpm

***TCA2** Turbo current sensor 2

0 : Abnormal
1 : Normal

***OH2** Abnormal turbo temperature 2

0 : Abnormal
1 : Normal

DIIML04

	#7	#6	#5	#4	#3	#2	#1	#0
964			*OH3	*TCA3	*REV3	*VIB3	*AR3	*IAL3

***IAL3** Inverter alarm 3

0 : Abnormal
1 : Normal

***AR3** Frequency signal 3

0 : Mismatch
1 : Match

***VIB3** Vibration sensor 3

0 : Abnormal
1 : Normal

***REV3** Rotation sensor 3

0 : 8000 rpm or more
1 : Less than 8000 rpm

***TCA3** Turbo current sensor 3

0 : Abnormal
1 : Normal

***OH3** Abnormal turbo temperature 3

0 : Abnormal
1 : Normal

DIIML06
[842]

	#7	#6	#5	#4	#3	#2	#1	#0
966	*PSA08	*PSA07	*PSA06	*PSA05	*PSA04	*PSA03	*PSA02	*PSA01

Displays the operating of power supply units No.1 through No.18.

DIIML07

	#7	#6	#5	#4	#3	#2	#1	#0
967	*PSA16	*PSA15	*PSA14	*PSA13	*PSA12	*PSA11	*PSA10	*PSA09

No.966 & 967 Power suplly signal alarm

1 : Normal
0 : Abnormal

DOIML00	#7	#6	#5	#4	#3	#2	#1	#0
968		ACSI	PLS	SEL1.4	SEL1.3	SEL1.2	SEL1.1	SEL1.0

SEL1.0 to SEL1.4 Select signals for discharge tube monitor data

PLS Pulse command signal

1 : Filter provided

0 : No filter provided

ACSI Access notice signal

0 : OFF

1 : ON

DOIML01	#7	#6	#5	#4	#3	#2	#1	#0
969						HSCST	SEP2	SEP1

SEP1 Pressure/power select signal

SEP2 Pressure/power select signal

HSCST High–speed A/D conversion start

DOIML02	#7	#6	#5	#4	#3	#2	#1	#0
970	PS08	PS07	PS06	PS05	PS04	PS03	PS02	PS01

DOIML03	#7	#6	#5	#4	#3	#2	#1	#0
971	PS16	PS15	PS14	PS13	PS12	PS11	PS10	PS09

PS01–PS16 Power select signals 1 to 16

0 : Not selected

1 : Selected

DOIML04	#7	#6	#5	#4	#3	#2	#1	#0
972	TWV	BPV	PTL	GRDY	VEN	RPA	RBA	PUG

PUG [855.5] Purge valve

0 : Closed

1 : Open

RBA [855.6] Roots blower activation

0 : Stopped

1 : Activated

RPA [855.7] Vacuum pump activation

0 : Stopped

1 : Started

VEN [856.0] Air release valve

0 : Closed

1 : Open

GRDY [856.1] Laser gas supply valve

0 : Closed

1 : Open

PTL [856.3] Flashing light

0 : Off
1 : On

BPV [856.6] Bypass valve

0 : Closed
1 : Open

TWV Three–way valve

0 : Air release
1 : Open

DOIML05

	#7	#6	#5	#4	#3	#2	#1	#0
973	LSCST		PCS	FW	IB	*PCL	OFS	SHOP

SHOP [856.2] Shutter open command

0 : Closed
1 : Open

OFS [856.4] Off sequence

0 : OFF
1 : ON

***PCL [856.5]** DC power alarm clear

0 : Clear
1 : Normal

IB Semiconductor laser–on command

0 : OFF
1 : ON

FW Inverter start signal

0 : Stopped
1 : Started

PCS Gas pressure PWM command

LSCST Low speed A/D conversion start

0 : OFF
1 : ON

R@LSDIC2

	#7	#6	#5	#4	#3	#2	#1	#0
974								

RF power unit alarms 1 to 8

0 : Normal
1 : Abnormal

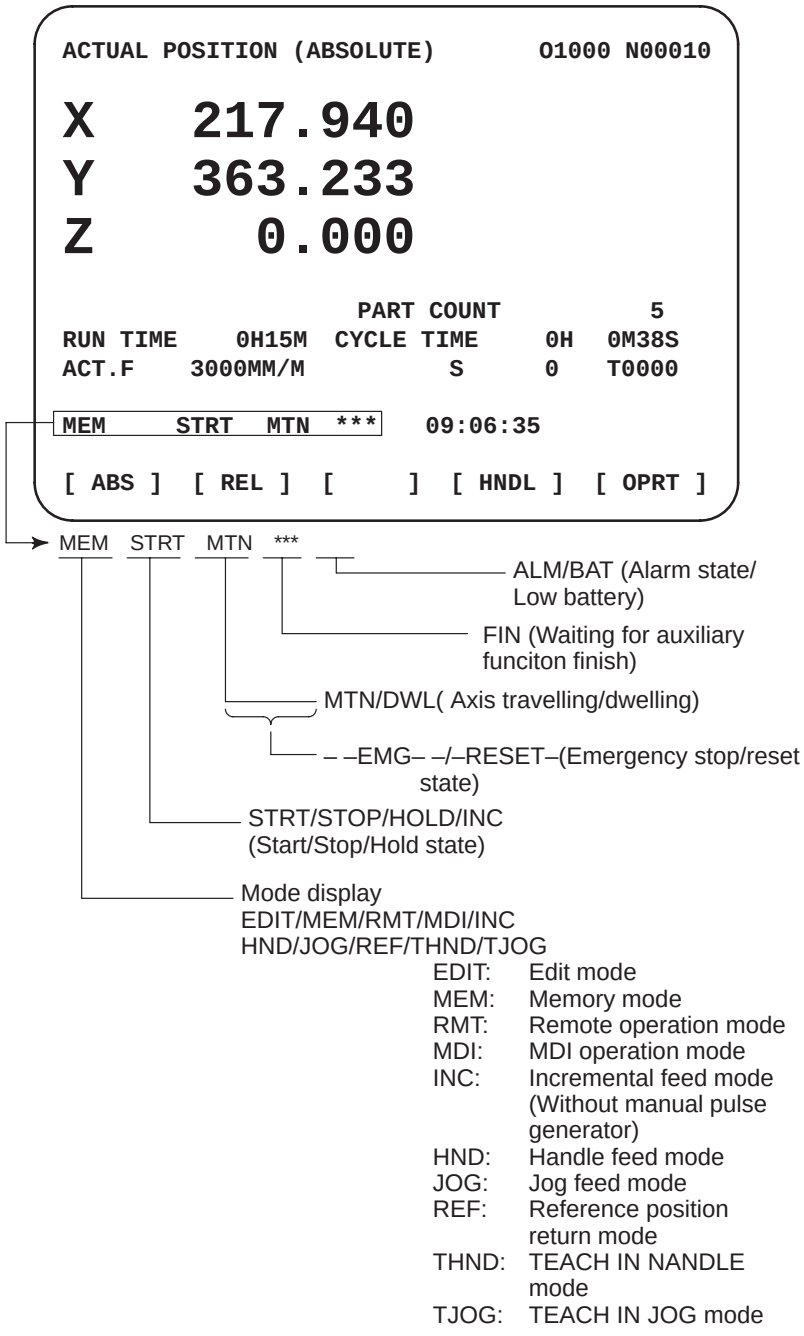
	#7	#6	#5	#4	#3	#2	#1	#0
975								

RF power unit alarm 9 to 16

0 : Normal
1 : Abnormal

R@SNSAL		
980	Gas pres. sensor alm	
R@ADALM1		
981	A/D conv–1 alm	
R@ADALM2		
982	A/D conv–2 alm	
R@ALVLT		
983	Voltage down	
R@ALPWR		
984	Power down	
R@RFPWR		
985	Beam reflection	
986	Laser efficiency	

1.7
NC STATE DISPLAY



1.8 WAVE FORM DIAGNOSTIC FUNCTION

Tuning becomes easier by graphically displaying servo error amount and torque command, etc. (Graphic option is required).

1.8.1 Setting Parameters

(1) Set a parameter to utilize the servo waveform diagnostic function.

	#7	#6	#5	#4	#3	#2	#1	#0
3112								SGD

#0(SGD) 0 : Do not display servo waveform (usual graphic display).
1 : Displays servo waveform (usual graphic display function cannot be used.

(2) Turn off the power once and turn it on again.

1.8.2 Waveform Diagnostic Parameter Screen

1. Press the SYSTEM key to display a system screen such as aparameter.
2. Press the next menu key ▷ several times, and the soft key **[W.DGNS]** is displayed.
3. Press **[W.DGNS]**, then the parameter screen for the waveform diagnosis is displayed.

```
WAVE DIAGNOSE (PARAMETER)

SAMPLING TIME            TRIGGER       0:  0
CONDITION          0

(CH-1)                   (CH-2)
DATA NO.        0        DATA NO.     0
UNIT            0        UNIT         0
SIGNAL NO.      0:0      SIGNAL NO.   0:0









[       ][ W.GRPH ][       ][       ][       ]
```

1 SAMPLING TIME : 6~32767 [msec]

2 TRIGGER : To trigger the wave diagnosis using an external signal, set the address (G) of the signal.
Address section;0~3000,Bit section;0~7

3 CONDITION : Set a condition to start the wave diagnosis.
0= Only the soft key START is valid.
1= Started by soft key START and rise of trigger signal.
2= Started by soft key START and fall of trigger signal.

4 DATA NO : 00=No data is displayed.
0n=Position error of nth axis (Every 8msec)
1n=Move command of nth axis
2n=Torque command of nth axis
3n=Position error of nth axis(Every 2msec)
99=On/Off state of signal (Signal address can be set)

Note
Address in G are used as they are addresses in F are added by 512.

PMC address	Signal address
G000～G127	000～127
F000～F127	512～639

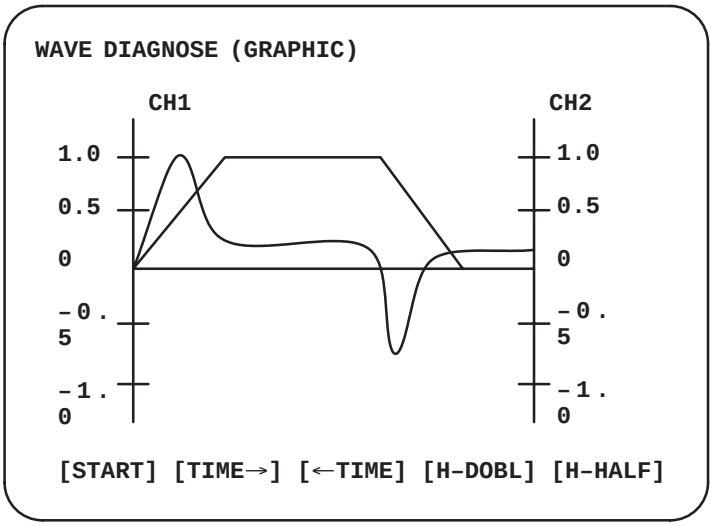
5 UNIT :

6 SIGNAL no : Set the signal address when data no. is 99.

4. Move the cursor, input a numeral and press the INPUT key to set a required item.

1.8.3 Graphic of Wave Diagnosis data

1. Press soft key **[W.GRPH]**, then graph of waveform diagnosis is displayed.



2. Press soft key **[(OPRT)]**, then the following soft keys are displayed. The following three sets of soft keys are displayed by the ▷ key.

[START] [TIME→] [←TIME] [H–DOBL] [H–DOBL]

[START] [CH–1↑] [CH–1↓] [V–DOBL] [V–HALF]

[START] [CH–2↑] [CH–2↓] [V–DOBL] [V–HALF]

1 **[START]** :Starts Graphic data
2 **[TIME→]** :Shift the waveform of channel 1 and 2 rightward
3 **[←TIME]** : Shift the waveform of channel and 2 leftward
4 **[H–DOBL]** :Double the time scale of the waveform of channel 1 and 2
5 **[H–HALF]** :Half the time scale of the waveform of channel 1 and 2
6 **[H–DOBL]** :Double the height of waveform of channel 1 and 2
7 **[V–HALF]** :Half the height of waveform of channel 1 and 2
8 **[CH–1↑]** : Shift the zero point of channel 1 upward
9 **[CH–1↓]** : Shift the zero point of channel 1 downward
10 **[CH–2↑]** : Shift the zero point of channel 2 upward
11 **[CH–2↓]** : Shift the zero point of channel 2 downward

1.9 OPERATING MONITOR

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

1.9.1 Display Method

1. Set a parameter to display operating monitor.

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

#5:(OPM)

0 : Operating monitor is not displayed.

☆ 1 : Operating monitor is displayed.

2. Press the [POS] key to display the position display screen.
3. Press continuous menu key [▷], then soft key **[MONI]** is displayed.
4. Press the soft key **[MONI]**, then the operating monitor screen is displayed.

```
OPERATING MONITOR              O0001 N00001
 (LOAD METER)

 X : ■■■■ *  80%      S1: ■■■■■■■■■■201%

 Y :  * * * * *   0%   (SPEED METER RPM)
                                ■■■■
 Z :  * * * * *   0% S1:  * * *      1500

                        PART COUNT     5
 RUN TIME    0H15M      CYCLE TIME  0H 0M38S
 ACT.F     3000 MM/M

MEM STRT MTN ***           09:06:35
[ ABS ] [ REL ] [ ALL ] [ HNDL ] [ OPRT ]
```

Notes

1. The bar graph for the load meter shows load up to 200%.
2. The bar graph for the speed meter shows the ratio of the current spindle speed to the maximum spindle speed (100%). Although the speed meter normally indicates the speed of the spindle motor, it can also be used to indicate the speed of the spindle by setting bit 6153. (OPS) of parameter 311 to 1.
3. The servo axes for their load meters are displayed are set to parameter No. 3151 to 3. If parameters 3151 to 3153 are all zero, the load meter of the basic axes are displayed.
4. For 10” LCD/14” CRT, the bar of the load meter that exceed 100% shows purple color.

(1) Associated Parameters

3151	Axis number for which the 1st load meter for servo motor is displayed
3152	Axis number for which the 2nd load meter for servo motor is displayed
3153	Axis number for which the 3rd load meter for servo motor is displayed
3160	Rated load of the load meter of each axis

(Setting value)

Motor model	Set value
5–0	172
4–0S	170
3–0S	170
2–0S	162
1–0S/3000	173
1–0S	162
0S	149
5S/3000	151
5S	154
10S	162
10S/3000	163
20S/1500	202
20S/3000	174
20S	173
30S/2000	180
30S/3000	176
30S	163

Motor model	Set value
40	184
50S	178
60S	174
70S	189
0L	154
5L	154
6L	166
7L	195
10L	220

1.10 LIST OF OPERATIONS

Reset

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Resetting run hour			–	POS	[(OPRT)] [RUNPRE]→[EXEC]
Resetting no. of machined parts			–	POS	[(OPRT)] [PTSPRE]→[EXEC]
Resetting OT alarm			At Power ON	–	<P> and <CAN>
Resetting alarm 100			–	–	<CAN> and <RESET>

Registration from MDI

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Inputting parameters		Yes	MDI or E.Stop	SYSTEM (PARAM)	Parameter no.→[NO.SRH]→Data→<INPUT> → PWE =0 →<RESET>
Inputting offset values	OFF		–	OFFSET	Offset number→[NO.SRH]→Offset value→<INPUT>
Inputting setting data	OFF		MDI	SETTING	Setting no.→[NO.SRH]Data→<INPUT>
Input of PMC parameters, counter and data table	OFF		MDI or E.Stop	SYSTEM (PMC)	[PMCPRM]→[COUNTR] or [DATA]→Data→<INPUT>
Inputting PMC parameters (Timer, keep relay)		OFF			[PMCPRM]→[TIMER] or [KEEPRL]→Data→<INPUT>
Tool length measurement			JOG	POS→ OFFSET	<POS>(Display of relative coordinate)<AXIS>→[ORIGIN] →<OFFSET>→Jog the tool to measuring position Offset no.→[NO.SRH]→<AXIS>→[INP.C]

Input/Output with FANUC Cassette

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Heading a file			EDIT	PROG	<N>→File no.→[▶]→[F SRH]→[EXEC]
Deleting a file	OFF		EDIT	PROG	<N>→File no.→[▶]→[DELETE→[EXEC]
Collating a program			EDIT	PROG	Heading a file→<O>→Program number→[(OPRT)] →[▶]→[READ]→[EXEC]

Inputting From FANUC Cassette

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Inputting parameters		OFF	EDIT or E.Stop	SYSTEM (PARAM)	[(OPRT)]→[▶]→[READ]→[EXEC]
Inputting PMC parameters		OFF	E.Stop	SYSTEM (PMC)	[▶]→[I/O]→(CANNEL NO)<1> <INPUT>→(DEVICE NAME) [FDCAS]→(KIND OF DATA) [PARAM]→[READ]→(FILE NO) File no.<INPUT>→[EXEC]
Inputting offset values	OFF		EDIT	OFFSET	(Heading a file no.)→[(OPRT)]→[▶]→[READ]→[EXEC]
Registering a program	OFF		EDIT	PROG	<N>→File no.→<INPUT>→[▶]→[READ]→[EXEC]
Inputting macro variables	OFF		EDIT	PROG	<N>→File no.→<INPUT>→[▶]→<O>→Program no. →[READ]→[EXEC]
			MEMORY	PROG	<START>

Output to FANUC Cassette

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Output of parameter			EDIT	SYSTEM (PARAM)	[(OPRT)]→[▶]→[PUNCH]→[EXEC]
Output of PMC parameter			EDIT	SYSTEM (PMC)	[▶]→[I/O]→(CANNEL NO)<1> <INPUT>→(DEVICE NAME) [FDCAS] →(KIND OF DATA) [PARAM] → [WRITE] → (FILE NO) <–> <1> <INPUT>→[EXEC]
Output of offset			EDIT	OFFSET	[(OPRT)]→[▶]→[PUNCH]→[EXEC]
Output of all programs			EDIT	PROG	<O>→–9999→[▶]→[PUNCH]→[EXEC]
Output of one program			EDIT	PROG	<O>→Program no.→[▶]→[PUNCH]→[EXEC]
Output of macro variables			EDIT	OFFSET	[▶]→[MACRO]→[(OPRT)]→[▶]→[PUNCH]→[EXEC]

Search

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Searching a program number			MEMORY or EDIT	PROG	<O>→Program no.→[O SRH]
Searching a sequence number			MEMORY	PROG	Program no. search→<N>→Sequence number→[NSRH]
Searching an address word			EDIT	PROG	Data to be searched→[SRH↑] or[SRH↓] or <↑> <↓> (cursor key)
Searching an address only			EDIT	PROG	Address to be searched [SRH↑] or[SRH↓] or <↑> <↓> (Cursor key)
Searching an offset number			–	OFFSET	Offset no.→[NO.SRH]
Searching a diagnostic number			–	SYSTEM (DGNOS)	Diagnostic number→[NO.SRH]
Searching a parameter number			–	SYSTEM (PARAM)	Parameter no.→[NO.SRH]

Edit

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Display of memory capacity used			EDIT	PROG	[LIB]
Deleting all programs	OFF		EDIT	PROG	<O>→–9999→<DELETE>
Deleting a program	OFF		EDIT	PROG	<O>→Program no.→<DELETE>
Deleting several blocks	OFF		EDIT	PROG	<N>→Sequence no.→<DELETE> (Deleted up to a block with a specified sequence no.)
Deleting a block	OFF		EDIT	PROG	<EOB>→<DELETE>
Deleting a word	OFF		EDIT	PROG	Searching a word to be deleted→<DELETE>
Changing a word	OFF		EDIT	PROG	Searching a word to be changed→New Data→<ALTER >
Inserting a word	OFF		EDIT	PROG	Searching a word immediately before a word to be searched→New Data→<INSERT>

Collation

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Collating memory	ON		EDIT	PROG	[(OPRT)]→[▶]→[READ]→[EXEC]

Playback

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Input of NC data			TEACH–IN JOG/ HANDLE	PROG	Jog the machine→<X>,<Y> or <Z>→<INSERT> → NC data → <INSERT> → <EOB> → <INSERT>

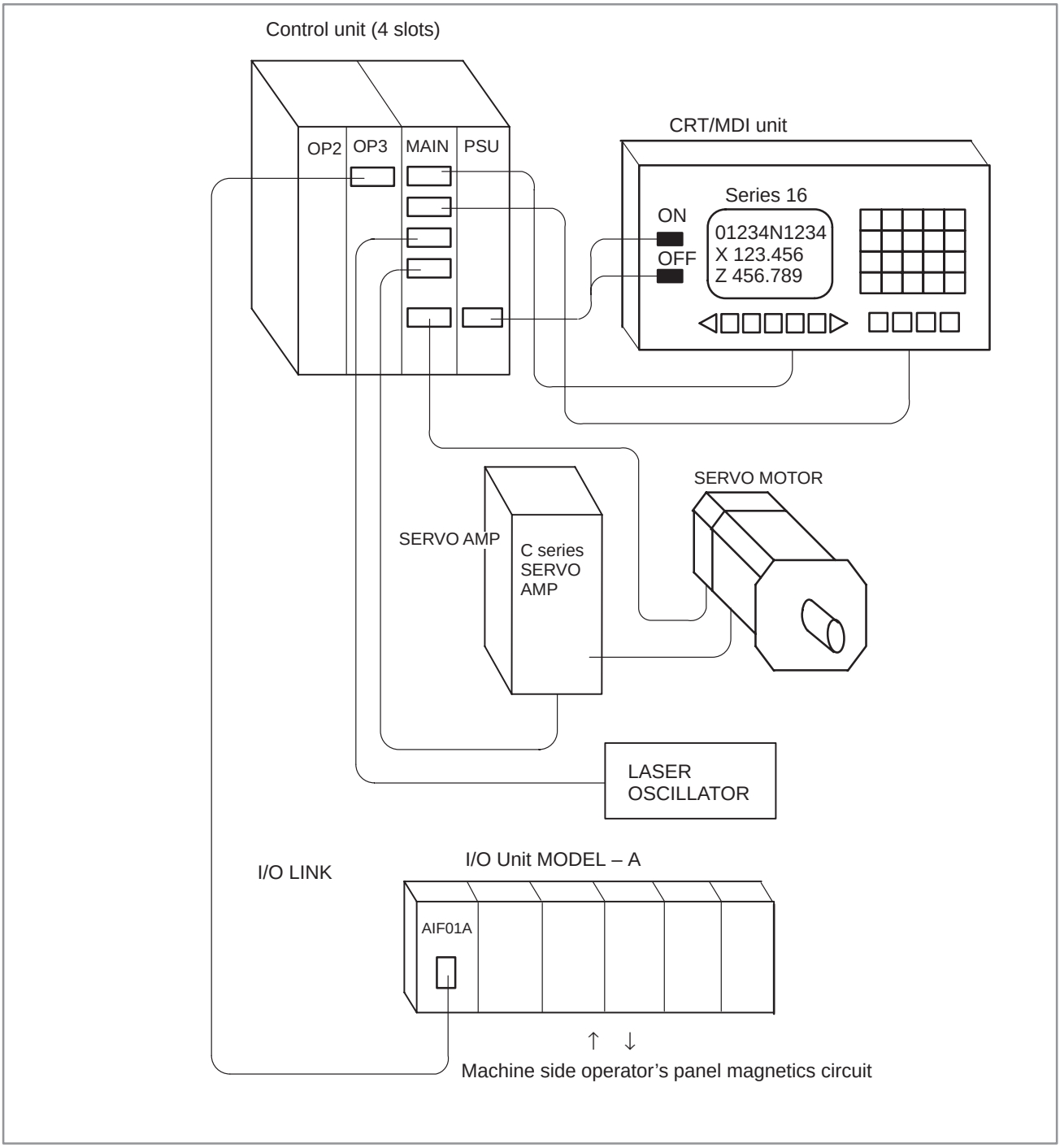
Clear

Function	Data protection key	Parameter write=1	Mode	Function key	Operation
Memory all clear			At power ON		16M/16T : <RESET>AND<DELETE> 16T(On 2path are controlled)
					16T(On 2path are controlled) (Main side): <CAN>AND<1> (Sub side) : <CAN>AND<2>
Parameter/offset clear		○	At Power ON		16M/16T : <RESET>
					16T(On 2path are controlled) (Main side): <RESET>AND<1> (Sub side) : <RESET>AND<2>
Clearing a program		○	At Power ON		16M/16T : <DELETE>
					16T(On 2path are controlled) (Main side): <DELETE>AND<1> (Sub side) : <DELETE>AND<2>
Program under edition at power off(PS101)			–		<PROG>AND<RESET>
PMC RAM (Note1)			At Power ON		<X>AND<0> (O)

2 HARDWARE

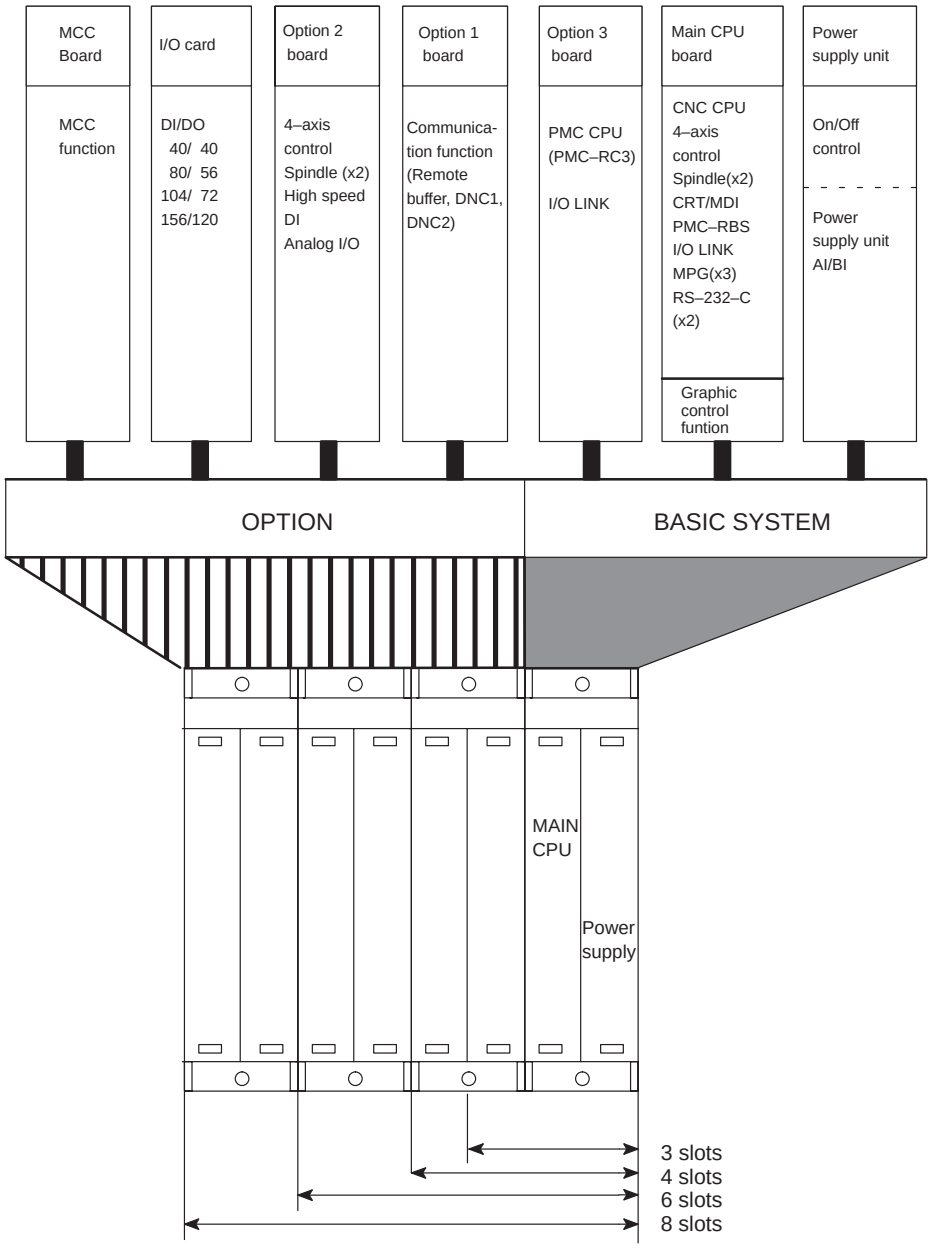
This chapter describes structure of CNC control section, connection of units and the functions of PCBs and modules mounted on PCBs.

2.1 STRUCTURE



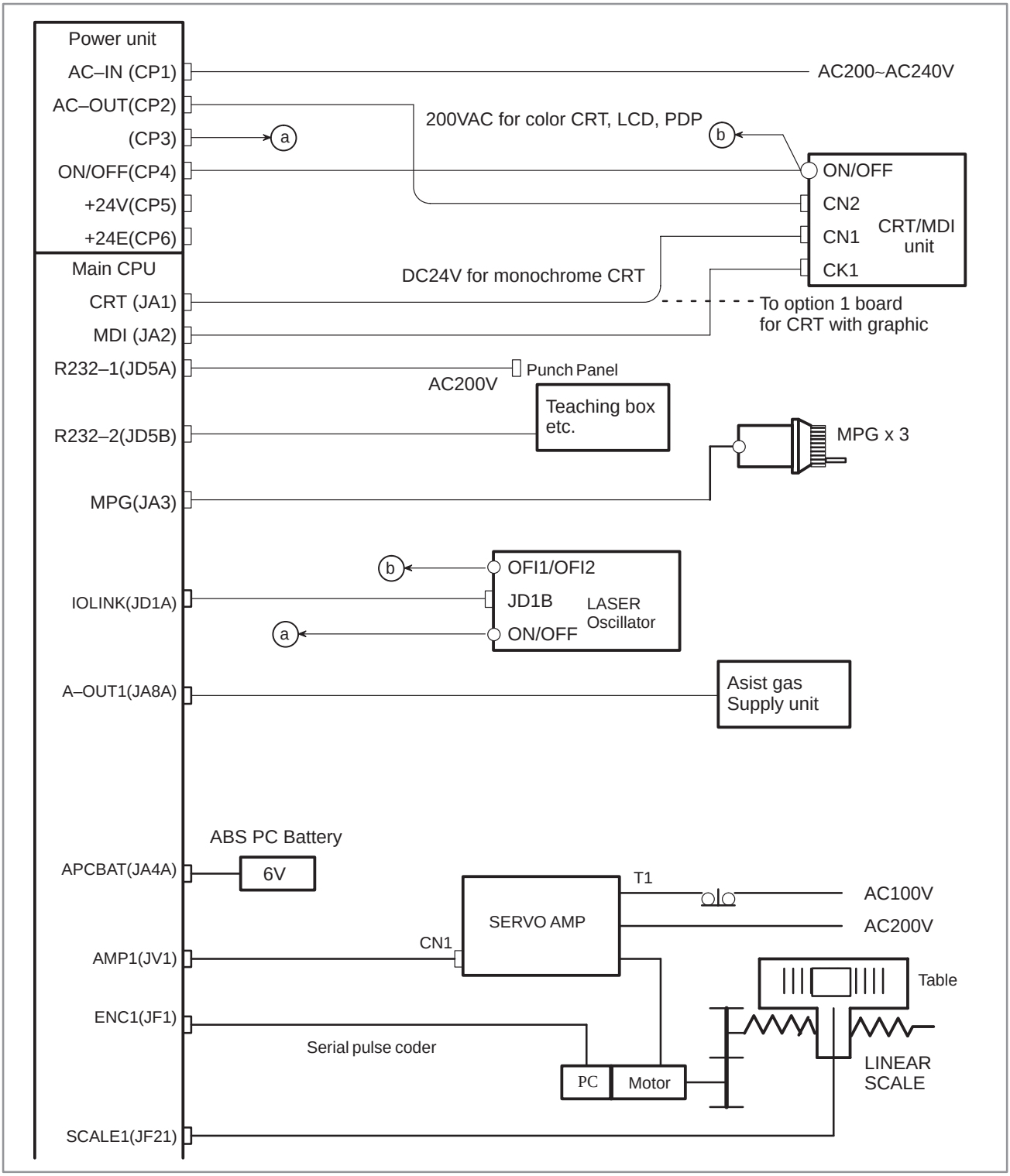
2.2 GENERAL OF HARDWARE

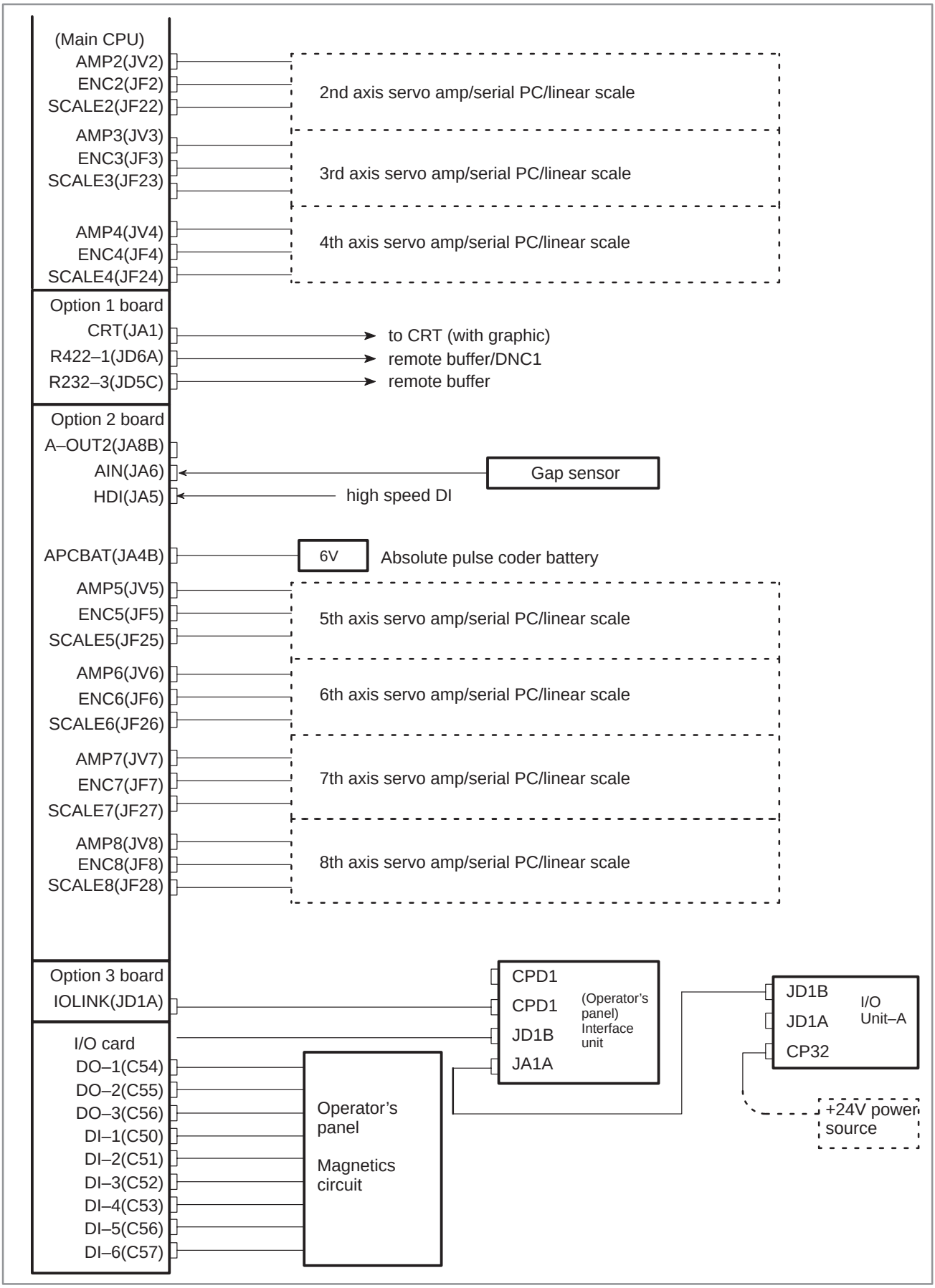
2.2.1 Series 16



2.3 TOTAL CONNECTION DIAGRAM

2.3.1 16–LB

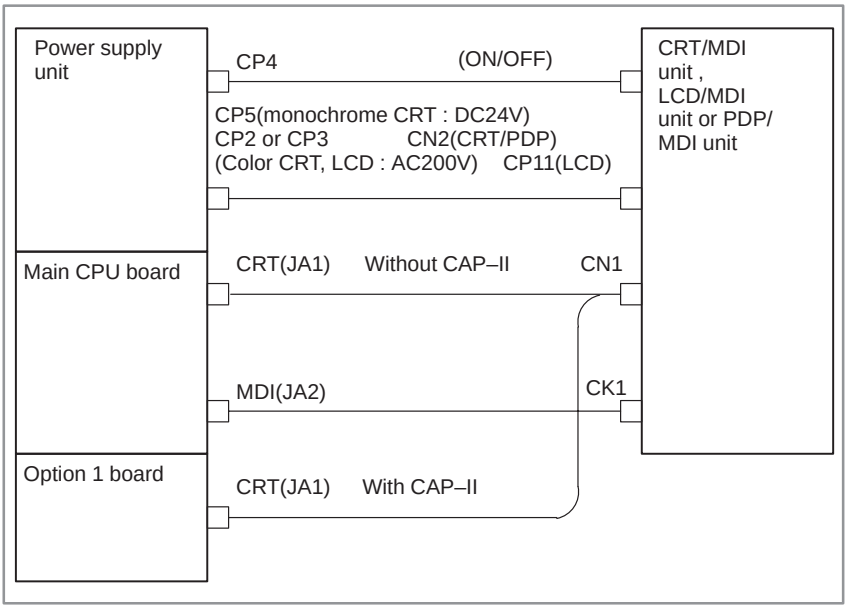



(Main CPU)
AMP2(JV2)
ENC2(JF2)
SCALE2(JF22)
2nd axis servo amp/serial PC/linear scale
AMP3(JV3)
ENC3(JF3)
SCALE3(JF23)
3rd axis servo amp/serial PC/linear scale
AMP4(JV4)
ENC4(JF4)
SCALE4(JF24)
4th axis servo amp/serial PC/linear scale
Option 1 board
CRT(JA1)
to CRT (with graphic)
R422–1(JD6A)
remote buffer/DNC1
R232–3(JD5C)
remote buffer
Option 2 board
A–OUT2(JA8B)
AIN(JA6)
Gap sensor
HDI(JA5)
high speed DI
APCBAT(JA4B)
6V
Absolute pulse coder battery
AMP5(JV5)
ENC5(JF5)
SCALE5(JF25)
5th axis servo amp/serial PC/linear scale
AMP6(JV6)
ENC6(JF6)
SCALE6(JF26)
6th axis servo amp/serial PC/linear scale
AMP7(JV7)
ENC7(JF7)
SCALE7(JF27)
7th axis servo amp/serial PC/linear scale
AMP8(JV8)
ENC8(JF8)
SCALE8(JF28)
8th axis servo amp/serial PC/linear scale
Option 3 board
IOLINK(JD1A)
CPD1
CPD1
JD1B
JA1A
(Operator's panel) Interface unit
JD1B
JD1A
CP32
I/O Unit–A
+24V power source
I/O card
DO–1(C54)
DO–2(C55)
DO–3(C56)
DI–1(C50)
DI–2(C51)
DI–3(C52)
DI–4(C53)
DI–5(C56)
DI–6(C57)
Operator's panel
Magnetics circuit

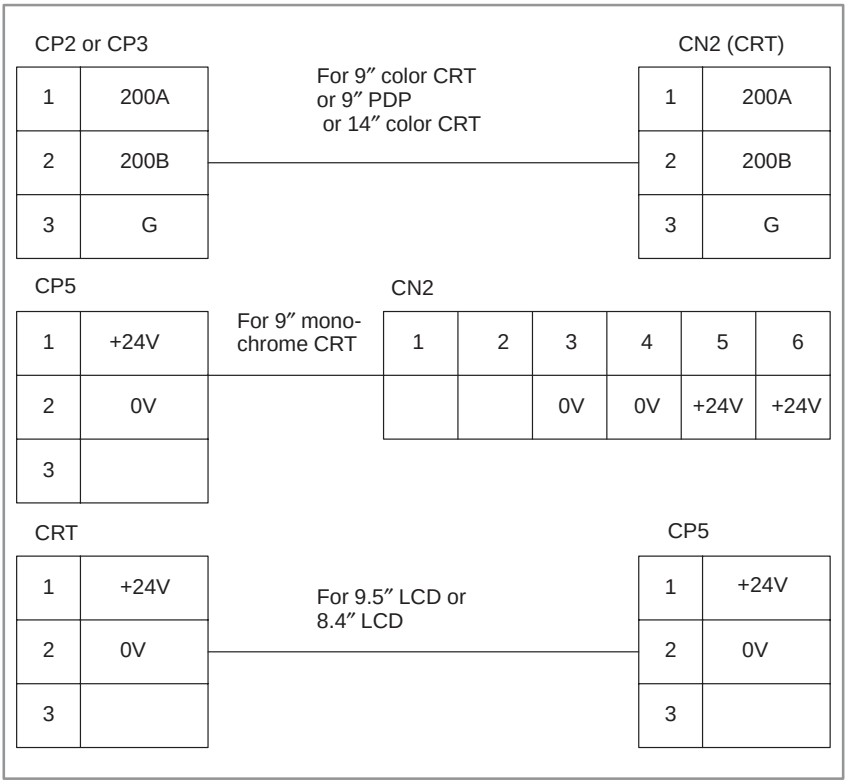
2.4 INTER–MACHINE CONNECTION

2.4.1 CRT/MDI unit

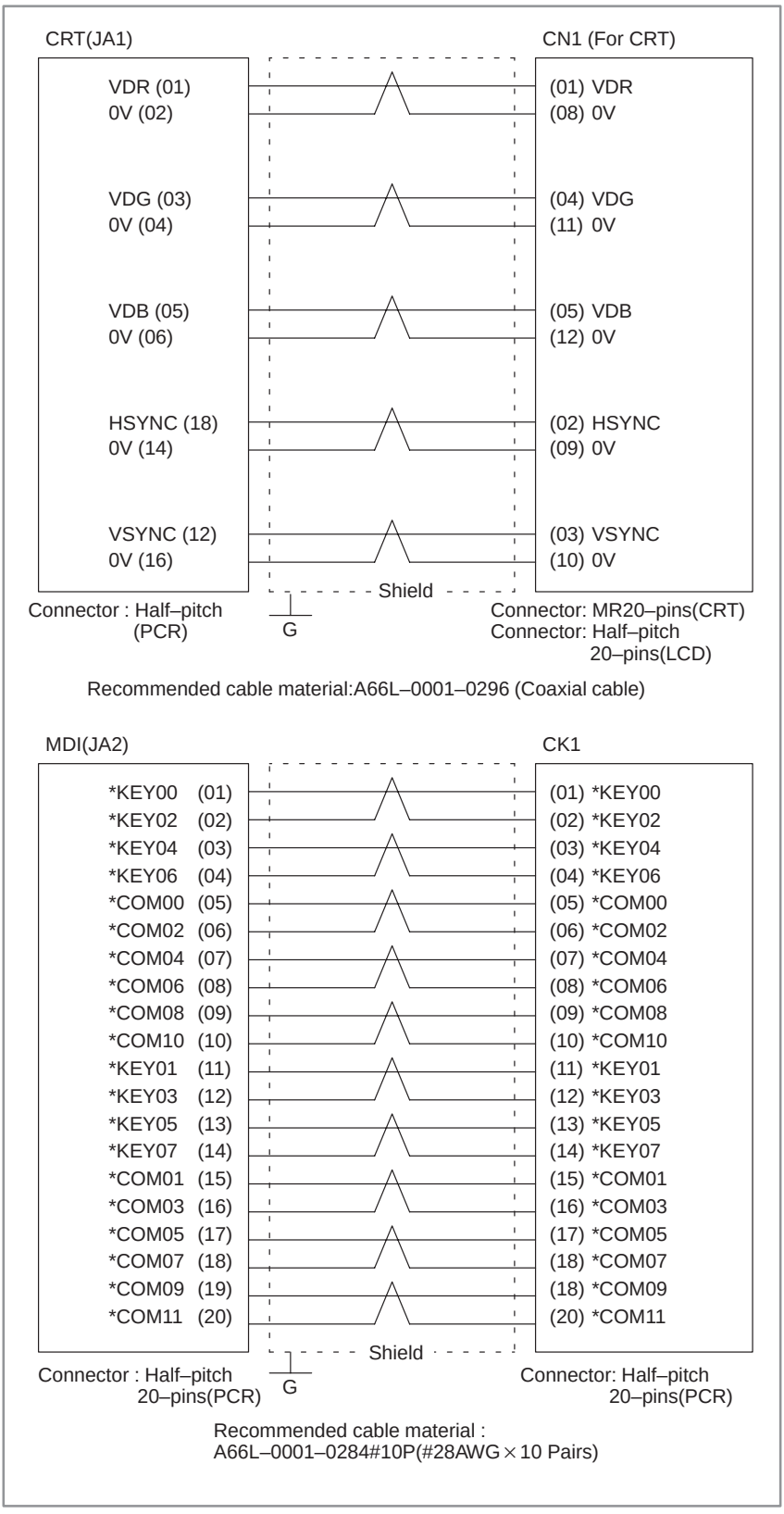
- **Connection of Series 16**



- **Terminal layout**

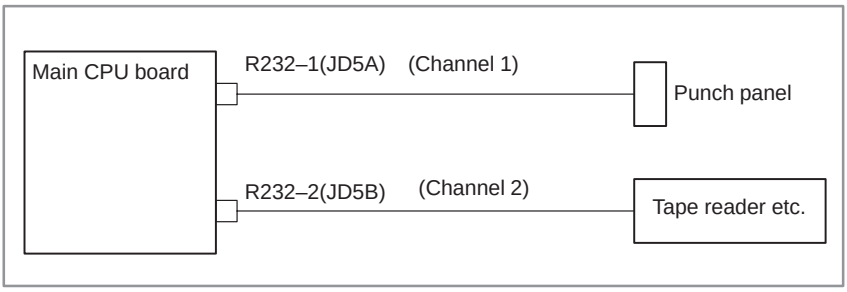


● Cable connection

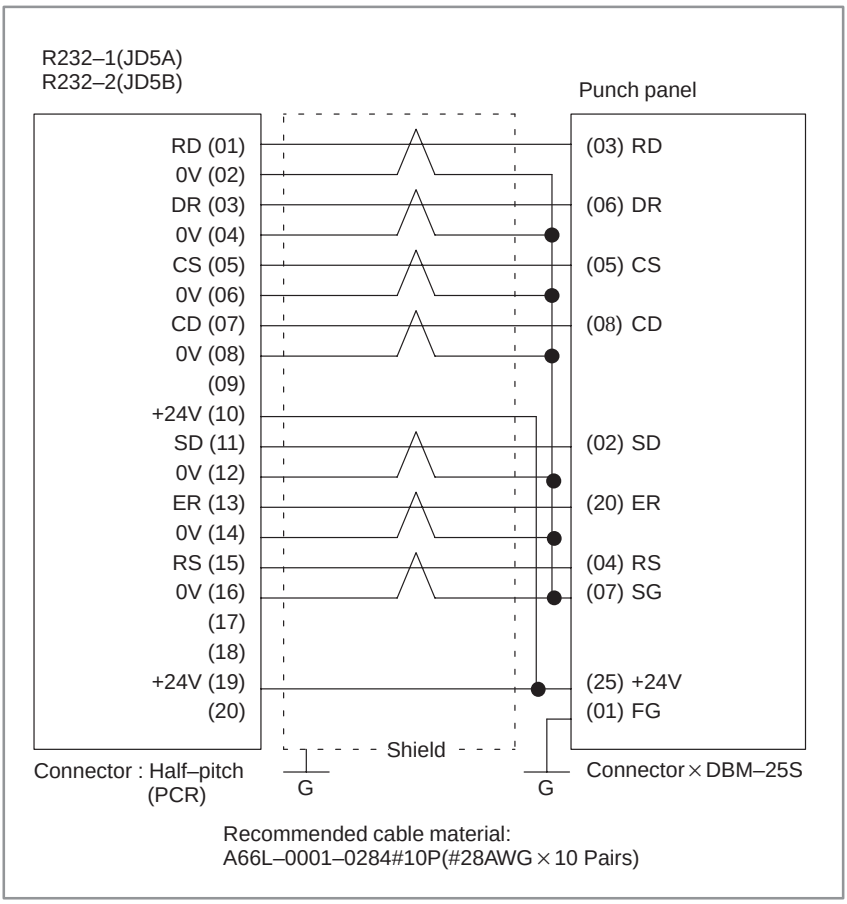


2.4.2 Reader/Puncher Interface

- **Connection**

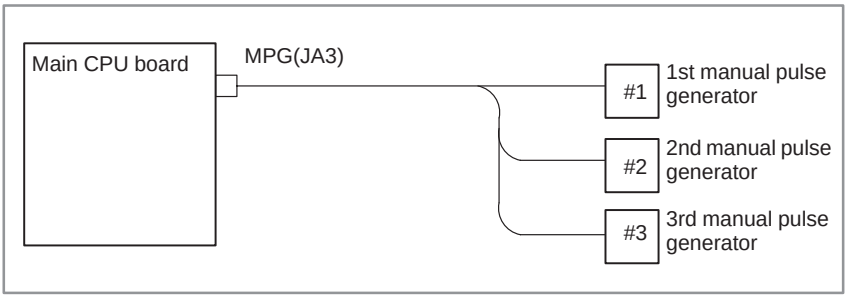


- **Cable connection**

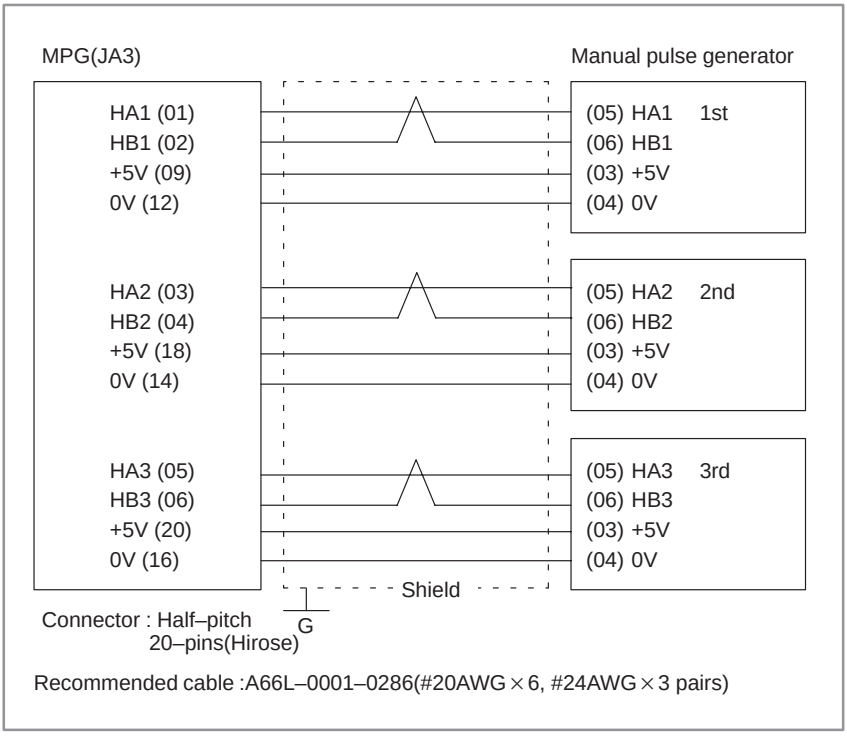


2.4.3
Manual Pulse Generator

- **Connection**



- **Cable connection**



- **Voltage drop by cable length**

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

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

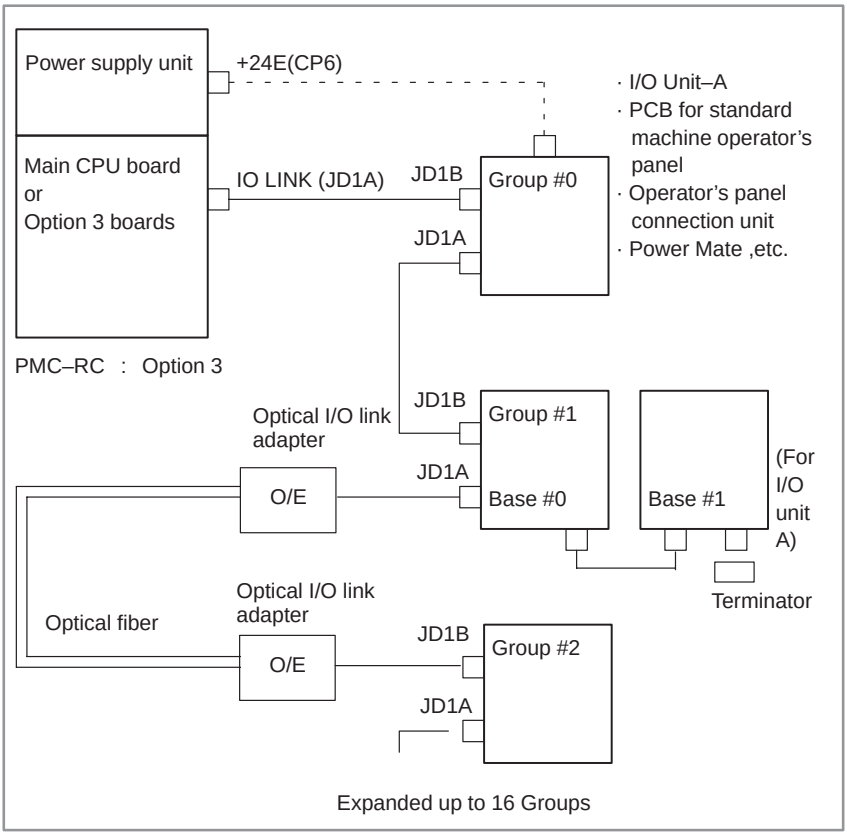
Where A : manual pulse generator's current (0.1A)
R : Registance per cable length
L : Cable length
m : No. of cables

When cable A66L–0001–0286 is used for one unit of manual pulse generator, registance is 0.0394Ω/m and 3 cables are used. Therefore, cable length can be extended up to 50 m according to the following equation:

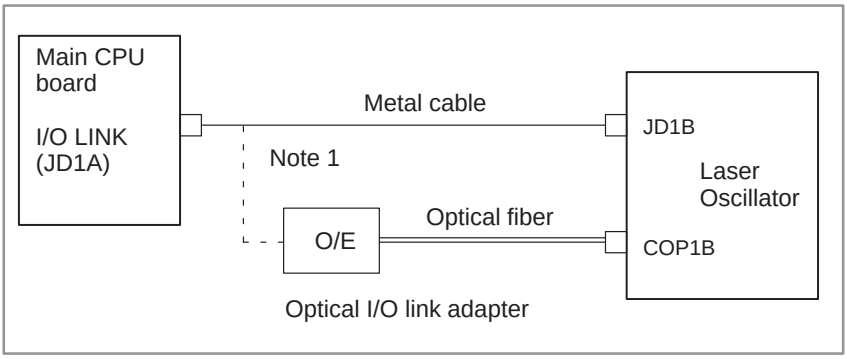
$$L = \frac{V \times m}{2A \times R} = \frac{0.2 \times 3}{2 \times 0.1 \times 0.0394} = 76.75[m]$$

2.4.4 I/O LINK

- **Connection**



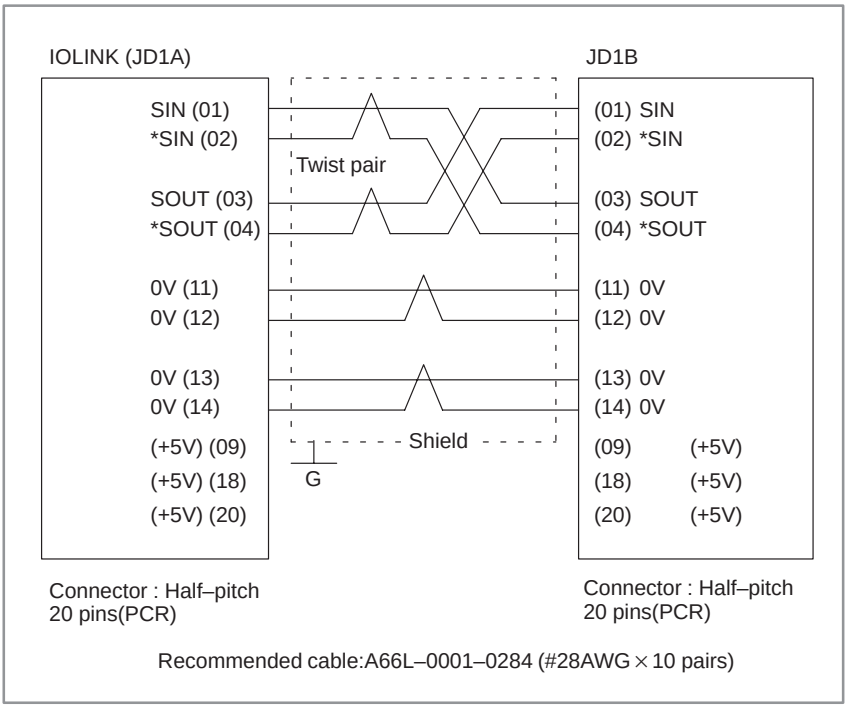
- **Connection (Laser oscillator)**



Notes

1. When the required cable length exceeds 10 m, use an optical fiber cable with an optical I/O link adapter. The laser oscillator provides connectors for both metal and optical fiber cables. Connect the cable to the appropriate connector.
2. Depending on whether a metal or optical fiber cable is used for communication with the CNC, set pins SP5 and SP6 on the laser interface PCB (A16B–1110–0260) as follows:
   1 When using a metal cable, jumper 1 and 2.
   2 When using an optical fiber cable, jumper 2 and 3.
   Refer to the FANUC LASER C Series Maintenance Manual (B–70015E) for details.

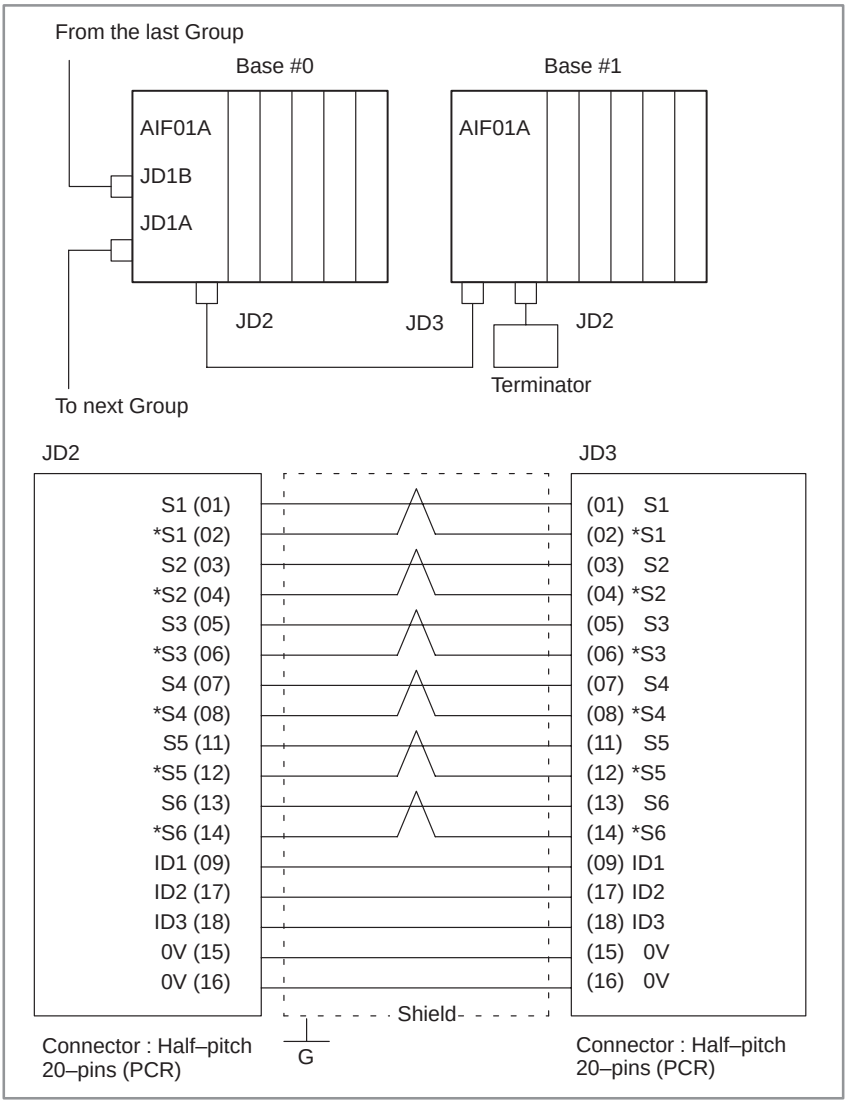
- **Cable connection within group**



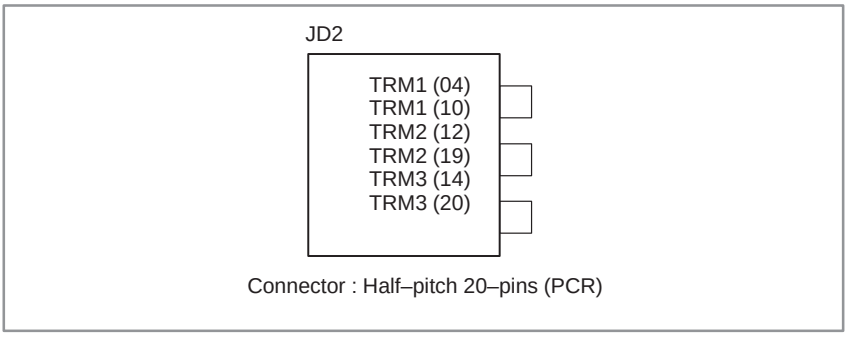
Note

Connect +5V when optical I/O link adapter is used. Do not connect when metal cable is used.
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)**

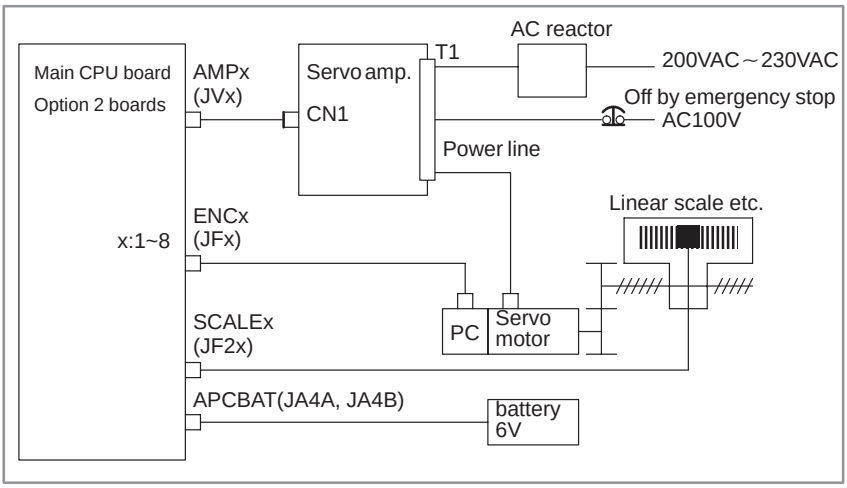


- **Cable connection in the terminator**

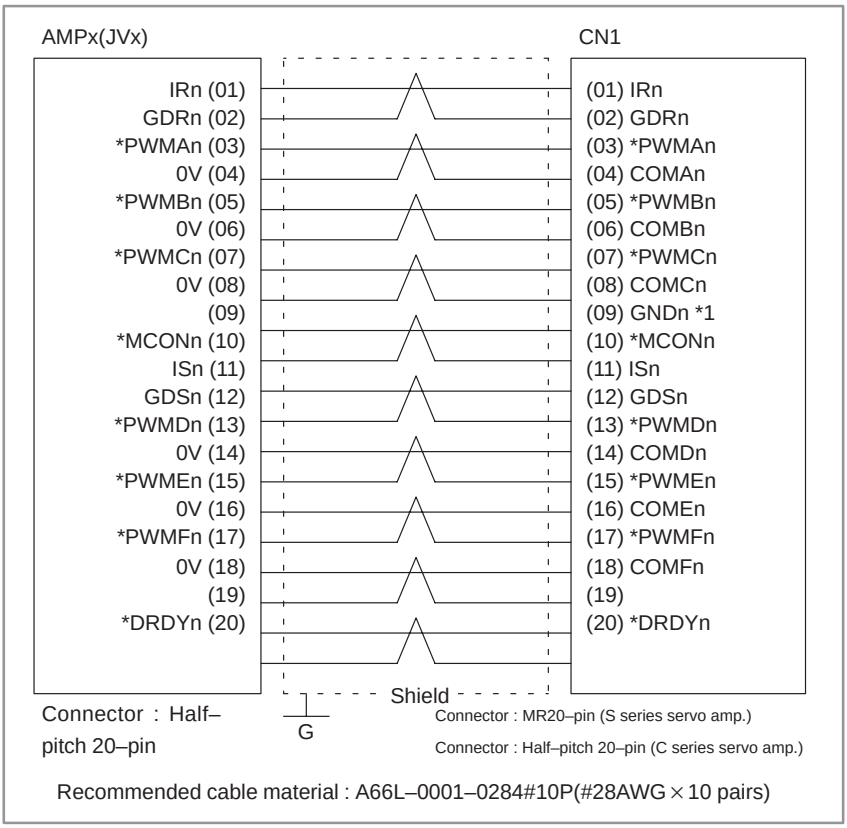


2.4.5
Servo Interface

- **Connection**

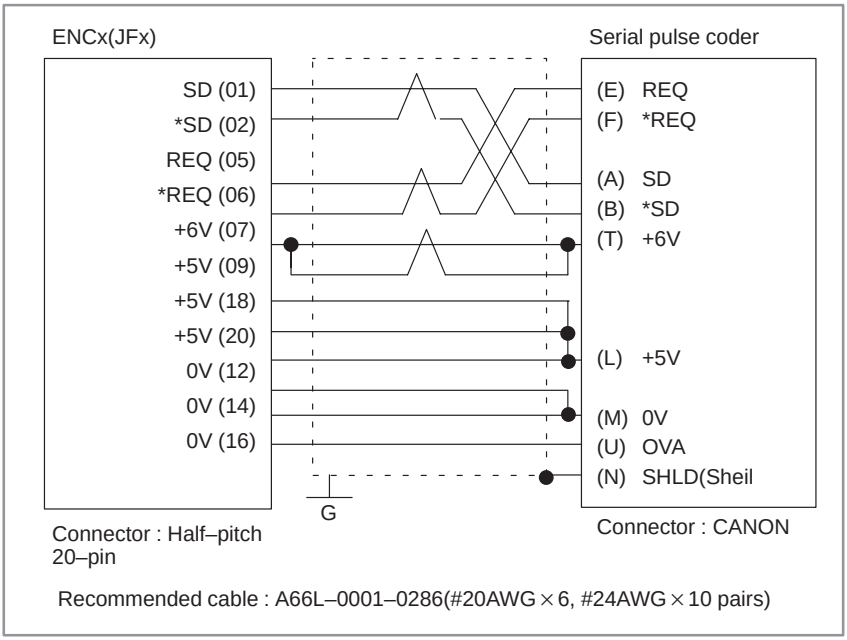


- **Connection to C series servo amplifier**



Notes
1. Not used for C series amplifier.
2. Suffix n in signal name is an axis number 1 to 8.

- **Connection of serial pulse coder**



Note
Be sure to note voltage drop by cable resistance.

- **Serial pulse coder A**

$$\text{Voltage drop(Max)} = 0.25[V] \quad \geqq \quad \frac{0.40 \times R \times 2L}{M}$$

0.40 : Current consumed by pulse coder
R : Resistance per unit length of cable [Ω/m]
L : Cable length [m]
M : No. of wires to 5V and 0V

[Ex1] A66L–0001–0286(20/0.18,0.0394W/m) : L (Max)=23.79m

[Ex2] A66L–0001–0157(50/0.18,0.016W/m) : L (Max)=58.59m

However, as a cable of 11 dia. cannot be clamped with the half–pitch connector, prepare a relaying connector or fabricate the cabel by peeling off the sheeth and covering a heat–shrinkable tube.

- **Serial pulse coder C**

$$\text{Voltage drop (Max)} = 0.20[V] \geqq \frac{0.35 \times R \times 2L}{M}$$

0.35 : Current consumed by pulse coder
R : Resistance per unit length of cable [Ω/m]
L : Cable length [m]
M : No. of wires to 5V and 0V

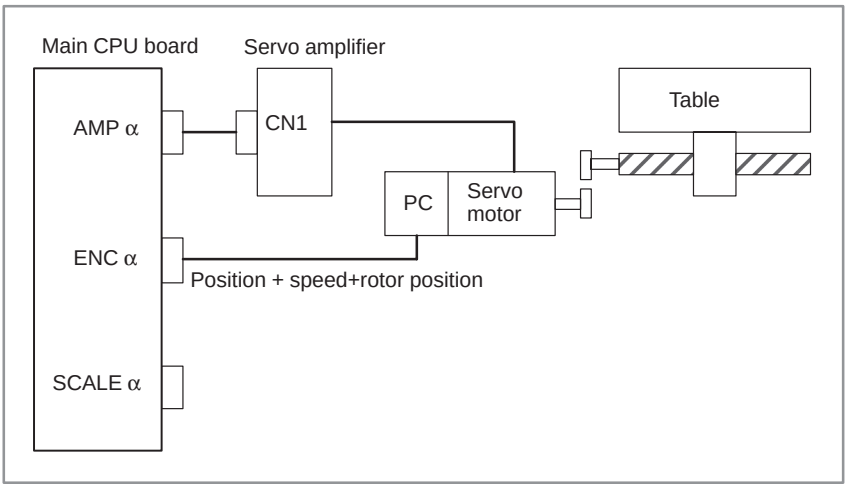
[Ex1] A66L–0001–0286(20/0.18,0.0394W/m) : L (Max)=21.75m

[Ex2] A66L–0001–0157(50/0.18,0.016W/m) : L (Max)=53.57m

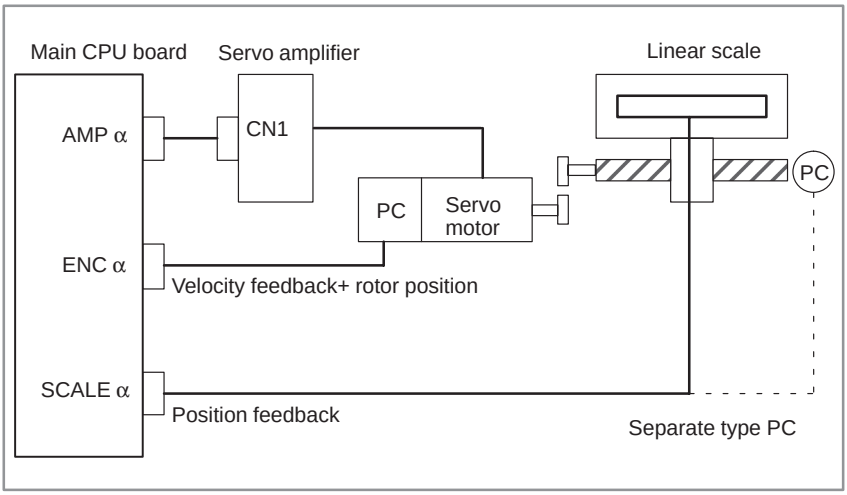
However, as a cable of 11 dia. cannot be clamped with the half–pitch connector, prepare a relaying connector or fabricate the cabel by peeling off the sheeth and covering a heat–shrinkable tube.

2.4.6 Connections by Type of Detectors

- **Built–in pulse coder**



- **Separate type pulse coder, Linear scale**



- **Connector positions**

	Connection cable between main CPU board and servo amp.	Built–in pulse coder	Separate type pulse coder or linear scale	
			Feedback cable from motor	Cable from separate type PC
1st axis	AMP1	ENC1	ENC1	SCALE1
2nd axis	AMP2	ENC2	ENC2	SCALE2
3rd axis	AMP3	ENC3	ENC3	SCALE3
4th axis	AMP4	ENC4	ENC4	SCALE4

- **Associated parameters**

	#7	#6	#5	#4	#3	#2	#1	#0
1815							OPTx	

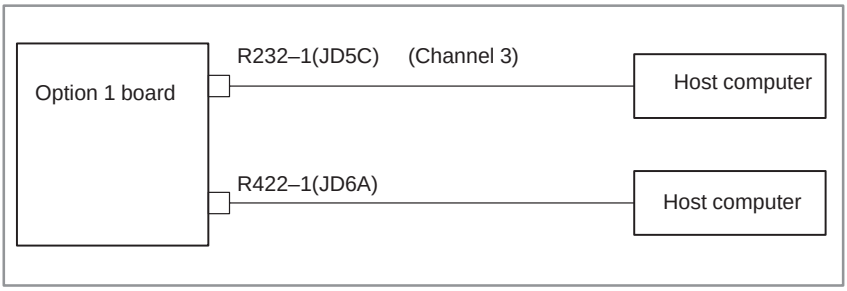
#1 (OPTx) Separate type pulse coder of position detector is :

0 : used

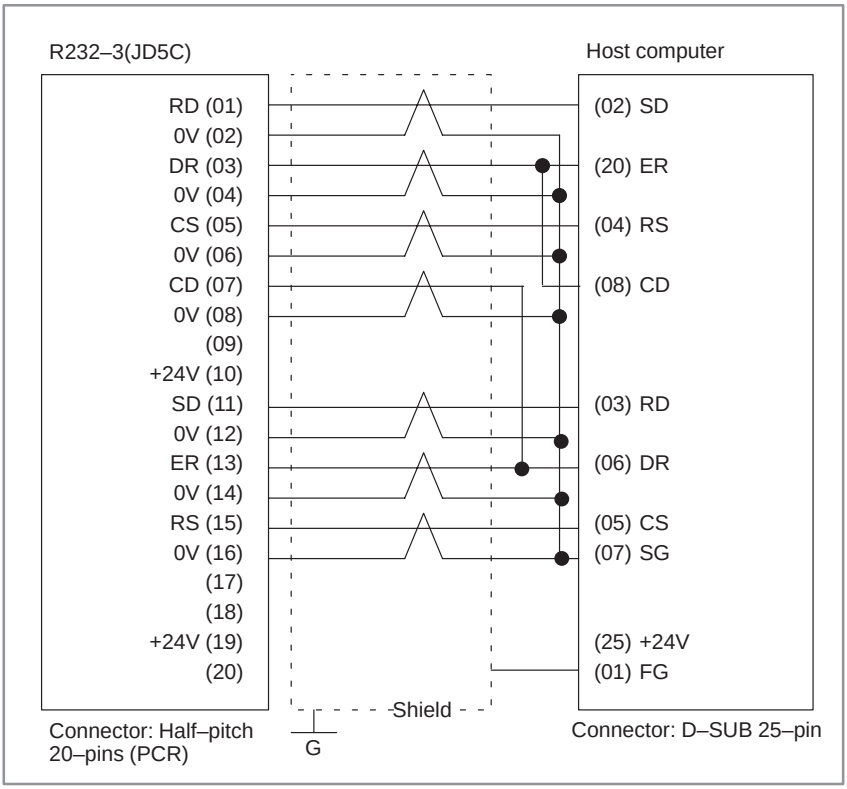
1 : not used

2.4.7
Remote Buffer Interface

- **Connection**

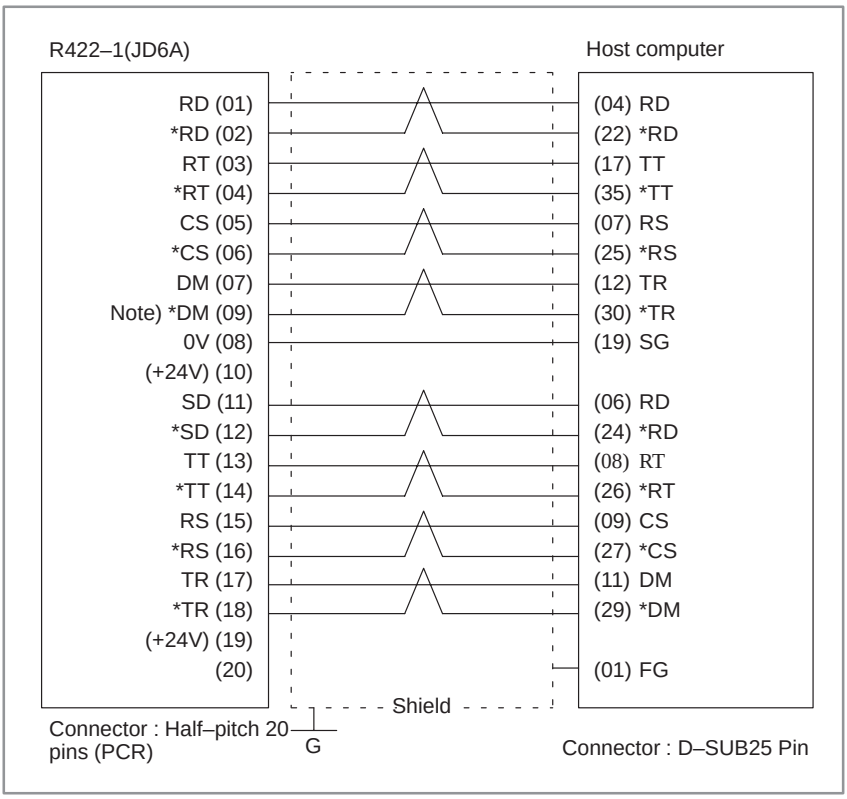


- **Example of cable connection**



Notes
1. Connect RS when CS is not used.
2. Connect as follows when protocol A or extended protocol A is used:
   a) Connect to ER when DR is not used.
   b) Always connect CD to ER

- **Example of RS–422 cable**

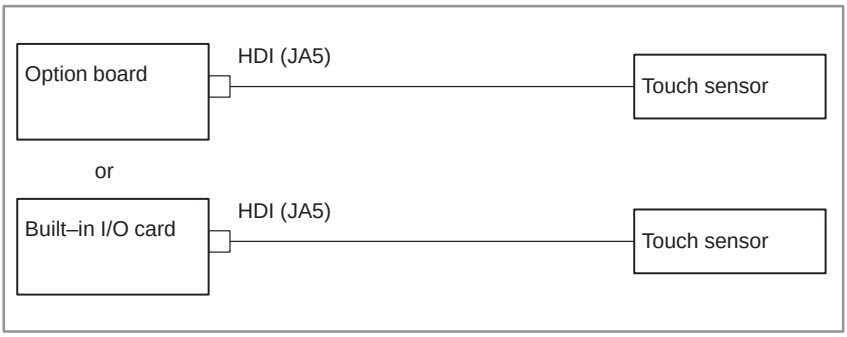


Note

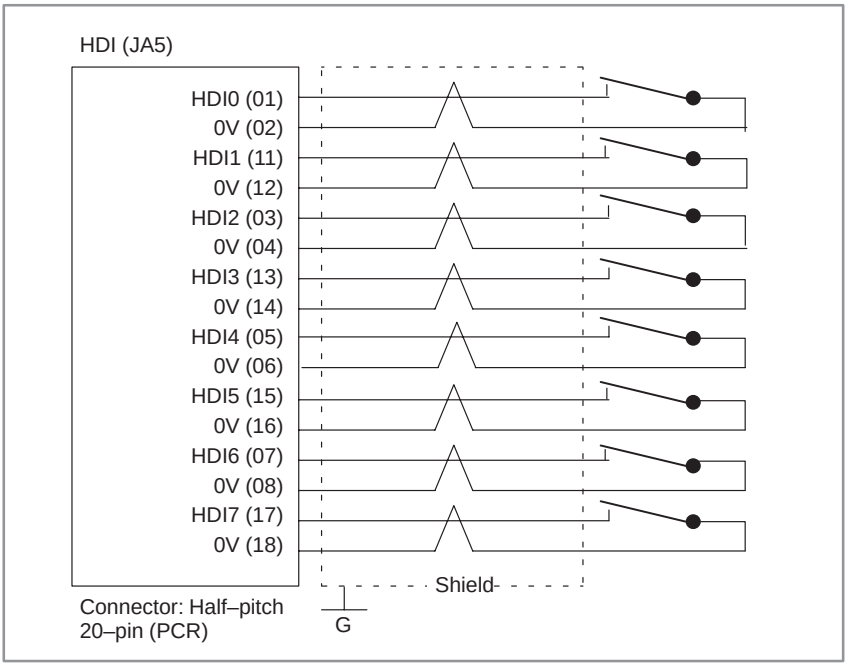
Be sure to use the twisted pair cable. Note that pin arrangement of *DM signal on NC side is not regular to escape from damage due to wrong connection.

2.4.8 High–speed DI Signal Interface

- **Connection diagram**

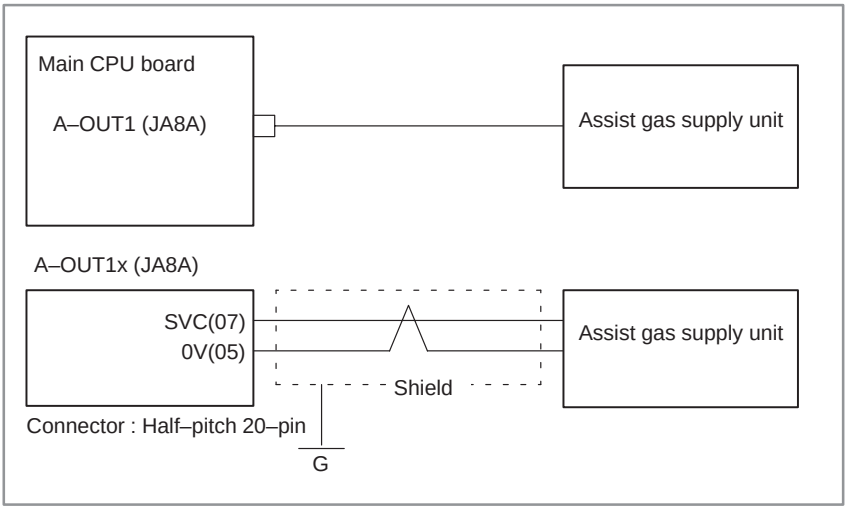


- **Connection details**

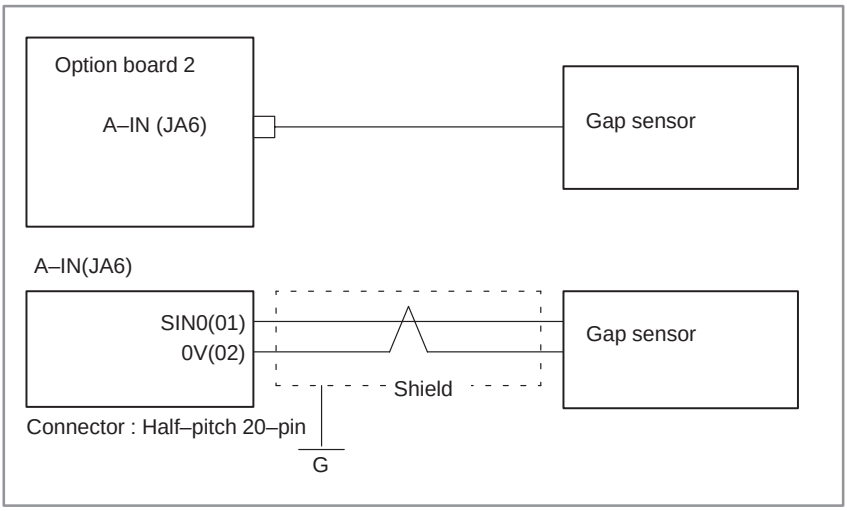


Parameter 6200 and 6202 decide which signals are used for the high speed skip signal.

2.4.9 Assist Gas Pressure Analog Output Signal



2.4.10 Tracing Detection Signal



2.4.11 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:

(1) Cabinet manufactured by the machine tool builder for housing the control unit or peripheral units;

(2) Cabinet for housing the flexible turnkey system provided by FANUC:

(3) Operation pendant, manufactured by the machine tool builder, for housing the CRT/MDI unit or operator’s panel ;

(4) Equivalent to the above.

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

Room temperature	In operation 0° to 45° In storage or transportation –20° to 60°
Change in temperature	1.1°C/minute max.
Relative humidity	Normal : 75% or less Temporary (with 1 month) : 95% or less
Vibration	In operation : 0.5 G or less
Environment	Normal machine shop environment (The environment must be considered if the cabinets are in a location where the density of dust, coolant, and/or organic solvent is relatively high.)

2.4.12 Power Capacity

The power capacity of the CNC control unit, which in this section means the specification required for the power supply, is obtained by adding the power capacity of the control section and the power capacity of the servo section.

Power capacity of the control section	When the control unit has four slots or less, and power supply AI is used.	0.4KVA
	When the control unit has six or more slots, or power supply BI is used.	1KVA
Power capacity of the servo section	Depends on servo motor type.	

2.4.13 Action Against Noise

The CNC has been steadily reduced in size using surface–mount and custom LS1 technologies for electronic components. The CNC also is designed to be protected from external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and noise has many uncertain factors. It is important to prevent both noise from being generated and generated noise from being introduced into the CNC. This precaution improves the stability of the CNC machine tool system.

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

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

- **Separating signal lines**

The cables used for the CNC machine tool are classified as listed in the following table :
Bind 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 and 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 (24 VDC)	
	DI/DO cable between the CNC and power magnetics cabinet	
	DI/DO cable between the CNC and machine	
C	Cable between the CNC 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 CNC and Oscillator	
	Cable between CNC and gap censor	
	Cable for the manual pulse generator	
	Cable between the CRT and MDI	
	RS232C and RS422 interface cables	
	Cable for the battery	
	Other cables to be covered with the shield	

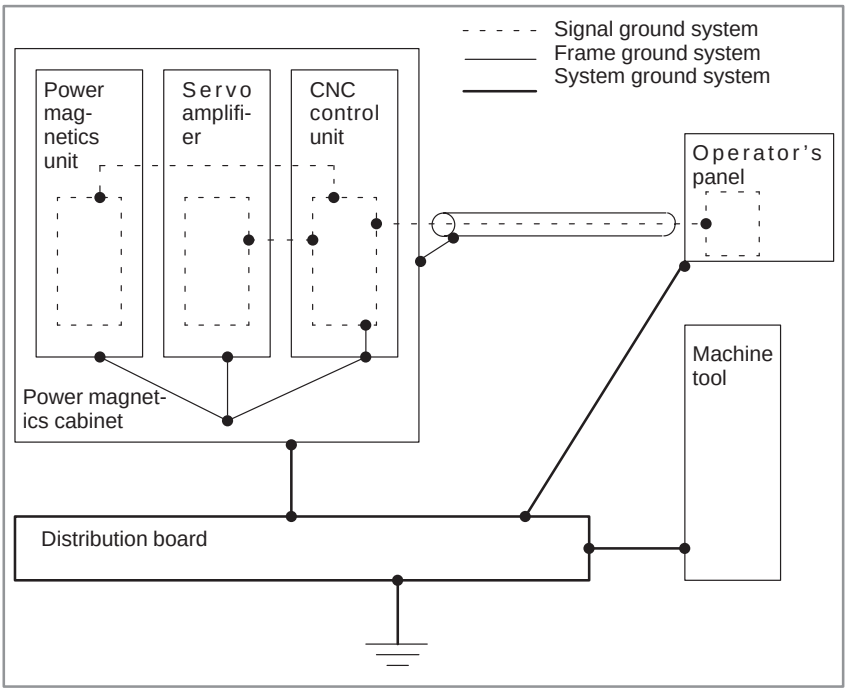
Notes
1. The groups must be 10 cm or more apart from one another when binding the cables in each group.
2. The electromagnetic shield refers to shielding between groups with grounded steel plates.

● Ground

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

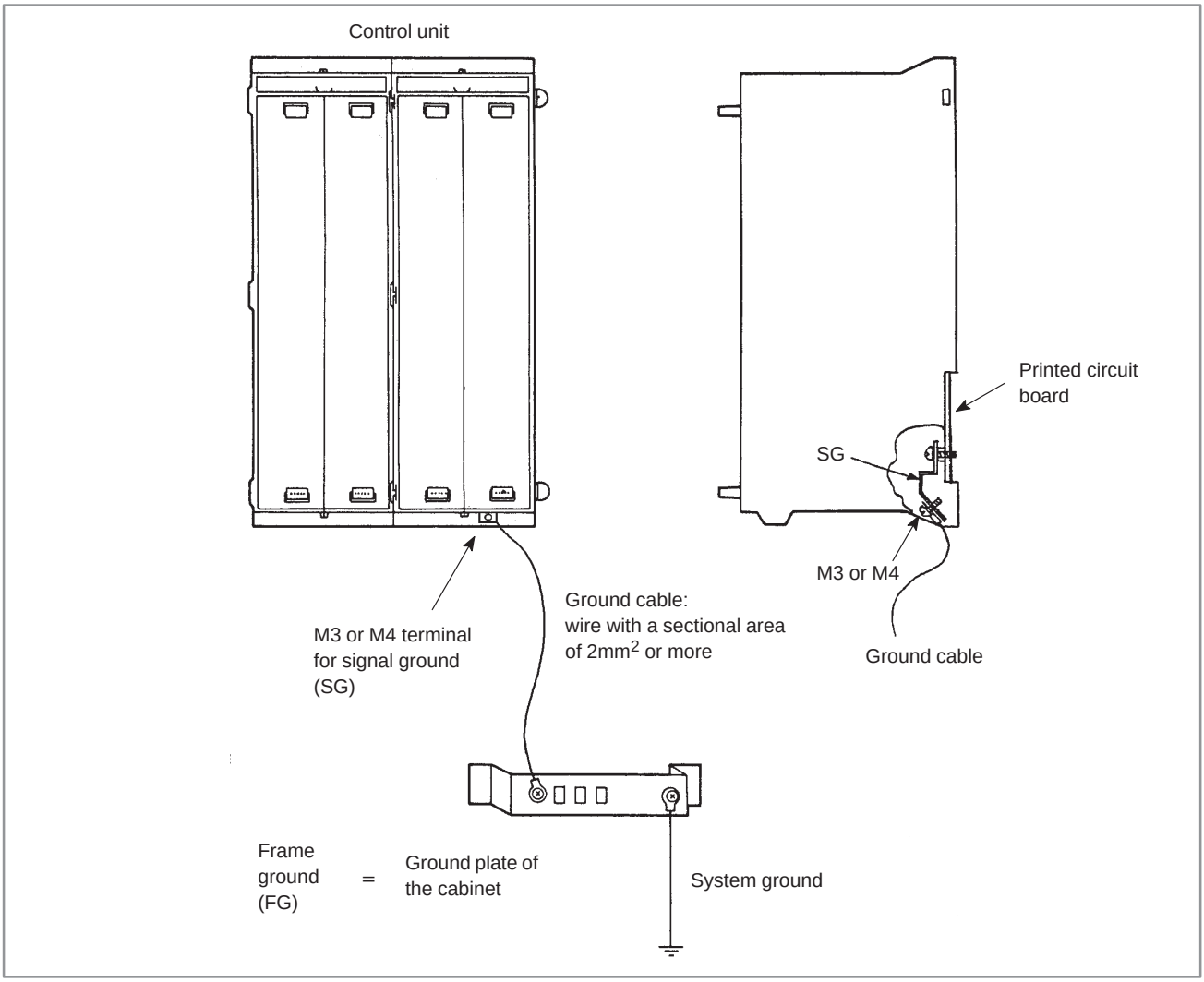
1. Signal ground system (SG)
   The signal ground (SG) supplies the reference voltage (0V) of the electrical signal system to the machine.
2. Frame ground system (FG)
   The frame ground system (FG) is used for safety, and suppressing external and internal noises. In the frame ground system, the frames and cases of the units, panels, and shields for the interface cables between the units are connected.
3. 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 CNC 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 safely 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 signal ground (SG) 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 signal ground (SG) terminal.
The SG terminal is located on the printed circuit board at the rear of the control unit.

● Noise suppressor

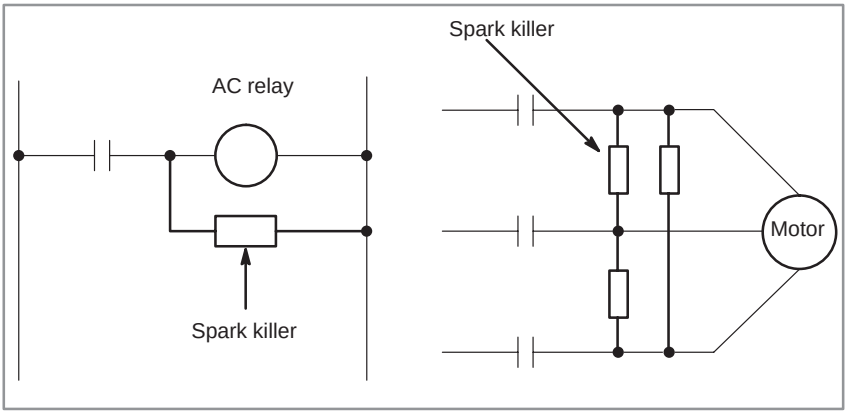
The AC/DC solenoid and relay are used in the power magnetics cabinet. A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage induced through the cable causes the electronic circuits to be disturbed.
To reduce the pulse voltage, use a spark killer for an AC device or a diode for a DC device.

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.
(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 (1(A)) and DC resistance of the stationary coil :

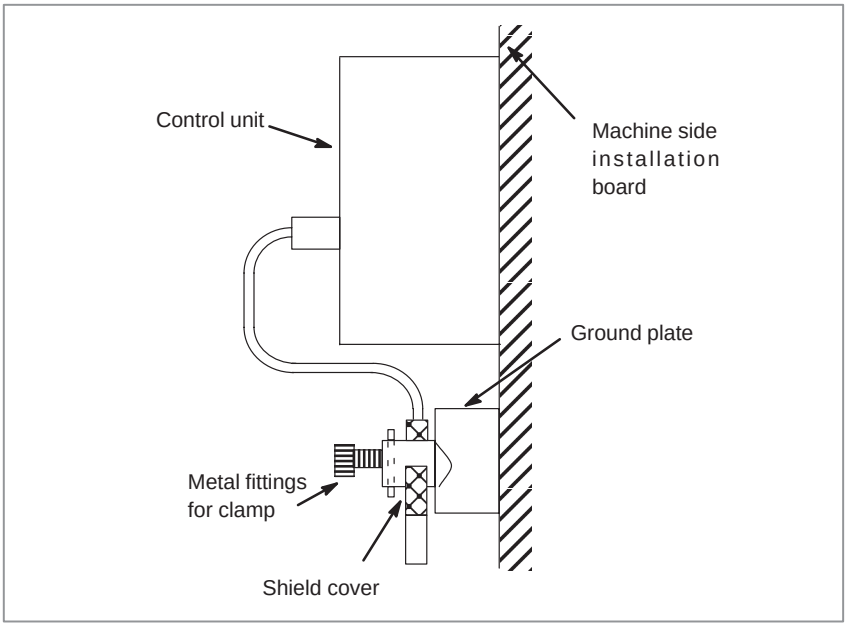
1) Resistance (R):Equivalent to DC resistance of the coil
2) Capacitance (C): $\frac{I^2}{10}$ ≦ $\frac{I^2}{20}$ *(μF)*

Equivalent circuit of the spark killer



- **Cable clamp and shield processing**

The CNC cables that required 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. Metal fittings for clamp are attached to the control unit. The ground plate must be made by the machine tool builder, and set as follows:



2.5 LED DISPLAY AND MODULE CONFIGURATION OF PCB

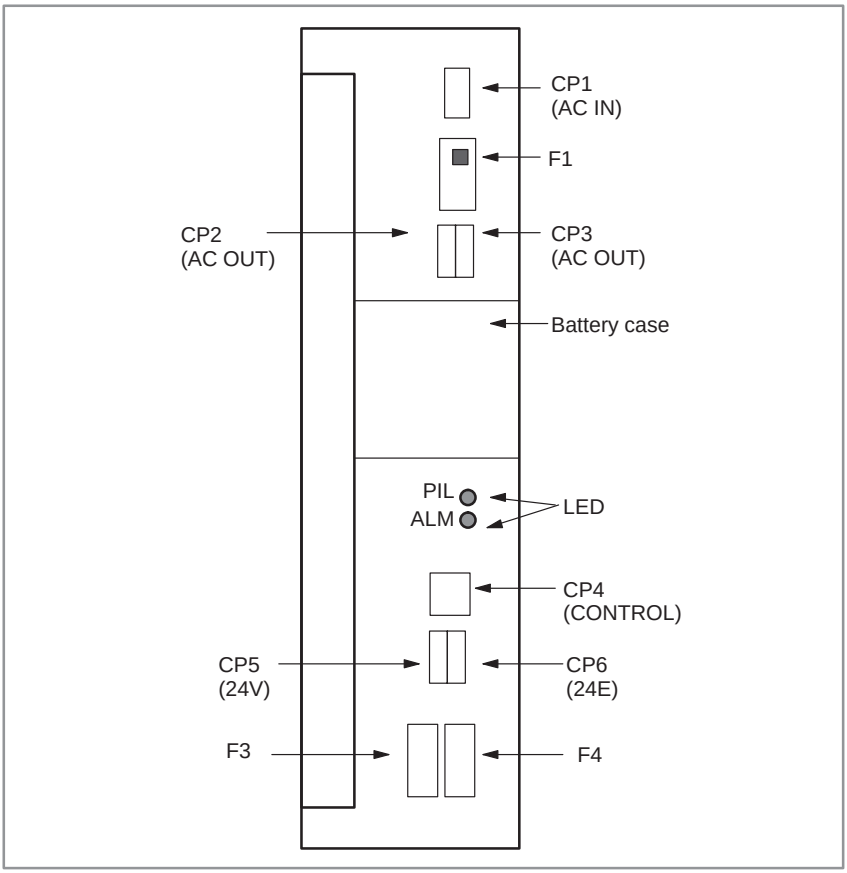
2.5.1 Power Supply Unit

Name	Code
Power supply unit AI	A16B–1212–0900
Power supply unit BI	A16B–1212–0870

- **LED display**

PIL(Green)	This LED is lit when the input AC power voltage is supplied to CP1.
ALM(Red)	This LED is lit when overcurrent,overvoltage, or low voltage occurs in direct current output voltage.

- **Disposition of Connector, etc.**



Locations of connectors and fuses

● Fuse

Fuses

Power supply	Ordering code	Symbol	Rating	Individual code
AI	A02B–0200–K100	F1	7.5A	A60L–0001–0245#GP75
		F3	3.2A	A60L–0001–0075#3.2
		F4	5AS	A60L–0001–0046#5.0
BI	A02B–0200–K101	F1	7.5A	A60L–0001–0245#GP75
		F3	5A	A60L–0001–0075#5.0
		F4	5AS	A60L–0001–0046#5.0

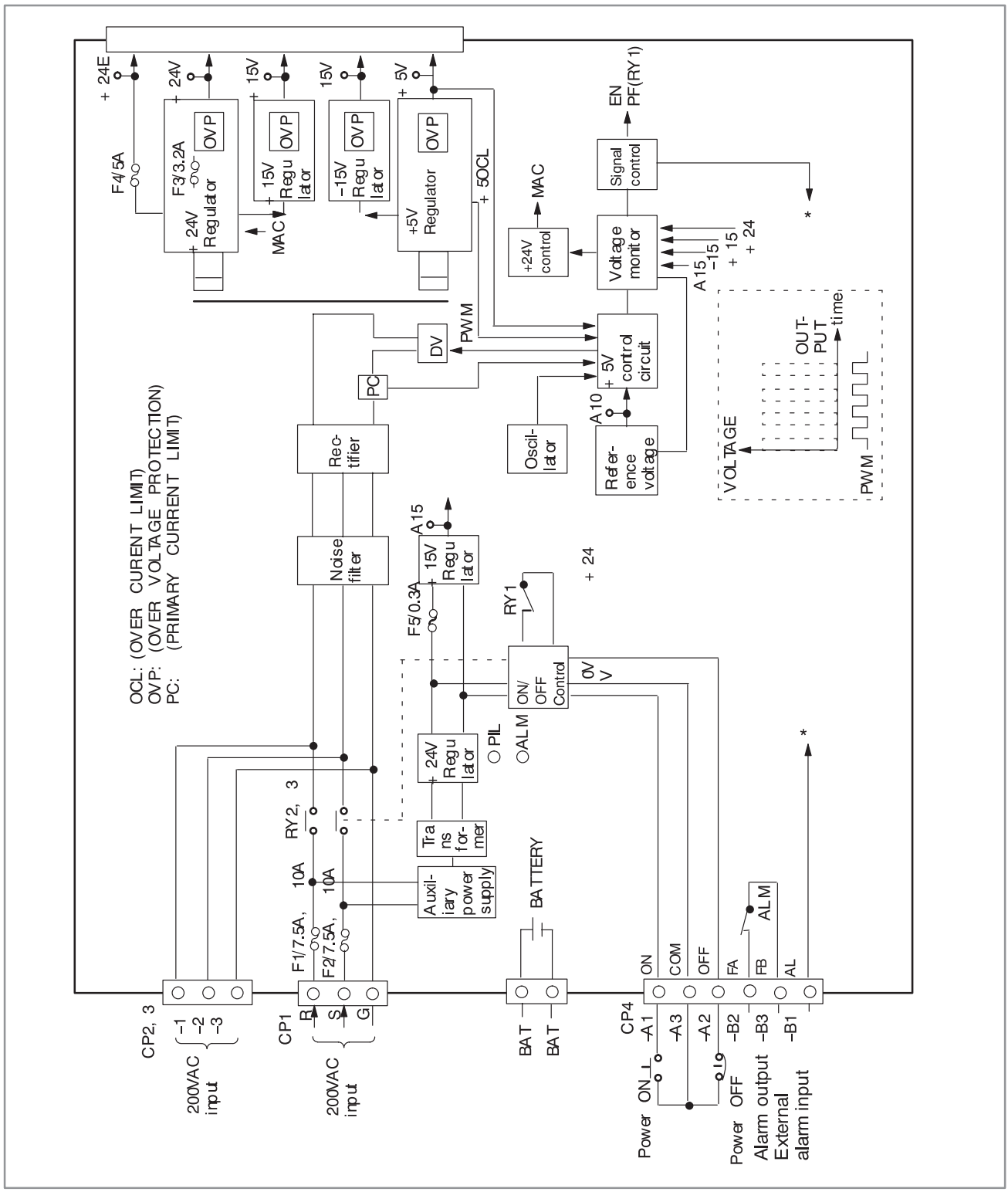
Circuit protected by fuses

Symbol	Use
F1	200–VAC input
F3	Power supply for 9″ monochrome CRT or LCD
F4	I/O unit, etc.

● Battery

Lithium battery code : A98L–0031–0012

- **Block diagram for power supply unit**



2.5.2 Main CPU Board

Name	Code
Main CPU board	A16B–3200–0110

- **LED display**

1 LED status in power on routine (Green LED)
□:OFF ■:ON

STATUS □□□□	Power OFF
STATUS ■■■■	Initial status after power on (CPU is not run yet)
STATUS ■□■■	Waiting for other CPU's answer (ID setting)
STATUS □□■■	Detect other CPU's answer (Finished of ID setting)
STATUS ■■□■	FANUC BUS initialized
STATUS □■□■	PMC initialization (1) finished
STATUS ■□□■	All PCBs configuration finished
STATUS ■■■□	PMC initial running finished (PMC–RB only)
STATUS □■■□	Waiting for digital servo initialization
STATUS ■□□□	All initialized, running

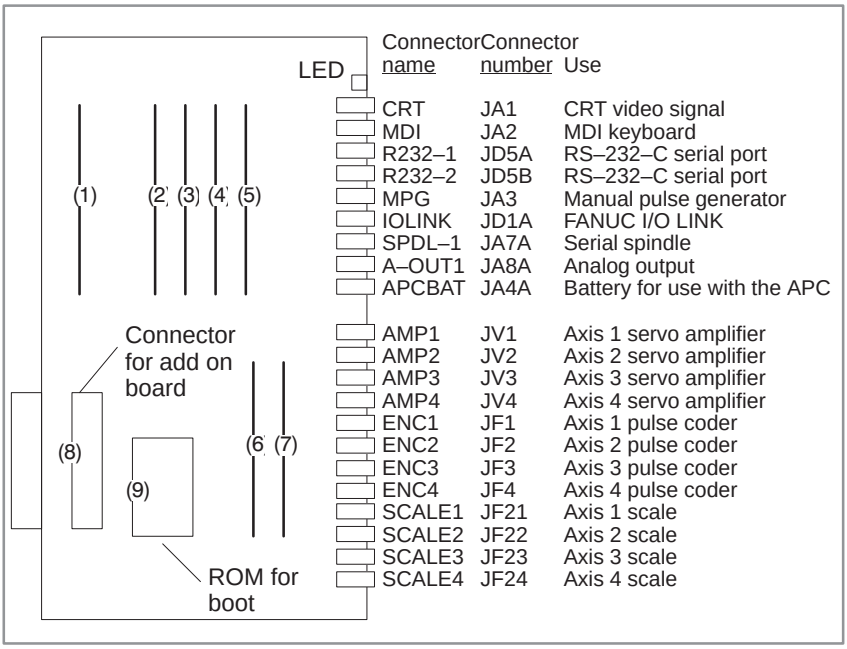
2 LED status in power of alarm □:OFF ■:ON ×:Don't care

STATUS □■□□ ALARM ■■□	RAM parity alarm occured in main CPU board or servo alarm occured in OPTION–2 board
STATUS □■□□ ALARM □■■	Servo alarm (watch dog alarm) occured
STATUS □■□□ ALARM □■□	Other system alarm occured
STATUS ■■■■ ALARM ×■×	The system is stopped before the CPU is activated

3 LED display when the system, fitted with option 2 board (with sub–CPU), is not started □:OFF ■:ON

STATUS ■■□□ ALARM □□□	An error occurred in the BASIC SRAM of the option 2 board (with sub–CPU). Replace the option 2 board.

● Location of modules



No.	Name	Specifications	Function	Display of system configuration screen
(1)	FROM module	A20B–2902–0080	CNC system, servo system, graphic system, Additional SRAM	FLASH ROM MODULE: 4MB
		A20B–2902–0081		FLASH ROM MODULE: 4MB
		A20B–2902–0082		FLASH ROM MODULE: 2MB
		A20B–2902–0090		FLASH ROM MODULE: 8MB
		A20B–2902–0091		FLASH ROM MODULE: 8MB
		A20B–2902–0092		FLASH ROM MODULE: 6MB
(2)	DRAM module	A20B–2901–0940	RAM for the CNC system	RAM: 6MB
		A20B–2901–0941		RAM: 4MB
		A20B–2901–0942		RAM: 2MB
(3)	PMC module	A20B–2901–0960	PMC control	PMC MODULE
		A20B–2901–0961		
(4)	CRTC module	A20B–2902–0270	CRT text display control	CRTC MODULE: 14″ CRT
		A20B–2902–0271		CRTC MODULE: 9″ CRT
		A20B–2902–0272		LCD
		A20B–2902–0273		MMC–III 14″
		A20B–2902–0275		MMC–IV LCD, MMC–IV 14″
(5)	Spindle module	A20B–2901–0982	Analog signal output	ANALOG SPINDLE LSI
(6)	Servo module	A20B–2902–0060	Servo control 3 or 4 axis	SERVO 3/4 AXIS
		A20B–2902–0061		
(7)	Servo module	A20B–2902–0060	Servo control 1 or 2 axis	SERVO 1/2 AXIS
		A20B–2902–0061		

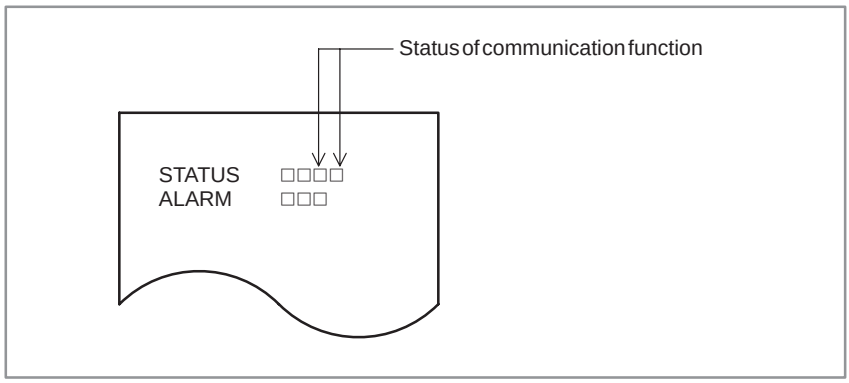
Add on board

No.	Name	Specifications	Function	Display of system configuration screen
(8)	Graphic function board	A20B–8200–0010	Graphic display control	SYSTEM CONFIG SLOT:UD MODULE:009A
		A20B–8200–0011		

2.5.3 Option 1 board

Name	Specifications	Function
Option 1 board	A16B–2200–0913	Remote buffer
	A16B–2200–0914	DNC1

- **LED display**

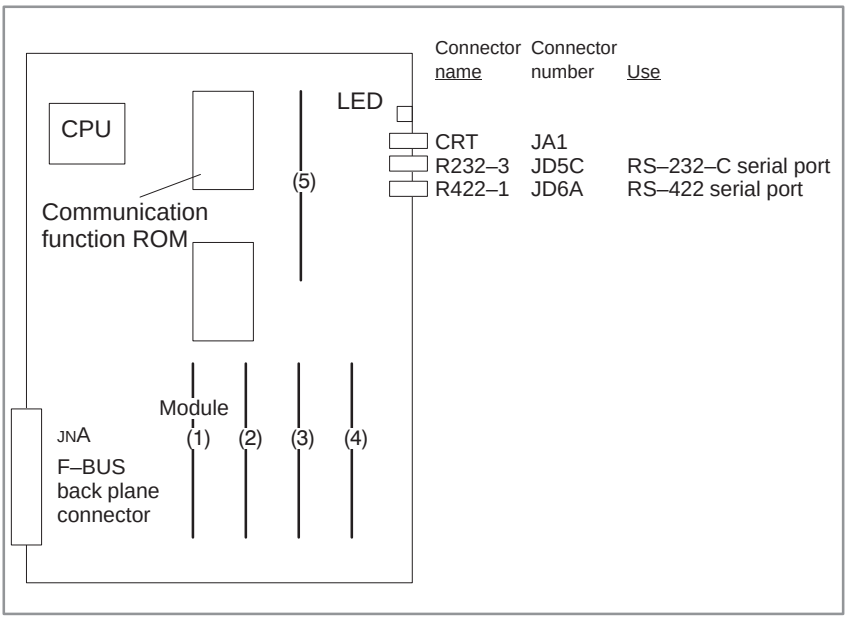


· Communication function

□:OFF, ■:ON, ×:Don't care ☆:Blink

STATUS ■■■■ ALARM ■□□□	Initial status after power on (CPU is not run yet)
STATUS ××□■ ALARM □□□	Remote buffer CPU initialized, running
STATUS ××☆☆ ALARM □□□	Communication error occured from OPTION 1 board

● Location of modules



● Type of modules

(5)	Communication control module	A20B–2901–0361	Communication control	COMMUNICATION MODULE MOUNTED

2.5.4 Option 2 board

Name	Specifications	Function
Option 2 board	A16B–2202–0401	Additional axis

● LED display

· LED display transition when the power is turned on□:OFF, ■:ON
The STATUS LEDs are green and the ALARM LEDs are red.

No.	LED display	NC statue
1	STATUS □□□□	When power is off
2	STATUS ■■■■	Startup status immediately after power is turned or CPU is not running
3	STATUS □■■■	Initializing RAM
4	STATUS ■□■■	Software ID has been set, initialization of keys, ALL CLR
5	STATUS □□■■	Waiting for software initialization 1
6	STATUS ■■□■	Waiting for software initialization 2, Initializing CMOS
7	STATUS □■□■	Initializing position coder
8	STATUS □■■□	Waiting for digital servo system startup
9	STATUS ■□□□	Startup has been completed and the system is now in normal operation mode.

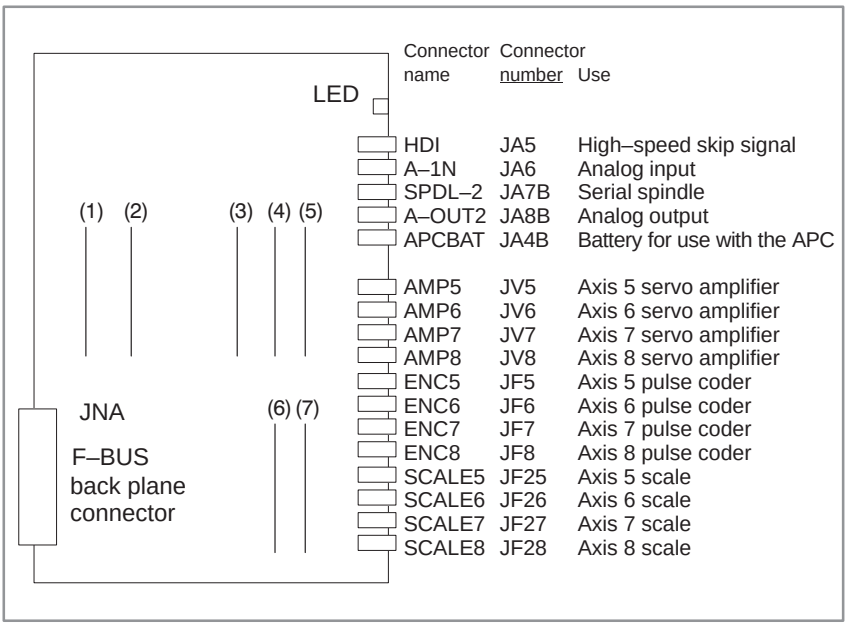
· LED display when an erro occurs □:OFF, ■:ON

No.	LED display	NC statue
1	STATUS □■□□ ALARM ■□□	RAM parity error occurred.
2	STATUS □■□□ ALARM □□■	Servo alarm (watch dog, etc.) occurred
3	STATUS □■□□ ALARM □□□	Other alarm occurred

· LED display when system is not started □:OFF, ■:ON

No.	LED display	NC statue
1	STATUS ■■■■ ALARM ■□□	An SRAM parity error occurred.
2	STATUS ■■□□ ALARM ■□□	A DRAM parity alarm occurred. Replace the DRAM module.
3	STATUS ■■□□ ALARM □□□	A RAM module of at least 2M is not mounted, or another alarm occurred. Check and replace the DRAM module.

● Location of modules

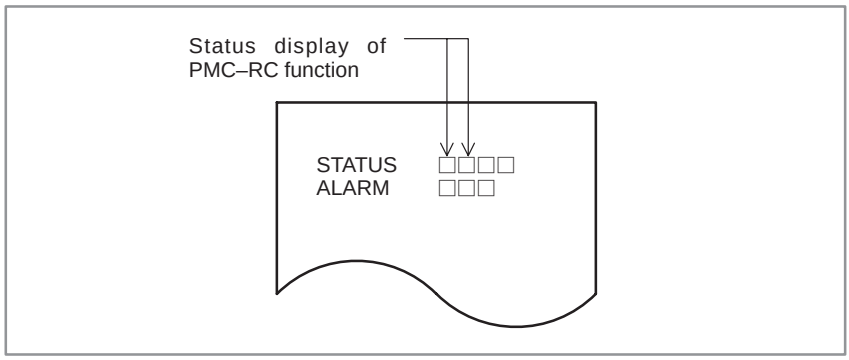


No.	Name	Specifications	Function	Display of system configuration screen
(1)	FROM module	A20B–2902–0081	2nd path macro	FLASH ROM MODULE:4MB
		A20B–2902–0082		FLASH ROM MODULE:2MB
(2)	SRAM module	A20B–2900–0541	CNC system RAM	ADDITIONAL SRAM:
		A20B–2900–0991		
(3)	DRAM module	A20B–2901–0940	CNC system RAM	DRAM:6MB
		A20B–2901–0941		DRAM:4MB
		A20B–2901–0942		DRAM:2MB
(4)	Spindle module	A20B–2901–0980	Spindle control	SERIAL SPINDLE L ANALOG SPINDLE L
		A20B–2901–0981		SERIAL SPINDLE L
		A20B–2901–0982		ANALOG SPINDLE L
(5)	HAM module	A20B–2900–0280	Analog I/O+HDI	H–SKIP DI & ANALOG I/O:
		A20B–2900–0281	HDI	H–SKIP DI
(6)	Servo module	A20B–2902–0060	Servo control 7th or 8th axis	SERVO 7/8 AXIS
		A20B–2902–0061		
(7)	Servo module	A20B–2902–0060	Servo control 5th or 6th axis	SERVO 5/6 AXIS
		A20B–2902–0061		

2.5.5 Option 3 board

Name	Specifications	Function
Option 3 board	A16B–3200–0054	PMC–RC

● LED display



· LED display of PMC–RC function

(i) LED display transition when the power is turned on

□: OFF, ■:ON, ◆:Don't care, ☆: Blink

No.	LED display	NC statue
1	STATUS ■■◆◆	Startup status immediately after power is turned on
2	STATUS □■◆◆	Waiting for each processor in the system to set its ID
3	STATUS ■□◆◆	Waiting for each processor in the system to complete startup
4	STATUS □□◆◆	The PMC–RC function startup has been completed and the system is now in normal operation.

(ii) LED display when an error occurs

□: OFF, ■: ON, ◆: Don't care, ☆:Blink

No.	LED display	NC statue
1	STATUS ☆☆◆◆ ALARM □□□	NMI from another board (LEDs are flashing simultaneously). Check other boards' LED display
2	STATUS □☆◆◆ ALARM ■□□	The parity error of the memory for LADDER or work occurred. Initialize the memory for LADDER or replace it for work RAM MODULE
3	STATUS ☆□◆◆ ALARM □□□	A bus error occurred (incorrect memory access). Replace the option 3 board.
4	STATUS ■☆◆◆ ALARM □□□	Communication error occurred in I/O Link. Check the Link device and the cables.
5	STATUS ☆■◆◆ ALARM ■□□	The parity error etc. occurred in the PMC control module. Replace the PMC control module.
6	STATUS ★☆◆◆ ALARM □□□	A checksum error occurred in the system program memory. The DRAM module for the PMC may have failed.

· LED display when an error occurs

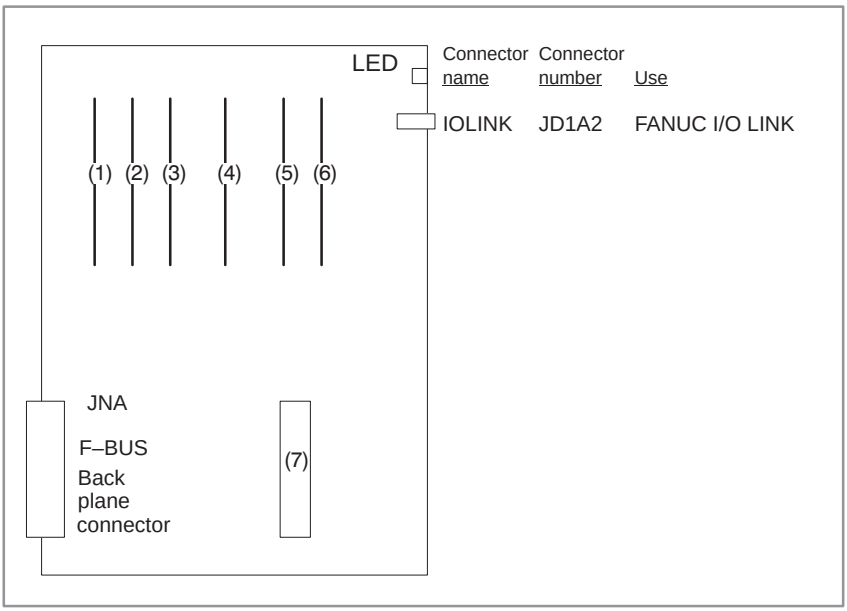
□: OFF, ■: ON, ★☆: Blink, ◆: Don't care

No.	LED display	NC statue
1	STATUS ◆◆★★ ALARM □□□	NMI from another board (STATUS LEDs 3 and 4 are flashing simultaneously). Check other boards' LED display.
2	STATUS ◆◆★□ ALARM □□□	A bus error occurred (incorrect memory access). Replace the option 3 board.

· Alarm LED display □:OFF, ■:ON

LED display	Description	Cause and required action
ALARM □□■	An I/O link error occurred.	Check the link devices and cables.
ALARM □■■	A parity error occurred in the DRAM for PMC	The DRAM module for PMC may have failed.
ALARM ■□■	A parity error occurred in the DRAM for PMC	The DRAM module for PMC may have failed
ALARM ■■□	The CPU for PMC is not started	Check whether the main board has been activated normally
ALARM ■■■	The operation of the PMC module is abnormal	The PMC module may have failed

● Location of modules



No.	Name	Specifications	Function	Display of system configuration screen
(4)	DRAM module for PMC	A20B–2902–0197	DRAM for PMC	DRAM(APPLICATION) :1MB
		A20B–2902–0198		DRAM(APPLICATION) :512KB
(5)	PMC module	A20B–2901–0960		PMC MODULE:PMP2
		A20B–2901–0961		PMC MODULE:PMP2
(6)	Not used in Series 16			

Add on board

No.	Name	Specifications	Function	Display of system configuration screen
(7)	Communication function board	A20B–2200–0010	Communication function control	
		A20B–2200–0011		

2.5.6 I/O Card (Sink Type Output)

Name	Code	Function
I/O card (sink type output)	A16B–2200–0950	DI : 104 DO : 80 With high–speed skip
	A16B–2200–0951	DI : 104 DO : 72 With high–speed skip
	A16B–2200–0952	DI : 80 DO : 56 With high–speed skip
	A16B–2200–0953	DI : 40 DO : 40 With high–speed skip
	A16B–2200–0954	High–speed skip only
	A16B–2200–0955	DI : 104 DO : 80 Without high–speed skip
	A16B–2200–0956	DI : 104 DO : 72 Without high–speed skip
	A16B–2200–0957	DI : 80 DO : 56 Without high–speed skip
	A16B–2200–0958	DI : 40 DO : 40 Without high–speed skip
I/O card add–on board	A20B–9001–0480	DI : 52 DO : 40 Use with A16B–2200–0950 or A16B–2200–0955 listed above

Note
This printed circuit board has no LED display.

2.5.7 I/O Card (Source Type Output)

Name	Code	Function
I/O card (Source type output)	A16B–2200–0981	DI : 104 DO : 72 With high–speed skip
	A16B–2200–0982	DI : 80 DO : 56 With high–speed skip
	A16B–2200–0983	DI : 40 DO : 40 With high–speed skip
	A16B–2200–0986	DI : 104 DO : 72 Without high–speed skip
	A16B–2200–0987	DI : 80 DO : 56 Without high–speed skip
	A16B–2200–0988	DI : 40 DO : 40 Without high–speed skip

Note
This printed circuit board has no LED display.

2.6 LIST OF THE PCBS AND UNITS

2.6.1 Control Unit Rack

Name		Drawing No.	Remarks
Control unit rack (Without MMC–IV)	3 Slots	A02B–0200–B505	
	4 Slots	A02B–0200–B502	
	6 Slots	A02B–0200–B503	
	8 Slots	A02B–0200–B504	
Control unit rack (With MMC–IV)	4 Slots	A02B–0200–B522	
	6 Slots	A02B–0200–B523	
	8 Slots	A02B–0200–B524	

2.6.2 Power Unit

Name		Drawing No.	Remarks
Power unit	AI	A16B–1212–0900	
	BI	A16B–1212–0870	

2.6.3 Control Unit P.C.B.

Name		Drawing No.	Remarks
Main CPU board	Series 16	A16B–3200–0010	
Option 1 board	Remote buffer	A16B–2200–0913	
	DNC1	A16B–2200–0914	
Option 2 board	Without sub–CPU	A16B–2202–0401	
Option 3 board	PMC–RC	A16B–3200–0054	
I/O card (sink output type)	A (DI:40 DO:40)	A16B–2200–0958	
	B (DI:80 DO:56)	A16B–2200–0957	
	C (DI:104 DO:72)	A16B–2200–0956	
	D (DI:156 DO:120)	A16B–2200–0955	
	E (DI:40 DO:40)	A16B–2200–0953	With high–speed skip signal input
	F (DI:80 DO:56)	A16B–2200–0952	
	G (DI:104 DO:72)	A16B–2200–0951	
	H (DI:156 DO:120)	A16B–2200–0950	
	Expansioon board	A20B–9001–0480	Used together with D or H
	High–speed skip signal input only	A16B–2200–0954	
I/O card (source output type)	A (DI:40 DO:40)	A16B–2200–0988	
	B (DI:80 DO:56)	A16B–2200–0987	
	C (DI:104 DO:72)	A16B–2200–0986	
	D (DI:40 DO:40)	A16B–2202–0983	With high–speed skip signal input
	E (DI:80 DO:56)	A16B–2200–0982	
	F (DI:104 DO:72)	A16B–2200–0981	

Add on board

Name	Drawing No.	Remarks
Communication function board	A20B–2200–0010	Used as Option 3
	A20B–2200–0011	
Graphic function board	A20B–8200–0010	Used as Main
	A20B–8200–0011	

2.6.4 Modules

Name		Drawing No.	Remarks
PMC control module	For PMC–RC3	A20B–2900–0143	
	PMC–RB3/RC3 with SLC	A20B–2901–0960	
High–speed DI, analog I/O module	Analog I/O+high–speed skip DI	A20B–2900–0280	
	High–speed skip DI	A20B–2900–0281	
Graphic control module		A20B–2900–0311	
SRAM module (512 KB)		A20B–2900–0541	
14–bit A/D converter module		A20B–2900–0580	
SRAM module (2 MB)		A20B–2900–0991	
DRAM SRAM module		A20B–2901–0413	
DRAM module	6MB	A20B–2901–0940	
	4MB	A20B–2901–0941	
	2MB	A20B–2901–0942	
Spindle control module	Serial+analog	A20B–2901–0980	For main CPU board
	Analog	A20B–2901–0982	
	Serial+analog	A20B–2901–0984	For option 2 board
	Serial	A20B–2901–0985	
	Analog	A20B–2901–0986	
Servo control module		A20B–2902–0060	
		A20B–2902–0061	
FROM/SRAM module	FROM 4MB+SRAM 512KB	A20B–2902–0080	
	FROM 4MB	A20B–2902–0081	
	FROM 2MB	A20B–2902–0082	
FROM/SRAM module	FROM 8MB+SRAM 2MB	A20B–2902–0090	
	FROM 8MB	A20B–2902–0091	
	FROM 6MB	A20B–2902–0092	
DRAM module	1MB	A20B–2902–0197	
	512KB	A20B–2902–0198	
CRT control module (Without MMC–III, IV)	For 14″CRT	A20B–2902–0270	
	For 9″CRT, PDP	A20B–2902–0271	
	For 9.5″, 8.4″ LCD	A20B–2902–0272	
CRT control module (With MMC–III, IV)	14″CRT (MMC–III)	A20B–2902–0273	
	9.5″, 8.4″ LCD 14″CRT (MMC–IV)	A20B–2902–0275	

2.6.5 CRT/MDI Unit

For system without MMC–IV

Name		Specification	Remarks
9″CRT/MDI (small size, monochrome)	MB	A02B–0120–C041#MA	
9″CRT/MDI (small size, color)	MB	A02B–0120–C042#MA	
9″CRT/MDI (standard, monochrome)	MB	A02B–0120–C051#MA	
9″CRT/MDI (standard, color)	MB	A02B–0120–C052#MA	
9″PDP/MDI (standard key)	MB	A02B–0120–C081#MA	
9″ separate–type CRT unit	Mono-chrome	A02B–0120–C111	
	Color	A02B–0120–C112	
9″ separate–type PDP unit	Mono-chrome	A02B–1020–C113	
Separate–type MDI unit (small size)	MB	A02B–0120–C121#MA	
Separate–type MDI unit (standard)	MB	A02B–0120–C122#MA	
14″ CRT/MDI (color, landscape type)	MB	A02B–0120–C071#MA	
14″ CRT/MDI (color, portrait type)	MB	A02B–0120–C072#MA	
9.5″ LCD/MDI (color, landscape type)	MB	A02B–0200–C061#MB	
9.5″ LCD/MDI (color, portrait type)	MB	A02B–0200–C062#MB	

For system with MMC–IV

Name		Specification	Remarks
14″ CRT/MDI (color, landcape type)	MB	A02B–0200–C071#MB	
14″ CRT/MDI (color, portrait type)	MB	A02B–0200–C072#MB	
9.5″ LCD/MDI (color, landcape type)	MB	A02B–0200–C065#MB	
9.5″ LCD/MDI (color, portrait type)	MB	A02B–0200–C066#MB	
8.4″ separate–type LCD unit	Color	A02B–0200–C051	
Separate–type MDI unit (small size)	MB	A02B–0120–C121#MA	
Separate–type MDI unit (standard)	MB	A02B–0120–C122#MA	

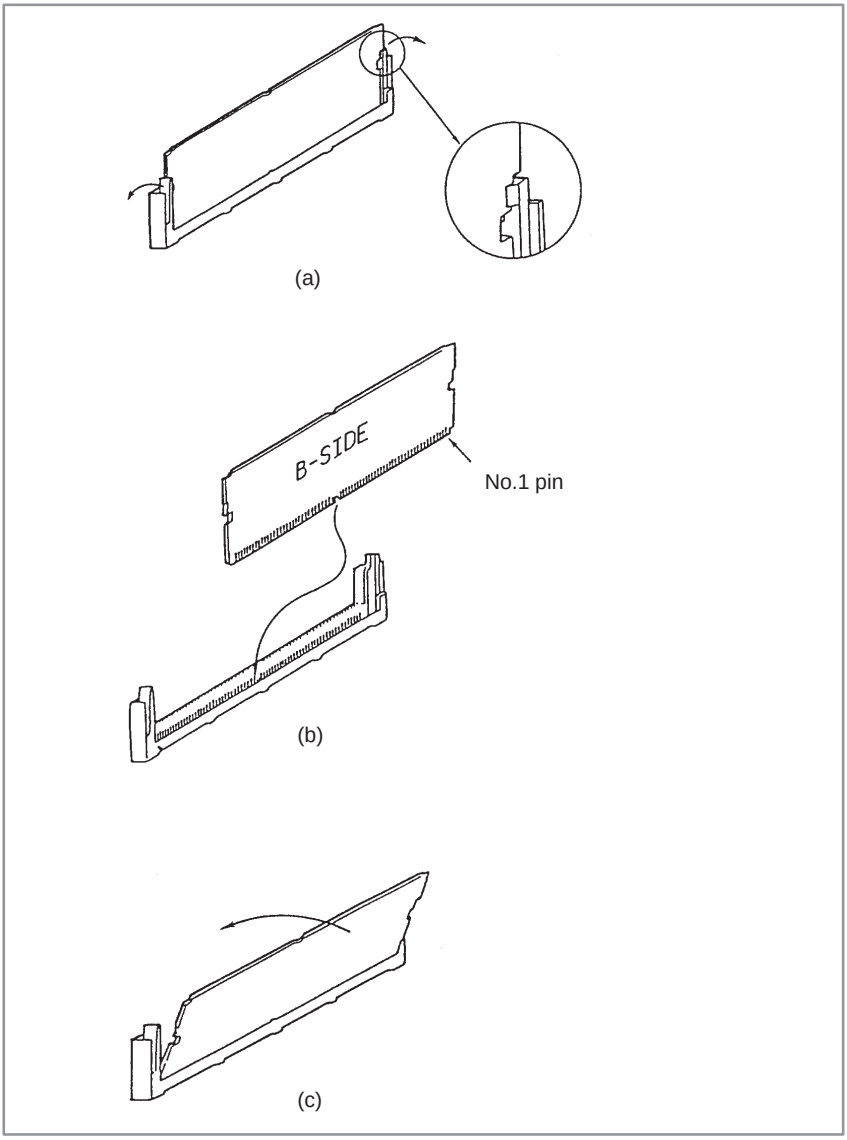
2.7 HOW TO REPLACE THE MODULES

2.7.1 Removing

(1) Pull the latches of the module socket outwards. (Fig.(a))
(2) Pull out the module upward. (Fig.(b))

2.7.2 Insertion

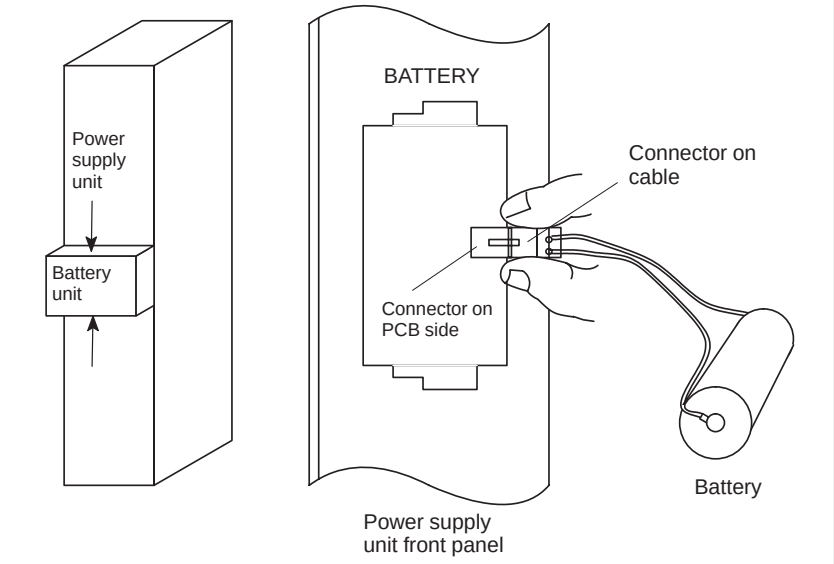
(1) Insert the new module board diagonally with B–SIDE outward (Fig.b)
(2) While pushing on the upper edge of the module board, raise it until it is locked (Fig.(c)).



2.8 HOW TO REPLACE THE BATTERIES

2.8.1 Replace the Battery for Memory Back Up

1. Lithium battery (Order number is *A02B–0200–K102) is required.
2. The battery used for memory back up is located on the front of the main board.
3. Remove the battery cover on the main board by holding the upper and lower part of the battery cover and pulling it towards you. Then take off the battery.
4. Remove the connector on the main board towards you.
   If you replace the battery while the CNC power is off, you should replace it within 30 minutes. If it will take more than 30 minutes, you should replace the battery with power on. Or the CNC memory contents will be lost.
5. Connect the connector of new battery.
6. Mount a battery and put the battery cover back on.



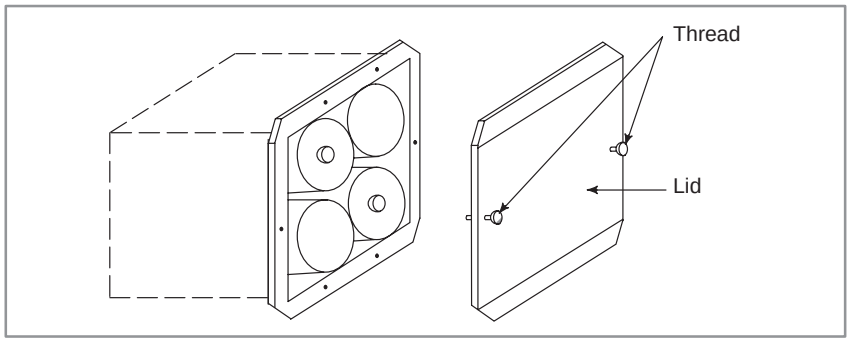
Battery Replacement

* FANUC's order number : A98L–0031–0012

2.8.2 Replacing Batteries for Separate Absolute Pulse Coder

1. Prepare 4 commercially available dry cell batteries
2. Turn on CNC power.
   If the batteries are replaced with the power off ,absolute position of the machine is lost.
3. Loosen the screws of battery case lid and remove the lid.
   Consult with the MTB's manual for where the battery case is installed.
4. Replace the batteries in the case.
   Take care to place the batteries facing in the correct direction. (Insert the batteries as shown in the diagram with 2 facing one way and 2 the other.)

- **Figure of replacing batteries**



5. Having exchanged the batteries put the lid back on.
6. Turn off the power once, then turn it to on.
7. A battery alarm may be generated, but execute power off and on.
8. Procedure completes.

2.9 HOW TO REPLACE FAN MOTOR

Fan ordering information

	Ordering code	Number of units required
For 2–slot rack	A90L–0001–0378	For 1–slot rack
For 1–slot rack	A90L–0001–0385#A	For 2–slot rack

1. Remove the control section printed circuit board underneath the fan to be replaced.
2. There is a backplane inside the slot. The fan motor cable is connected to the backplane. Grasp the left and right side of the cable connector attached to the backplane and remove it.
3. Open the upper lid of the control section rack. Insert a philips head screwdriver into the hole at the center front of the lid. The latch holding the cover in place can be released by prying with the screwdriver in the direction shown in (3) of following figure.
4. Open the lid sufficiently and remove the fan motor. Since the fan itself is not screwed into the rack, it can be easily removed.
5. Install the new fan motor. Guide the fan motor cable through the hole and into the rack.
6. Close the lid until the latch locks.
7. Attach the fan motor cable to the connector on the back plane. At this time,affix the middle portion of the cable to the hooks at the back of the rack.
8. Insert the removed control section printed circuit board.

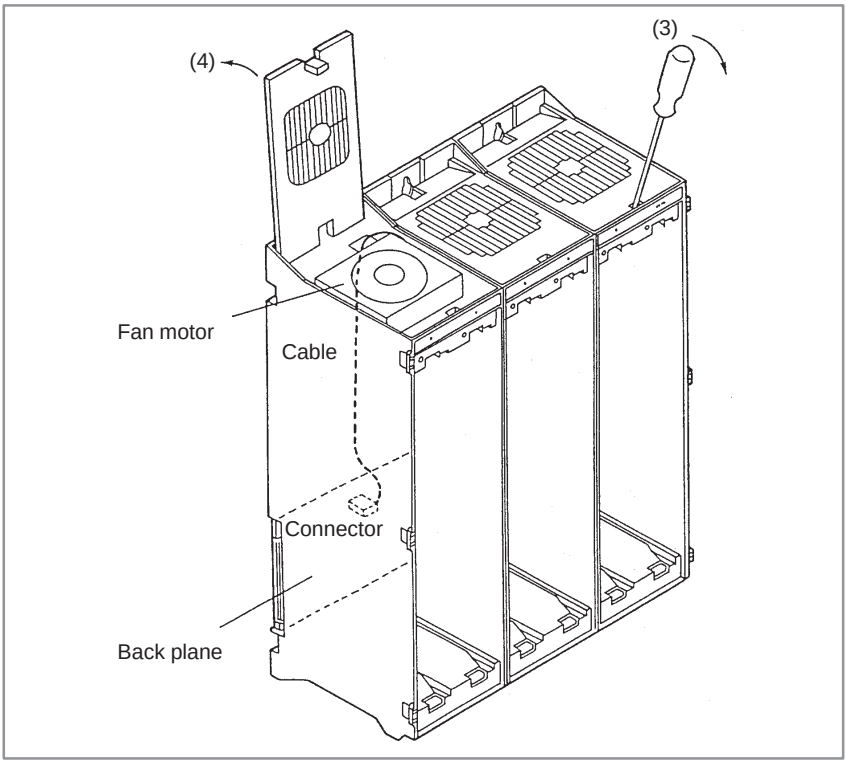


Fig. 2.9 Fan Motor Replacement

2.10 FUSE REPLACEMENT IN POWER SUPPLY UNIT

When a fuse blows in the power supply unit of the CNC, find and correct the cause of the failure and replace the fuse.
Each fuse has a small window in which a white mark appears when the fuse has blown.
Fig. 1 shows the fuse mounting diagram, and table 1 shows the fuse lists.

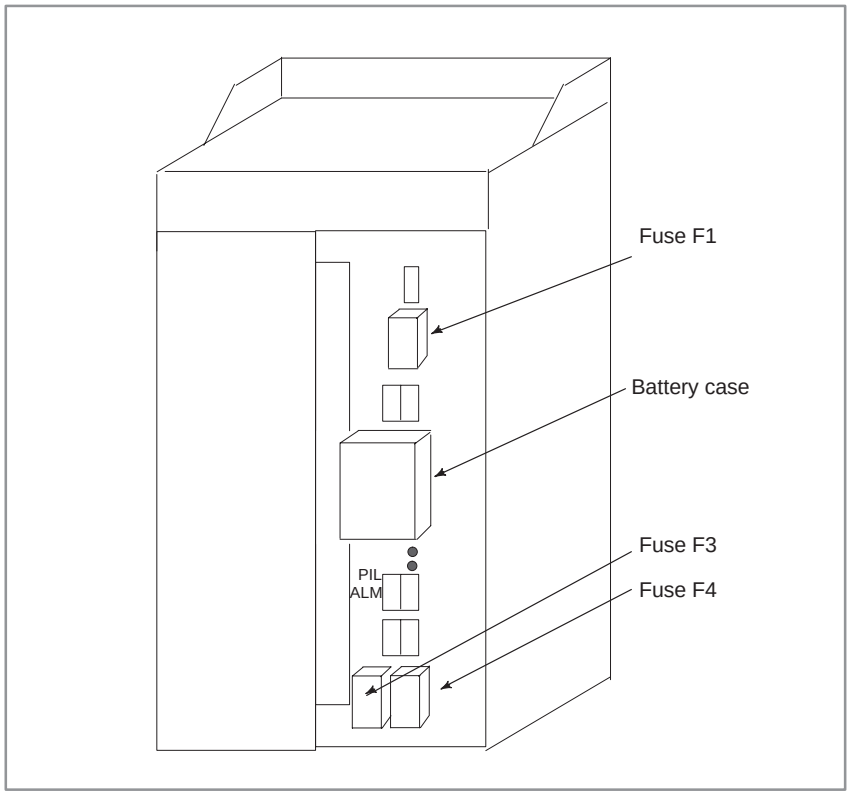


Fig.1 Mounting positions of fuses in the power supply unit

Table 1. Fuses

Power supply	Specifications	Symbol	Capacity	Parts specifications
AI	A02B–0200–K100	F1	7.5A	A60L–0001–0245#GP75
		F3	3.2A	A60L–0001–0075#3.2
		F4	5AS	A60L–0001–0046#5.0
BI	A02B–0200–K101	F1	7.5A	A60L–0001–0245#GP75
		F3	5A	A60L–0001–0075#5.0
		F4	5AS	A60L–0001–0046#5.0

Table 2. Uses of each fuse

Symbol	Uses
F1	For inputting 200VAC
F3	For power supply of 9″monochrome CRT or LCD
F4	For I/O unit, etc.

2.11 MAINTENANCE OF HEAT PIPE TYPE HEAT EXCHANGER

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.

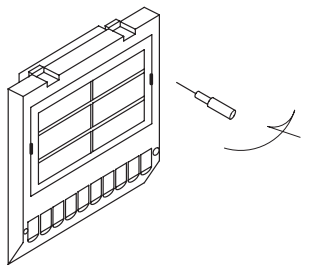
Air filter cleaning and replacement

Air filter cleaning and replacement method

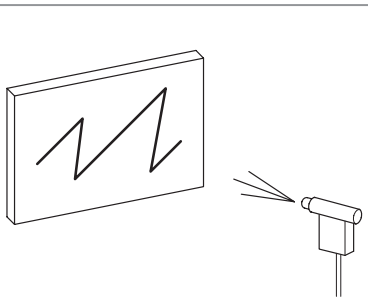
Procedure

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.

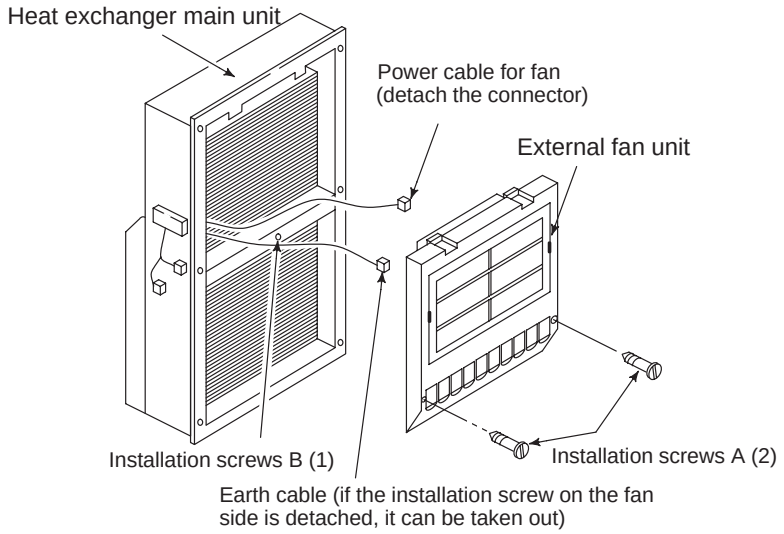
Cleaning heat exchanger

Cleaning heat exchanger

Procedure

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.



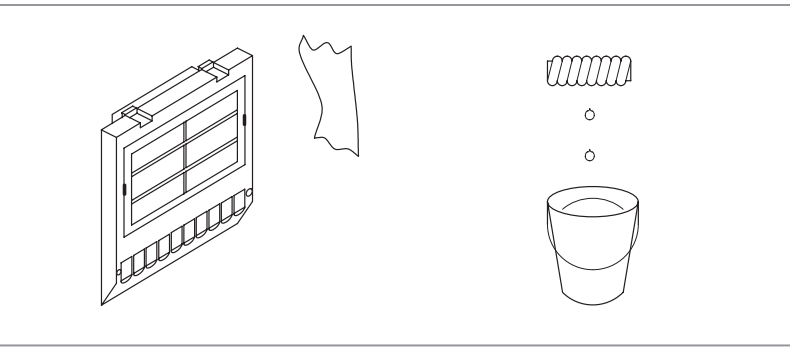
Detach the two installation screws (A) of the external fan unit, and detach the unit from the main unit by sliding it down. Detach the power source cable to the fan and the earth cable. Also detach installation screws (B).

- **Cleaning fan unit**

Method of cleaning fan unit

Procedure

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

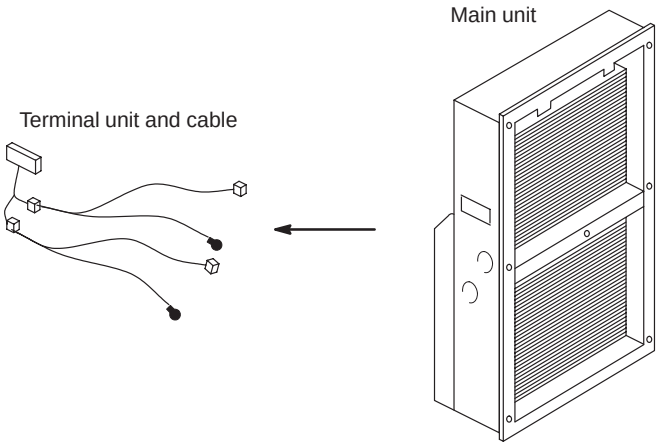
Procedure

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

Procedure

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.

Procedure

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

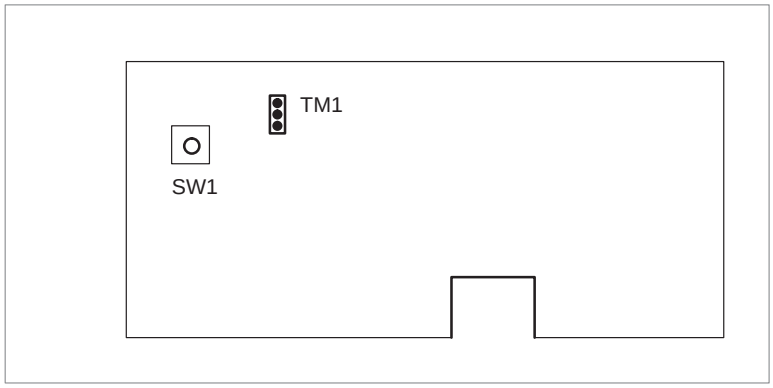
2 Install the fan unit in the original position. At this time, do not forget to connect the fan power cable and the earth cable.

2.12 HOW TO REPLACE THE COLOR LIQUID CRYSTAL DISPLAY

The color liquid crystal display is provided with a setting switch tuner for precisely adjust video signal.
This setting is required for each NC unit and the cables used to display max. quality.

- **Tuning locations**

Color Liquid Crystal Display(Rear Part)



- **Tuning flicker (TM1)**

If the display flickers, set TM1 to another position. Doing so usually eliminates the flicker.

- **Setting display position in horizontal direction**

1 Screen display can be moved by dot unit in horizontal direction.
2 Adjust SW1 to the location where whole object is displayed, There is only one location, that fits a screen.
Usually it is not required to tune this setting, because the most suitable position has been set before shipment.

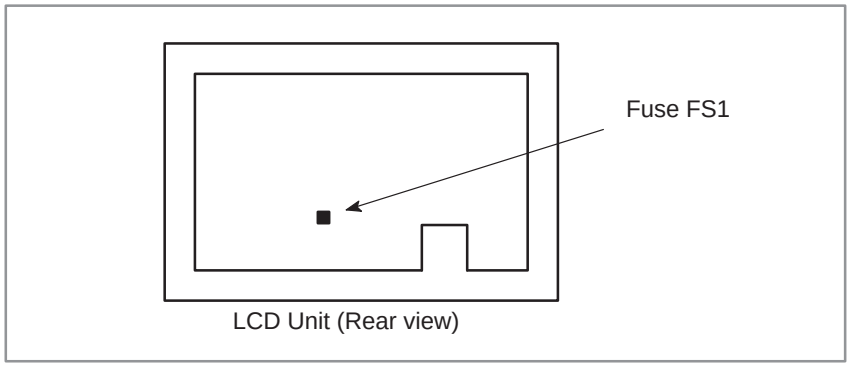
- **Others**

Do not change setting or the volume, etc. except above descriptions.

2.13 REPLACING THE LCD FUSE

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

- **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 : A20B–0200–K103 *
Rating : 5.0 A

***In–house code : A60L–0001–0290#LM50**

2.14 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 (5,000 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.
Remark) When the screen display is not required, the display and backlight can be turned off by pressing a key.
Doing so will increase the useful life of the backlight.
Suppressing the screen display

While holding down the CAN key, press any function key (for example, the POS key).

Restoring the screen display

Press any function key (for example, the POS key).

3 INPUT AND OUTPUT OF DATA

After you change a SRAM module, you must set various data again. This chapter describes the procedures to input and output the parameters, the part programs and the tool offset values.

3.1 SETTING PARAMETERS FOR INPUT/OUTPUT

- **Setting procedure of parameters**

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                                   FCV

      0    0    0    0    0    0    0    0
0012  RMV                 MIR
   X  0    0    0    0    0    0    0    0
   Y  0    0    0    0    0    0    0    0
   Z  0    0    0    0    0    0    0    0
   B  0    0    0    0    0    0    0    0
0020 I/O  CHANNEL
                              S    0 T0000

REF **** *** ***          10:15:30
[ 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) 1234 | EOB | 4567 | EOB | 9999 | INPUT

0		1234
0	⇒	4567
0		9999
0		0

(Ex.2) 1234 | EOB | EOB | 9999 | INPUT

0		1234
0	⇒	0
0		9999
0		0

3 To set the same data use =.

(Ex.) 1234 | EOB | = | EOB | = | INPUT

0		1234
0	⇒	1234
0		1234
0		0

4 For bit parameters,

(Ex.) 1 | 1 | EOB | = | EOB | = | 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.

3.2 INPUTTING/ OUTPUTTING DATA

The main CPU memorized the following data.
Outputting the data 1/O device while the CNC is rurnning normally

(1) CNC paramter
(2) PMC parameter
(3) Pitch error compensation amount
(4) Custom macro variable values
(5) Tool compensation amount
(6) Part program (machining program, custom macro program)

3.2.1 Confirming the Parameters Required for Data Output

Be sure that data output cannot be done in an alarm status.
Parameters required for output are as follows :

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

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

0020	Selection of I/O channel

0 : Channel 1 (JD5A OF MAIN CPU)
1 : Channel 1 (JD5A OF MAIN CPU)
2 : Channel 2 (JD5B OF MAIN CPU)
3 : Channel 3 (JD5C OF OPTION 1)

In the examples of following operations, data is input/output by connecting an I/O device to JD5A.

	#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/output data.
1 : ASCII code is used.

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

0102	Pecification number of input/output device

0	RS–232–C (control codes DC1 to DC4 used)
1	FANUC bubble cassette B1/B2
2	FANUC Floppy cassette adapter F1
3	PROGRAM FILE Mate. FANUC FA card adapter ,FANUC Floppy cassette adapter, FSP–H
4	Not used
5	Portable tape reader
6	FANUC PPR, FSP–G, FSP–H

0103	Baud Rate

1: 50 5: 200 9: 2400
2: 100 6: 300 ☆10: 4800
3: 110 7: 600 11: 9600
4: 150 8: 1200 12: 19200 [BPS]

3.2.2 Outputting CNC Parameters

In case of PPR, steps 2 and 3 are not required.

1. Select **EDIT** mode.
2. PROG Press PROG key and soft key **PRGRM** to select a program text.
3. Press soft key **[(OPRT)]** and soft key ▷.

   And then, put out the head of file by pressing **[FSRH]** 0 **[EXEC]**.
4. Press SYSTEM key and soft key **[PARAM]** to display parameter screen.
5. Press soft key **[(OPRT)]** ,and soft key ▷.
6. Press soft key **[PUNCH]** and **[EXEC]**,and the parameters are started to be output.

3.2.3 Outputting PMC Parameters

1. Select MDI 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.
   [X] [X] [X] [X] [X] [X] [1] [X] [INPUT]
   Where, mark x is a former value
   Thus, data input/output screen has been selected.
7. Select EDIT mode.
8. Press soft key [◁] then key [▷].
9. 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.
10. In CHANNEL NO item, input [1] [INPUT] to select I/O channel 1.
11. In DEVICE item, press soft key **[FDCAS]** to select the floppy cassette.
12. In KIND DATA item, press soft key **[PARAM]**.
13. In FUNCTION item, press soft key **[WRITE]**.
14. In FILE No item, specify a file name. In this example input as follows:
    [¿] [P] [M] [C] [INPUT]
15. Press soft key **[EXEC]**. Then PMC parameters are started to be output.
16. After the PMC parameters have been output, set PARAMETER WRITE to 0.
17. Press [RESET] to release alarm 100.

3.2.4 Outputting Pitch Error Compensation Amount

1. Select EDIT mode.
2. Press [SYSTEM] key several times, press soft key **[PARAM]**,and **[PITCH]** to select the SETTING screen for pitch error amount.
3. Press soft key **[(OPRT)]** and [▷].
4. Press soft key **[PUNCH]** and **[EXEC]**, then pitch error compensation amount is started to be output.

3.2.5 Outputting Custom Macro Variable Values

When custom macro function is equipped, values of variable no. 500 and later are output.

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

3.2.6 Outputting Tool Compensation Amount

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.

3.2.7 Outputting Part Program

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

	#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.

3.2.8 Inputting CNC Parameters

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 Confirm that PARAMETER WRITE=1.
   3 Press SYSTEM key to select the parameter screen.
   4

0020	Selectionof I/O channel

☆ 0 : Channel 1 (JD5A of MAIN CPU board)
1 : Channel 1 (JD5A of MAIN CPU board)
2 : Channel 2 (JD5B of MAIN CPU board)
3 : Channel 3 (JD5C of Option 1)

5

	#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

0102	Specification number of I/O device

0	RS–232–C (control codes DC1 to DC4 are used.)
1	FANUC Bubble cassette B1/B2
2	FANUCFloppy cassette F1
3	PROGRAM FILE Mate, FANUC FA Card adapter, FANUC Floppy casette adapter, FSP–H
4	Not used
5	Portable tape reader
6	FANUC PPR, FSP–G, FSP–H

7

0103	Baud rate

1:	50	5:	200	9:	2400
2:	100	6:	300	☆10:	4800
3:	110	7:	600	11:	9600
4:	150	8:	1200	12:	19200 [BPS]

3. Press soft key [▷]
4. Press soft key **[READ]** and **[EXEC]**. Then input of parameters are started.
5. Because alarm 300 will generate for the system with absolute pulse coder, set parameter 1815#5 to 0.

	#7	#6	#5	#4	#3	#2	#1	#0
1815			APCx					

#5(APCx) 0 : Position detector is other than absolute pulse coder.

1 : Position detector is absolute pulse coder.

6. After the parameters have been input, turn off the power once then turn it on.

3.2.9 Inputting PMC Parameters

Set the emergency stop state.
Operation of 12 is not required when PPR is used.

1. Turn off (KEY4=1) the program protect key.
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.
   [0] [0] [0] [0] [0] [0] [1] [0] [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. In FILE NO item, press [2] [INPUT] to select file no. 2.
13. Press soft key **[EXECT]** and the PMC parameters are started to be input.
14. After data has been read, turn off power and turn it on.

3.2.10 Inputting Pitch Error Compensation Amount

1. Release the emergency stop and select EDIT mode.
2. Confirm that PARAMETER WRITE=1 on the setting screen.
3. Press [PROG] key and soft key **[PRGRM**] to display program contents.
4. Press soft key **[(OPRT)]**, [▷] , **[F SRH]**, and [3] **[EXEC]** to select the pitch error compensation file.
5. Press [SYSTEM] key several times, soft key **[PARAM]**, [▷] and **[PITCH]** to select the screen for pitch error compensation amount.
6. Press soft key **[(OPRT)]** and [▷] key.
7. Press soft key **[READ**] and **[EXEC]**, then the pitch error compensation amount is started to be input.
8. After data has been input, press [OFFSET SETTING] key twice to display the SETTING screen and return the PARAMETER WRITE to 0.

3.2.11 Inputting Custom Macro Variable Values

If the system is equipped with the custom macro fucntion, input the variable values.
For PPR, item 4 is not required.

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)]**, [▷], **[F SRH]**, and [ ] **[EXEC]** to select a file.
5. Press soft key **[(OPRT)]** and key [▷].
6. Press address O, 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.
7. Select MEMORY mode on the machine operator's panel and press cycle start button.
   When the program is executed, macro variables are set.
8. Press [OFFSET SETTING] key, [▷] key and soft key **[MACRO]** to select the custom macro variable screen.
9. Press 500 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]**.
10. Select EDIT mode again.
11. Press [PROG] key to select the program display screen.

12. Press address O and a program number (0001 for example) ,then press DELETE to delete the program.

3.2.12 Inputting Tool Compensation Amount

Item 4 is not required for PPR.

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

3.2.13 Inputting Part Programs

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

	#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.

	#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.

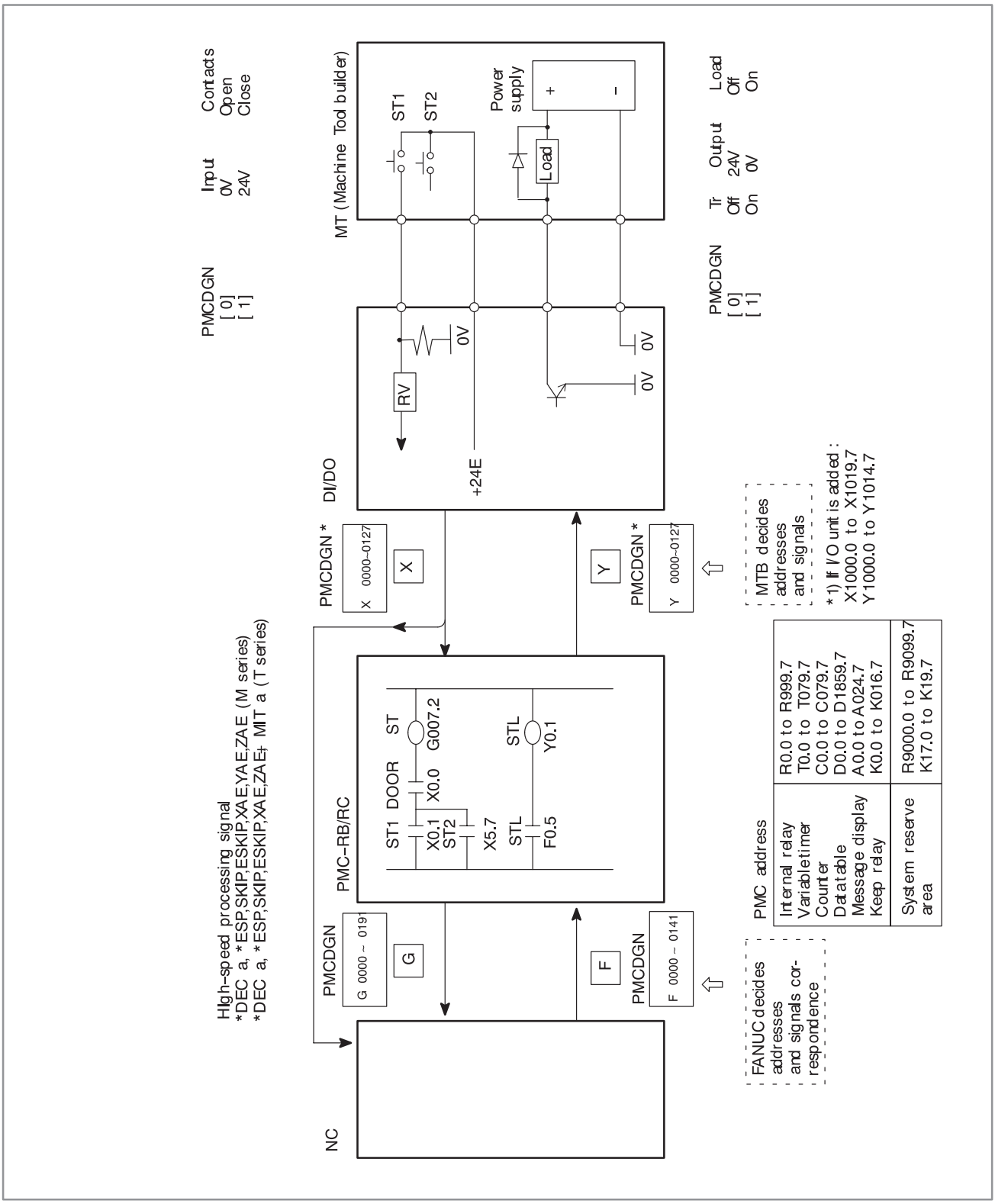
For PPR, item 4 is not required.

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)]**, ▷ **[F SRH]**, and X **[EXEC]** to select a part program file.
5. Press soft ◁ key ,**[(OPRT)]** and ▷ key.
6. Press soft key **[READ]** and **[EXEC]**, then data input is started.

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 CNC, and confirmation method of on/off state of these signals.
It also describes system configuration of PMC, parameters of PMC, ladder and how to display time chart of the signals on the CRT.
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–RC3
Programming method language		Ladder C
Number of ladder level		3
Level–1 Cycle Time		8 ms
Basic Instruction Execution Time		0.10 (μs/step)
Program capacity		
• Ladder (step)		
		Approx. 16,000
		Approx. 24,000
• Symbol/comment (Note 1)		1 to 128KB
• Message		0.1 to 64KB
• Language only		max. 896KB
Instruction	(Basic)	12 kinds
	(Function)	68 kinds
Internal relay	(R)	1618 byte
Message request	(A)	25 byte
Non–volatile		
• Var. Timer	(T)	80 byte
• Counter	(C)	80 byte
• Keep relay	(K)	20 byte
• Data table	(D)	3000 byte
Subprogram	(P)	512 programs
Label	(L)	9999 labels
Fixed timer		Timer No. 100 devices specified
Input/output		
• I/O Link	(I)	1024 points max.
	(O)	1024 points max.
• I/O card	(I)	156 point max.
	(O)	120 point max.
Sequence program storage media		Flash memory

Note
Normal size of a symbol, a comment, and a message are 32KB, and 2.1KB, respectively. Max. size of a symbol and a comment are each 64KB.

4.2.2 Address

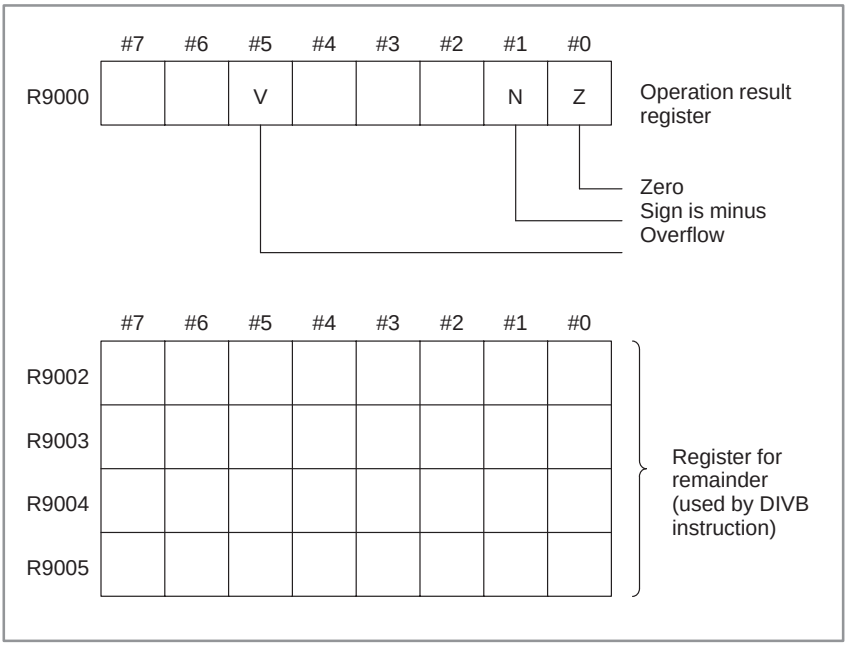
	Type	Byte	Address	Explanation
G	PMC⇒CNC	256	G000.0~G255.7	
F	CNC⇒PMC	256	F000.0~F255.7	
Y	PMC⇒MT	143	Y000.0~Y127.7	FANUC I/O LINK
			Y1000.0~Y1014.7	I/O card *(1)
X	MT⇒PMC	148	X000.0~X127.7	FANUC I/O LINK
			X1000.0~X1019.7	I/O card *(1)
A	Message display	25	A000.0~A024.7	
R	Internal relay	1100	R000.0~R999.7	In case of RC C Max.R1499.7 is available
			R9000.0~R9099.7	Operation result, system reserve area
T	Variable timer	80	T000.0~T079.7	
K	Keep relay	20	K000.0~K016.7	
			K017.0~K019.7	System reserve area
C	Counter	80	C000.0~C079.7	
D	Data table	1860	D0000.0~D1859.7	In case of RC C Max. D2999.7 is available

*(1) No address can be changed when I/O is used.

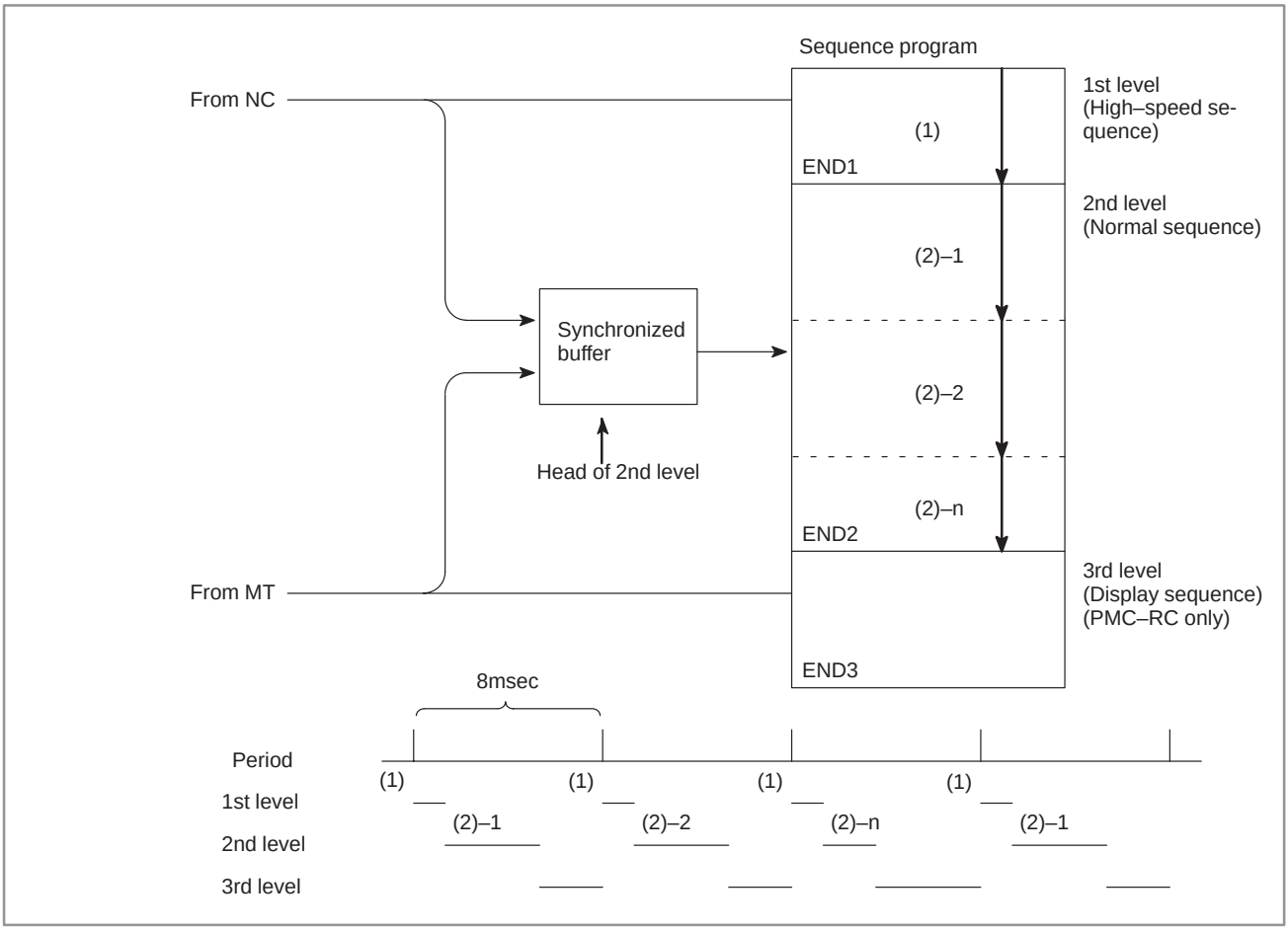
4.2.3 Built–in Debug Function

Function	Contents
Display of sequence program	Dynamic display of ladder diagram
Diagnostic function	•Title data display • signal status (symbol can be displayed) • PMC alarm display • Signal trace • Memory contents display (PMC–RC only) • Signal waveform display (PMC–RC only) • Task status display (PMC–RC only) • I/O connection status display (PMC–RC only)
Setting and displaying data	• Timer • Counter • Keep relay • Data table
Sequence program edit function	Ladder diagram editing (This feature is integrated in PMC–RC)

4.2.4 System Reserve Area of Internal Relay



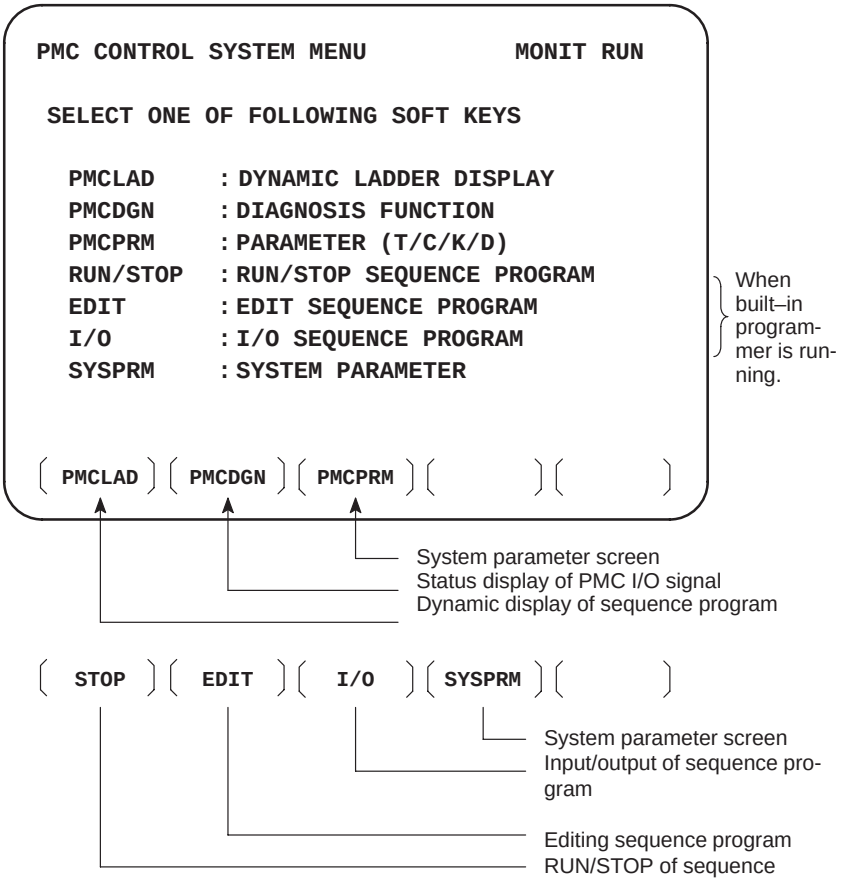
4.2.5 Execution Period of PMC



4.3 PMC SCREEN

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:



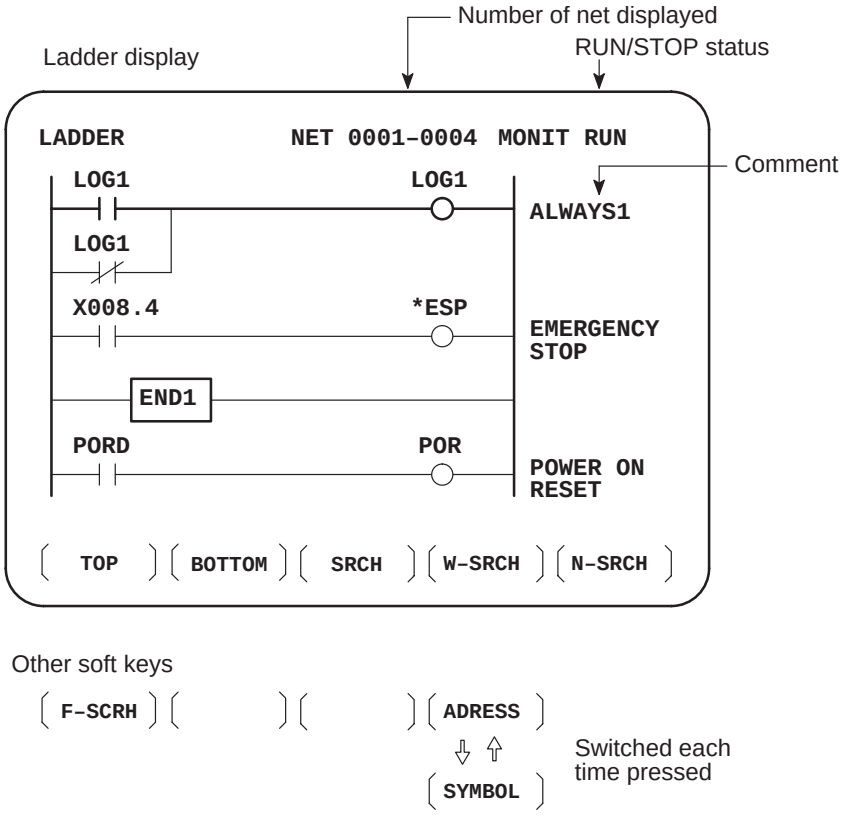
The no. of menus to be displayed changes depending on presence/absence of built–in programmer.

	PMC–RC3
RUN/STOP	○
EDIT	○
I/O	○
SYSPRM	○

X: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. Green (Low brightness) display Contacts :open Relay :off
2. White (High brightness) display Contacts : closed Relay : on

- **Search method**

1. Use the 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]

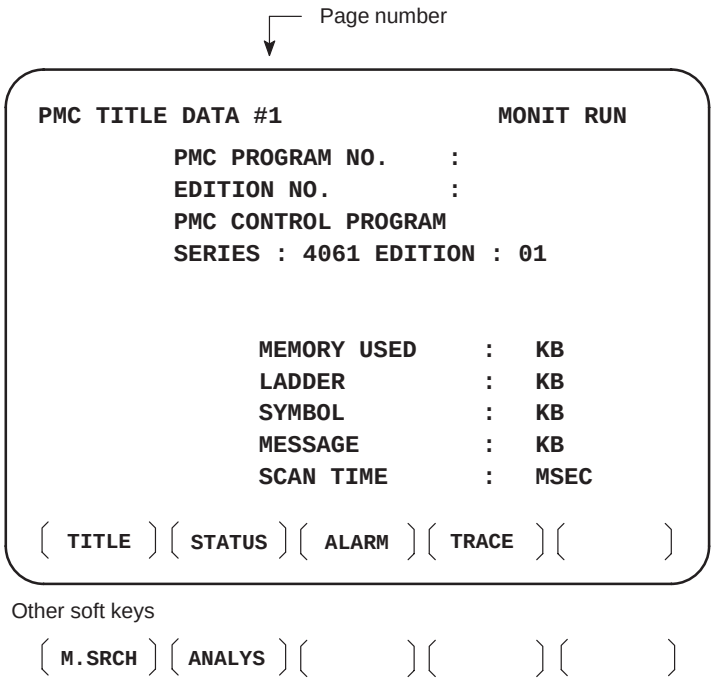
- The search function searches a signal in the forward direction and displays the ladder with the searched signal at its head. Because there may exist plural contacts, repeat the search operation to find plural locations, repeat the search operation to find plural locations with the specified signal.
- 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.

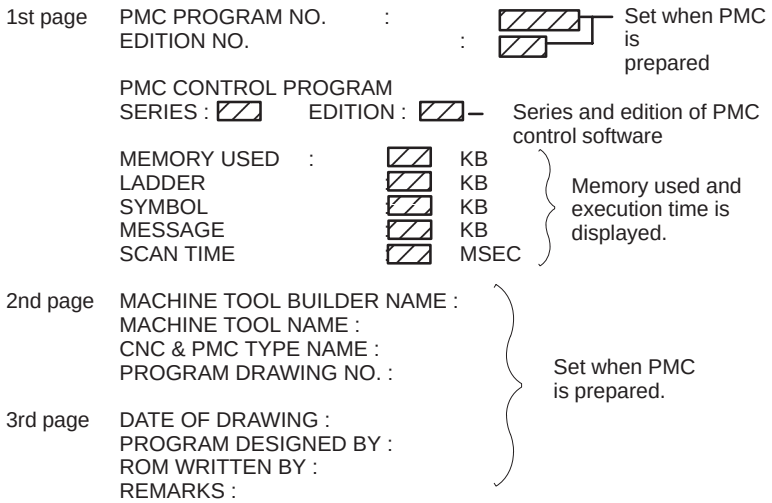
4.3.3 PMCDGN SCREEN

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

● TITLE screen

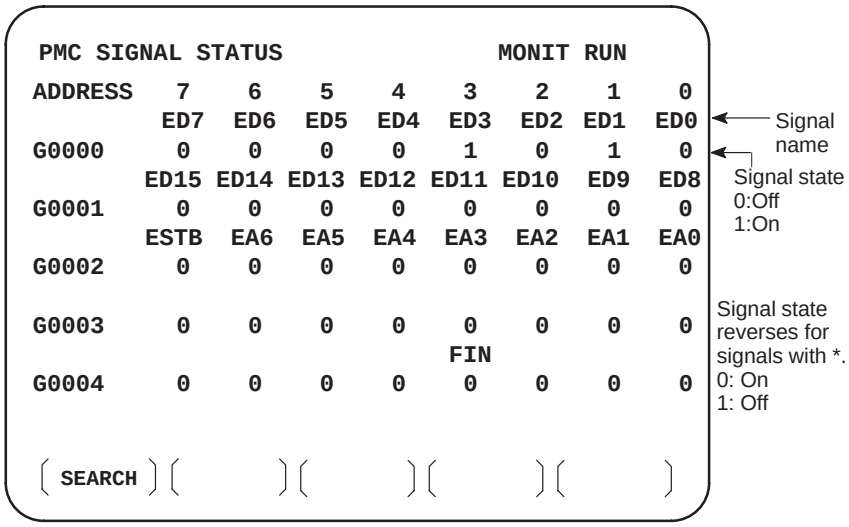
The title data registered when a ladder program is prepared is displayed.





- **STATUS screen**

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

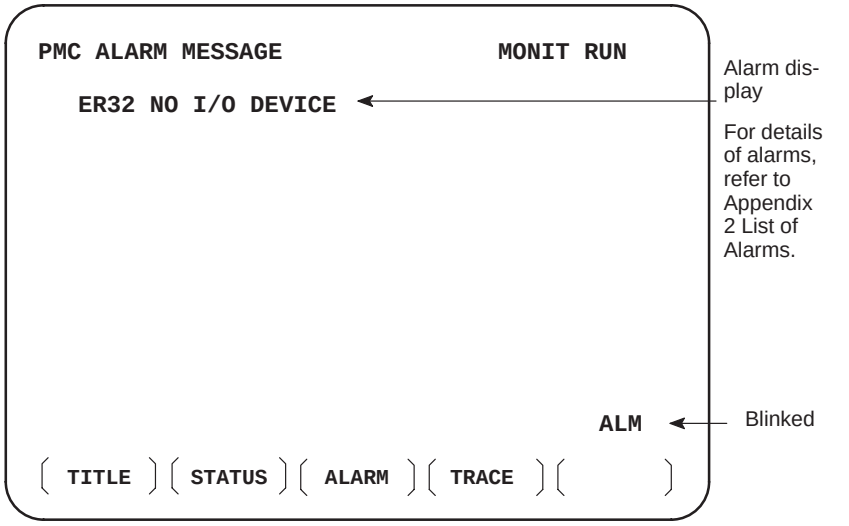


[Search Method]

- 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.



● 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)
1STTRACE  ADDRESS  CONDITION
  ADDRESS  TYPE     : (0:PMC/1:PHY)
  ADDRESS           :
  MASK  DATA        :
2NDTRACE  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.

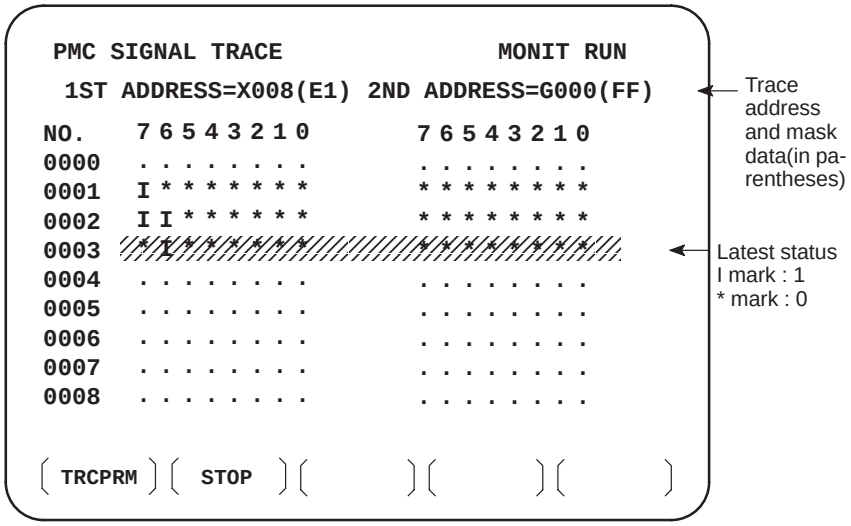
d. MASK DATA: The bits to be traced are specified by a hexadecimal number (2 digits).
   For example, to trace the signals at bit 7,6,5 and 0, set E1 (hexadecimal) to MASK DATA.

	#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



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.

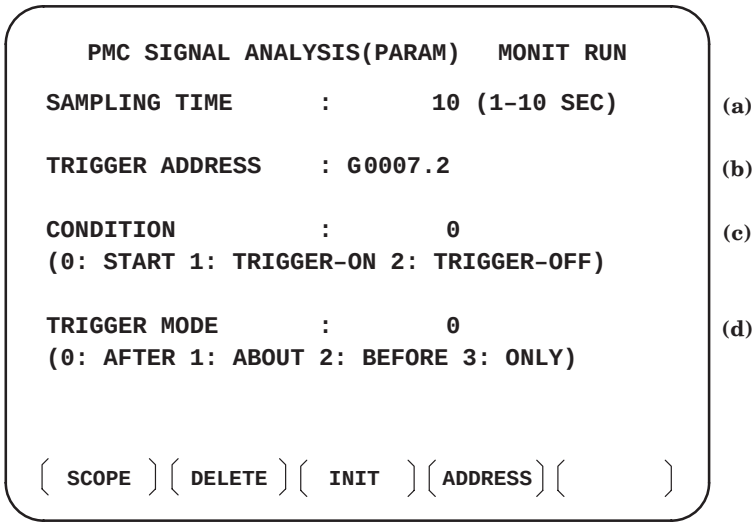
#5 0 : Tracing starts by **[EXEC]**.

1 : Tracing starts automatically after power on.

- **ANALYS screen**

(Optional function of PMC–RC)
Change of signals is displayed as the same display as that on the oscilloscope.

1 Parameter setting screen (1st page)



Select each item by cursor key

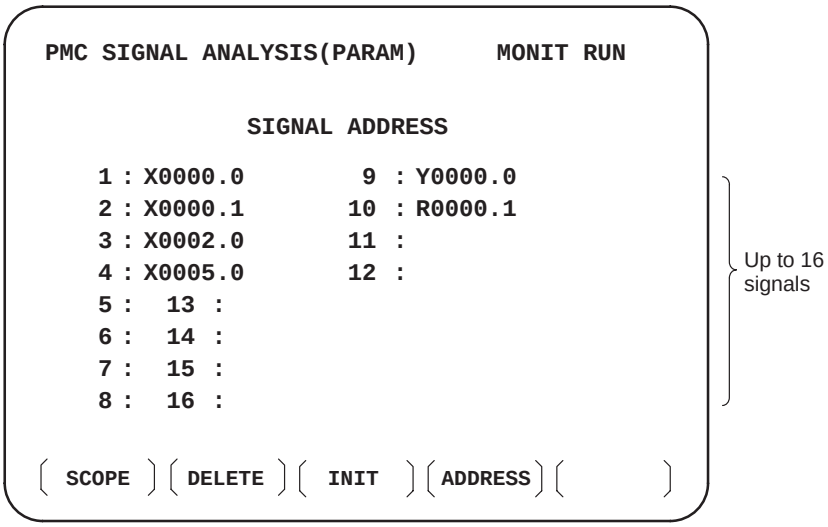
(a) Set a sampling time.

(b) Specifies an address from which recording of signals is started.

(c) Set a condition under which recording is initiated.
- 0 : Started by soft key **[START]**
- 1 : Started by rise of a trigger signal after you press the soft key **[START]**
- 2 : Started by fall of a trigger signal after you press the soft key **[START]**

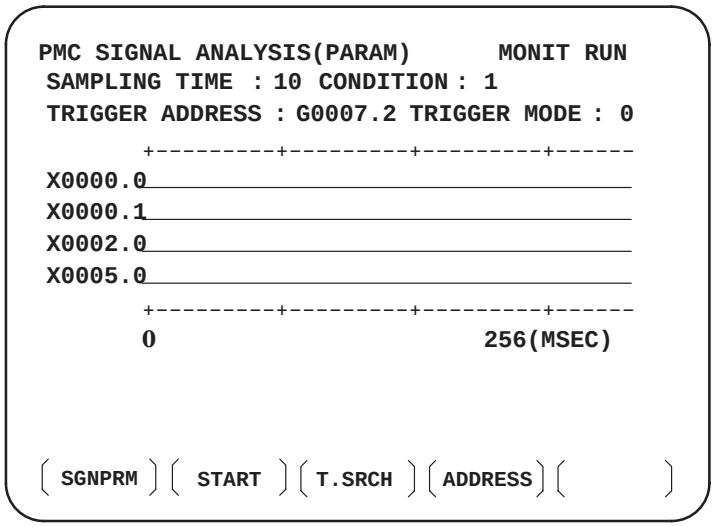
(d) Set a trigger mode
- 0 : Record signal status after the trigger condition is satisfied.
- 1 : Record signal status before and after the trigger condition is satisfied.
- 2 : Record signal status before the trigger condition is satisfied.
- 3 : Record signal status when the trigger condition is satisfied. (Display is same as trace memory).

2 Parameter setting screen (2nd page)



a. Soft key **[SCOPE]**: Select signal waveform display screen
b. Soft key **[DELETE]**: Delete data on the cursor position
c. Soft key **[INIT]** : Initialize parameters of signal waveform display
d. Soft key **[ADDRESS]** or **[SYMBOL]** : Switch addresses and symbols for display

3 SCOPE screen



The above screen is for a system with graphic display.
I and * are used for display if graphic function is not equipped.

a. Soft key **[SGNPRM]** : Returns to parameter screen.

b. Soft key **[START]** or **[STOP]** :Start or stop the record.
(If TRIGGER MODE=3, signal is displayed when you press STOP key.)

c. Soft key **[T.SRCH]** :Displayed for a specified time.

d. Soft key **[ADDRESS]** or **[SYMBOL]** :Switch addresses and symbols for display

e. Soft key **[EXCHG]** : Change order of signals displayed.
·Press soft key **[EXCHG]**
·Move the cursor to a signal to be changed.
·Press soft key **[SELECT]**.
·Move the cursor to the destination.
·Press **[TO]** and **[EXEC]**, then the signal changes its order.

f. Soft key **[SCALE]**: Changes time scale for graphic display. Scale changes from 256 to 512, and to 1024 msec every time you press the key.

g. Cursor key ⬅ ➡ : Scrolls time axis forward and backward

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

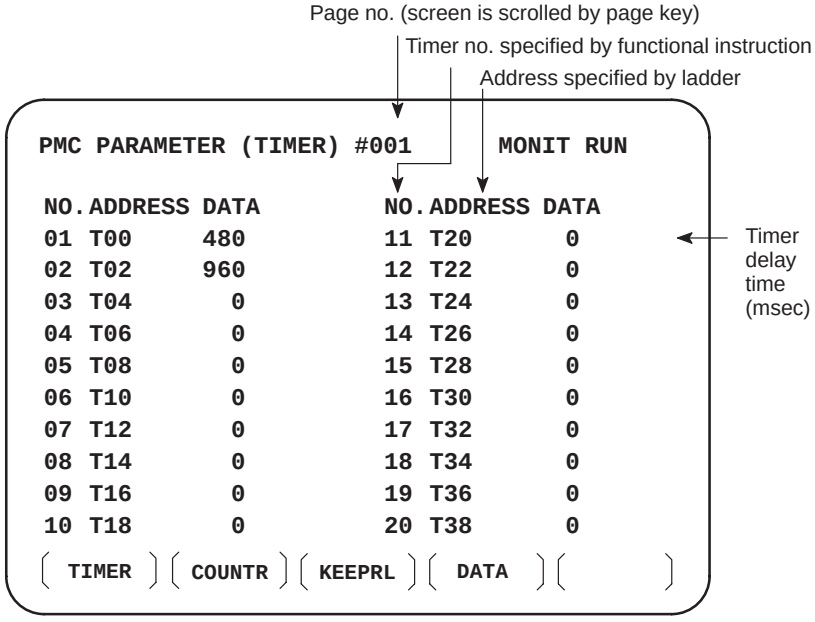
4 Press cursor key and move the cursor to a desired number.

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**

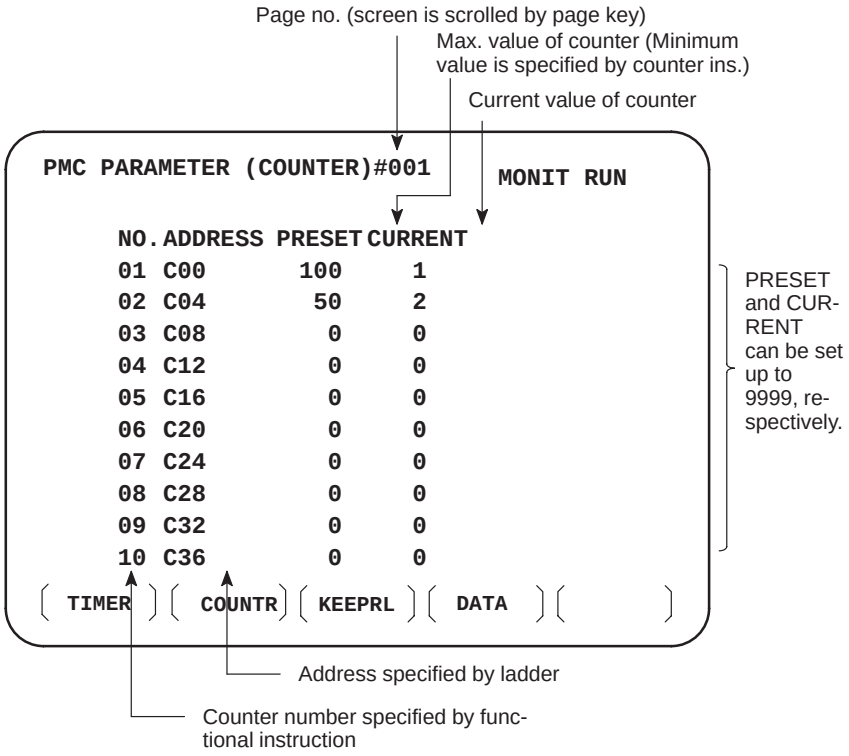
This screen is used for setting timer time of the functional instruction (SUB 3).



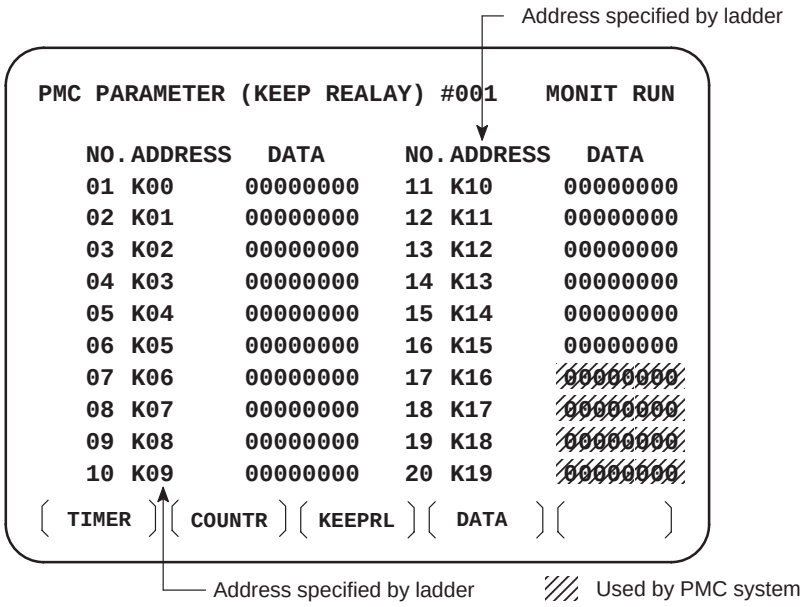
Timer set time : Timer no. 1 to 8 is max. 1572.8 sec and its accuracy is 48ms.
Timer no. 9 to 40 is max. 262.1 sec and its accuracy is 8ms.

- **COUNTER screen**

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



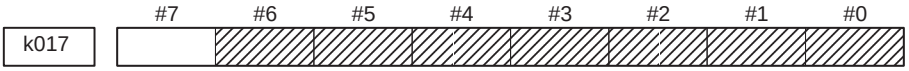
- **KEEP RELAY screen**



1 Nonvolatile memory control

#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.



#6(PMC–RC) 0: Pressing **[EXEC]** key initiates sampling by signal waveform display function.
1: Turning power to on initiates sampling by signal waveform display function.

#5 0 : Signal tracing starts by soft key **[EXEC]** in signal trace function.
1 : Signal tracing starts automatically by power on in signal trace function.

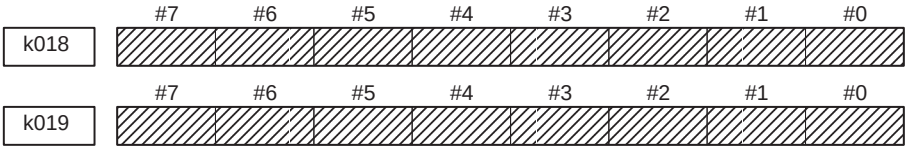
#4 0 : Data input cannot be done in memory contents display function.
1 : Data input can be done in memory contents display function.

#3(PMC–RB) 0 : Executes ladder in the ROM
1 : Executes ladder in the RAM module.

#2 0 : Ladder is not executed at power on.
1 : Ladder is automatically executed at power on.

#1 0 : Built–in programmer is not used.
1 : Built–in programmer is used.

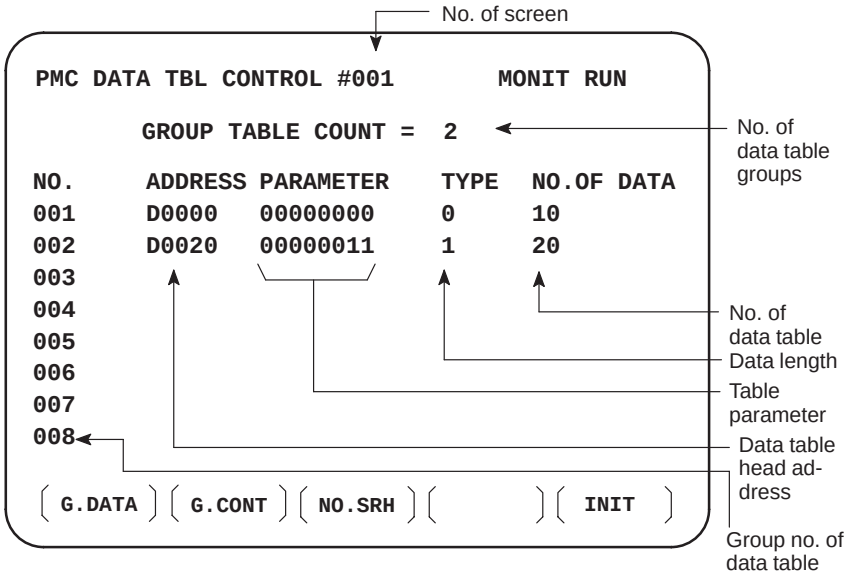
#0 0 : Dynamic display of ladder is executed.
1 : Dynamic display of ladder is not executed.



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)

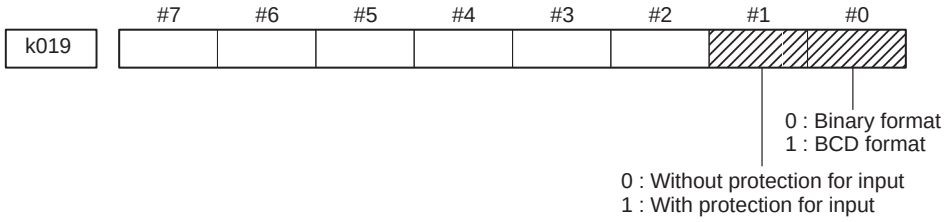
b. NO. OF GROUPS **[G.CONT]**: Set the no. of groups of data table.

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

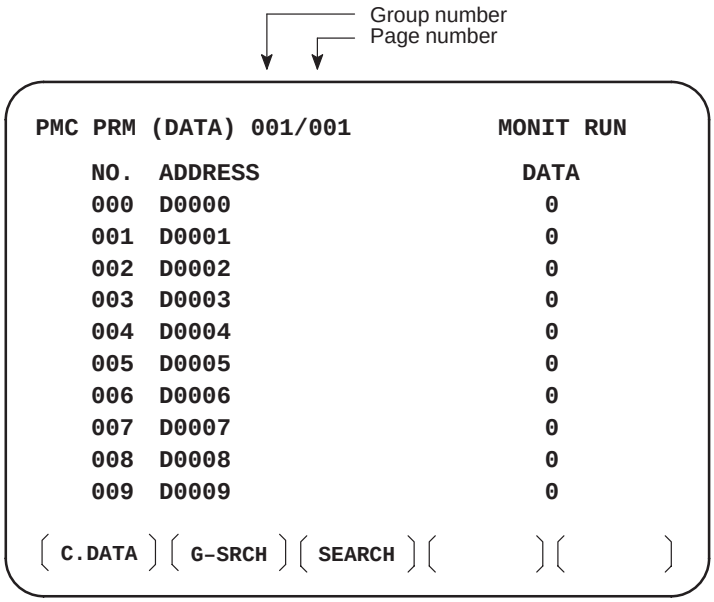


TYPE

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



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 LIST OF SIGNALS BY EACH MODE

- **Automatic operation**

MODE		INPUT/OUTPUT SIGNAL	FEED RATE, ETC
AUTOMATIC OPERATION	EDIT	[PMC ⇒ CNC] KEY3(Program protect key)	
	MEM MDI RMT	[PMC ⇒ CNC) ST (Cycle start) *SP (Feed hold) SBK (Single block) DRN (Dry run) BDT1~9 (Block delete) MIα (Mirror image) PN1~8 (External program no. search) MINP (External program input) DNCI (DNC input mode) HSα1A~D (Handle interrupt axis select) AFL (Auxiliary function neglect) FIN, MFIN2, MFIN3 (Auxiliary function complete) MFIN, TFIN, BFIN (High speed M/S/T function complete)	[PMC ⇒ CNC] *FV0~7 (Feed rate override) *AFV0~7 (2nd feed rate override) OVC (Override cancel) ROV1,ROV2, HROV, *HROV0~6 (Rapid traverse override)
		[CNC ⇒ PMC] STL (Cycle start LED) SPL (Feed hold LED) MF, M00~M31 / MF2, M200~M215 / MF3, M300~M315 (Miscellaneous function) TF, T00~T31 (Tool function) BF, B00~B31 (2nd miscellaneous func.) DEN (Distribution end) OP (automatic operating) GR1O~GR3O(Gear selection)	

● Manual operation

MODE			INPUT/OUTPUT SIGNAL	FEED RATE, ETC
MANUAL OPERATION	Handle/ incremental		[PMC ⇒ CNC] HSnA~D (Axis selection) n:1~3(No. of MPGs)	[PMC ⇒ CNC] MP1, MP2 (Multiplier)
	JOG		[PMC ⇒ CNC] RT (Rapid traverse)	[PMC ⇒ CNC] *JV0~15 (Manual feedrate override) +α, –α (Manual feed move command) ROV1, ROV2 HROV *HROV0~6 (Rapid traverse override)
		ZRN	[PMC ⇒ CNC] ZRN(Reference position return mode) [MT ⇒ CNC] *DECα (Reference position deceleration)	
			[CNC ⇒ PMC] ZPα ZP2α, ZP3α, ZP4α (Reference position return completion)	

● Laser oscillator operation

[PMC→CNC]	
RUN	Oscillator start
CLRDY	Chiller prepared completion
HVON	Discharge start completion
AGRDY	Assist gas prepared
AGST	Assist gas start
SHTON	Shutter open
*SHTLC	Shutter lock
BEMON	Beam on
*BEMLC	Beam lock
POV0～7	Power override
*DU1～16	Pulse duty override
*FOV0～7	Pulse frequency override
*AOV0～7	Assist gas presure override
PTS	Piercing time shortening
PTE	Piercing time extension
SCLON	Guide light on
[CNC→PMC]	
PURGE	Purge completion
WAIT	Oscillator starting
CLON	Chiller start request
LRDY	Discharge start prepared completion
RFHV	Base discharge starting
LSTR	Oscillating
AG1, AG2, AG3	Assist gas selection
WKP	Process pressure busy
SHTONL	Shutter on state
SHTOFL	Shutter off state
BEAM	Beam outputing
CW, PULSE	Mode state output
MWRN	Laser power alarm
LARM	Laser alarm

● Laser relation

[PMC→CNC]	
ZTRM	Tracing axis selection
ZAPR	Approach feed
TCST	Tracing start
TRCKM	Tracing check mode
REST2	Program restart
ALNAXS	Manual point fxing operation mode
HNDCD	Hand coordinate mode
NRSH	Proximity point search busy
[CNC→PMC]	
TRCL	Tracing operation
TRALM	Tracing alarm
TRERS	Tracing impossible start
LNSR	Proximity point search

● Others

Others	[PMC ⇒ CNC] MD1~4 (Mode selection) *ESP (Emergency stop) KEY1~4 (Memory protection key) MLK,MLKα (All axes/ each axis 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) EXLM (Stored stroke limit external switching) ±LMα, RLSOT (Software limit external setting) *±Lα (Overtravel limit) *±EDα (External deceleration of each axis)
	[CMC ⇒ PMC] MA (NC ready) SA (Servo ready) AL (NC alarm) RST (Resetting) BAL (Battery alarm) INPα (In–position) MVα (Axis moving)

4.5 SIGNAL AND SYMBOL CORRESPONDENCE TABLE

	SYMBOL	PMC address	Signal names
A	*ABSM	G006.2	Manual Absolute Signal
	AFL	G005.6	Auxiliary Function Lock Signal
	*AFV0~7	G013.0～7	2nd Feedrate Override Signal
	AGRDY	G221.7	Assist Gas Prepared Signal
	AGST	G222.5	Assist Gas Start Signal
	AG1, AG2, AG3	F222.0～2	Assist Gas Select Signal
	AL	F001.0	Alarm Signal
	ALMA, B	F045.0, F049.0	Spindle Alarm Signal
	ALNAXS	G226.2	Manual Point Fxing Operation Mode Signal
	*AOV0～7	G229.0～7	Assist Gas Pressure override Signal
	AR0~15	F040.0～7. F041.0～7	Actual Spindle Speed Signal
	ARSTA, B	G071.0. G075.0	Spindle Alarm Reset Signal
B	BAL	F001.2	Battery Alarm Signal
	BDT1~9	F044.0, F045.0～7	Optional Block Skip Signal
	BEAM	F221.7	Beam In–outputting Signal
	*BEMLC	F222.1	Beam Lock Signal
	BEMON	F222.4	Beam On Signal
	BF	F007.7	B Function Strobe Signal
	BCLP	F061.1	B Axis Clamp Signal
	BUCLP	F061.0	B Axis Unclamp Signal
	*BECLP	G038.7	B Axis Clamp Completion Signal
	*BEUCL	G038.6	B Axis Unlamp Completion Signal
	B00~B31	F030～033	B Function Binary Code Signal
	BFIN	G005.7	B Function Completion Signal
	BGEACT	F053.4	Background Editing Signal

	SYMBOL	PMC address	Signal names
C	CDZ	G053.7	Chamfering Signal
	CHPA, B	F046.0 F050.0	Power Cable Switching Signal
	CFINA, B	F046.1 F050.1	Switch Completion Signal
	CLON	F221.4	Chiller Start Request Signal
	CLRDY	F221.6	Chiller Prepared Signal
	CON	G027.7	Cs Axis Contouring Control Signal
	CSS	F002.2	Constant Surface Speed Control Signal
	CTHαA, B	G070.2, 3, G074.2, 3	Clutch/Gear Selection Signal
	CW, PULSE	F222.6, 5	Mode State Output Signal
D	*DEC1~8	X009.0~7	Reference Position Return Deceleration Signal
	DEN	F001.3	Distribution End Signal
	DM00	F009.7	Decoded M00 Signal
	DM01	F009.6	Decoded M01 Signal
	DM02	F009.5	Decoded M02 Signal
	DM30	F009.4	Decoded M30 Signal
	DNCI	F043.5	Operation by I/O device Mode
	DRN	G046.7	Dry Run Signal
	DTCH1~8	G124.0~7	Controlled Axis Detach Signal
	*DU1～16	G220.0～4	Duty Override Signal
E	*ESP	X008.4, G008.4	Emergency Stop Signal
	ERS	G008.6	External Reset Signal
	ENB	F001.4	Spindle Enable Signal
	ENB2, 3	F038.2, 3	2nd/3rd Spindle Enable Signal
	EF	F008.0	External Operation Function Signal
	EFIN	G005.1	External Operation Completion Signal
	*±ED1~8	G118.0~7 G120.0~7	External Deceleration Signal
	ESTB	G002.7	External Data Input Strobe Signal
	EA0~6	G002.0~6	External Data Input Address Signal
	ED0~15	G000.0~7 G001.0~7	External Data Input Data Signal
	EREND	F060.0	Read End Signal
	ESEND	F060.1	Search End Signal

	SYMBOL	PMC address	Signal names
E	ENBKY	F053.7	Key Enable Signal
	EXSTP	G058.2	External Read/Punch Stop Signal
	EXWT	G058.3	External Punch Start Signal
	EXRD	G058.1	External Read Start Signal
	EXLM	G007.6	Stored Stroke Limit 1/2 Select Signal
F	FIN	G004.3	M, S, T, B Function Finish (Completion) Signal
	*FLWP	G007.5	Follow–up Signal
	F1D	G016.7	F 1 digit Selection Signal
	*FOV0～7	G228.0～7	Frequency Override Signal
	FSCSL	F044.1	Cs Axis Contouring Control Mode Select Completion Signal
	*FV0~7	G012.0~7	Feedrate Override Signal
G	GRα 0	F034.0~2	Gear Selection Output Signal
	GRα	G028.1, 2 G029.0~2	Gear Selection Input Signal
	GOQSM	G039.7	Offset Write mode Input Signal
H	HA, HB		Output Signal from MPG
	HNDCD	G226.3	Hand Coordinate Mode Signal
	HSnA~D	G018.0~7 G019.0~3	Manual Handle Feed Axis Select Signal
	HSαIA~D	G041.0~7 G042.0~3	Handle Interrupt Axis Select Signal
	HROV	G096.7	Rapid Traverse Override Select Signal
	*HROV0~6	G096.0~6	Rapid Traverse Override Signal
	HVON	G222.7	Discharge Start Signal
I	*IT	G008.0	All Axis Interlock Signal
	*IT1~8	G130.0~7	Each Axis Interlock Signal
	INHKY	F053.0	Inhibit Key Input Signal
	INCH	F002.0	Inch Input Signal
	INP1～8	F104.0~7	In–position Signal
J	*JV0~15	G010~011	JOG Feedrate Override Signal
	±JI~J8	G100.0~7 G102.0~7	Feed Axis Direction Signal
K	KEY1~4	G046.3~6	Memory Protection Key Signal

	SYMBOL	PMC address	Signal names
L	*±L1~8	G114.0~7 G116.0~7	Overtravel Limit Signal
	LARM	F221.0	Laser Alarm Signal
	±LM1~8	G110.0~7 G112.0~7	Software Limit External Set Signal
	LNSR	F225.1	Proximity point Search Busy Signal
	LRDY	F221.1	Discharge Start Prepared Signal
	LSTR	F221.6	In–oscillating Signal
M	MA	F001.7	NC Ready Signal
	MABSM	F004.2	Manual Absolute Confirmation Signal
	MAFL	F004.4	Auxiliary Function Lock Confirmation Signal
	MBDT1~9	F004.0 F005.0~7	Optional Block Skip Confirmation Signal
	MCFNA, B	G071.3 G075.3	Power Cable Condition Verification Signal
	MD1~4	G043.0~2	Mode Selection Signal
	MDRN	F002.7	Dry Run Confirmation Signal
	MD10~40	F073.0~2	Software Operation Panel Mode Output Signal
	MDTCH1~8	F110.0~7	Controlled Axis Detach Confirming Signal
	MEDT	F003.6	EDIT Mode Confirmation Signal
	MINP	F058.0	External Data Input Start Signal
	±MIT1~8 (Tseries)	X004.2~5	Tool Compensation Measured Value Direct Input B Signal
	±MIT1~4 (Mseries)	G132.0~3 G134.0~3	Interlock Signal for Each axis and Direction Signal
	MI1~8	G106.0~7	Mirror Image Signal
	MF	F007.0	M Function Strobe Signal
	MF2	F008.4	2nd M Function Strobe Signal
	MF3	F008.5	3rd M Function Strobe Signal
	MFIN	G005.0	M Function Finish (Completion) Signal
	M00~M31	F010~13	M Function Binary Code Signal
	M200~215	F014~015	2nd M Function Binary Code Signal
	M300~315	F016~017	3rd M Function Binary Code Signal
	MLK	G044.1	Machine Lock Signal
	MLK1~8	G108.0~7	Each Axis Machine Lock Signal
	MH	F003.1	H Mode Confirmation Signal

	SYMBOL	PMC address	Signal names
M	MINC	F003.0	INC Mode Confirmation Signal
	MJ	F003.2	J Mode Confirmation Signal
	MMDI	F003.3	MDI Mode Confirmation Signal
	MMEM	F003.5	MEM Mode Confirmation Signal
	MMLK	F004.1	Machine Lock Confirmation Signal
	MMI1~8	F108.0~7	Mirror Image Confirmation Signal
	MP1, MP2	G019.4, 5	Incremental Feed Multiply Signal
	MRDYA, B	G070.7 G074.7	Machine Ready Signal
	MRMT	F003.4	RMT Mode Confirmation Signal
	MREF	F004.6	REF Mode Confirmation Signal
	MSBK	F004.3	Single Block Confirmation Signal
	MTCHIN	F003.7	TCHIN Mode Confirmation Signal
	MV1~8	F102.0~7	Axis Moving Signal
	MVD1~8	F106.0~7	Axis Moving Direction Signal
	MWRN	F220.6	Laser Power Alarm Signal
N	NRSH	G226.0	Proximity Point Search Signal
O	OFN0~5	G039.0~5	Offset Number Input for Tool Compensation Measured Signal
	OP	F000.7	Automatic Operation Signal
	ORCMA, B	G070.6 G074.6	Spindle Orientation Command Signal
	OUT0~7	F072.0~7	Software Operator’s Panel General Purpose Switch Signal
	OVC	G006.4	Override Cancel Signal
P	PA, PB		Power Unit Ready Signal
	PC2SLC	G028.7	Position Coder 1/2 Select Signal
	PN1~8	G009.0~3	Workpiece Number Search Signal
	POV0～7	G223.0～7	Power Override Signal
	PRC	G040.6	Position Recode Signal
	PRGDPL	F053.1	Program Screen Display Signal
	PRTSF	F062.7	Required Machined Parts Reach Signal
	PSW1~10	F070.0~ F071.2	Position Switch Signal
	PTE	G221.3	Piercing Time Extension Signal
	PTS	G221.2	Piercing Time Shortening Signal

	SYMBOL	PMC address	Signal names
P	PURGE	G221.2	Purge Completed Signal
R	RCHA, B	G071.7 G075.7	Power Cable Condition Verification Signal
	RCHPA, B	F046.2 F050.2	Output Switching Request Signal
	RCFNA, B	F046.3 F050.3	Spindle Switch Completion Signal
	REST2	G226.1	Program Restart Signal
	RFHV	F221.5	Base In–discharging Signal
	RGTAP	G061.0	Rigid Tapping Signal
	RGSPM	F065.1	Spindle Rotate CCW Signal in Rigid Tapping Mode
	RGSPP	F065.0	Spindle Rotate CW Signal in Rigid Tapping Mode
	RLSOT	G007.7	Softeware Limit Release Signal
	ROV1, 2	G014.0, 1	Rapid Traverse Override Signal
	R01I~12I	G032.0	Spindle Speed 12–bit Binary Code Input Signal
	R01O~120	G036.0~ G037.3	Spindle Speed 12–bit Binary Code Output Signal
	RPD0	F002.1	Rapid Traverse Operation Mode Signal
	RPBSY	F053.2	Read/Punch Busy Signal
	RPALM	F053.3	Read/Punch Alarm Signal
	RRW	G008.6	Reset & Rewind Signal
	RSLA, B	G071.6 G075.6	Spindle Output Switching Request Signal
	RST	F001.1	Reset Signal
	RT	G019.7	Manual Rapid Traverse Signal
	RUN	G222.6	Control Start Signal
	RWD	F000.0	Rewinding Signal
S	SA	F000.6	Servo Unit Ready Signal
	SBK	G046.1	Single Block Signal
	SCLON	G222.2	Guide Light On Signal
	*SHTLC	G222.0	Shutter Lock Signal
	SHTOFL	G220.3	Shutter Off State Signal
	SHTON	G222.3	Shutter Open Signal
	SHTONL	F220.4	Shutter On State Signal
	ST	G007.2	Cycle Start Signal

	SYMBOL	PMC address	Signal names
S	STL	F000.5	Cycle Start Lamp Signal
	*SP	G008.5	Feed Hold Signal
	SPL	F000.4	Feed Hold Lamp Signal
	SF	F007.2	S Function Strobe Signal
	S00~S31	F022~025	S Function Binary Code Signal
	SFIN	G005.2	S Function Finish (Completion) Signal
	SFRA, B	G070.5 G074.5	Spindle Forward Direction Signal
	SRVA, B	G070.4 G074.4	Spindle Reverse Direction Signal
	SVC		Spindle Velocity Command (Analog Voltage) Signal
	SAR	G029.4	Spindle Speed Arrival Signal
	*SSTP	G029.6	Spindle Stop Signal
	*SSTP2, 3	G027.4, 5	2nd/3rd Spindle Stop Signal
	SOR	G029.5	Spindle Orientation Command
	SOV0~7	G030	Spindle Speed Override Signal
	SOCNA, B	G071.4 G075.4	Spindle Soft–start/Stop Cancel Signal
	SVF1~8	G126.0~7	Servo Enable Off Signal
	STLK	G007.1	Start Lock Signal
	SKIP	X004.7	Skip Signal
	SIND	G033.7	Spindle Control Selection Signal
	SSIN	G033.6	Spindle Polarity Selection Signal
	SGN	G033.5	Output Voltage Polarity Signal
	SRN	G006.0	Program Restart Signal
	SMZ	G053.6	Error Detect Signal (In–position Check)
	SPAL	F035.0	Spindle Alarm Signal
	SPSTP	G028.6	Spindle Stop Confirmation Signal
	SCLP	F038.0	Spindle Clamp Signal
	SUCLP	F038.1	Spindle Unclamp Signal
	*SCPF	G028.5	Spindle Clamp Completion Signal
	*SUCPF	G028.4	Spindle Unclamp Completion Signal
	SPPHS	G038.3	Spindle Synchronous Phase Control Signal
	SPSYC	G038.2	Spindle Synchronous Control Signal

	SYMBOL	PMC address	Signal names
S	SPSLA, B	G071.2 G075.2	Spindle Selection Signal
	STRD	G058.5	Data Input & Operation Simultaneous Mode Signal
	STWD	G058.6	Data Output & Operation Simultaneous Mode Signal
	SWS1~3	G027.0~2	Spindle Switch Signal
	SYNC1~4	G138.0~3	Simple Synchronous Axis Selection Signal
	SUNC4J	G140.3	Simple Synchronous Manual 4th Axis Selection Signal
T	TAP	F001.5	Tapping Mode Signal
	TCST	G225.3	Tracing Start Signal
	TF	F007.3	T Function Strobe Signal
	T00~T31	F026~029	T Function Binary Code Signal
	TFIN	G005.3	T Function Finish (Completion) Signal
	THRD	F002.3	Threading Mode Signal
	TL1~256	G047.0~7 G048.0	Tools Group Number Signal
	TLRST	G048.7	Tool Change Reset Signal
	TLSKP	G048.5	Tool Skip Signal
	TLCH	F064.0	Tool Change Command Signal
	TLNW	F064.1	New Tool Select Signal
	TLMLA, B	G070.0 G074.0	Low–speed Torque Limit Signal
	TLMHA, B	G070.1 G074.1	High–speed Torque Limit Signal
	TMRON	G053.0	General Purpose Timer ON Signal
	TRALM	F220.7	Tracing Alarm Signal
	TRCKM	G225.2	Tracing Check Mode Signal
	TRCL	F220.2	Tracing Operation
	TRERS	F220.0	Tracing Impossible Start Signal
U	UI0~UI15	G054~055	Input Signal by Custom Macro Function Signal
	UO0~131	F054~059	Output Signal by Custom Macro Function Signal
	UINT	G053.3	Custom Macro Interrupt Signal
W	WAIT	F221.3	Control Busy Signal
	WKP	F220.5	Process Pressure Busy Signal

	SYMBOL	PMC address	Signal names
W	WOSQM	G039.6	Work Coordinate System Shift Amount Write Mode Signal
	WOSET	G040.7	Work Coordinate System Shift Amount Write Input Signal
X	XAE	X004.0	Automatic Tool Compensation X Axis Reach Signal
Y	YAE	X004.1	Automatic Tool Compensation Y Axis Reach Signal
Z	ZAPR	G225.1	Approach Feed
	ZRN	G043.7	Reference Position Return Mode Signal
	ZP1~8	F094.0~7	1st Reference Position Return Completion Signal
	ZP21~28	F096.0~7	2nd Reference Position Return Completion Signal
	ZP31~38	F098.0~7	3rd Reference Position Return Completion Signal
	ZP41~48	F100.0~7	4th Reference Position Return Completion Signal
	ZRF1~8	F102.0~7	Floating Reference Position Return Completion Signal
	ZAE	X004.2	Automatic Tool Compensation Z Axis Reach Signal
	ZTRM	G225.0	Tracing Axis Selection Signal

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 machine tool.

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 15 to 26 and 39 to 84.

1 For185V input amplifier (A06B–xxxx–B□□□)

Format number	42	54	56	57	58	59	60
Drawing number (Item of xxxx)	0531	0506	0561	0562	0564	0571	0572
Model name	5–0	30/ 2000	0L	5L	6L	7L	10L

2 For 200V to 230V input amplifier (A06B–xxxx–B□□□)

Format number	43	44	45	46	47	48	49
Drawing number (Item of xxxx)	0532	0433	0371	0372	0313	0314	0316
Model name	4–0S	3–0S	2–0SP	1–0SP	0S	5S	6S

Format number	50	51	52	53	80	82	
Drawing number (Item of xxxx)	0315	0505	0502	0590	0382	0384	
Model name	10S	20S/ 1500	20S	30S	5T	10T	

3 For 200V to 230V input amplifier (for large motor) (A06B–xxxx–B□□□)

Format number	39	40	41				
Drawing number (Item of xxxx)	0331	0332	0333				
Model name	50S	60S	70S				

4 For 200V to 230V input amplifier (for high speed motor) (A06B–xxxx–B□□□)

Format number	61	62	63	64	65	66	67
Drawing number (Item of xxxx)	0371	0373	0313	0514	0317	0318	0319
Model name	2–0SP	1–0SP/	0S	5S/ 3000	10S/ 3000	20S/ 3000	30S/ 3000

Format number	73	78	79	81	83	84	
Drawing number (Item of xxxx)	0320	0583	0381	0383	0385	0374	
Model name	6S/ 3000	40S/ 2000	0T/ 3000	5T/ 3000	10T/ 3000	00SP	

5 For 185V input amplifier (for L series high–speed motor) (A06B–xxxx–B□□□)

Format number	68	69	70	71	72		
Drawing number (Item of xxxx)	0561	0562	0564	0571	0572		
Model name	0L/ 3000	5L/ 3000	6L/ 3000	7L/ 3000	10L/ 2250		

6 For a series(A06B–xxxx–B□□□)

Format number	15	16	17	18	19	20	21
Drawing number (Item of xxxx)	0123	0127	0128	0142	0143	0147	0148
Model name	α3/ 3000	α6/ 2000	α6/ 3000	α12/ 2000	α12/ 3000	α22/ 2000	α22/ 3000

Format number	22	23	24	25	26
Drawing number (Item of xxxx)	0152	0153	0161	0162	0163
Model name	α30/ 2000	α30/ 3000	αM3	αM6	αM9

(3) ARBITARY AMR(for 5–0S to 3–0S)

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	2001	AMR7	AMR6	AMR5	AMR4	AMR3	AMR2	AMR1	AMR0

#7	#6	#5	#4	#3	#2	#1	#0	Motor model
1	0	0	0	0	0	1	0	5–0S
0	0	0	0	0	0	1	1	4–0S, 3–0S
0	0	0	0	0	0	0	0	other than above

Set “00000000” for serial pulse coder C.

(4) CMR

DGN	1820	Command multiply ratio

1 When CMR is 1/2 to 1/27 Set value= $\frac{1}{\text{CMR}}$ +100

2 When CMR is 0.5 to 48 Set value=2×CMR

(5) Turn off power once, then turn it to on.

(6) Feed gear N/M

PRM	2084	n of flexible feed gear
PRM	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

Examples of calculation

		1/1000 mm	1/10000 mm
1 rotation of motor	8mm	n=1/m=125	n=2/m=25
	10mm	n=1/m=100	n=1/m=10
	12mm	n=3/m=250	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	n=1/m=5
	10mm	n=1/m=4
	12mm	n=3/m=10

(7) Direction of Travel

PRM	2022	Direction of motor rotation

111 : Positive (CCW) –111 : Reverse (CW)

(8) No. of velocity pulses and position pulses

1 For serial pulse coder A or B and serial α pulse coder

	Parameter no.	Resolution 1/1000mm		Resolution 1/10000mm	
		Full close	Semi close	Full close	Semi close
High resolution setting	2000	xxxx xxx 0		xxxx xxx 1	
Separate detector	1815	0010 0010	0010 0000	0010 0010	0010 0000
Velocity feedback pulses	2023	8192		819	
Position feedback pulses	2024	NS	12500	NS/10	1250

2 For serial pulse coder C

	Parameter no.	Resolution 1/1000mm	
		Full close	Semi close
High resolution setting	2000	xxxx xxx1	
Separate detector	1815	0000 0010	0000 0000
Velocity feedback pulses	2023	4000	
Position feedback 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.

(9) Reference counter

PRM	1821	Reference counter capacity(0～99999999)

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.

	#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 (Hard-ware)
	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.

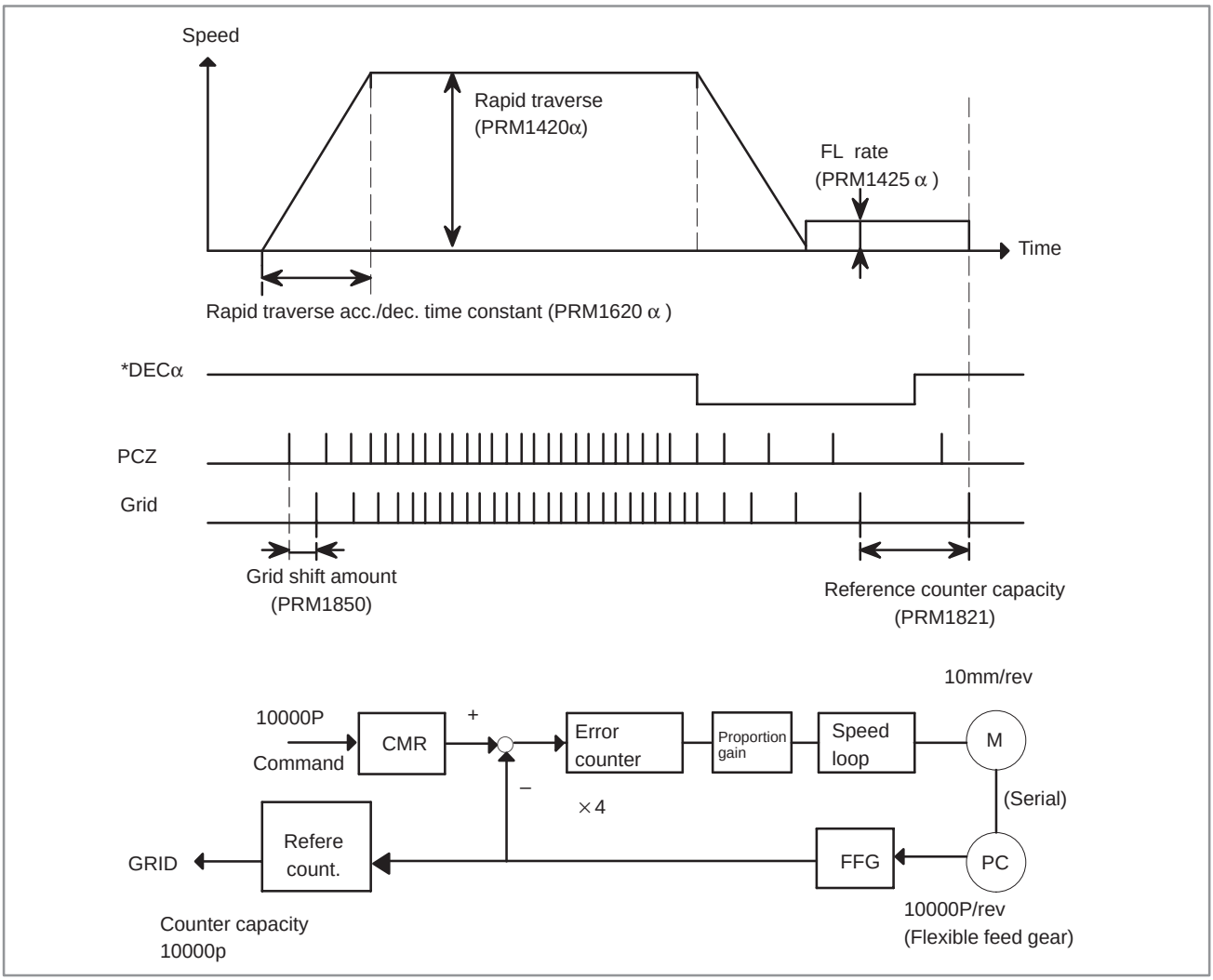
#5 (MCC) : Contacts of electro–magnetic contactor of servo amplifier is blown

#4 (LDM) : LED of serial pulse coder is abnormal.

#3 (PMS) : No. of feedback pulses are in error because serial pulse coder C 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]

When the resolution is 0.0001mm, set the value in the unit ten times the detection unit.

PRM	1815	#7	#6	#5	#4	#3	#2	#1	#0
				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 : Position detection is performed by the pulse coder built in the motor.

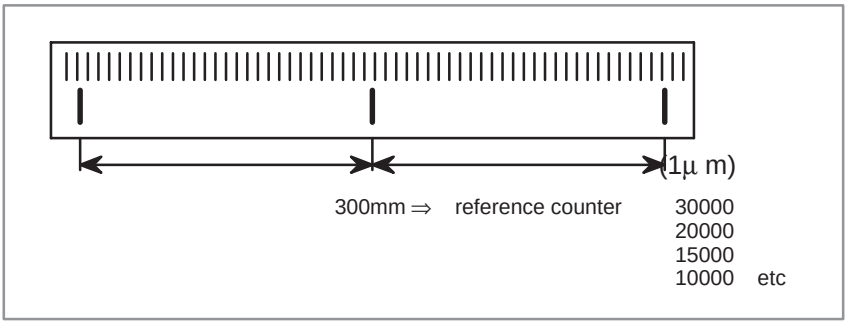
1 : Separate type pulse coder or linear scale is used.

- **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:

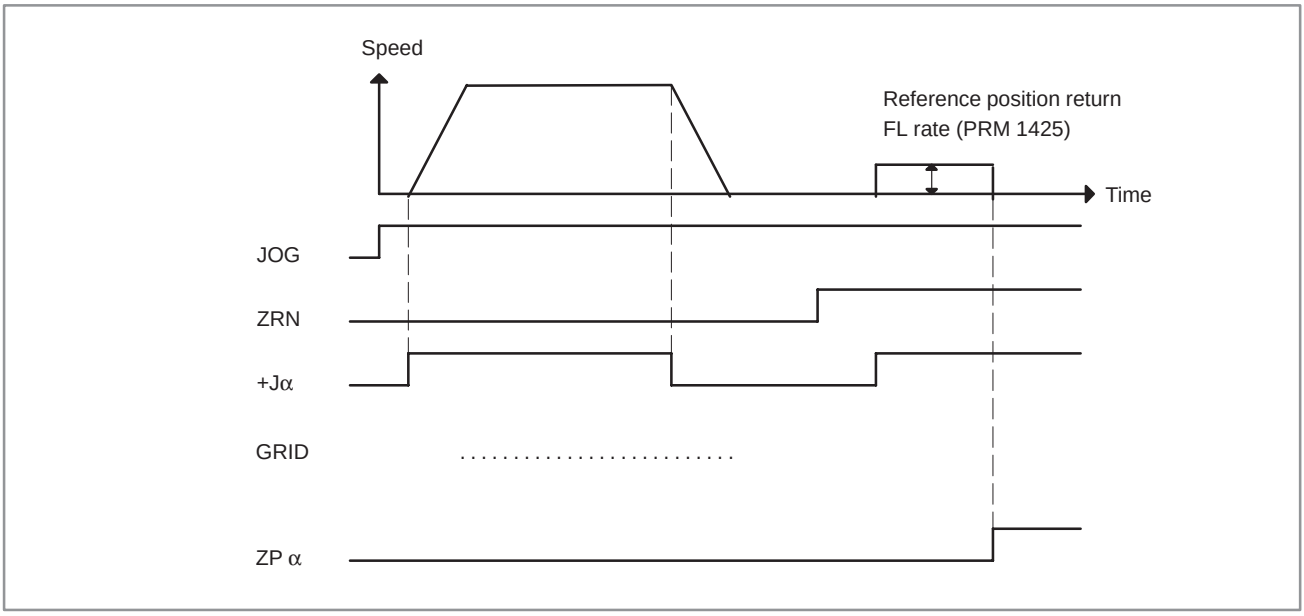
Example



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 –.

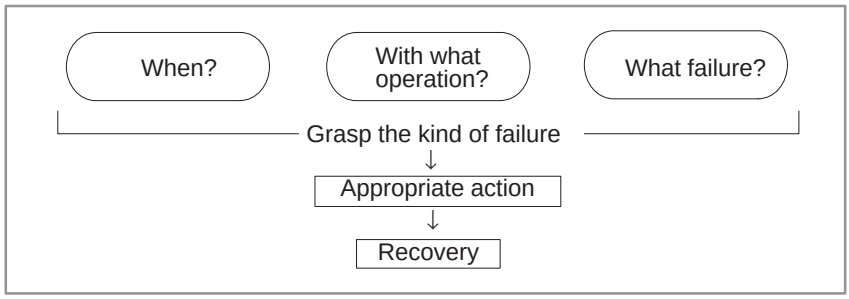
After ZRN signal becomes 1, manual feed direction is always the direction set by this parameter irrespective of an axis selection signal.

6 TROUBLESHOOTING

This chapter describes troubleshooting procedure. If your system employs FANUC CONTROL MOTOR α series, also refer to its manuals listed in preface of this manual.

6.1 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 :



6.1.1 Investigating the Conditions under which Failure Occurred

(1) When and how many times (frequency of occurrences)
(2) With what operation
(3) What failure occurred

1 When did the failure occur?

Date and time?
Occurred during operation? (how long was the operation?)
Occurred when the power was turned on?
Was there any lightening surge, power failure, or other disturbances to the power supply?
How many times has it occurred
Only once?
Occurred many times ? (How many times per hour, per day, or per month?)

2 With what operation did it occur ?

What was the NC mode when the failure occurred?
Jog mode/memory operation mode /MDI mode /reference position return mode
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 spindles>
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 45°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 NC unit
2) Name of the machine tool builder and type of machine
3) Software series/version of the NC
4) Specifications of the servo amplifier and motor

(for a failure related to the servo)

See the drawing issued by the machine tool builder for the locations of the NC unit and servo.

We use the following specification codes :
Servo : A06B–□□□□–H□□□
Servo : A06B–□□□□–B□□□
(□ represents a number)

6.2 POWER CANNOT BE TURNED ON

Points

Confirm the green LED PIL and red LED ALM on the front of power unit.

1) Proceed to item 1 when green LED PIL is turned off.
2) Proceed to item 2 when green LED is lit and red LED AML is turned off.
3) Check item 3 when red LED ALM is lit.

Causes and Remedies

1 LED is turned off

(1) Fuse F1 or F2 on the power unit front panel is blown.

(a) Input power voltage is too high.

(b) Power unit is faulty.

(2) Input voltage is low

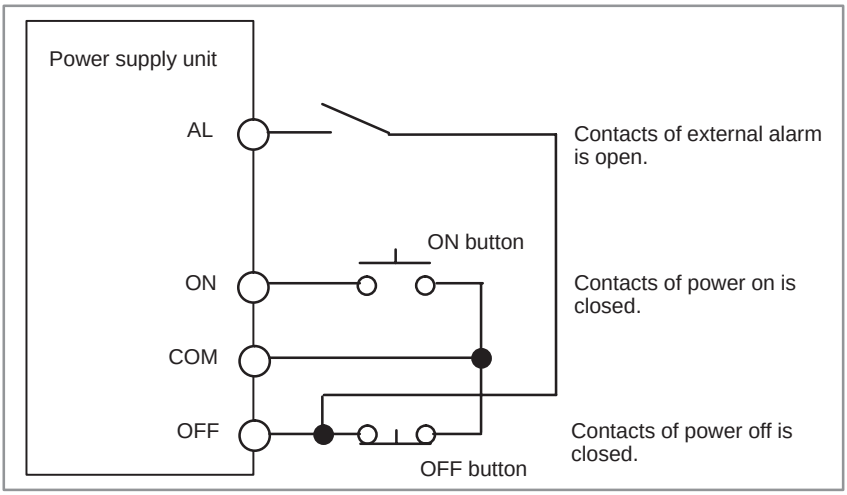
Measure voltage at R and S terminals of connector CPI to confirm appropriate voltage is supplied.
If it is not normal, check machine side magnetics circuit.

200VAC, +10%,	50/ 60Hz,	±1Hz, 1ϕ
220VAC, +10%,	60Hz,	±1Hz, 1ϕ

(3) Power supply unit is faulty.

2 Conditions for power on are not satisfied.(PIL is lit and ALM is off)

Conditions for power on are as follows:

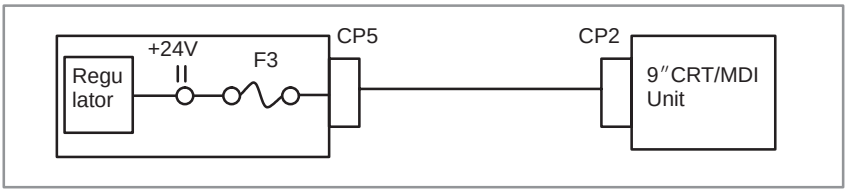


For details, refer to **2.5.1 Power Supply Unit**.

3 LED ALM is lit

(1) Fuse F3 is blown on the front panel of power unit

Check whether +24V is short–circuited or grounded. (See figure below).



For details, refer to 2.4.
9″CRT unit is faulty.

(2) Power supply unit is faulty.

(a) Remove connector CP2, CP3, CP5, and CP6.

(b) Turn off the power of the machine and retract the power unit from the controller.

(c) Turn on power of NC.

(d) When LED ALM is lit, power unit is faulty.
If ALM is not lit, power supply unit is normal.

Note
When a work is conducted with power supply unit removed, perform the work within 30 minutes (Data in memory may be lost)

(3) Load (+5V) is grounded or short–circuited

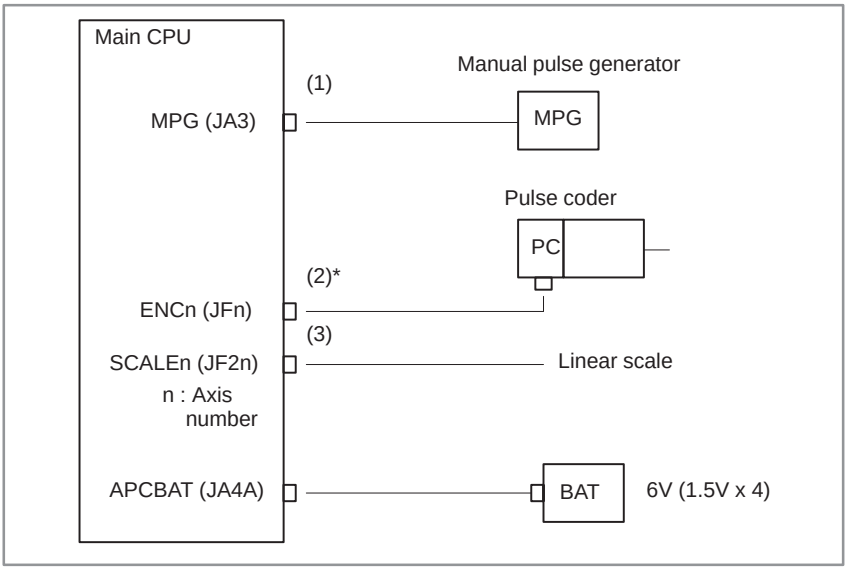
(a) With power supply unit installed on the control unit, turn off the power on the machine side.

(b) Remove cables (1) to (3) in the figure below, turn on power of NC and check LED ALM.

Note
To release lightening of ALM, turn off NC power.

(c) When LED ALM is turned off while removing the cable, the load connected by the removed wire may be faulty.

Notes
When removing the cable note the following :
1. If 6V battery is connected as shown below, absolute position of the machine may be lost when cable (2) is removed. Therefore, the machine position must be established by reference position return ,after releasing the alarm.
2. If 6V battery is not connected, the above operation is not needed.



(d) If AlM does not light by power on of NC, any of load connected to (1) to (3) may be faulty. Check whether grounding or short–circuiting exists or not. If it is present, replace the appropriate part or cable.

(4) Short–circuiting within the controller (PCB may be faulty)

Power is supplied to PCBs through the back panel.
Check it by the steps below :

1) Remove a PCB in a slot and turn on power, then confirm lightening of LED ALM. Repeat this operation to each PCB.
2) When ALM does not light at power on with a PCB removed, the PCB may be faulty.

Note
Perform an operation with a PCB removed within 30 minutes, otherwise data in memory may be lost.

6.3 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 CNC status display

(4) Check CNC 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
X1008				*ESP				
G0008				*ESP				

ESP=0 indicates that emergency stop signal is input.

2 When built–in I/O card is not used.

	#7	#6	#5	#4	#3	#2	#1	#0
X0008				*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 operation (JOG) mode
HND : Manual handle (MPG) mode
MDI : Manual data input (MDI) mode
MEM : Automatic operation (Memory) mode
EDIT : EDIT (Memory edit) mode

<Mode select signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1
						↓	↓	↓
Manual operation (JOG) mode						1	0	1
Manual handle (MPG) mode						1	0	0
Manual data input (MDI) mode						0	0	0
Automatic operation (Memory) mode						0	0	1
EDIT (Memory edit) mode						0	1	1

(2) Check 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 / START LOCK	: 1
	006	SPINDLE SPEED ARRIVAL CHECK (Example)	: 0
	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 [Position Error] >PARAM 1826
[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 servo alarm 400, 410, and 411.

b. Interlock or start lock signal is input

There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
3003					DIT	ITX		ITL

#0 ITL=0 shows interlock signal *IT is effective. To (1)
#2 ITX=0 shows interlock signal *ITn is effective. To (2)
#3 DIT=0 shows interlock signal ±MITn is effective. To (3)
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 Axis interlock signal (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130	*IT8	*IT7	*IT6	*IT5	*IT4	*IT3	*IT2	+IT1

*ITn=0 shows interlock signal is input.

3 Interlock signal per axis and direction (+/– MITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0132					+MIT4	+MIT3	+MIT2	+MIT1
G0134					–MIT4	–MIT3	–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.

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	
G0108	MLK8	MLK7	MLK6	MLK5	MLK4	MLK3	MLK2	MLK1

MLK : All axes machine lock

MLKn : Each axis machine lock

When the signal is 1, the corresponding machine lock signal is input.

6.4 JOG OPERATION CANNOT BE DONE

Points

(1) Check whether position display is operating.
(2) Check CNC 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
						↓	↓	↓
	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	+J8	+J7	+J6	+J5	+J4	+J3	+J2	+J1
G0102	–J8	–J7	–J6	–J5	–J4	–J3	–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 / START LOCK (Example)	: 1
	006	SPINDLE SPEED ARRIVAL CHECK	: 0
	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 [Position Error] >PARAM 1826 [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 servo alarm 400, 410, and 411.

b. Interlock or start lock signal is input

There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

		#7	#6	#5	#4	#3	#2	#1	#0
PARAM	3003					DIT	ITX		ITL

#0 ITL=0 shows interlock signal *IT is effective. To (1)
#2 ITX=0 shows interlock signal *ITn is effective. To (2)
#3 DIT=0 shows interlock signal ±MITn is effective. To (3)
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 Axis interlock signal (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130	*IT8	*IT7	*IT6	*IT5	*IT4	*IT3	*IT2	+IT1

*ITn=0 shows interlock signal is input.

3 Interlock signal per axis and direction (+/– MITn) is input

· M series

	#7	#6	#5	#4	#3	#2	#1	#0
G0132					+MIT4	+MIT3	+MIT2	+MIT1
G0134					–MIT4	–MIT3	–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

6.5 HANDLE OPERATION CANNOT BE DONE

Points

(1) Check another manual operation (JOG) is accepted.

(2) Check CNC status display

Causes and Countermeasure

1 JOG operation is not acceptable, either

Consult with item 8.3 and 8.4.

2 When only handle operation (MPG) 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 HND, mode selection is correct.
If it is not HND, mode select signal is not input correctly. Check the mode select signal using the PMC's diagnostic function(PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1
						↓	↓	↓
	Manuale handle mode					1	0	0

(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	HS2D	HS2C	HS2B	HS2A	HS1D	HS1C	HS1B	HS1A
G0019					HS3D	HS3C	HS3B	HS3A

When axis select switch for manual handle feed is selected on the machine operator's panel, if the signals are input as follows, it is normal.

Selected axis	HSnD	HSnC	HSnB	HSnA
no selection	0	0	0	0
1st axis	0	0	0	1
2nd axis	0	0	1	0
3rd axis	0	0	1	1
4th axis	0	1	0	0
5th axis	0	1	0	1
6th axis	0	1	1	0
7th axis	0	1	1	1
8th axis	1	0	0	0

In the above table, n is the number of the manual pulse generator (MPG) and up to 3 MPGs can be used.
A feed axis is selected by 4–bit code of A to D.

(3) Manual handle feed multiplication 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

7113	Magnification of handle feed m(1A127)
7114	Magnification of handle feed n(1A1000)

	#7	#6	#5	#4	#3	#2	#1	#0
7102								HNGx

#0(HNGx) Direction of MPG and travel of machine

0 : same direction

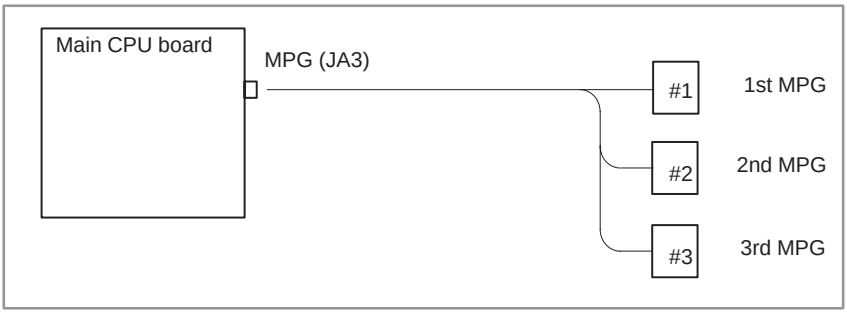
1 : reverse direction

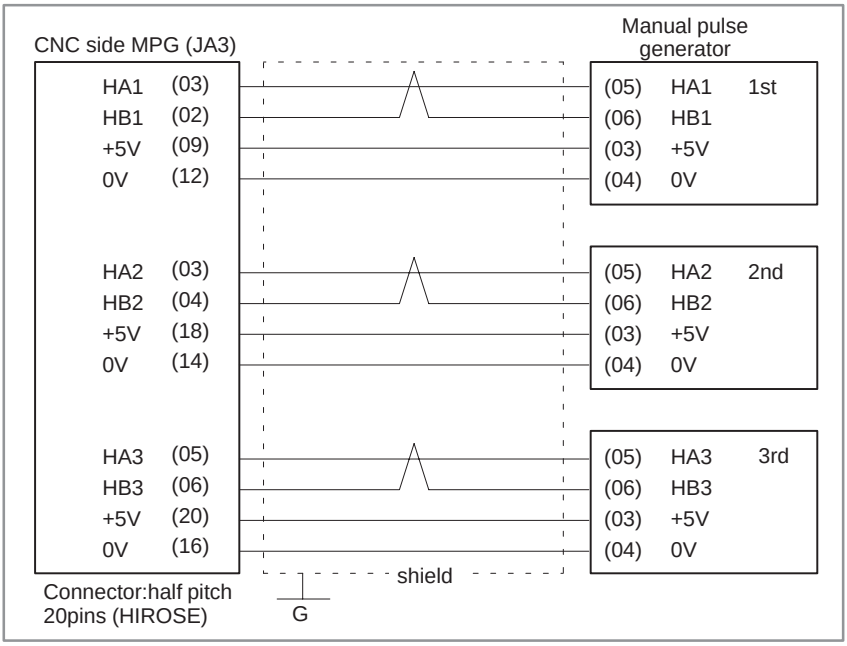
7110	No. of MPGs used (1A3)

(4) Checking manual pulse generator

Check disconnection of cable or short circuit.

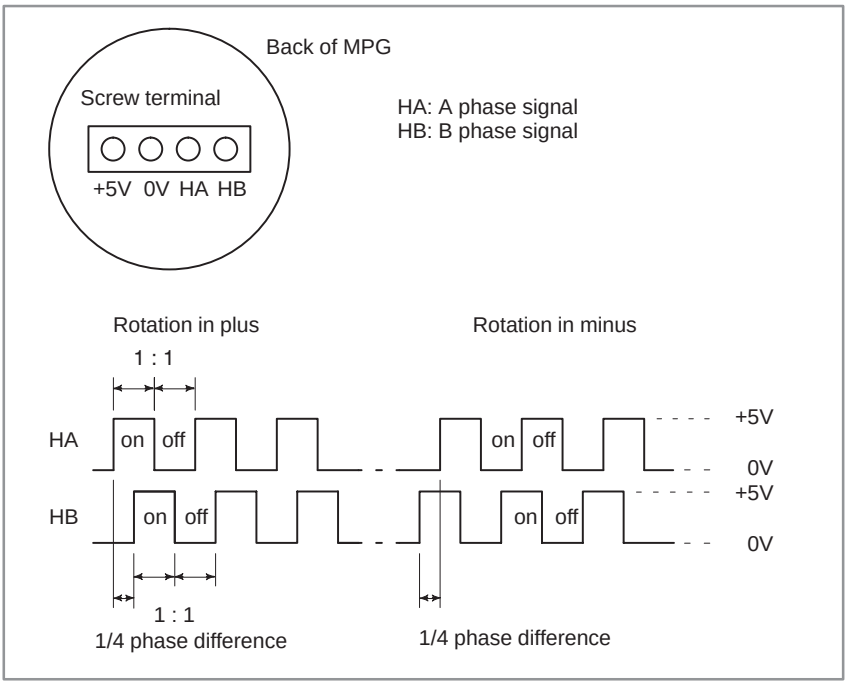
(a) Incorrect of cable





(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.

6.6 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 CNC.

Causes and Remedies

When manual operation is either impossible, perform countermeasure, based on the previous ite "Jog operation cannot be done".
Confirm that a correct mode is selected according to the mode select status of CNC status display. Also, by confirming the automatic operation status it is possible to identify cycle operation, feed hold and cycle stop state.

1. When cycle operation is not started (Cycle start LED does not light)

"****" is displayed at status display on 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)
MEM :Memory 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
0	0	0	1	Memory operation mode
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

(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)

CNC'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 / START LOCK	: 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/B) 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	HSIF							

#7(HSIF) 0 : M/S/T/B is of normal interface.

1 : M/S/T/B 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	BFIN				TFIN	SFIN		MFIN

#0(MFIN) M function finish signal

#2(SFIN) S function finish signal

#3(TFIN) T function finish signal

#4(BFIN) 2nd auxiliary function finish signal

	#7	#6	#5	#4	#3	#2	#1	#0
F0007	BF				TF	SF		MF

#0(MF) M function strobe signal

#2(SF) S function strobe signal

#3(TF) T function strobe signal

#7(BF) B function strobe signal

Signal	End state	
Finish signal	0	1
strobe 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 [Position Error] > PARAM 1826 [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, 4n0 and 4n1.

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

<2nd override signal (option)>
Feed rate is overridden more finely using the signals below:
See MTB's manual whether this feature is equipped.

	#7	#6	#5	#4	#3	#2	#1	#0
G0013	*AFV7	*AFV6	*AFV5	*AFV4	*AFV3	*AFV2	*AFV1	*AFV0

***AFVn** 2nd feed rate override

<State of override signal>

*FV7 · · · · · · · *FV0	
1 1 1 1 1 1 1 1	0%
1 1 1 1 1 1 1 0	1%
:	:
1 0 0 1 1 0 1 1	100%
:	:
0 0 0 0 0 0 0 0	245%
0 0 0 0 0 0 0 0	0%

*AFV7 · · · · · · *AFV0	
1 1 1 1 1 1 1 1	0%
1 1 1 1 1 1 1 0	1%
:	:
1 0 0 1 1 0 1 1	100%
:	:
0 0 0 0 0 0 0 1	245%
0 0 0 0 0 0 0 0	0%

f. Interlock signal or start lock signal is input

<Common to T series and M series>
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		ITL

#0 (ITL) 0 : Interlock signal(*IT) is valid.
#2 (ITX) 0 : Interlock signal (*ITn) is valid.
#3 (DIT) 0 : Interlock signal (± MITn) is valid.

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 Interlock signal per each axis (*ITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0130	*IT8	*IT7	*IT6	*IT5	*IT4	*IT3	*IT2	*IT1

***ITn** When the bit is 0, the corresponding axis's interlock signal is input.

3 Interlock signal per axis and direction(+/– MITn) is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0132					+MIT4	+MIT3	+MIT2	+MIT1
						↓	↓	↓
G0134					–MIT4	–MIT3	–MIT2	–MIT1

***+MITn** Interlock signal is input to the corresponding axis and direction with the signal being 0.

4 Controlled axis detach function is running. A detached axis is specified for travelling.

*This function is valid when CNC parameter 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	MDTCH8	MDTCH7	MDTCH6	MDTCH5	MDTCH4	MDTCH3	MDTCH2	MDTCH1

When signal MDTCHn 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 CNC 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	DTCH8	DTCH7	DTCH6	DTCH5	DTCH4	DTCH3	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. 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

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%

h. NC is in a reset state

In this case, the CNC's status display shows RESET. Refer to item 1.

(2) 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 per axis

(b) Rapid traverse override signals

	#7	#6	#5	#4	#3	#2	#1	#0
G0014							ROV2	ROV1
G0096	HROV	*HROV6	*HROV5	*HROV4	*HROV3	*HROV2	*HROV1	*HROV0

(HROV–0) (HROV=1)

ROV1	ROV2	Override
0	0	100%
1	1	50%
0	1	25%
1	1	Fo

*HROV6 *HROV0	Override
1 1 1 1 1 1 1	0%
1 1 1 1 1 1 0	1%
:	:
0 0 1 1 0 1 1	100%

1421	Rapid traverse override F0 rate

(3) Only feed (other than G00) does not function

(a) Maximum feed rate set by parameter is incorrect.

1422	Maximum feedrate

Feed rate is clamped at this upper feed rate.

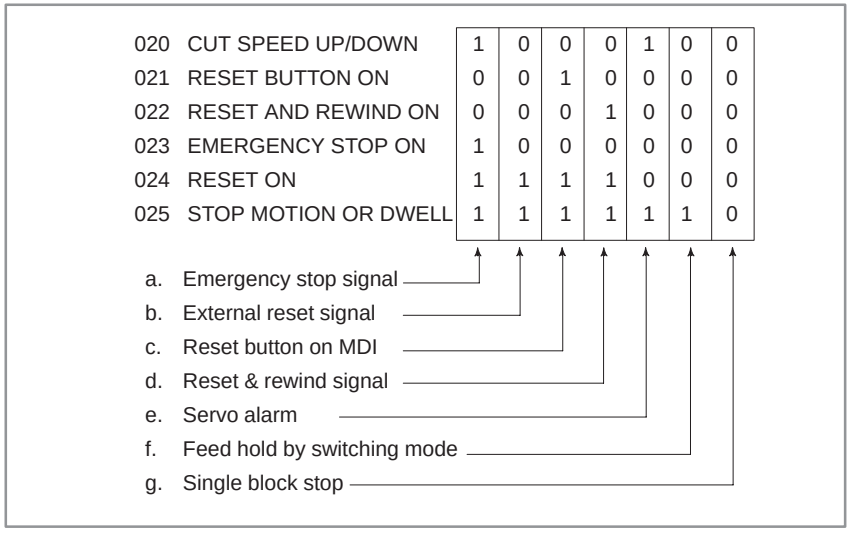
6.7 CYCLE START LED SIGNAL HAS TURNED OFF

Points

(1) After cycle operation is started, then stopped, check as follows:
(2) Confirm cycle start LED on machine operator's panel.
(3) Confirm CNC's diagnostic function

Causes and Remedies

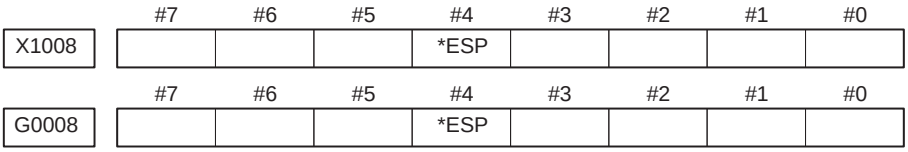
The reason why cycle start LED signal (STL) has turned off are displayed on CNC's diagnostic numbers 020 to 025 as follows:



Details of signals a to g are as follows:
Confirm the signals concerned using diagnostic function (PMCDGN).

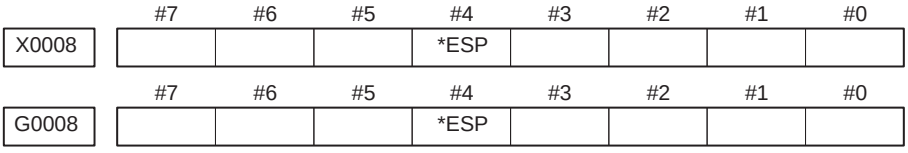
a. Emergency stop is input

1 When I/O card is used :



***ESP=0** : Emergency stop signal is input :

2 When I/O card is not used:



***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 HANDLE	1	1	1
	TEACH IN JOG	1	1	0

<Feed hold signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0008			*SP					

#5(*SP) When this signal is 0, the feed hold signal is input.

g. 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.

6.8 NOTHING IS DISPLAYED ON CRT

Points

Check whether it is a trouble of display or a trouble of the system.

Judgement of the point

Check whether the STATUS LED on the main board shows the following state.

	1	2	3	4	
STATUS	○	×	×	×	(○ : on, × : off)

If the status shows the above state, the system is normal.
Therefore, display system may be faulty.
If the status shows other state, a hardware other than the display system may be troublesome.

Causes and remedies

1. When the display system is in trouble

(1) Confirmation item

1 Is power supplied to the display?

2 Is a video signal connected?Isn't it disconnected? or braked?

(2) Causes and remedies

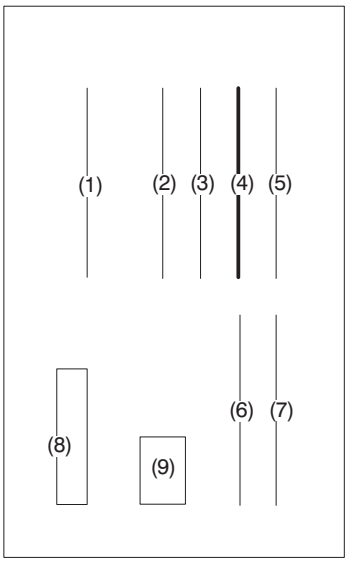
1 Power to the display is faulty. (Exchange power supply unit).

2 Cable connection is faulty. (Correct the connection).

3 Module is faulty (Exchange CRT control module)

4 Display is faulty.

<CRT control module mounting position> Main CPU board



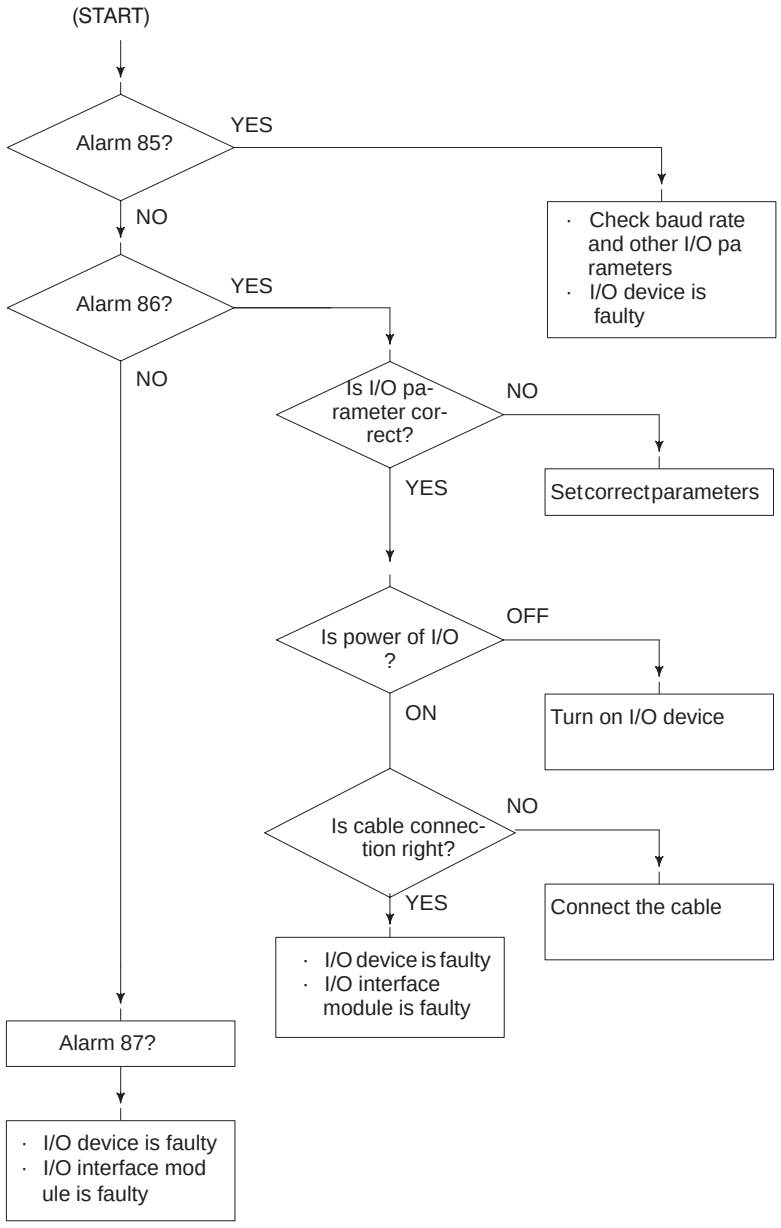
(6) Change CRT control module specification : A20B–2901–0270 to A20B–2901–0275

2. When system is in trouble

	1	2	3	4	
STATUS	○	×	×	×	(○ : on, × : off)

When STATUS LED on the main board is other than above, check LEDs on the main CPU board and other optional boards,identify the trouble and make an appropriate action. See 5.4.2 for LED display.

6.9 ALARM 85 TO 87 (READER/PUNCHER INTERFACE ALARM)



Causes

(a) Parameters on reader/puncher interface are not correct.

Check the following setting data and parameters.

(b) External I/O device or host computer is faulty.

(c) I/O board is faulty.

(d) Cable between NC and I/O device is faulty.

Countermeasures

(a) Parameters on reader/puncher interface are not correct.

Check the following setting data and parameters:
<Setting>
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 002		0	1	2	3	
Feed		0101#7	0111#7	0121#7	0131#7	
Data input code		0101#3	0111#3	0121#3	0131#3	
Stop bit		0101#0	0111#0	0121#0	0131#0	
Type of I/O device		102	112	122	132	
Baud rate		103	113	123	133	
Communication method	0135#3	–	–	–	0	1
		RS–232C				RS–422
Connector		MAIN CPU BOARD			OPTION–1 BOARD	
		JD5A		JD5B	JD5C	JD6A

Numbers in the table indicate parameters and bit numbers.
Example) 101#7:bit7 of parameter 101.

Note
For data communications by RS–422, refer to parameters 134 and 135.

	#7	#6	#5	#4	#3	#2	#1	#0
0101	NFD				ASI			SB2
0111								
0121								
0131								

#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 0122 0132	Type of I/O device

Value	TYPE OF I/O DEVICE
0	RS–232–C (control codes DC1 to DC4 are used)
1	FANUC CASSETTE B1/B2 (bubble cassette)
2	FANUC CASSETTE F1 (Old type FLOPPY CASSETTE ADAPTOR)
3	FANUC PROGRAM FILE Mate, FANUC FA CARD ADAPTOR FANUC FLOPPY CASSETTE ADAPTOR, FANUC SYSTEM P–MODEL H, FANUC Handy File
4	Not used
5	Portable tape reader
6	FANUC PPR, FANUC SYSTEM P–MODEL G, FANUC SYSTEM P–MODEL H

0103 0113 0123 0133	Baud rate

Value	Baud rate
7	600
8	1200
9	2400
10	4800
11	9600
12	19200

When bit#3 of parameter no. 0135=1 (RS–422 interface), the following setting is also available.

Value	Baud rate
13	38400
14	76800
15	86400

Check the following parameters also, when parameter no.0020 is 3.

	#7	#6	#5	#4	#3	#2	#1	#0
0134			CLK	NCD		SYN	PRY	

#5(CLK) 0 : Internal clock is used for baud rate clock of RS–422 interface.
1 : External clock is used for baud rate clock of RS–422 interface.

#4(NCD) 0 : CD (signal quality detection) of RS–232C interface is checked.
1 : CD (signal quality detection) of RS–232C interface is not checked.

#2(SYN) 0 : In protocol B, NC reset/alarm is not informed to the host.
1 : In protocol B, NC reset/alarm is informed to the host by SYN and NAK code.

#1(PRY) 0 : No parity bit
1 : With parity bit

	#7	#6	#5	#4	#3	#2	#1	#0
0135	RMS				R42	PRA	ETX	ASC

#7(RMS) In protocol A, status of remote / tape operation of SAT command is

0 : Always transmitted by 0.

1 : Transmitted by the contents of remote / tape switching request issued by SET command from the CNC.

#3(R42) 0 : Interface is of RS–232C.

1 : Interface is of RS–422.

#2(PRA) 0 : Communication protocol is protocol A

1 : Communication protocol is protocol B

#1(ETX) 0 : End code of protocol A or extended protocol A is CR of ASCII/ISO.

1 : End code of protocol A or extended protocol A is ETX of ASCII/ISO.

#0(ASC) 0 : All the communication codes except for NC data is ISO code.

1 : All the communication codes except for NC data is ASCII code.

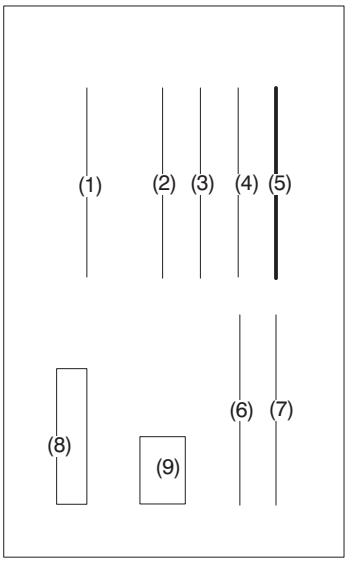
(b) External I/O device or Host computer is in trouble

(i) Check whether the setting on communication of external I/O device or host computer is the same as that of the CNC. (baud rate, stop bits,etc.) If they are not the same, change the setting.

(ii) When spare I/O device presents, check whether it is possible to realize communication using the spare I/O device.

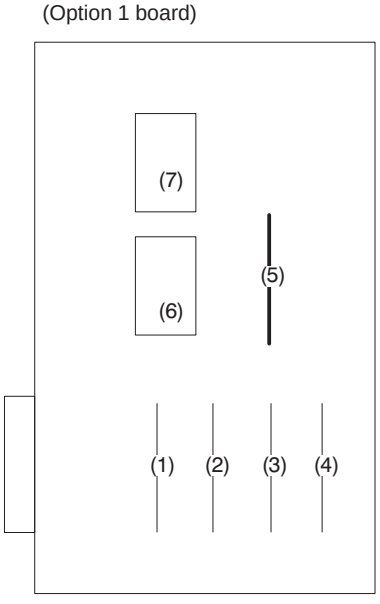
(c) Spindle module or communication control module is faulty

(i) When parameter no.0020 is 0 or 1 or 2 (JD5A,JD5B of Main CPU board) Replace the module since spindle module may be faulty.



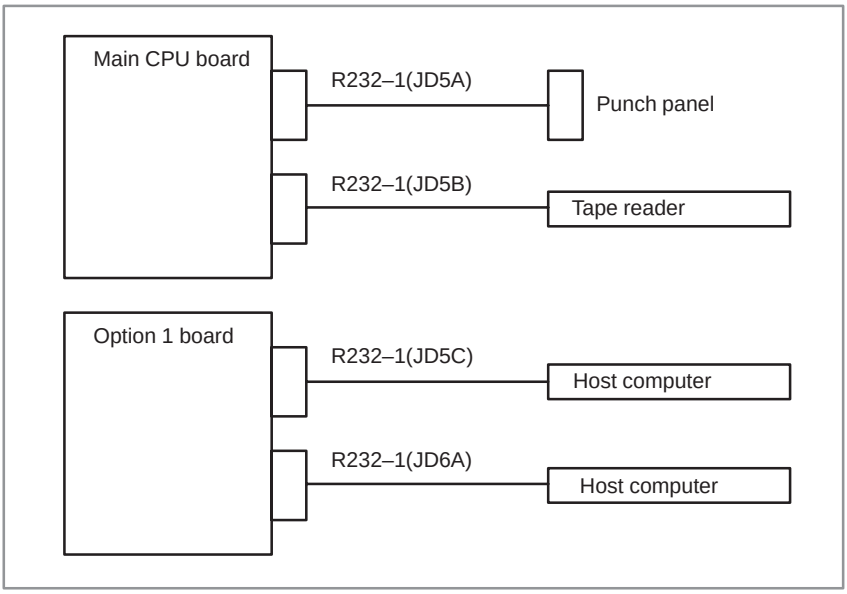
(5) Change the spindle module
Specification : A20B–2901–0980 to
A20B–2901–0982

(ii) When parameter no. 0020 is 2 or 3 (JD5C, JD6A of option 1 board) Because communication control module (5) may be faulty, replace the module.

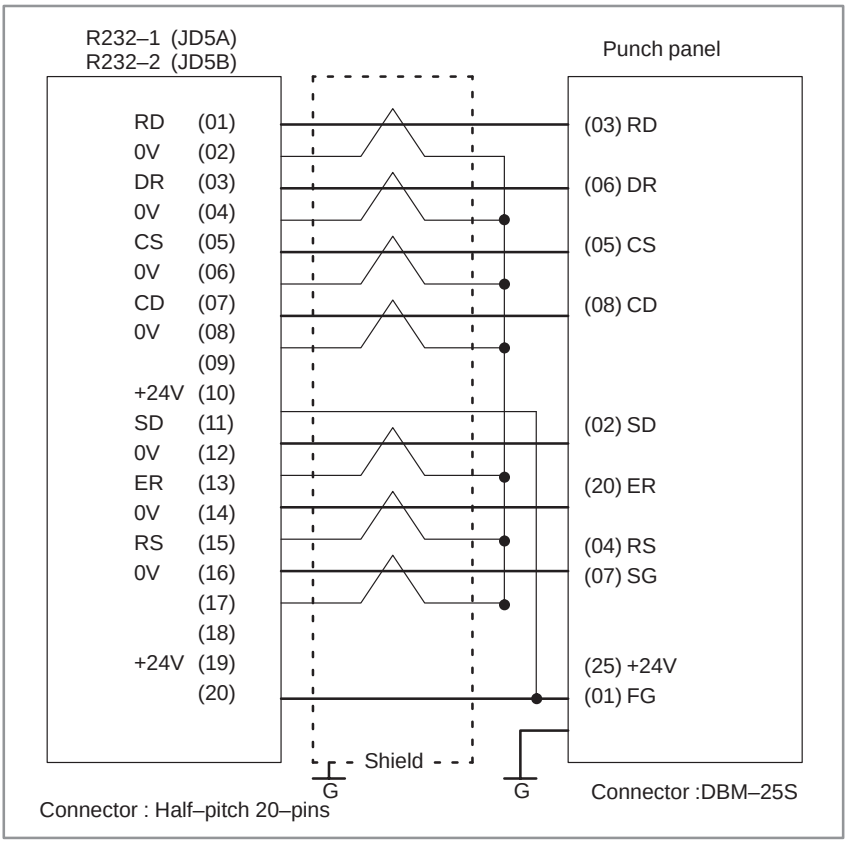


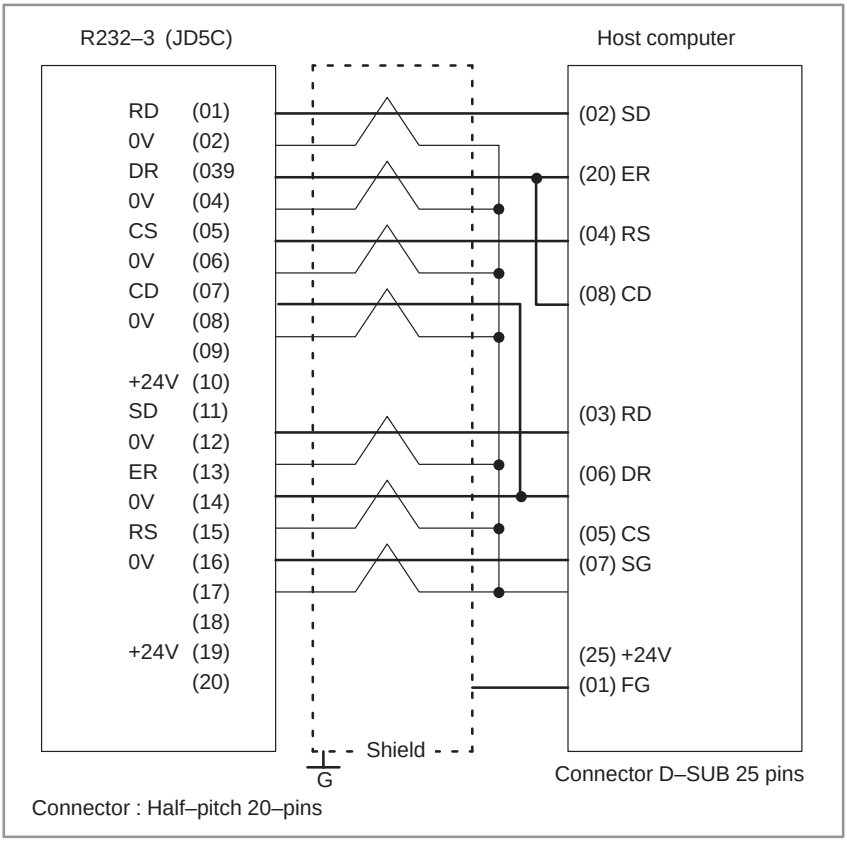
(5) Change communication control module
Specification : A20B-2900-0361

(d) Cable between NC and I/O device is faulty.
Check the cable for disconnection or wrong connection.

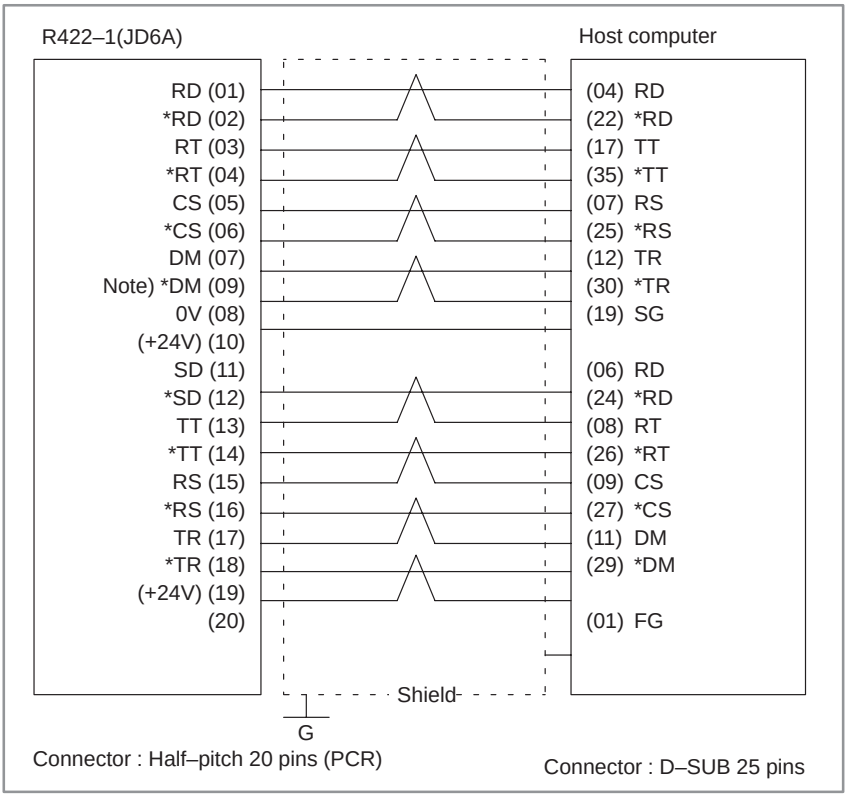


< Cable connection>



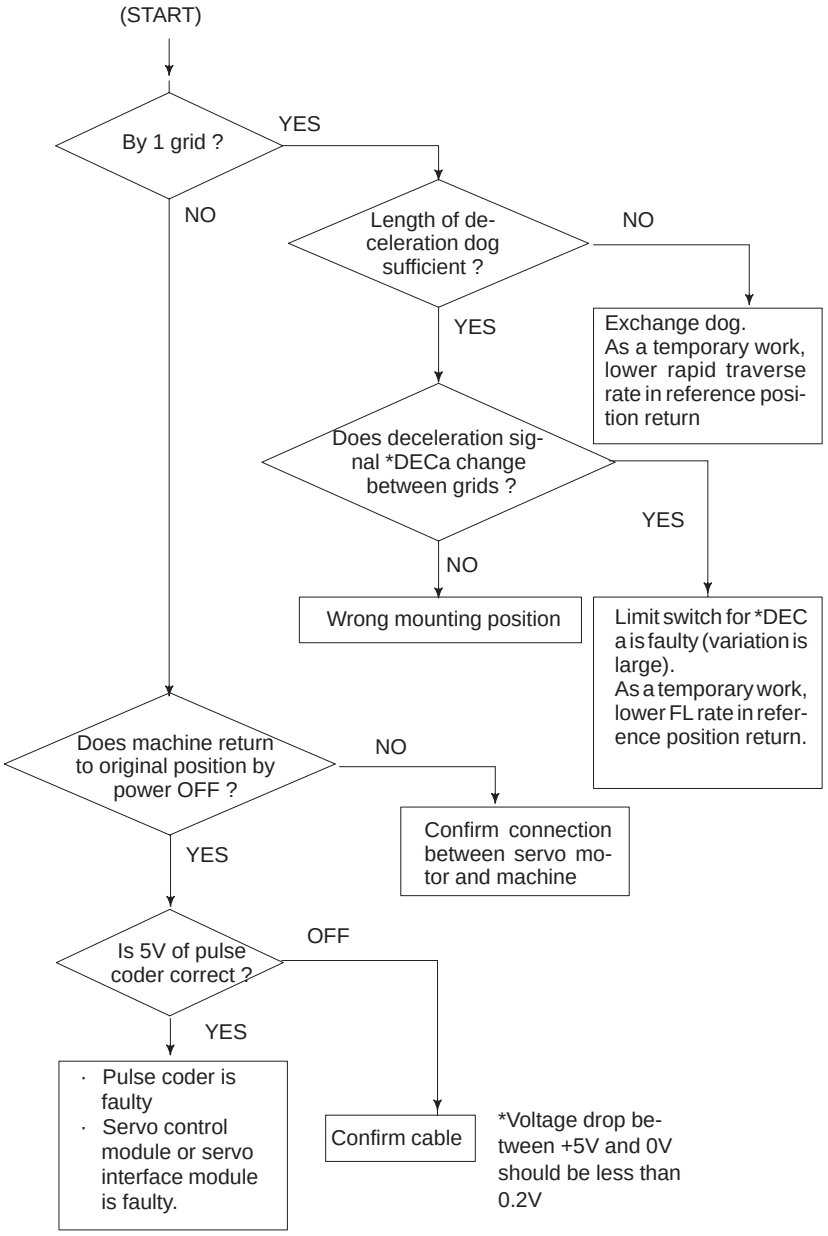


Notes
1. When CS is not used, connect it to RS.
2. For protocol A or extended protocol A: When DR is not used, connect it to ER. Always connect CD to ER.



Note
Always use a twisted pair cable.

6.10 REFERENCE POSITION DEVIATES

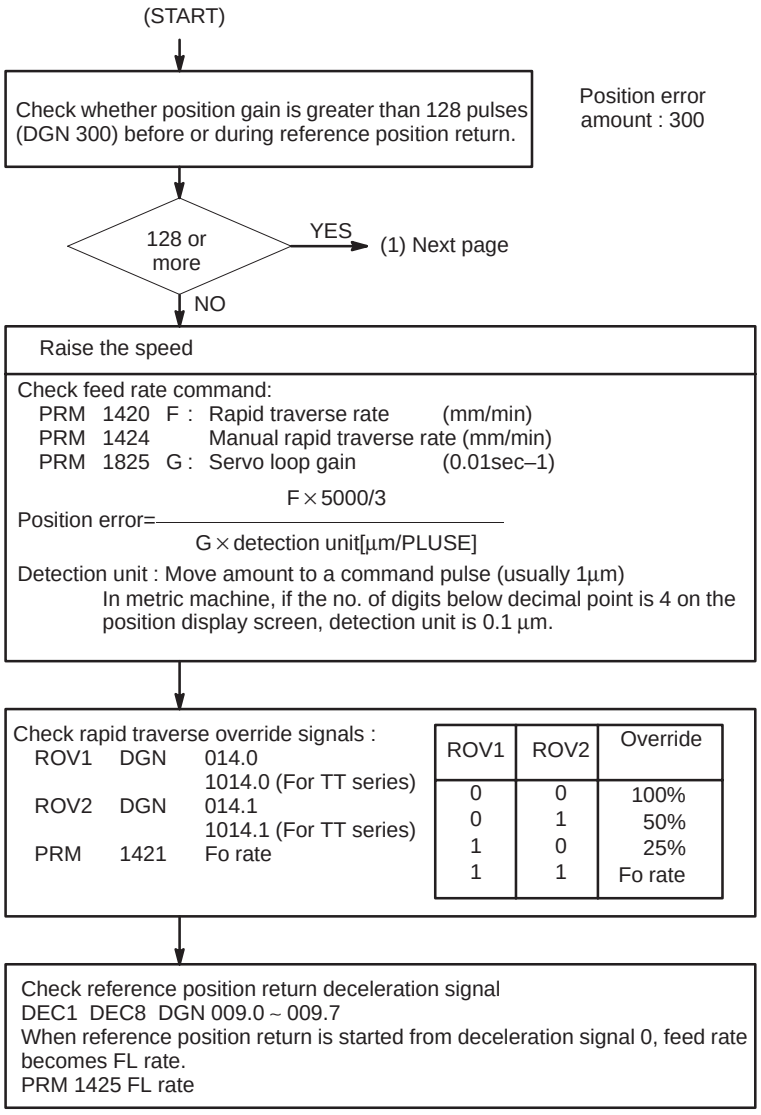


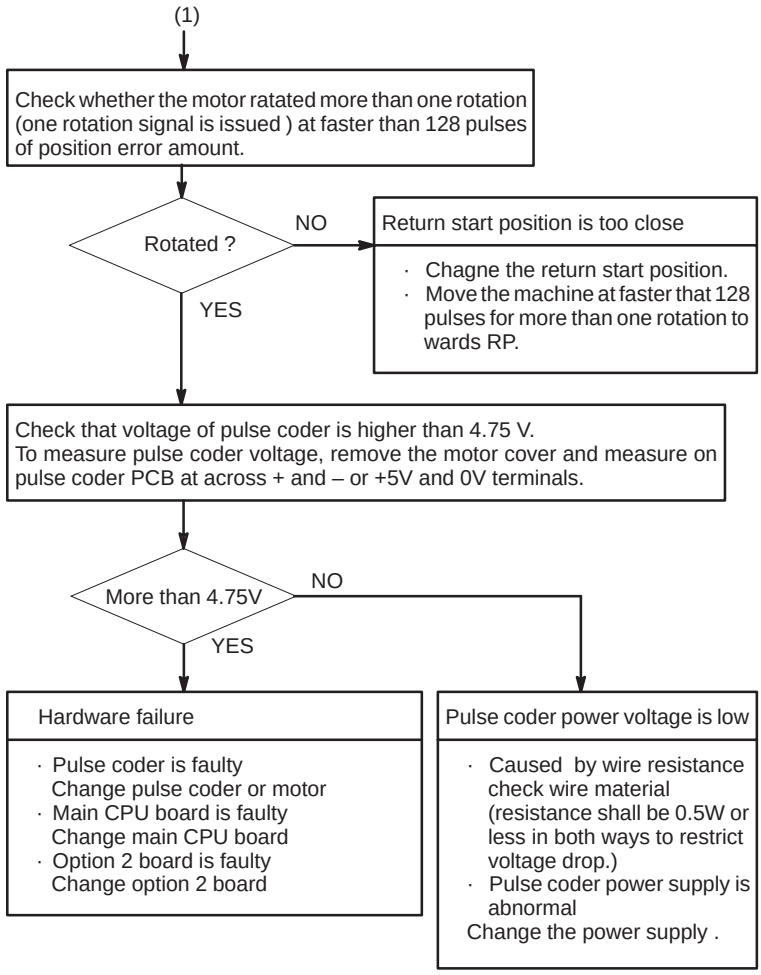
6.11 ALARM 90 (REFERENCE POSITION RETURN IS ABNORMAL)

Contents

Reference position return was executed when the following condition is not satisfied:
The CNC received one rotation signal at least one time when the axis is moving to the reference position at a speed higher than a speed equivalent to 128 pulses of position error amount(DGN300).

Countermeasures





Notes

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 main board is exchanged, all the data stored in memory is lost. Reset all the NC data again, referring to the data input/output item.

- **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.

6.12 ALARM 300 (REQUEST FOR REFERENCE POSITION RETURN)

Absolute position data in the serial pulse coder was lost.
(This alarm will be generated when serial pulse coder is exchanged or position feedback signal cable of the serial pulse coder is disconnected).

Remedies

Machine position must be memorized using the following method:

- **When reference position return function is present**

(1) Execute manual reference position return only for an axis for which this alarm was generated.When manual reference position return cannot be executed because of an another alarm, set parameter 1815#5 to 0 and release the alarm and perform manual operation.

(2) Press RESET key at the end of reference position return to release the alarm.

- **When 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.

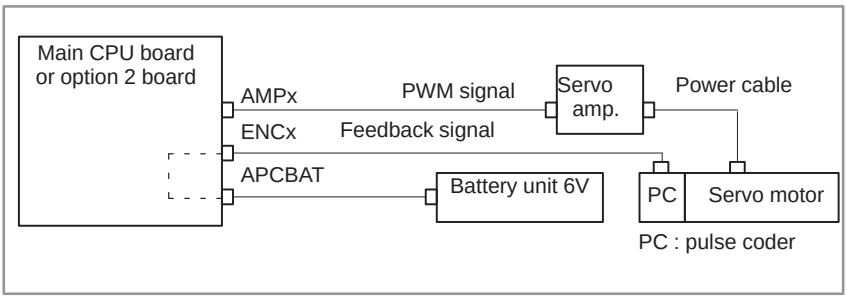
Related parameters

	#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



6.13 ALARM 301 TO 305 (ABSOLUTE PULSE CODER IS FAULTY)

Absolute pulse coder, cable or servo module is faulty.

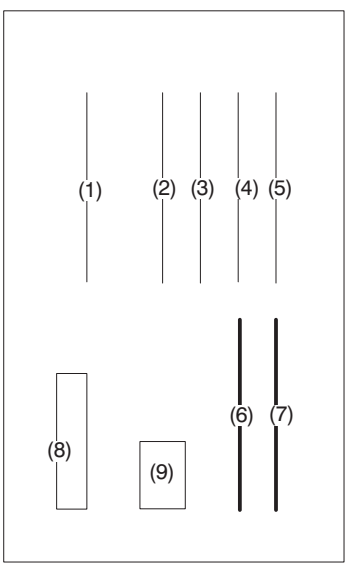
Countermeasures

1 Sway the cable connected to the JF1,JF2,JF3 and JF4 on the main CPU board or the cable conncted to the JF5,JF6,JF7 and JF8 on the option 2A, 2B board or the cable connected to the JF1, JF2 on the option 2C board. If the alarm is generated, exchange the cable.

2 Exchange the servo interface module
Exchange a module to which an alarm is generated (See figure below).

- The 1st and 2nd axis or 3rd and 4th axis : Exchange following main CPU board.

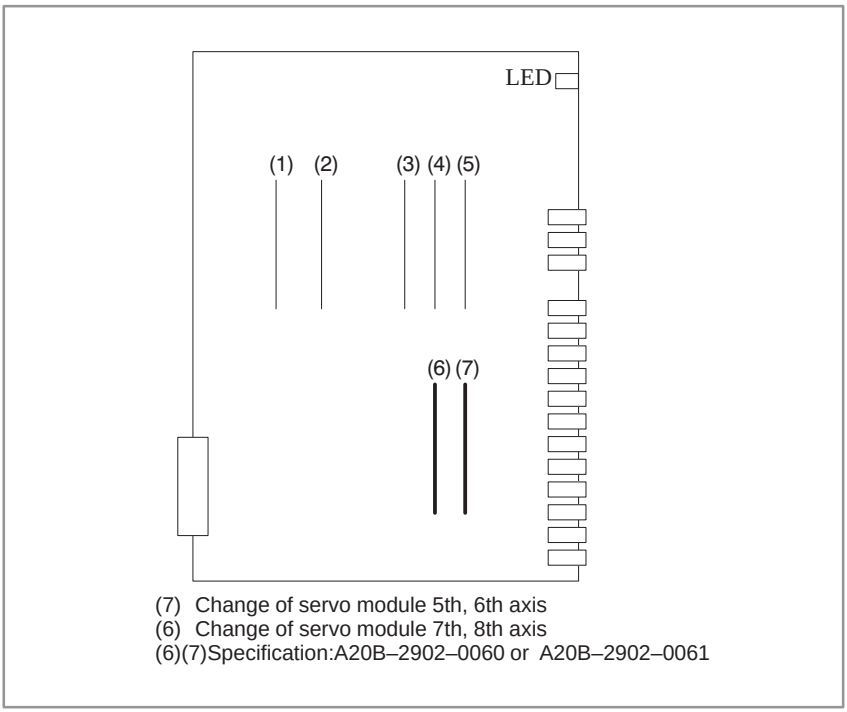
<Location of servo module> Main CPU board



(7) Change servo module 3rd 4th axis
(6) Change servo module
(6)(7)Specification : A20B–2902–0060 or
A20B–2902–0061

- The 5th and 6th axis or 7th and 8th axis :
  Exchange following module.

Option 2 board.



(7) Change of servo module 5th, 6th axis
(6) Change of servo module 7th, 8th axis
(6)(7)Specification:A20B–2902–0060 or A20B–2902–0061

6.14 ALARM 306 TO 308 (ABSOLUTE PULSE CODER BATTERY IS LOW)

This alarm is generated when absolute pulse coder battery becomes low.

Remedies

Exchange the battery connected to the connector JA4A on the main CPU board or the connector JA4B on the option 2 board.

> **Note**
> Change the batteries while power of NC is supplied.
> Do not change the battery (memory backup battery) for the control unit.

Replacing batteries for separate absolute pulse coder

1 Have 4 commercially available dry cell batteries ready.

2 Turn on power of the machine.

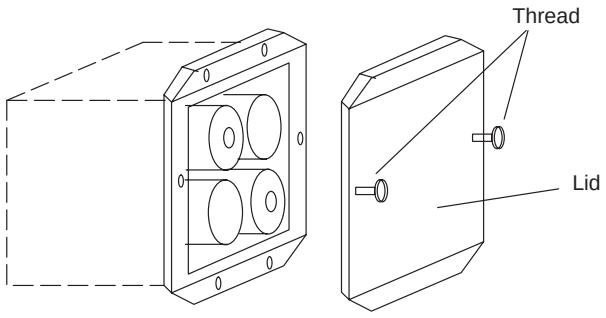
If the batteries are replaced with the power on, absolute position of the machine is lost.

3 Loosen the screws of battery case lid and remove the lid.

Consult with the MTB's manual for where the battery case is installed.

4 Replace the batteries in the case.

Take care to place the batteries facing in the correct direction. (Insert the batteries as shown in the diagram with 2 facing one way and 2 the other.)



Replacing Dry Cell Batteries

5 Having exchanged the batteries put the lid back on.

6 Turn off the power of the machine.

6.15 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**

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	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 **Notes**

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**

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

#4(LDA) LED of serial pulse coder is abnormal

#3(PMS) Pulses are not issued correctly by abnormality of serial pulse coder C or feedback cable.

(1) #4(LDA): LED in the serial pulse coder is abnormal.
Serial pulse coder is faulty⇒Refer to **Notes**

(2) #3(PMS): Pulses are not issued correctly by abnormality of feedback cable.

1 Fault of serial pulse coder ⇒Refer to **Notes**

2 Feedback cable is faulty.

Note
Reference position and machine's standard position are different from the ones before, adjust and set them correctly.

6.16 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 CNC.

		#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.

#5(STB) Stop bit error has generated.

Causes

1) #7(DTE):Response from serial pulse coder is absent.
   1 Signal cable is disconnected
   2 Serial pulse coder is faulty. ⇒ See note 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 Note 1.
   3 Main CPU board or Option 2 board is faulty ⇒ See Note 2

Notes
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 main board is changed. Set NC data again, referring to "chapter 3 data input/output".

6.17 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 CNC.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0200	OVL							

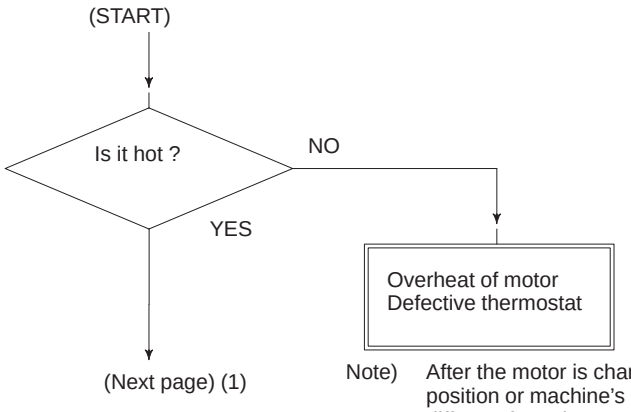
#7(OVL): 1 OVERLOAD ALARM is displayed.

Check details of alarms by DGN 201.

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

1	Overheat of servo motor
0	Overheat of servo amplifier

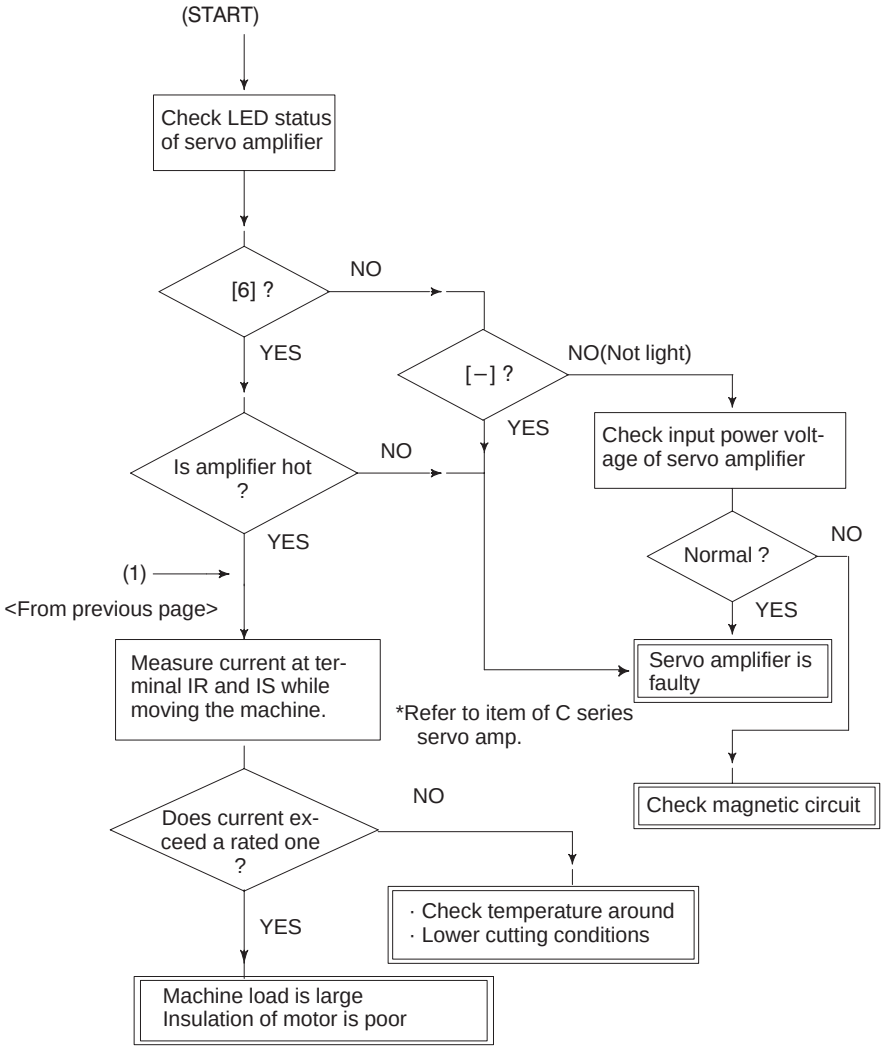
Overheat of servo motor



Note) After the motor is changed, reference position or machine's reference point is different from the one before replace ment. Set it again.

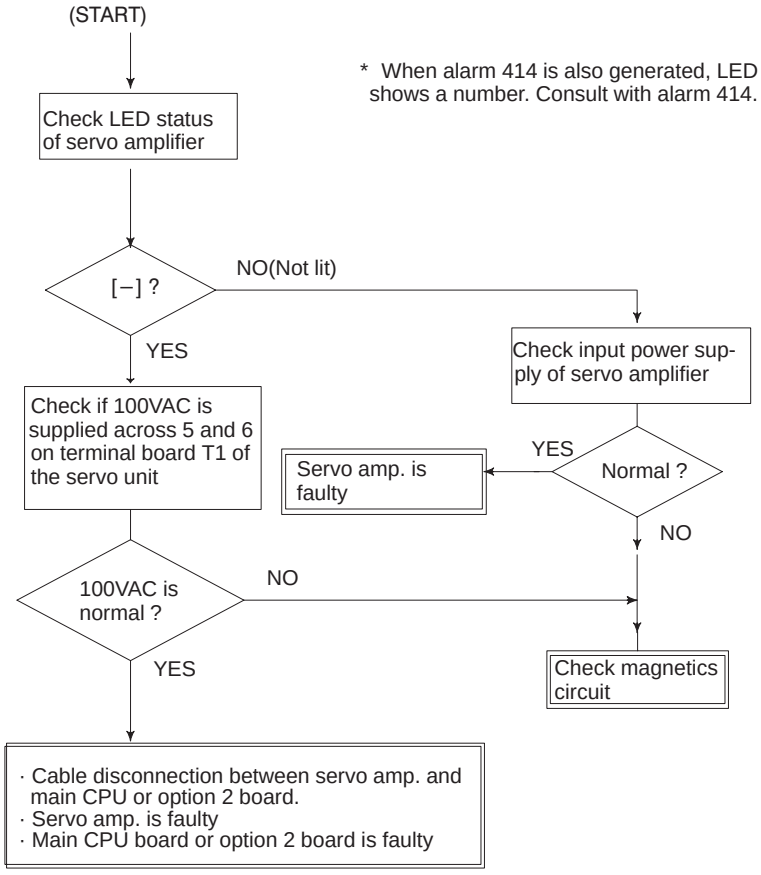
- **Overheat of servo amplifier**

LED 6 of servo amplifier is lit



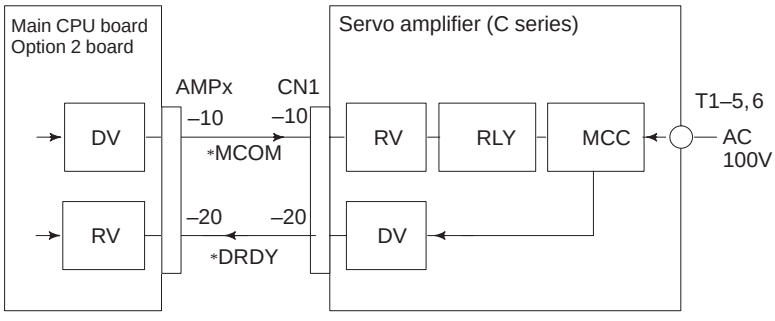
6.18 ALARM 401 (*DRDY SIGNAL TURNED OFF)

Ready signal (*DRDY) of servo amplifier is not turned on or turned off during operation.



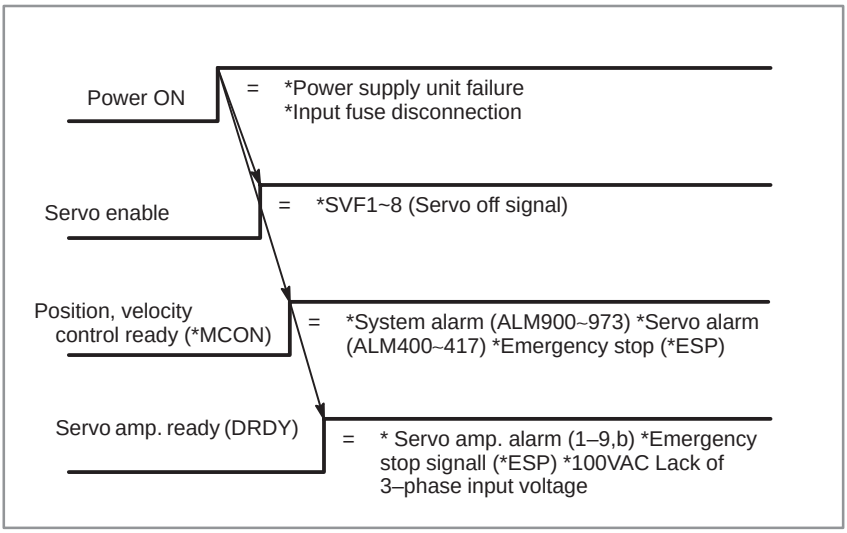
Note

When the main CPU board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3. “Data input/output” .



From 1st axis to 4th axis are main CPU board. 5th axis or later are option 2 board.

Power on sequence (NC⇔Servo amplifier)



6.19 ALARM 404 AND 405 (*DRDY SIGNAL TURNED ON)

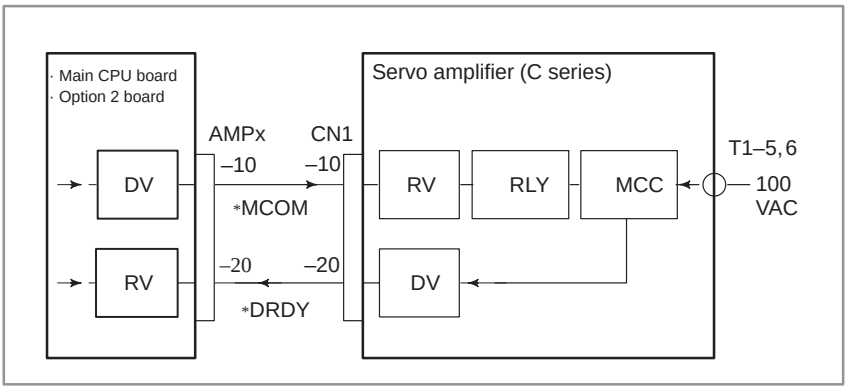
- **Alarm 404**

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 main CPU or between servo amplifier and option 2 board is faulty.
3 Main CPU or option 2 board is faulty.

Note
When the main CPU board is replaced, all the data stored in memory is lost. Set the NC data again, referring to chapter 3 “data input/output”.



From 1st axis to 4th axis are main CPU board. 5th axis or later are option 2 board.

- **Alarm 405 (Reference positin return is abnormal)**

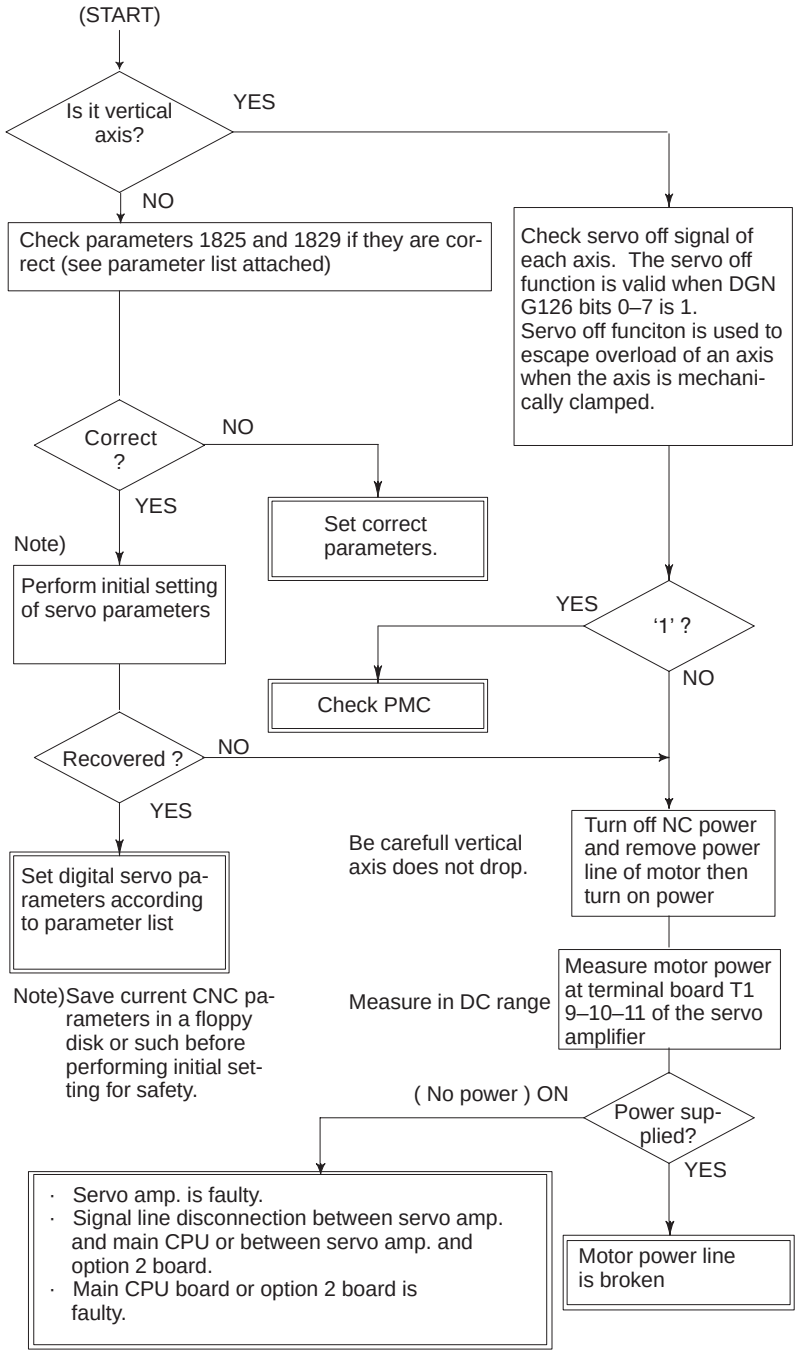
- **Causes**

Main CPU board or Option 2 board is faulty.

Note
When the main CPU board is replaced, all the data stored in memory is lost. Set the NC data again, referring to chapter 3 “data input/output”.

6.20 ALARM 410 (EXCESSIVE POSITION ERROR AMOUNT DURING STOP)

Position error amount at stop (DGN 300) exceeds a value set by parameter No. 1829.

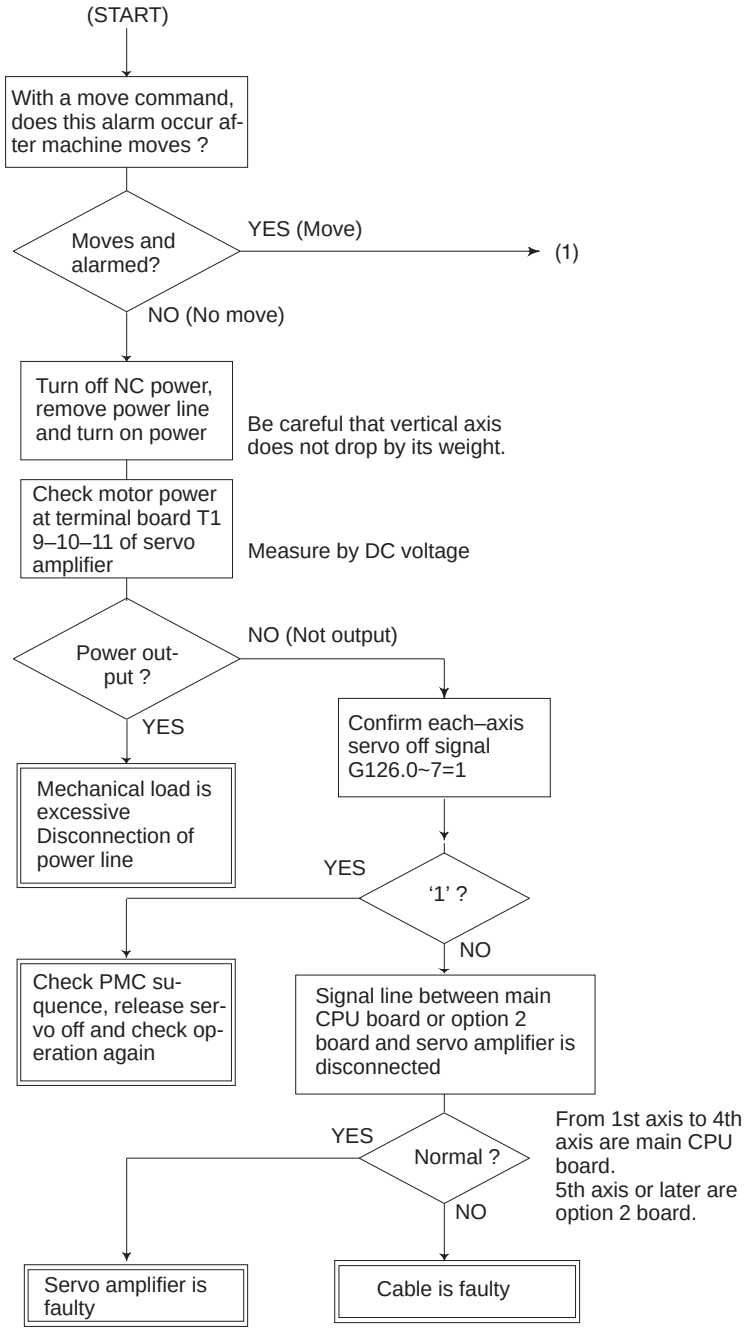


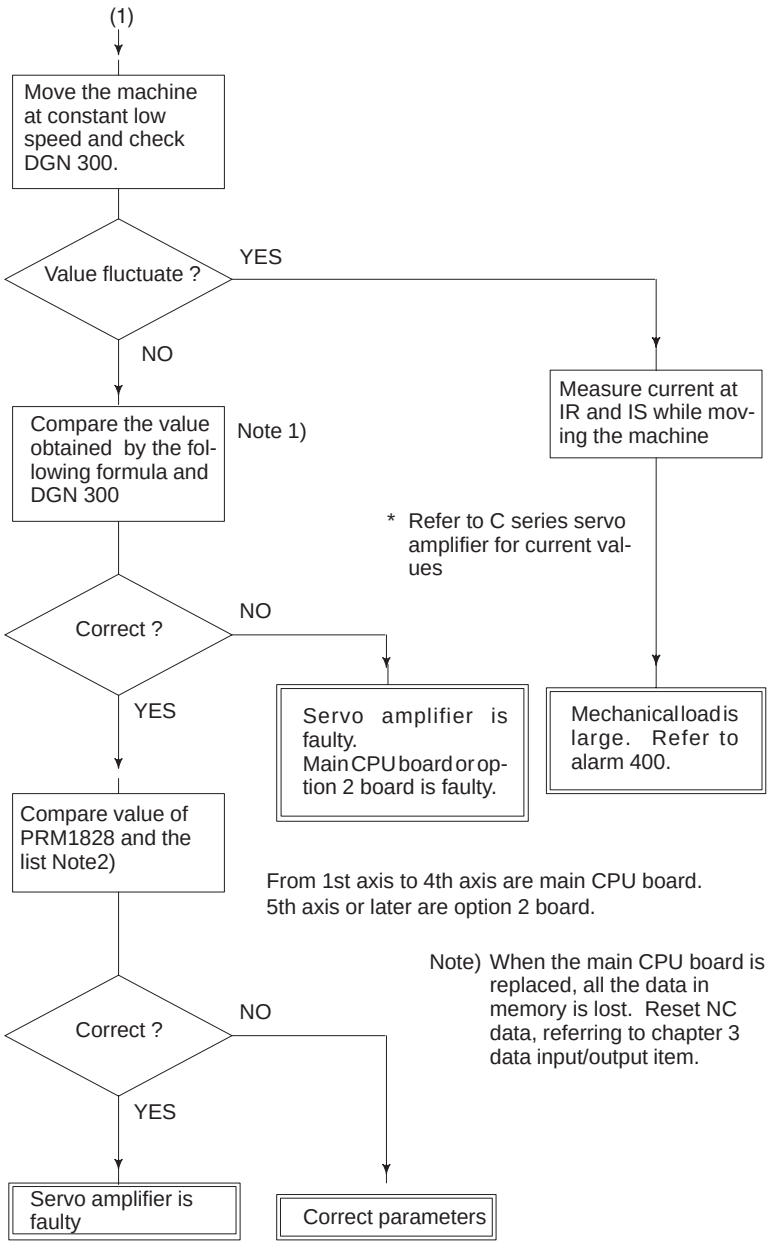
Note

When the main board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 “data input/output” .

6.21 ALARM 411 (EXCESSIVE POSITION ERROR DURING MOVE)

Position error amount during movement (DGN 300) exeeeds a value set by parameter 1828.

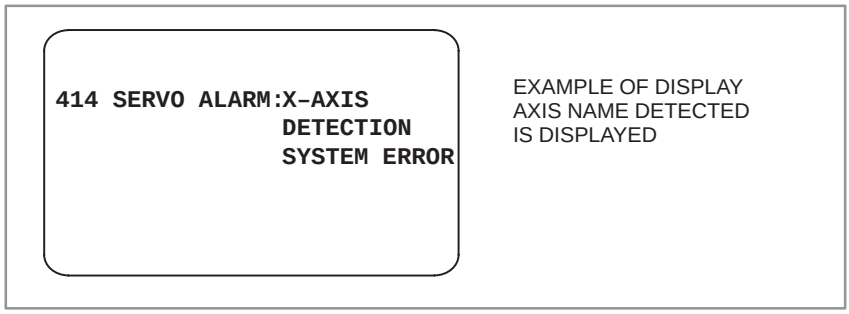




Notes

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 $\times 1.2$

6.22 ALARM 414 (DIGITAL SERVO SYSTEM IS ABNORMAL)



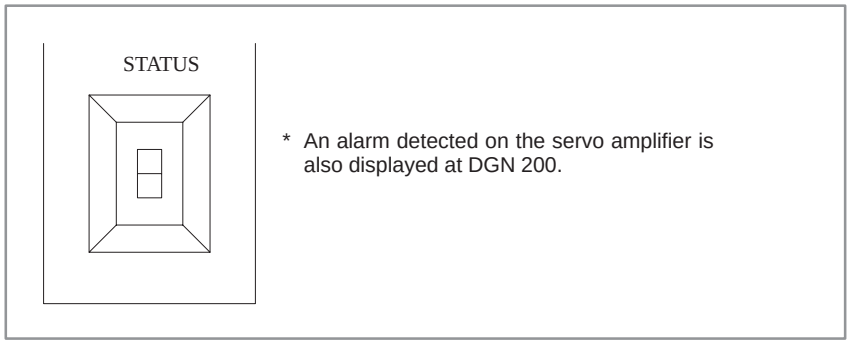
Points

Check details by CNC's diagnostic fucntion and LED display on the servo amplifier.

1

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

2 LED display on the servo amplifier



3

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

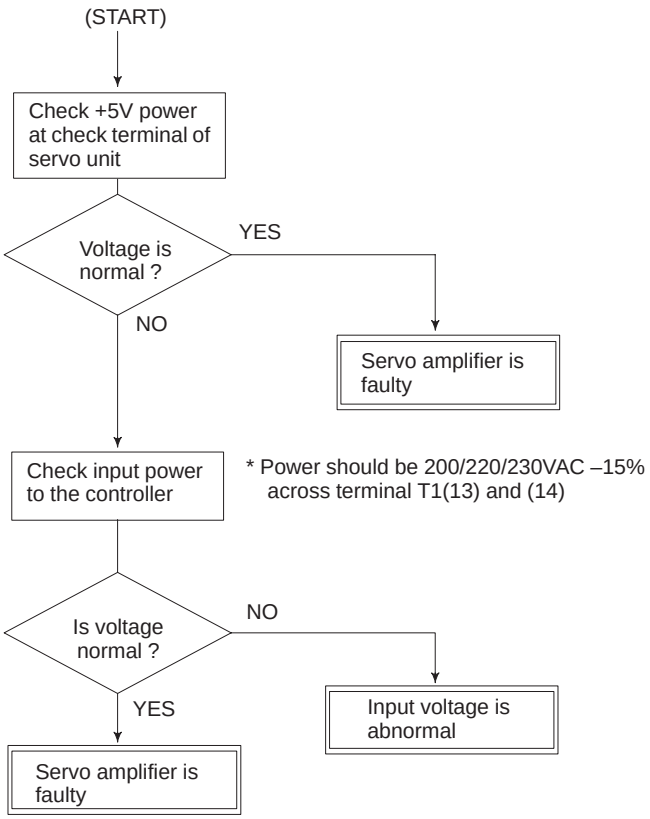
- **When DGN200 shows "1"**

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

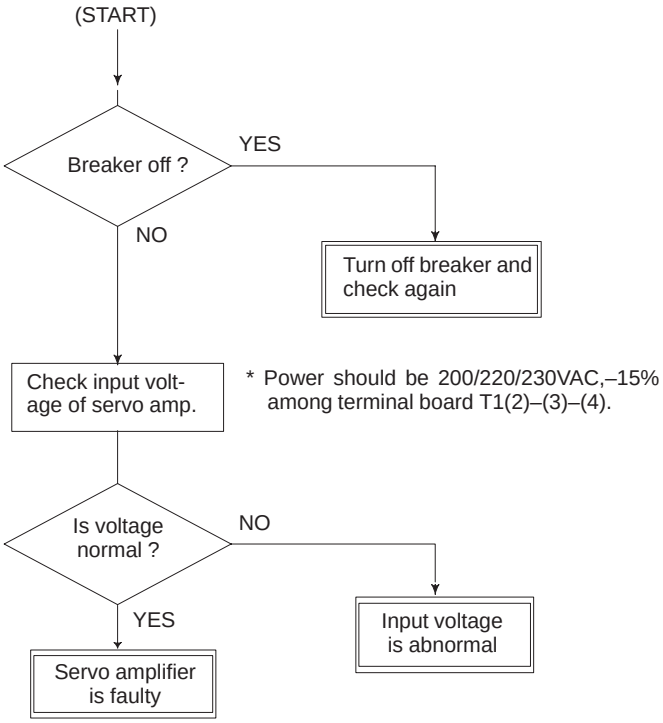
#6(LV) Low voltage alarm → LED [2] or [3] lights
#5(OVC) Over current alarm
#4(HCA) Abnormal current alarm → LED [8] lights
#3(HVA) Over current alarm → LED [1] lights
#2(DCA) Discharge alarm → LED [4] or [5] lights
#1(FBA) Disconnection alarm
#0(OFA) Overflow alarm

- **#6(LV):Insufficient voltage alarm**

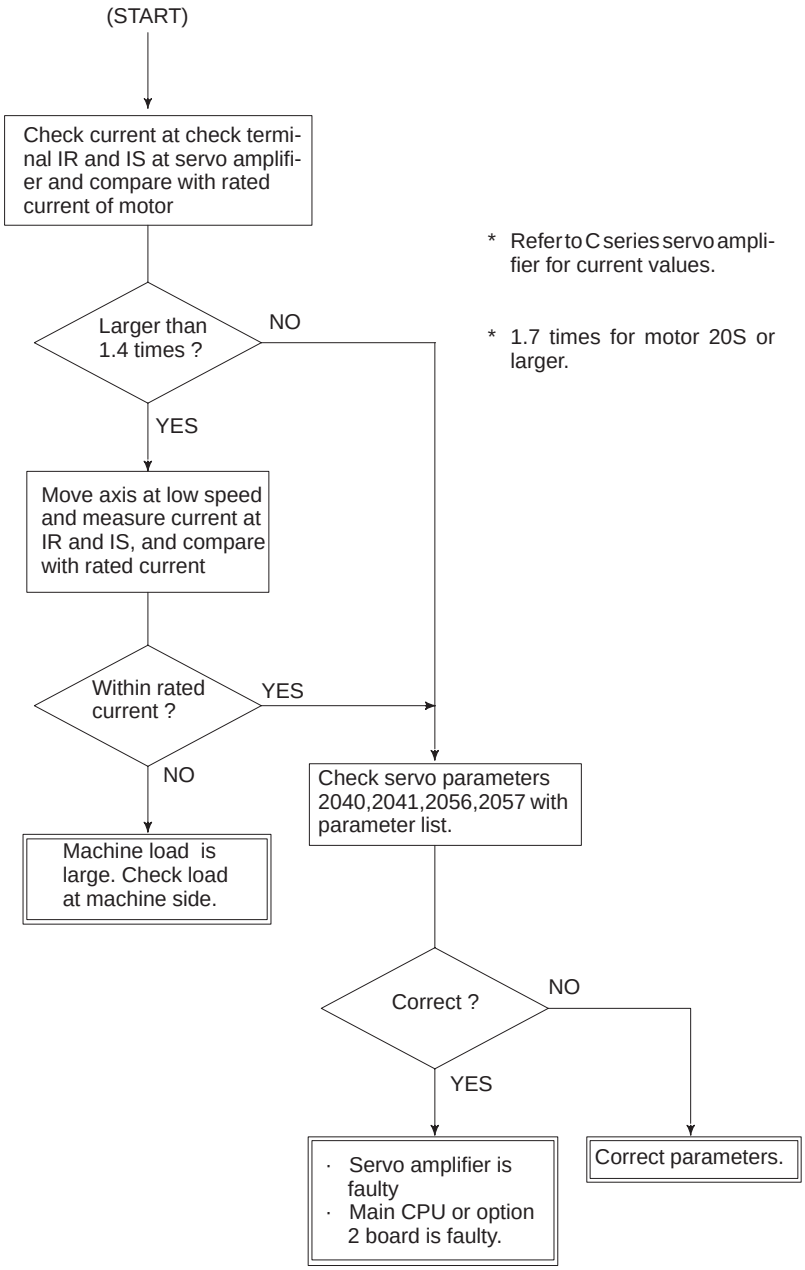
1 Servo amp LED [2] turns on (control power shortage)



2 Servo amp LED [3] turns on (DC power shortage)



- **#5(OVC):Over current detection by software**



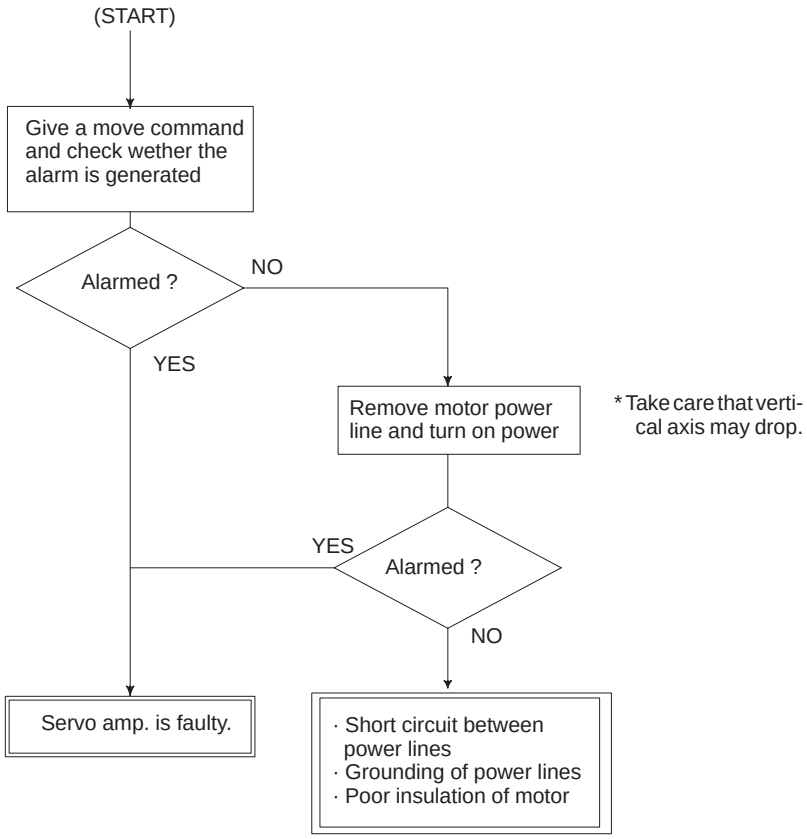
* Refer to C series servo amplifier for current values.

* 1.7 times for motor 20S or larger.

From 1st axis to 4th axis are main CPU board.
5th axis or later are option 2 board.

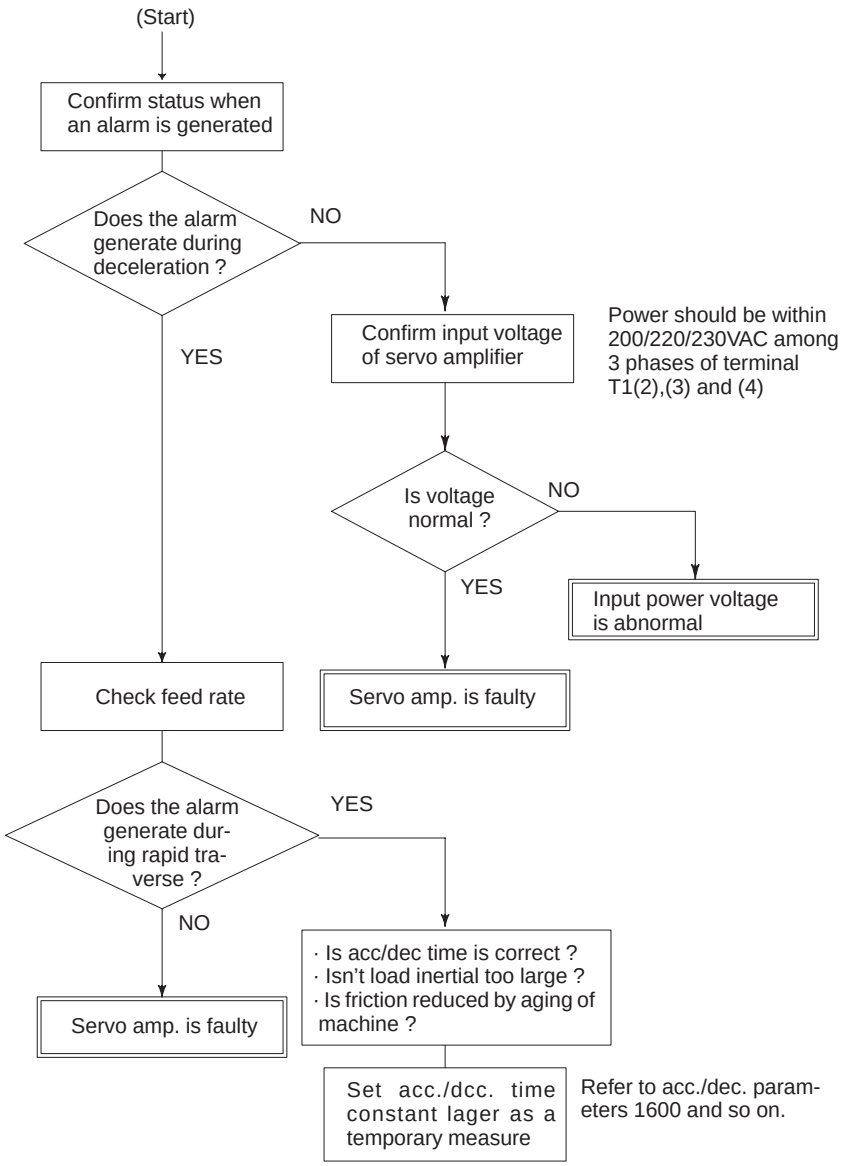
Note) When the main CUP board is replaced, all the data in memory is lost.Reset NC data, referring to chapter 3 “data input/output” .

- **#4(HCA):Abnormal current alarm (Servo amp. LED:[8] lights)**

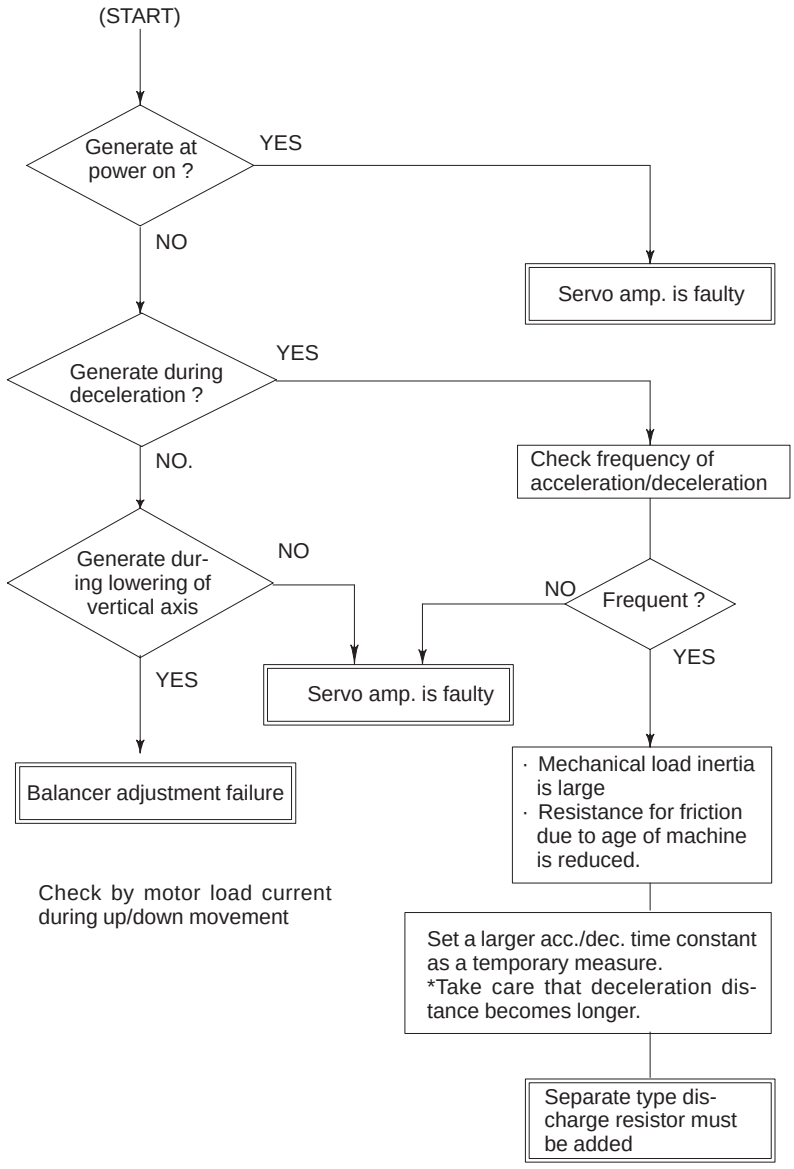


- **#3(HVA):Over voltage alarm (Servo amp.LED [1] lights)**

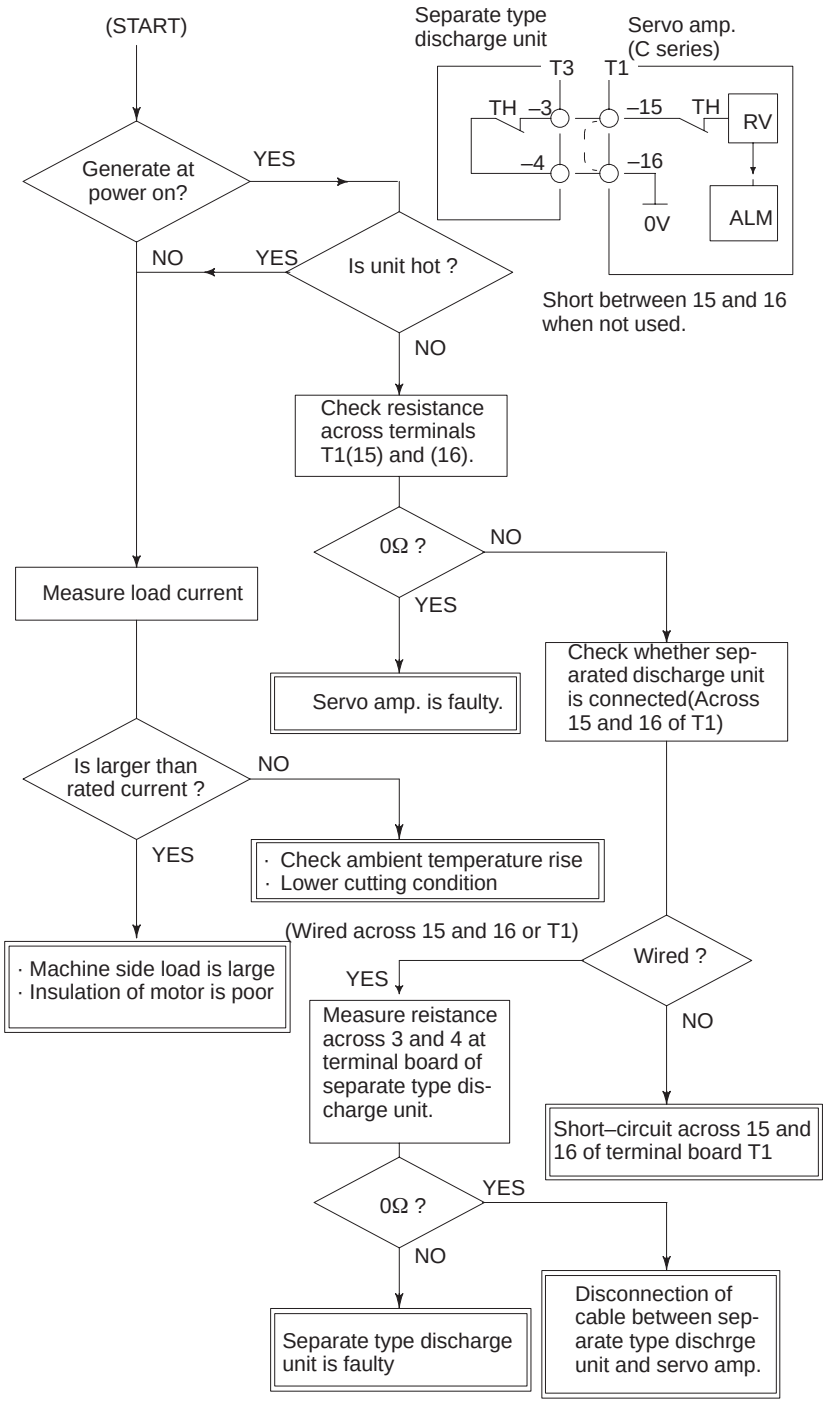
DC voltage in servo amp. is excessive.



- **#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.

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

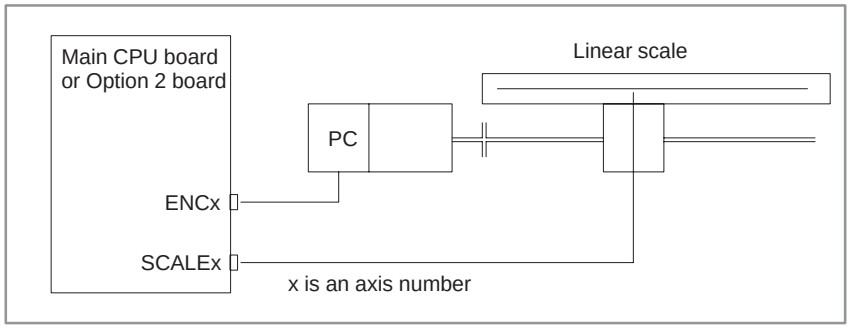
1	–	–	0	Built–in serial pulse coder disconnection	→ENC_X
1	–	–	1	Separate type position detector connection	→$SCALE_X$
0	–	–	0	Pulse coder disconnection (software)	Note

Note
This alarm is related with full–closed system.

- **Causes**

1 Signal cable is disconnected or short–circuited
2 Serial pulse coder or position detector is faulty Refer to Notes 1
3 Main CPU board or option 2 board is faulty. Refer to Notes 2

Notes
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 main CPU board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 "data input/output".



From 1st axis to 4th axis are main CPU board. 5th axis or later are option 2 board.

7)#0(OFA):Overflow alarm

Causes

1 Wrong setting of servo parameters 1800s.
2 Main CPU (1axis to 4 axes) or option 2 board (5 axes or more)

> **Note**
> When the main CPU board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 “data input/output ” .

When 1 is displayed at DGN 204

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

#6(OFS): A/D converter used for current feedback in the digital servo is abnormal.

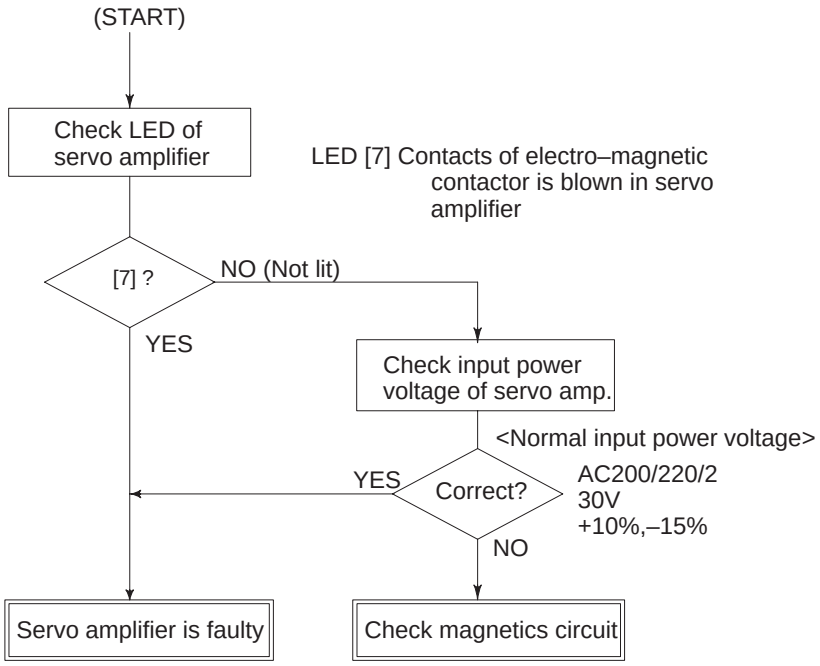
#5(MCC): Contacts of electromagnetic contactor in the servo amp. is blown.→LED 7 lights.

Serial pulse coder C is an incremental pulse coder.

- **#6(OFS):A/D converter is abnormal**

Main CPU board or option 2 board is faulty
When the main CPU board is replaced, all the data stored in memory is lost.
Set NC data again, referring to chapter 3 “ data input/output ”.

- **#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 Electro magnetic 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.

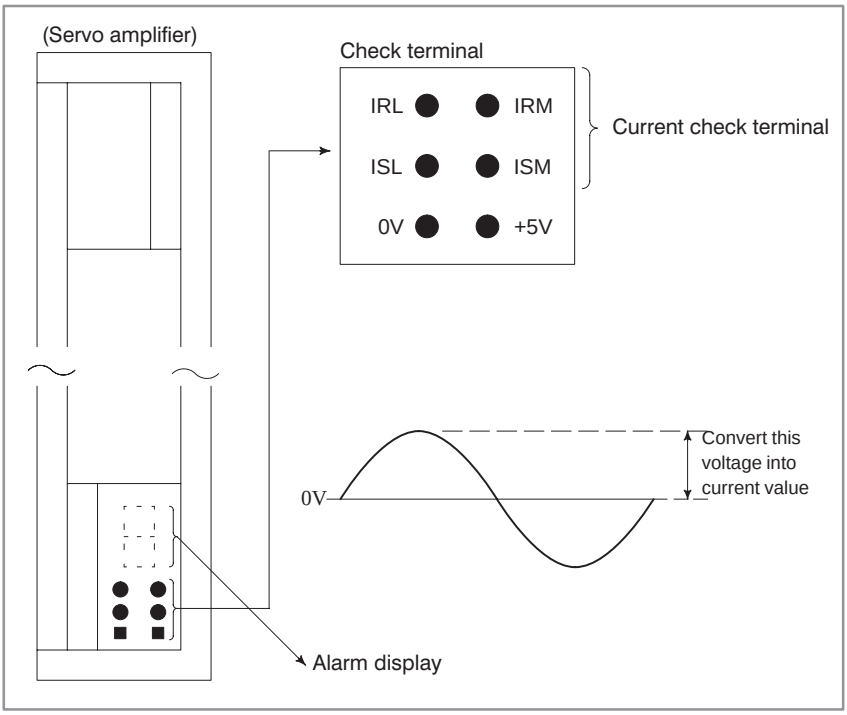
- **Terminal name and meaning**

Terminal name	Meaning
OV	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**



6.23 ALARM 416 (DISCONNECTION ALARM)

Position detection signal line is disconnected or short–circuited.

Point

Check the details using the CNC's diagnostic fucntion.

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

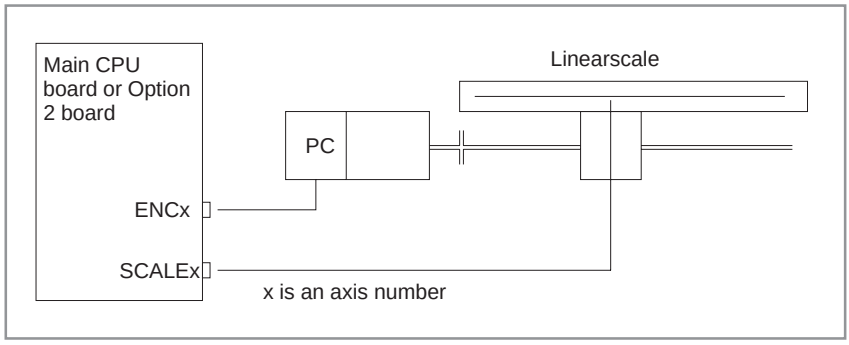
1	–	–	0	Built–in serial pulse coder disconnection	→ENC_X
1	–	–	1	Separate type position detector connection	→$SCALE_X$
0	–	–	0	Pulse coder disconnec-tion (software)	Note

Note
This alarm is related with full–closed system.

Causes

1 Signal cable is disconnected or short–circuitted
2 Serial pulse coder or position detector is faulty Refer to Note 1
3 Main CPU board or option 2 board is faulty Refer to Note 2

Notes
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 main board is replaced, all the data stored in memory is lost. Set NC data again, referring to chapter 3 " Data input/output" .



From 1st axis to 4th axis are main CPU board. 5th axis or more are option 2 board.

6.24 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 section 9.16.

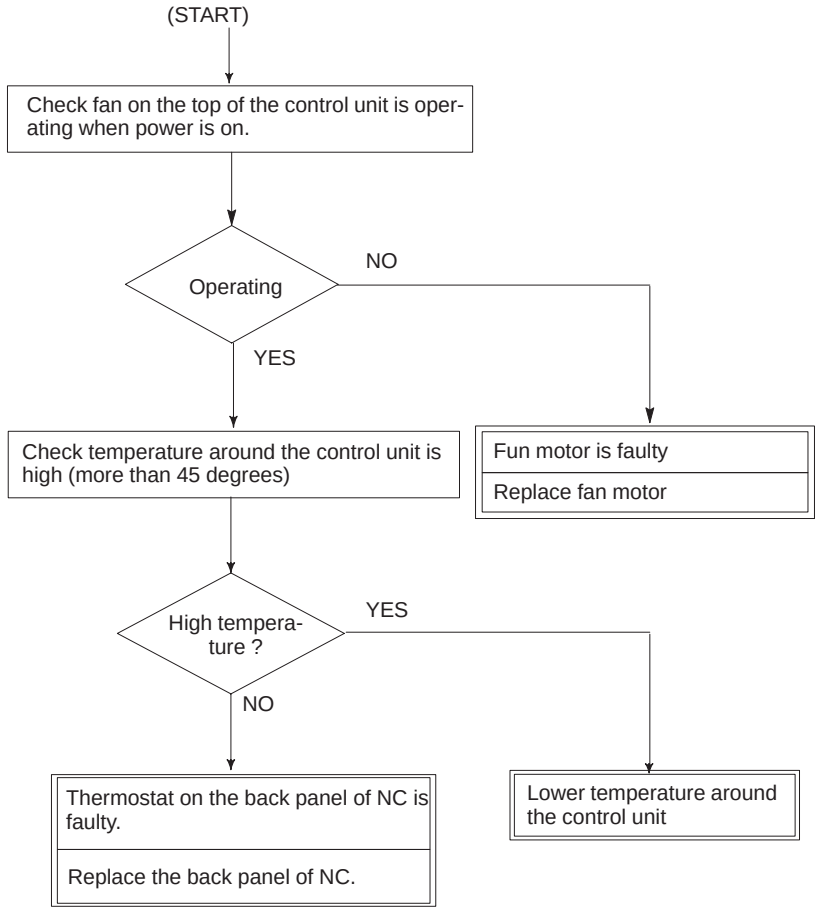
- **Causes**

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”.

6.25 ALARM 700 (OVERHEAT AT CONTROL SIDE)

Because an ambient temperature of the control unit becomes high, a thermostat mounted on the back panel of NC functions and informs an alarm.

Remedies



6.26 ALARM 900 (ROM PARITY ERROR)

ROM parity error occurred.

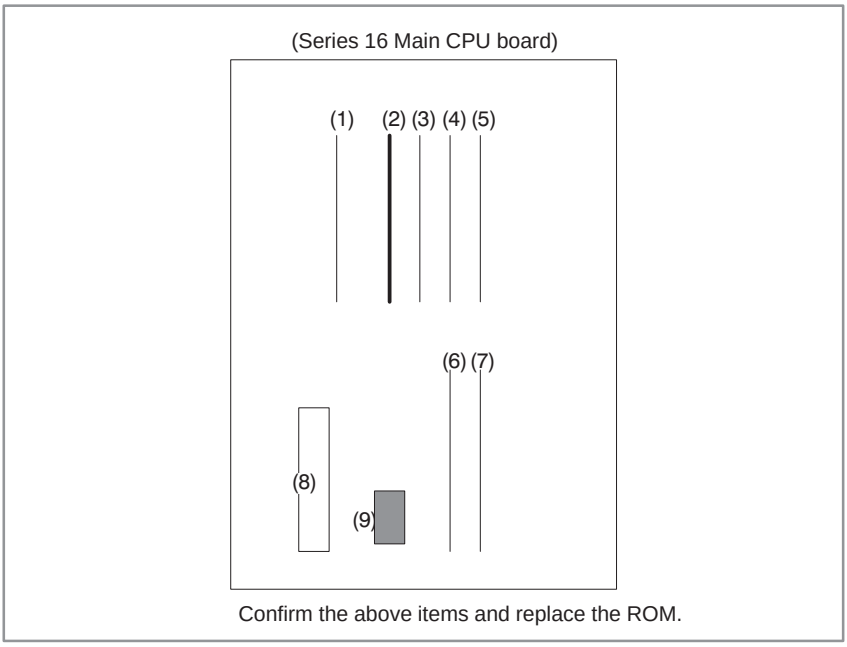
Causes and Remedies

(1) ROM module mounted on the main CPU board or ROM is defective.

```
SYSTEM ALARM                                B0A1-02

900  ROM PARITY

CNC  ROM MODULE : FC0
                                  Defective file
                                  or ROM is displayed
MACRO ROM MODULE
SERVO ROM
```

Confirm the series and versions of control software those are displayed on upper right of the screen.
*FROM module may be written data by machine tool builder.
*Mounting position of ROM/FROM module

(2) : FROM module (CNC control software, Control soft for digital servo, Graphic control software, and Macro ROM)
(9) : BOOT ROM (ROM for CNC system boot)



Confirm the above items and replace the ROM.

6.27 ALARM 910 TO 913 (SRAM PARITY)

Parity error of RAM module 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)

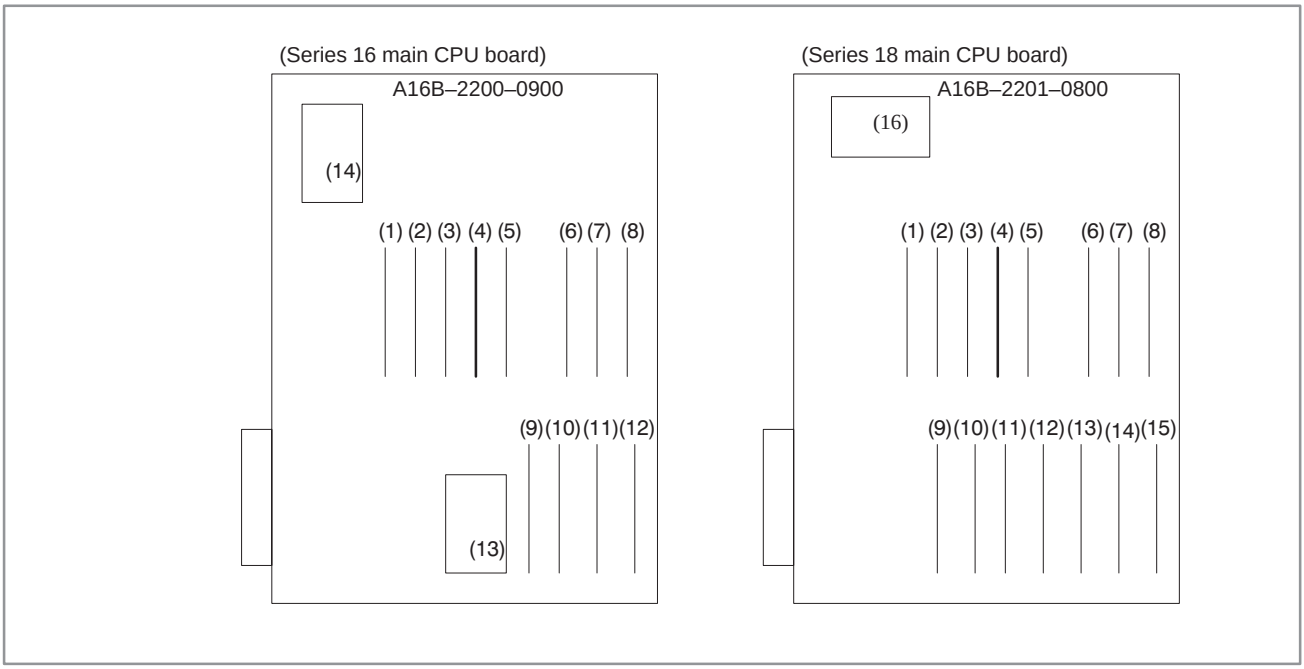
Causes and Remedies

(1) Causes are faults of RAM on the main board or RAM module, or fault of data memorized in RAM. 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 on the main board or RAM module may be faulty. Change (4)RAM module on main CPU board.
Set all the data again, referring to chapter 3 “data input/output”.

- **RAM module mounting position**

1 : SRAM module (Part program editing, parameters)



(2) Low voltage of memory back up battery. Battery alarm occurs if voltage is 2.6V or less (3.0V rating).

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 2.8 battery replacing item and change the batteries.

(3) Power supply unit is faulty

When alarm turns off by an operation of clearing all the memory, power supply unit may also be faulty.

6.28 ALARM 920 TO 923 (WATCH DOG OR RAM PARITY)

920: Watch dog alarm or RAM parity in servo control module has occurred in the 1st or 2nd axis
921: Above alarm has occurred in the 3rd or 4th axis
922: Above alarm has occurred in the 5th or 6th axis
923: Above alarm has occurred in the 7th or 8th axis

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.

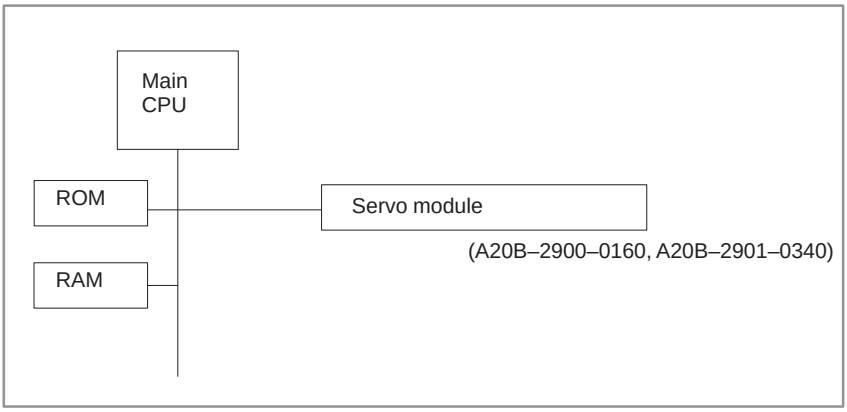
- **RAM parity error**

Refer to alarm 910 to 915

Causes and Remedies

- **Servo control module is faulty**

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 on the main CPU board for alarm 920 and 921; replace servo module on the option 2 board for alarm 922 and 923.



- **Main CPU board is faulty**

CPU or peripheral circuits may be faulty. Replace the main CPU board.

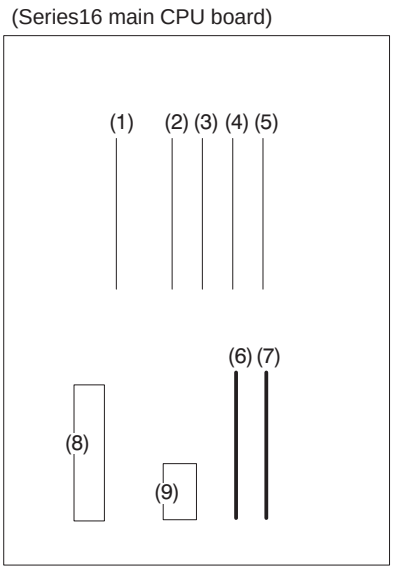
- **CNC control software ROM module is faulty**

Software may not work properly due to failure of FROM module. Change FROM module.

- **Power supply unit is faulty**

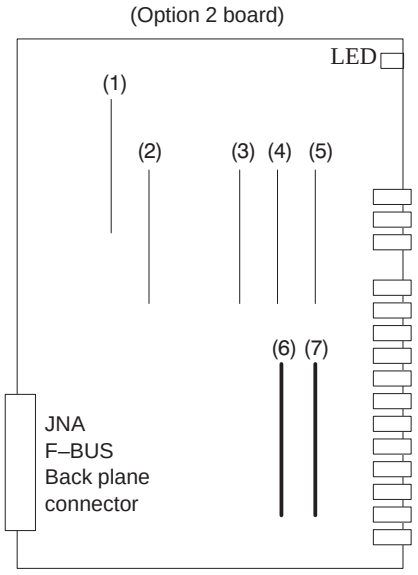
DC output voltage of power supply unit may be faulty. Replace the power supply unit.

Module mounting position (Main CPU board)



(2)(2) :SYSTEM(CNC control software)
(6) :AXIS2(3rd,4th axis digital servo control)
(7) :AXIS1(1st,2nd axis digital servo control)

Module mounting position (Series 16 option boards)



(6) : AXIS2 (7th,8th axis digital servo control)
(7) : AXIS1 (5th,6th axis digital servo control)

6.29 ALARM 924 (SERVO MODULE MOUNTING ERROR)

The digital 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 of servo module on main CPU or option 2 board. For location of servo module, refer to an installation diagram of alarm 920 to 923.

<Series 16 Main CPU board>
1st to 4th axis servo module
(A20B–2902–0060 or A20B–2902–0061)

<Option 2 board>
5th to 8th axis servo module
(A20B–2902–0060 or A20B–2902 –0061)

Unless these boards are mounted correctly, if this alarm still generates, change main CPU board, option 2 board and/ or servo module.

- **Kinds of servo module**

A20B–2902–0060	Standard
A20B–2902–0061	For Learning control

6.30 ALARM 930 (CPU ERROR)

CPU error (illeagal interrupt) has generated.

Causes and Remedies

1) Main CPU board is faulty

An interrupt which will not occur during usual operation has generated.
Peripheral circuit of the CPU may be abnormal. Change the main CPU board. If operation is performed normally by power off and on, noise may be a cause. Refer to 2.4.16. Action against noise.

6.31 ALARM 950 (PMC SYSTEM ALARM)

An error occurred when RAM test is being executed.

Causes and Remedies

The following causes are considered :

- **For PMC–RB**

Fault on Main CPU board

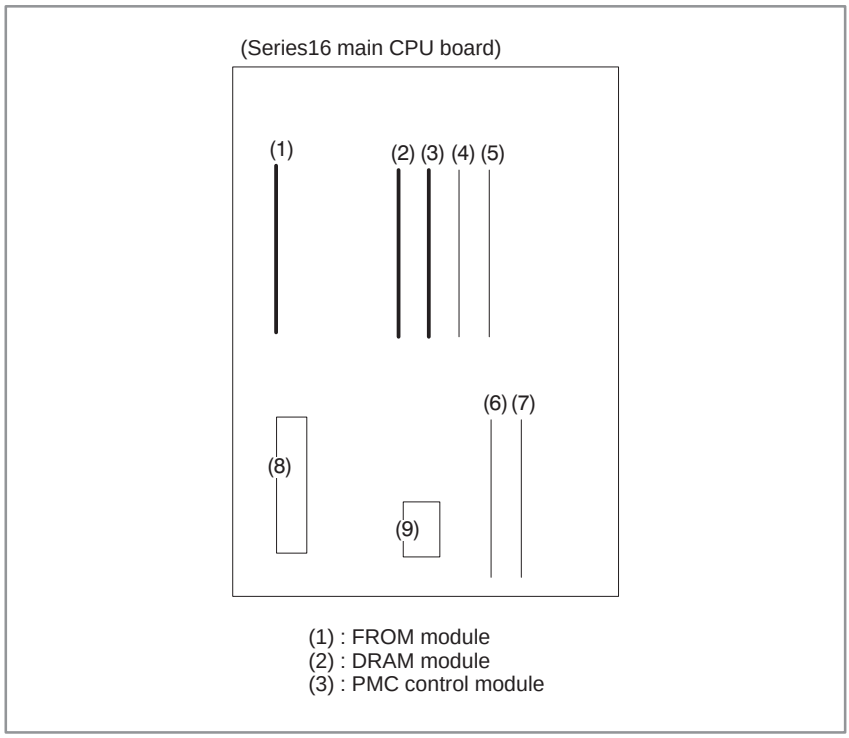
- PMC control module (3) is faulty.
- DRAM module (2) is faulty.
- FROM module (1) is faulty.

- **For PMC–RC**

Fault on Main CPU board

- PMC control module (5) is faulty.
- DRAM module (4) is faulty (Option 3 board)
- Option 3 board is faulty.

Module mounting position (Main CPU)



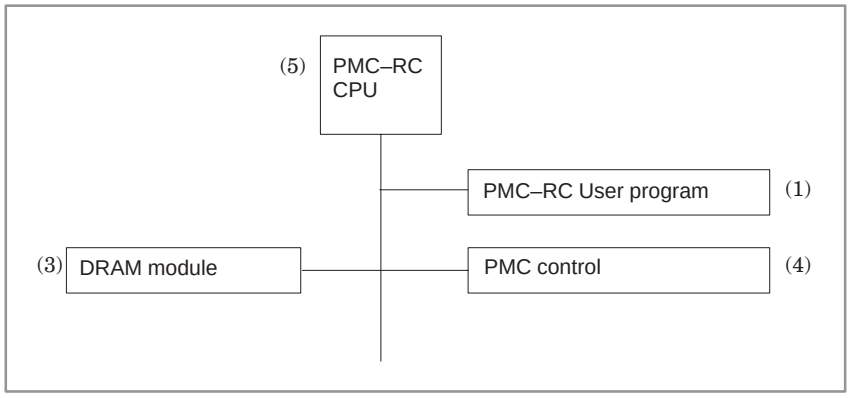
Refer to the next page for PMC–RC.

6.32 ALARM 951 (PMC–RC WATCH DOG ALARM)

A watch dog alarm has generated in PMC–RC.

Causes and Remedies

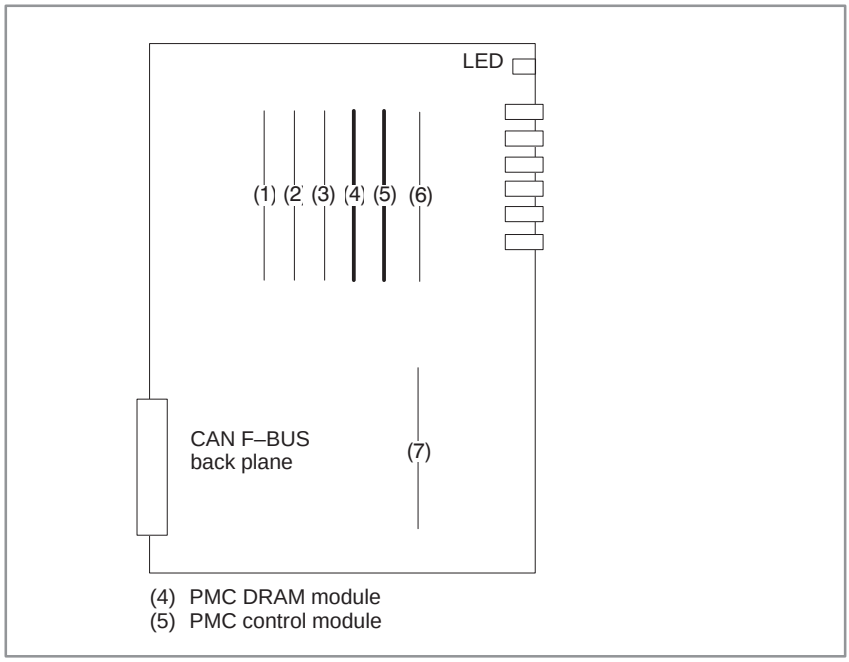
Option 3 board or a module on the option 3 board



- Option 3 board is faulty.
- PMC DRAM module (4) is faulty.
- PMC control module (5) is faulty.

Module mounting position

(Option 3 board)

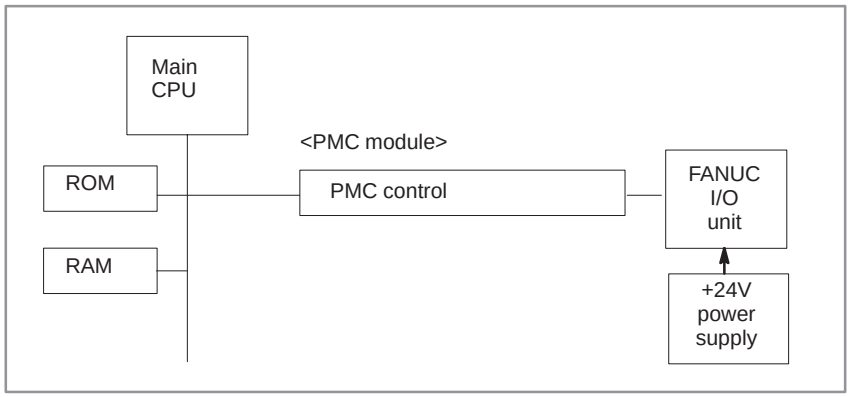


6.33 ALARM 970 (NMI ALARM IN PMC CONTROL MODULE)

RAM parity error or NMI has occurred in the PMC–RB control module.

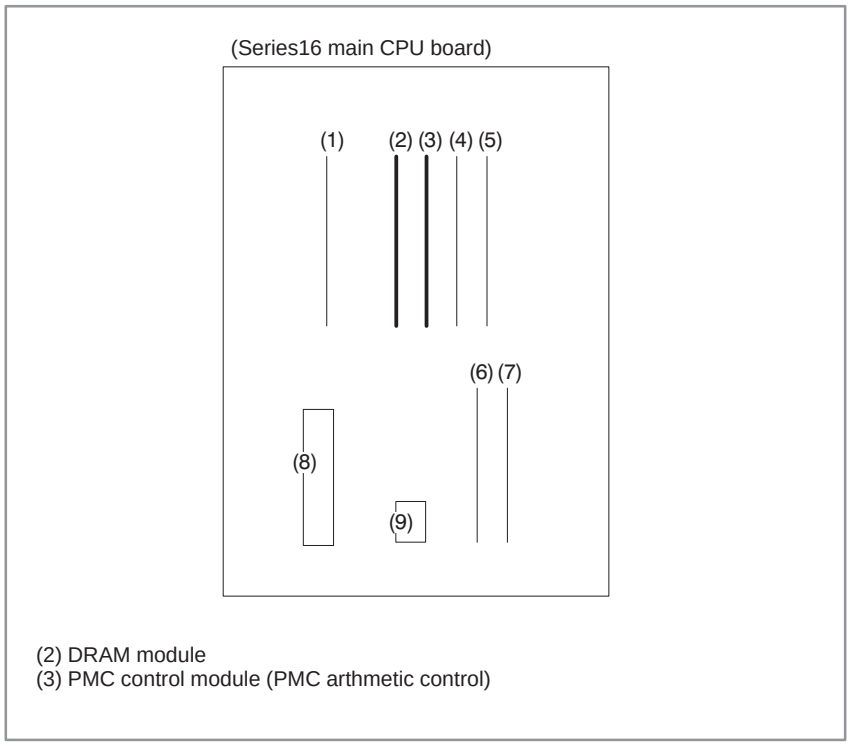
Causes and Remedies

Fault of PMC module is considered.



- PMC control module (3) is faulty.
- DRAM module (9) is faulty.

Module mounting position

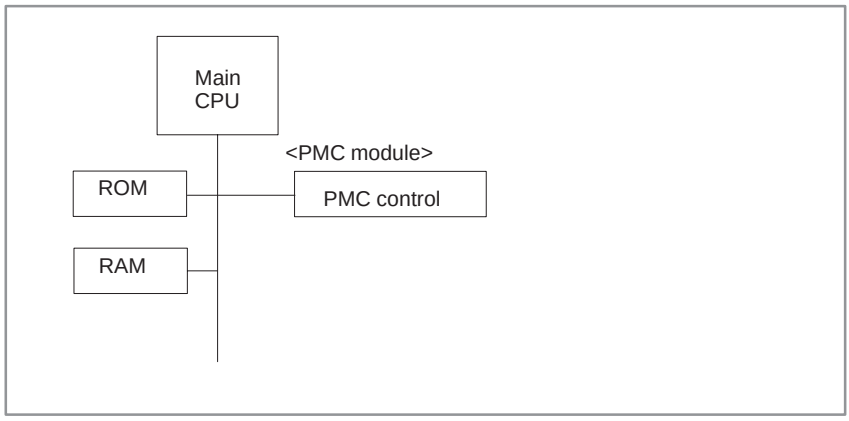


6.34 ALARM 971 (NMI ALARM IN SLC)

A communication error is detected between the CNC and Laser oscillator at SLC in the PMC control module.

Causes and Remedies

Fault of PMC module or fault of Laser interface board.
Other cause is noise on the comminication cable.



- PMC control module (3) is faulty.
- Laser interface board is faulty.

Disconnection or broken of cable.
Refer to previous page for the module mounting position.
Noises on the connection cable.

6.35 ALARM 972 (NMI ALARM)

NMI has generated in a board other than the main CPU board.

Causes and Remedies

1) Any of option boards shown below may be faulty.

- Option 1 board
- Option 2 board
- Option 3 board

Change above boards in the order, in which replacement is easier.

Note
When you change option 2 board, you must input data (parameters, programs, etc.) on sub side.
When you change loader control board, you must input data (parameters, programs, etc.) on loader side.

6.36 ALARM 973 (NMI ALARM BY UNKNOWN CAUSE)

An unknown NMI has generated.

Causes and Remedies

1) Main CPU board or power supply unit is faulty
   - Main CPU board is faulty.
   - Power supply unit is faulty.

Note
When the main CPU board is replaced, all the data in memory is lost. Set the NC data (parameter, offset and program etc) again.

2) Option boards may be faulty.
   - Option 1 board is faulty.
   - Option 2 board is faulty.
   - Option 3 board is faulty.

   Change above boards in the order, in which replacement is easier.

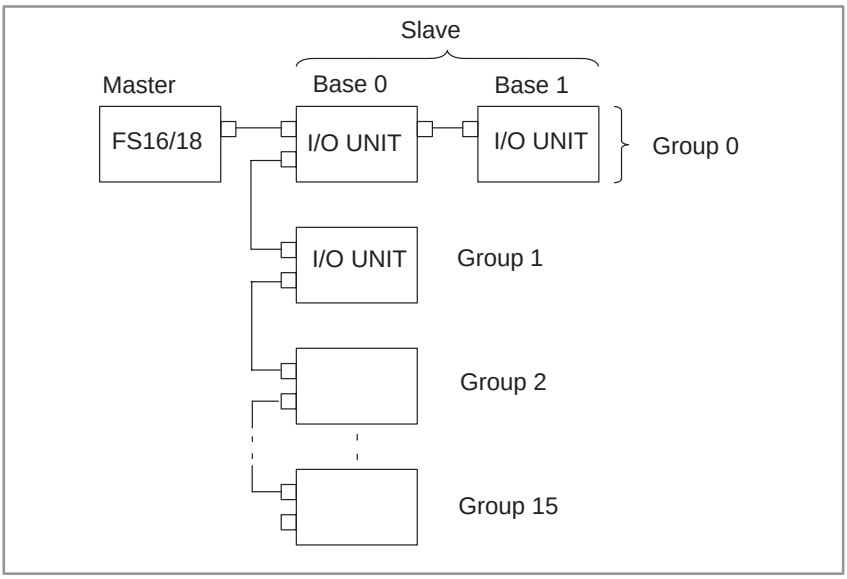
Note
When you change the option 2 board, you must input data (parameters, programs,etc.) on the sub side.
When you change loader control board, you must input data again (parameters, programs, etc.)

APPENDIX

A I/O UNIT MODEL A

A.1 SYSTEM CONFIGURATION

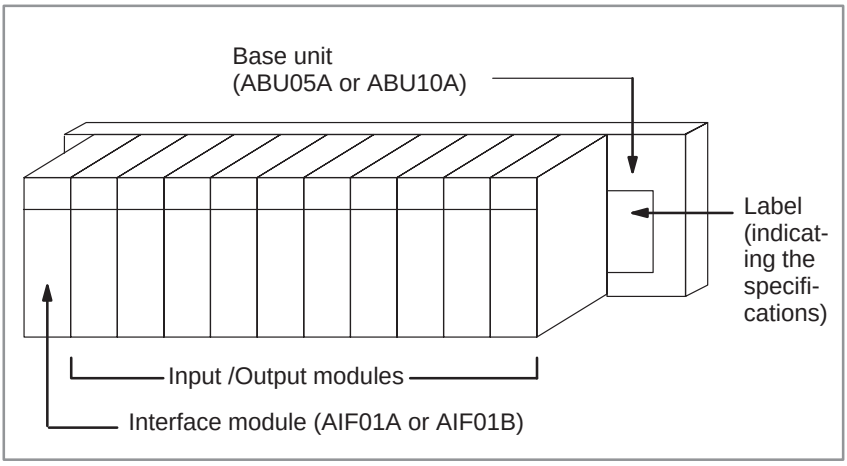
Up to 16 FANUC I/O Unit–MODEL A groups can be connected to a CNC through the FANUC I/O Link high–speed serial interface.



* 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 Operator's–panel connection unit
- One Series 0–C

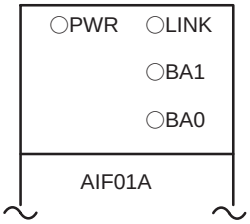
A.2 HARDWARE CONFIGURATION



A.3 LED INDICATION

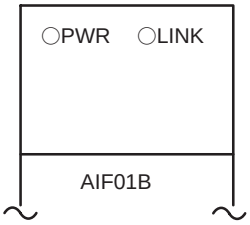
Modules having up to 16 input/output points are provided with LEDs to indicate their statuses.
Use these LED's to assist you with troubleshooting.

AIF01A



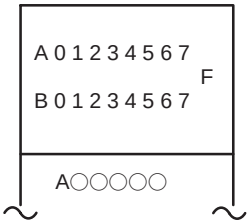
Symbol	Description
PWR	Indicates that the internal 24 VDC power supply is operating normally.
LINK	Indicates that the I/O Link is operating normally.
BA0 BA1	Indicates the number of the base from which data is being transferred. BA1 / BA0 / Base number ○ / ○ / Base #0 ○ / ● / Base #1 ● / ○ / Base #2 ● / ● / Base #3 ●: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.

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
A0A7 B0A7	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.

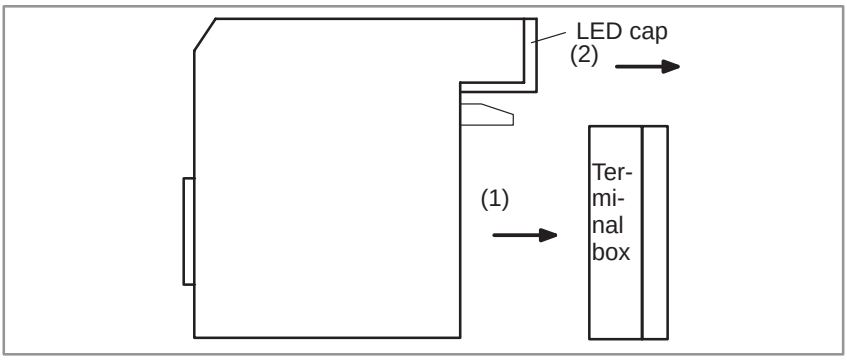
Module	Indication of whether a fuse has blown	Parts number of fuse	Rated current
AIF01A Interface module	PWR off	A60L–0001–0290#LM32	3.2A
AIF01B Interface module	PWR off	A60L–0001–0290#LM32	3.2A
A0D08C Output module (8 DC points)	F on	A60L–0001–0260#5R00	5A
A0D08D Output module (8 DC points)	F on	A60L–0001–0260#5R00	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

A.5 REMOVING A PRINTED CIRCUIT BOARD

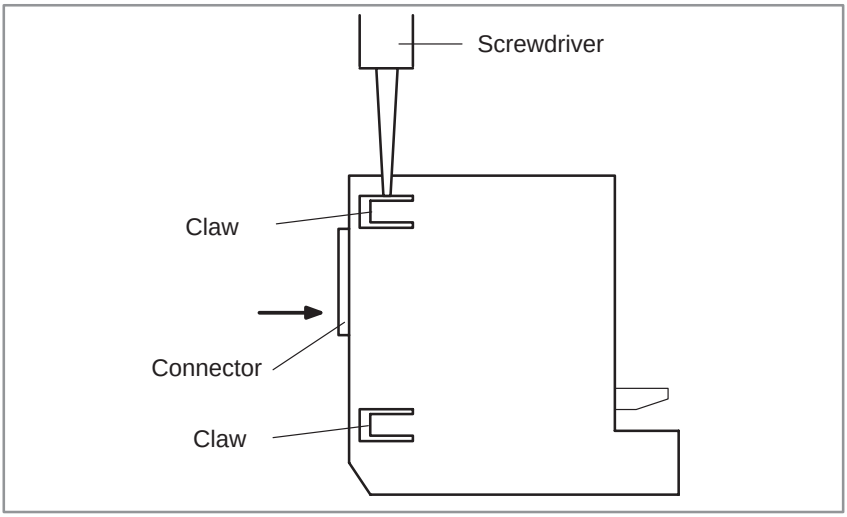
- **Removing a terminal–box–type input/output module**

1 Remove the terminal box, if necessary.

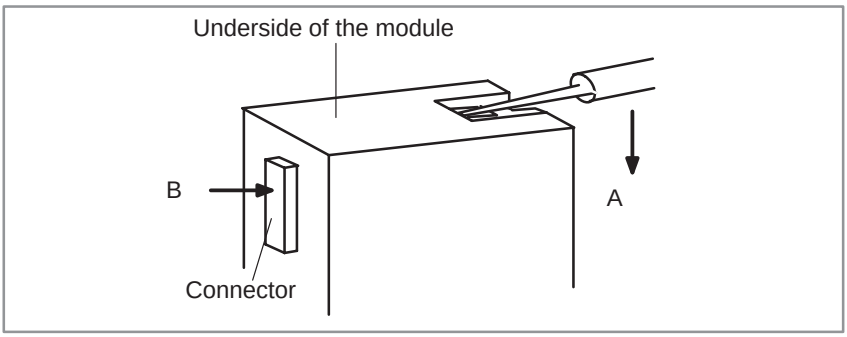
2 Remove the LED cap by pulling it in the direction indicated by the arrow.



3 While pushing the connector in the direction indicated by the arrow, use a screwdriver to release the two claws on the module case.

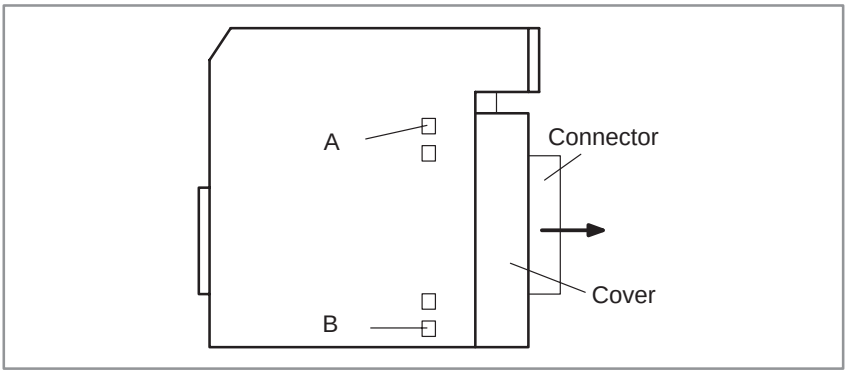


4 As shown on the right, insert a screwdriver into the gap between the module case and the connector of the terminal box. To remove the printed circuit board, push the connector in the direction indicated by arrow B while pushing the screwdriver in the direction indicated by arrow A.

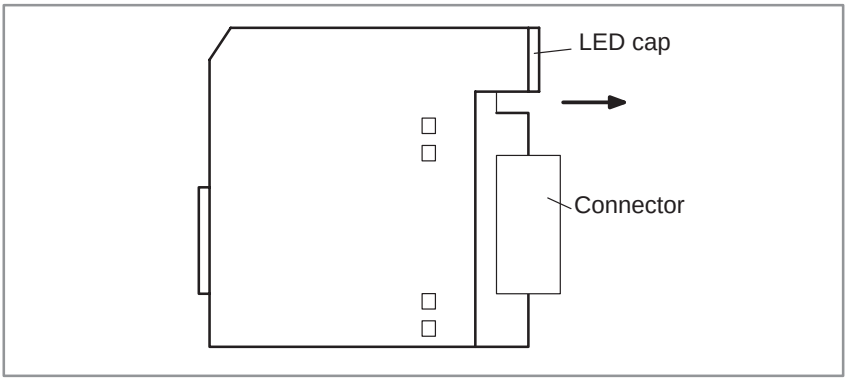


- **Removing a connector–type input/output module**

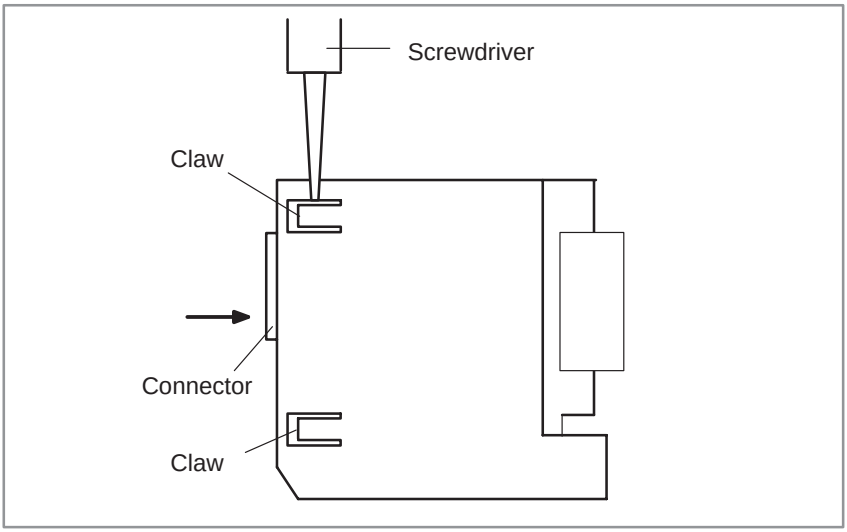
1 To remove the cover, pull it in the direction indicated by the arrow, while using a screwdriver to release claws A and B on both sides.



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

B.1 LIST OF ALARM CODES

(1) Program errors /Alarms on program and operation (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.
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.
015	TOO MANY AXES COMMANDED	An attempt was made to move the machine along the axes, but the number of the axes exceeded the specified number of axes controlled simultaneously. Alternatively, in a block where where the skip function activated by the torque–limit reached signal (G31 P99/P98) was specified, either moving the machine along an axis was not specified, or moving the machine along multiple axes was specified. Specify movement only along one axis.
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.
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.
025	CANNOT COMMAND F0 IN G02/G03	F0 (fast feed) was instructed by F1 –digit column feed 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 type C. Offset is not canceled but another axis is offset for the tool length offset type C. 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.

Number	Message	Contents
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 D/H code for tool length offset or cutter compensation 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.
033	NO SOLUTION AT CRC	A point of intersection cannot be determined for cutter compensation. Modify the program.
034	NO CIRC ALLOWED IN ST–UP / EXT BLK	The start up or cancel was going to be performed in the G02 or G03 mode in cutter compensation C. Modify the program.
035	CAN NOT COMMANDED G39	G39 is commanded in cutter compensation B cancel mode or on the plane other than offset plane. Modify the program.
036	CAN NOT COMMANDED G31	Skip cutting (G31) was specified in cutter compensation mode. Modify the program.
037	CAN NOT CHANGE PLANE IN CRC	G40 is commanded on the plane other than offset plane in cutter compensation B. The plane selected by using G17, G18 or G19 is changed in cutter compensation C mode. Modify the program.
038	INTERFERENCE IN CIRCULAR BLOCK	Overcutting will occur in cutter compensation C because the arc start point or end point coincides with the arc center. Modify the program.
041	INTERFERENCE IN CRC	Overcutting will occur in cutter compensation C. Two or more blocks are consecutively specified in which functions such as the auxiliary function and dwell functions are performed without movement in the cutter compensation mode. Modify the program.
042	G45/G48 NOT ALLOWED IN CRC	Tool offset (G45 to G48) is commanded in cutter compensation. Modify the program.
043	ILLEGAL T–CODE COMMAND	In a system using the DRILL–MATE with an ATC, a T code was not specified together with the M06 code in a block. Alternatively, the Tcode was out of range.
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, P3 and P4 are commanded for 2nd, 3rd and 4th reference position return command.
050	CHF/CNR NOT ALLOWED IN THRD BLK	Optional chamfering or corner R is commanded in the thread cutting block. Modify the program.
051	MISSING MOVE AFTER CHF/CNR	Improper movement or the move distance was specified in the block next to the optional chamfering or corner R block. Modify the program.
052	CODE IS NOT G01 AFTER CHF/ CNR	The block next to the chamfering or corner R block is not G01,G02 or G03. Modify the program.
053	TOO MANY ADDRESS COMMANDS	For systems without the arbitary angle chamfering or corner R cutting, a comma was specified. For systems with this feature, a comma was followed by something other than R or C Correct the program.
055	MISSING MOVE VALUE IN CHF/ CNR	In the arbitrary angle chamfering or corner R block, the move distance is less than chamfer or corner R amount.
058	END POINT NOT FOUND	In a arbitrary angle chamfering or corner R cutting block, a specified axis is not in the selected plane. Correct the program.

Number	Message	Contents
059	PROGRAM NUMBER NOT FOUND	In an external program 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.
064	SHAPE PROGRAM NOT MONOTONOUSLY	A target shape which cannot be made by monotonic machining was specified in a repetitive canned cycle (G71 or G72).
070	NO PROGRAM SPACE IN MEMORY	The memory area is insufficient. 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), 400 (option) or 1000 (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.
080	G37 ARRIVAL SIGNAL NOT ASSERTED	In the automatic tool length measurement function (G37), the measurement position reach signal (XAE, YAE, or ZAE) is not turned on within an area specified in parameter 6254 6255 (value ε). This is due to a setting or operator error.
081	OFFSET NUMBER NOT FOUND IN G37	Tool length automatic measurement (G37) was specified without a H code. (Automatic tool length measurement function) Modify the program.
082	H–CODE NOT ALLOWED IN G37	H code and automatic tool compensation (G37) were specified in the same block. (Automatic tool length measurement function) Modify the program.
083	ILLEGAL AXIS COMMAND IN G37	In automatic tool length measurement, an invalid axis was specified or the command is incremental. Modify the program.
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.

Number	Message	Contents
086	DR SIGNAL OFF	When entering data in the memory by using Reader / Puncher interface, the ready signal (DR) of reader / puncher was turned 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 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. Check the program contents.
092	AXES NOT ON THE REFERENCE POINT	The commanded axis by G27 (Reference position return check) did not return to the reference position.
094	P TYPE NOT ALLOWED (COORD CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the coordinate system setting operation was performed.) Perform the correct operation according to th operator's manual.
095	P TYPE NOT ALLOWED (EXT OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the external workpiece offset amount changed.) Perform the correct operation according to th operator's manual.
096	P TYPE NOT ALLOWED (WRK OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the workpiece offset amount changed.) Perform the correct operation according to the operator's manual.
097	P TYPE NOT ALLOWED (AUTO EXEC)	P type cannot be directed when the program is restarted. (After power ON, after emergency stop or P / S 94 to 97 reset, no automatic operation is performed.) Perform automatic operation.
098	G28 FOUND IN SEQUENCE RETURN	A command of the program restart was specified without the reference position return operation after power ON or emergency stop, and G28 was found during search. Perform the reference position return.
099	MDI EXEC NOT ALLOWED AFT. SEARCH	After completion of search in program restart, a move command is given with MDI. Move axis before a move command or don't interrupt MDI operation.
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.
109	P/S ALARM	A value other than 0 or 1 was specified after P in the G08 code, or no value was specified.
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 turns out to be invalid, an alarm No.111 is issued. -10^{47} to -10^{-29}, 0, 10^{-29} to 10^{47} Modify the program.
112	DIVIDED BY ZERO	Division by zero was specified. (including tan 90°) Modify the program.
113	IMPROPER COMMAND	A function which cannot be used in custom macro is commanded. Modify the program.

Number	Message	Contents
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 or in high–speed cycle machining. The header contents are improper. This alarm is given in the following cases: High speed cycle machining 1. The header corresponding to the specified machining cycle number called is not found. 2. The cycle connection data value is out of the allowable range (0 – 999). 3. The number of data in the header is out of the allowable range (0 – 32767). 4. The start data variable number of executable format data is out of the allowable range (#20000 – #85535). 5. The last storing data variable number of executable format data is out of the allowable range (#85535). 6. The storing start data variable number of executable format data is overlapped with the variable number used in the header. 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. Or BCD argument is negative, and other values than 0 to 9 are present on each line of BIN argument. Modify the program.
122	FOUR FOLD MACRO MODAL–CALL	The macro modal call is specified four fold. 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.
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 diagram to find the cause.
132	ALARM NUMBER NOT FOUND	No alarm No. concerned exists in external alarm message clear. Check the PMC ladder diagram.
133	ILLEGAL DATA IN EXT. ALARM MSG	Small section data is erroneous in external alarm message or external operator message. Check the PMC ladder diagram.
135	ILLEGAL ANGLE COMMAND	The index table indexing positioning angle was instructed in other than an integral multiple of the value of the minimum angle. Modify the program.

Number	Message	Contents
136	ILLEGAL AXIS COMMAND	In index table indexing.Another control axis was instructed together with the B axis. Modify the program.
139	CAN NOT CHANGE PMC CONTROL AXIS	An axis is selected in commanding by PMC axis control. Modify the program.
141	CAN NOT COMMAND G51 IN CRC	G51 (Scaling ON) is commanded in the tool offset mode. Modify the program.
142	ILLEGAL SCALE RATE	Scaling magnification is commanded in other than 1 – 999999. Correct the scaling magnification setting (G51 P_p ..... or parameter 5411 or 5421).
143	SCALED MOTION DATA OVERFLOW	The scaling results, move distance, coordinate value and circular radius exceed the maximum command value. Correct the program or scaling mangification.
144	ILLEGAL PLANE SELECTED	The coordinate rotation plane and arc or cutter compensation C plane must be the same. Modify the program.
145	ILLEGAL CONDITIONS IN POLAR COORDINATE INTERPOLATION	The conditions are incorrect when the polar coordinate interpolation starts or it is canceled. 1) In modes other than G40, G12.1/G13.1 was specified. 2) An error is found in the plane selection. Parameters No. 5460 and No. 5461 are incorrectly specified. Modify the value of program or parameter.
146	IMPROPER G CODE	G codes which cannot be specified in the polar coordinate interpolation mode was specified. See section II–4.4 and modify the program.
148	ILLEGAL SETTING DATA	Automatic corner override deceleration rate is out of the settable range of judgement angle. Modify the parameters (No.1710 to No.1714)
149	FORMAT ERROR IN G10L3	A code other than Q1,Q2,P1 or P2 was specified as the life count type in the extended tool life management.
150	ILLEGAL TOOL GROUP NUMBER	Tool Group No. exceeds the maximum allowable value. Modify the program.
151	TOOL GROUP NUMBER NOT FOUND	The tool group commanded in the machining program is not set. Modify the value of program or parameter.
152	NO SPACE FOR TOOL ENTRY	The number of tools within one group exceeds the maximum value registerable. Modify the number of tools.
153	T–CODE NOT FOUND	In tool life data registration, a T code was not specified where one should be. Correct the program.
154	NOT USING TOOL IN LIFE GROUP	When the group is not commanded, H99 or D99 was commanded. Correct the program.
155	ILLEGAL T–CODE IN M06	In the machining program, M06 and T code in the same block do not correspond to the group in use. Correct the program.
156	P/L COMMAND NOT FOUND	P and L commands are missing at the head of program in which the tool group is set. Correct the program.
157	TOO MANY TOOL GROUPS	The number of tool groups to be set exceeds the maximum allowable value. (See parameter No. 6800 bit 0 and 1) Modify the program.
158	ILLEGAL TOOL LIFE DATA	The tool life to be set is too excessive. Modify the setting value.
159	TOOL DATA SETTING INCOMPLETE	During executing a life data setting program, power was turned off. Set again.
175	ILLEGAL G107 COMMAND	Conditions when performing circular interpolation start or cancel not correct. To change the mode to the cylindrical interpolation mode, specify the command in a format of “G07.1 rotation–axis name radius of cylinder.”

Number	Message	Contents
176	IMPROPER G–CODE IN G107	Any of the following G codes which cannot be specified in the cylindrical interpolation mode was specified. 1) G codes for positioning: G28,, G73, G74, G76, G81 – G89, including the codes specifying the rapid traverse cycle 2) G codes for setting a coordinate system: G52,G92, 3) G code for selecting coordinate system: G53 G54–G59 Modify the program.
177	CHECK SUM ERROR (G05 MODE)	Check sum error Modify the program.
178	G05 COMMANDED IN G41/G42 MODE	G05 was commanded in the G41/G42 mode. Correct the program.
179	PARAM. (NO. 7510) SETTING ERROR	The number of controlled axes set by the parameter 7510 exceeds the maximum number. Modify the parameter setting value.
180	COMMUNICATION ERROR (REMOTE BUF)	Remote buffer connection alarm has generated. Confirm the number of cables, parameters and I/O device.
181	FORMAT ERROR IN G81 BLOCK	G81 block format error (hobbing machine) 1) T (number of teeth) has not been instructed. 2) Data outside the command range was instructed by either T, L, Q or P. Modify the program.
182	G81 NOT COMMANDED	G83 (C axis servo lag quantity offset) was instructed though synchronization by G81 has not been instructed. Correct the program. (hobbing machine)
183	DUPLICATE G83 (COMMANDS)	G83 was instructed before canceled by G82 after compensating for the C axis servo lag quantity by G83. (hobbing machine)
184	ILLEGAL COMMAND IN G81	A command not to be instructed during synchronization by G81 was instructed. (hobbing machine) 1) A C axis command by G00, G27, G28, G29, G30, etc. was instructed. 2) Inch/Metric switching by G20, G21 was instructed.
185	RETURN TO REFERENCE POINT	G81 was instructed without performing reference position return after power on or emergency stop. (hobbing machine) Perform reference position return.
186	PARAMETER SETTING ERROR	Parameter error regarding G81 (hobbing machine) 1) The C axis has not been set to be a rotary axis. 2) A hob axis and position coder gear ratio setting error Modify the parameter.
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.
194	SPINDLE COMMAND IN SYNCHRO–MODE	A contour control mode, spindle positioning (Cs–axis control) mode, or rigid tapping mode was specified during the serial spindle synchronous control mode. Correct the program so that the serial spindle synchronous control mode is released in advance.
195	MODE CHANGE ERROR	Switching command to contouring mode, Cs axis control or rigid tap mode or switching to spindle command mode is not correctly completed. (This occurs when the response to switch to the spindle control unit side with regard to the switching command from the NC is incorrect. This alarm is not for the purposes of warning against mistakes in operation, but because continuing operation in this condition can be dangerous it is a P/S alarm.)

Number	Message	Contents
197	C–AXIS COMMANDED IN SPINDLE MODE	The program specified a movement along the Cs–axis when the signal CON(DGN=G027#7) was off. Correct the program, or consult the PMC ladder diagram to find the reason the signal is not turned on.
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. Modify the program.
201	FEEDRATE NOT FOUND IN RIGID TAP	In the rigid tap, no F value is specified. Correct the program.
202	POSITION LSI OVERFLOW	In the rigid tap, spindle distribution value is too large. (System error)
203	PROGRAM MISS AT RIGID TAPPING	In the rigid tap, position for a rigid M code (M29) or an S command is incorrect. Modify the program.
204	ILLEGAL AXIS OPERATION	In the rigid tap, an axis movement is specified between the rigid M code (M29) block and G84 or G74 for M series (G84 or G88 for T series) block. Modify the program.
205	RIGID MODE DI SIGNAL OFF	Rigid mode DI signal is not ON when G84 or G74 for M series (G84 or G88 for T series) is executed though the rigid M code (M29) is specified.Consult the PMC ladder diagram to find the reason the DI signal (DGNG061.1) is not turned on.
206	CAN NOT CHANGE PLANE (RIGID TAP)	Plane changeover was instructed in the rigid mode. Correct the program.
210	CAN NOT COMAND M198/M199	M198 and M199 are executed in the schedule operation. M198 is executed in the DNC operation. Modify the program.
211	G31 (HIGH) NOT ALLOWED IN G99	G31 is commanded in the per revolution command when the high–speed skip option is provided. Modify the program.
212	ILLEGAL PLANE SELECT	The arbitrary angle chamfering or a corner R is commanded or the plane including an additional axis. Correct the program.
213	ILLEGAL COMMAND IN SYNCHRO–MODE	Movement is commanded for the axis to be synchronously controlled. Any of the following alarms occurred in the operation with the simple synchronization control. 1) The program issued the move command to the slave axis. 2) The program issued the manual continuous feed/manual handle feed/incremental feed command to the slave axis. 3) The program issued the automatic reference position return command without specifying the manual reference position return after the power was turned on. 4) The difference between the position error amount of the master and slave axes exceeded the value specified in parameter NO.8313.
214	ILLEGAL COMMAND IN SYNCHRO–MODE	Coordinate system is set or tool compensation of the shift type is executed in the synchronous control. Correct the program.
222	DNC OP. NOT ALLOWED IN BG.–EDIT	Input and output are executed at a time in the background edition. Execute a correct operation.
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 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. Correct the program.

Number	Message	Contents
232	TOO MANY HELICAL AXIS COMMANDS	Three or more axes (in the normal direction control mode two or more axes) were specified as helical axes in the helical interpolation mode.
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.
241	ILLEGAL FORMAT IN G02.2/G03.2	The end point, I , J , K , or R was not specified for involute interpolation.
242	ILLEGAL COMMAND IN G02.2/G03.2	An erroneous value was specified for involute interpolation. The start or end point was specified within the base circle. The value 0 was specified for I , J, K , or R,. The start or end point exceeds 100 revolutions from the involute curve start point.
243	OVER TOLERNCE OF END POINT	The end point was not positioned on the involute curve which started at the start point, and the end point was out of the range specified by parameter No.5610.
244	P/S ALARM	In the skip function activated by the torque limit signal, the number of accumulated erroneous pulses exceed 32767 before the signal was input. Therefore, the pulses cannot be corrected with one distribution. Change the conditions, such as feed rates along axes and torque limit, and try again.
245	T–CODE NOT ALOWEE IN THIS BLOCK	One of the G codes, G50, G10, and G04, which cannot be specified in the same block as a T code, was specified with a T code.
250	Z AXIS WRONG COMMAND (ATC)	In a system using the DRILL–MATE with an ATC, movement alogn the Z–axis was specified in a block in which a command for changing tools (M06 T_)was specified.
251	ATC ERROR	An error occurs in the DRILL–MATE in the following cases : When unusable T code is specified in M06 T_ When the M06 code is specified when the Z coordinate is positive in the machine coordinate system. When parameter No. 7810,which specifies the current tool number, is 0. When the M06 code is specified in the canned–cycle mode. When the M06 code is specified in a block in which a reference position return code, G27,G28, G29, or G30 is specified. When the M06 code is specified in the tool compensation mode (G41 to G44). When the M06 code is specified without any reference position return after the power is turned on or after the emergency stop is released. When the machine lock signal or the signal for ignoring the Z–axis is turned on while the tool is being changed. When a ”prying” condition is detected while the tool is changed. Refer to diagnosis parameter No. 530 for identifying the situations above.
252	ATC SPINDLE ALARM	An error due to excessive deviation occurs in spindle positioning during ATC operation. For details, see diagnosis parameter No.531. (Only for the DRILL–MATE)
253	G05 IS NOT AVAIRABLE	
4000	P/S ALARM	A near point can not be searched until “END OF RECORD” for near point search function. “END OF RECORD” is read for program re–start function (FS0–L type).
4001	P/S ALARM	Z axis is specified as gap control axis during near point search or program re–start (FS0–L type).

Number	Message	Contents
4002	UNAVAILABLE G–CODE IN SEARCH	G53 is commanded is specified with independent axis mode (PRM No. 15600#3 MIA=1) during near point search or program re–start (FS0–L type).
4004	3–D COORD. CONV. ALARM	One or two addresses of I, J, K are not commanded. X, Y, Z, 4 or 5 axis is not commanded.
4005	3–D COORD. CONV. ALARM	G27, G28 or G29 is commanded during three dimension coordinate conversion.
4006	3–D COORD. CONV. ALARM	G68 is commanded again during three–dimension coordinate conversion.
4007	3–D COORD. CONV. ALARM	G12 is commanded during three–dimension coordinate conversion.
4008	3–D COORD. CONV. ALARM	Scaling or coordinate system rotaion is commanded during three–dimension coordinate conversion.
4010	3–D TRANSFORM FORMAT ERROR	The command format of G98 is not right.
4011	CANNOT MAKE MATRIX	The matrix can not be made for operating of G98.
4012	CANNOT CONVERT	The coordinate can not be converted for G98.
4016	P/S ALARM	The radius value R is too large during G33 mode.
4017	P/S ALARM	A G code of 01 group except for G01 is commanded during G33 mode. Cutter compensation is commanded during G33 mode.
4021	P/S ALARM	A minus value is commanded as a nozzle length. A nozzle length is out of setting range. A total length of the 2nd arm and the nozzle length is 500mm (19.685inches) for maximum.
5000	ILLEGAL COMMAND CODE	The specified code was incorrect in the high–precision contour control (HPCC) mode.
5003	ILLEGAL PARAMETER (HPCC)	There is an invalid parameter.
5004	HPCC NOT READY	High–precision contour control is not ready.
5006	TOO MANY WORD IN ONE BLOCK	The number of words specified in a block exceeded 26 in the HPCC mode.
5007	TOO LARGE DISTANCE	In the HPCC mode, the machine moved beyond the limit.
5009	PARAMETER ZERO (DRY RUN)	The maximum feedrate (parameter No. 1422) or the feedrate in dry run (parameter No. 1410) is 0 in the HPCC model.
5010	END OF RECORD	The end of record (%) was specified. I/O is incorrect. modify the program.
5011	PARAMETER ZERO(CUT MAX)	The maximum cutting feedrate (parameter No. 1422)is 0 in the HPCC mode.
5016	ILLEGAL COMBINATION OF M CODE	M codes which belonged to the same group were specified in a block. Alternatively,an M code which must be specified without other M codes in the block was specified in a block with other M codes.
5020	PARAMETER OF RESTART ERROR	An erroneous parameter was specified for restarting a program. A parameter for program restart is invalid.
5030	ILLEGAL COMMAND (G100)	The end command (G110) was specified before the registratioin start command (G101, G102, or G103) was specified for the B–axis.
5031	ILLEGAL COMMAND (G100, G102, G103)	While a registration start command (G101, G102, or G103) was being executed, another registration start command was specified for the B–axis.
5032	NEW PRG REGISTERED IN B–AXS MOVE	While the machine was moving about the B–axis, at attempt was made to register another move command.

Number	Message	Contents
5033	NO PROG SPACE IN MEMORY B–AXS	Commands for movement about the B–axis were not registered because of insufficient program memory.
5034	PLURAL COMMAND IN G110	Multiple movements were specified with the G110 code for the B–axis.
5035	NO FEEDRATE COMMANDED B–AXS	A feedrate was not specified for cutting feed about the B–axis.
5036	ADDRESS R NOT DEFINED IN G81–G86	Point R was not specified for the canned cycle for the B–axis.
5037	ADDRESS Q NOT DEFINED IN G83	Depth of cut Q was not specified for the G83 code (peck drilling cycle). Alternatively, 0 was specified in Q for the B–axis.
5038	TOO MANY START M–CODE COMMAND	More than six M codes for starting movement about the B–axis were specified.
5039	START UNREGISTERED B–AXS PROG	An attempt was made to execute a program for the B–axis which had not been registered.
5040	CAN NOT COMMANDED B–AXS MOVE	The machine could not move about the B–axis because parameter No.8250 was incorrectly specified, or because the PMC axis system could not be used.
5041	CAN NOT COMMANDED G110 BLOCK	Blocks containing the G110 codes were successively specified in tool–tip radius compensation for the B–axis.
5043	TOO MANY G68 NESTING	The G68 command for three–dimensional coordinate conversion has been specified three or more times.
5044	G68 FORMAT ERROR	The G68 block contains a format error. This alarm occurs in the following cases: 1 One of I, J, and K is not specified in the G68 block (missing option for coordinate conversion). 2 I, J, and K are 0 in the G68 block. 3 R is not specified in the G68 block.
5060	ILLEGAL PARAMETER IN G02.3/G03.3	Parameter setting is illegal. No. 5641 (setting of the linear axis) is not specified. No. 5641 specifies an axis other than a linear axis. No. 5642 (setting of the rotation axis) is not specified. No. 5642 specifies an axis other than a rotation axis. The CNC cannot control the linear or rotation axis (the value of No. 1010 is exceeded).
5061	ILLEGAL FORMAT IN G02.3/G03.3	The command for exponential interpolation (G02.3/G03.3) contains a format error. Address I, J, or K is not specified. Addresses I, J, and K are 0.
5062	ILLEGAL COMMAND IN G02.3/G03.3	The command for exponential interpolation (G02.3/G03.3) contains an illegal value. The specified value is not suitable for exponential interpolation (for example, a negative value is subject to ln).

Note
HPCC : High precision contour control

(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) Laser alarms

Number	Message	Contents
4050	CONTOUR DATA ERROR	In the interpolation mode, the value of S, P, or Q is out of command range.
4051	ASSIST GAS DATA ERR.	In the assist gas command, the value of P or Q is out of command range.
4052	TRACE DATA ERROR	In the gap control command, the value of P is out of command range.
4053	PIERCING DATA ERROR	In the piercing mode, the value of S, P, Q or R is out of command range.
4054	E CODE DATA ERROR	The value of E is out of command range.
4055	E CODE NOT COMMANDED	The laser cannot be output because E code is not commanded.
4056	OPT. PATH NOT SET	The optical path cannot be compensated. Please return the reference point.
4057	G25 DATA ERROR	In the G25 command, command value is out of range.
4058	G26 DATA ERROR	In the G26 command, command value is out of range.
4060	TRACE ERROR EXCESS	Excessive error in the gap control axis
4061	A/D CONVERTER–1	Failure in A/D converter 1
4062	A/D CONVERTER–2	Failure in A/D converter 2
4063	RF POWER SUPPLY	Failure in RF power supply
4065	SHUTTER ACTION	Abnormal operation of the shutter
4066	DISCHARGING	A discharge tube does not work.
4067	LASER CABINET OH	Internal cabinet temperature too high
4068	BEAM REFLECTION	The laser beam returns to inside the resonator.
4069	LASER IF PCB	Failure in the power supply for laser IF PCB.
4070	CHILLER NOT READY	The chiller unit is not ready.
4071	ASSIST GAS NOT READY	Assist gas is not ready.
4072	CHILL FLOW	Insufficient cooling water
4073	LASER GAS PRES.	Pressure of mixed gas too low
4074	ROOTS BLOWER TEMP.	The Roots blower overheated.
4075	CHILL TEMP.	Cooling water temperature too low
4076	LASER POWER DOWN	Laser power too low
4077	ABSORBER TEMP.	The beam absorber overheated.
4078	LASER TUBE PRES.	Abnormal pressure of mixed gas in discharge tube

Number	Message	Contents
4079	PUSH RESET KEY	The emergency stop button is pressed.
4080	LASER TUBE EXHAUST	Gas leak in discharge tubes or gas tubing
4081	GAS PRES. CONTROL	The gas pressure control was performed, but the gas did not reach the specified pressure within the specified time.
4082	TUBE PRES. SENSOR	Failure in the pressure sensor
4083	SHUTTER NOT OPEN	The shutter does not open when laser is output.
4085	MIRROR CLEANING	The mirrors are dirty.
4086	CALL FOR SERVICE	Please call for service.
4087	SHUTTER OH	The shutter overheated.
4088	LASER VOLTAGE DOWN	The voltage of the discharge tubes is decreasing.
4089	ASSIST GAS NO SELECT	Assist gas is not output when laser is output.
4090	LASER NOT GENERATE	The laser is not oscillated when laser is output.
4091	INVERTER	Abnormal inverter
4092		
4093	BLOWER GREASE	Grease up for turbo–blower. The vibration occurs for turbo–blower.
4094	VANE PUMP	Abnormal operating of the vacuum pump
4095	A/D CONVERTER–3	Failure in A/D converter 3
4096	UNDER TRACING	Changing the gap control axis select signal during the gap control mode.
4097	TRACE AXIS SELECT	The gap control axis select signal is not commanded correctly.
4098	TRACE AXIS & PLANE	The gap control axis is selected for cutting plane.
4099	GAS PRES. NOT REACH	Laser gas pressure is not reached the specified pressure at the base discharge state.
4100	INVERTER 1	Abnormal operation of the inverter 1 for blower.
4101	OUT OF FREQUENCY 1	Inverter frequency is not reached the specified frequency within 120sec after start the blower 1.
4102	OUT OF VIBRATION1	Vibration occurs for turbo–blower 1.
4103	T.B NOT STOPPING 1	Rotation of turbo–blower 1 does not drop within 120 sec after RUN–OFF.
4104	TURBO OVER CURRENT 1	Over current for turbo–blower 1
4105	TURBO TEMP. 1	Turbo–blower 1 overheated
4106	BLOWER OIL SHORTAGE	Blower oil is shortage.
4107	MIRROR NOT INSTALLED	The mirror is not installed.
4110	INVERTER 2	Abnormal operation of the inverter 2 for blower.
4111	OUT OF FREQUENCY 2	Inverter frequency is not reached the specified frequency within 120 sec after start the blower 2.
4112	OUT OF VIBRATION 2	Vibration occurs for turbo–blower 2.
4113	T. B NOT STOPPING 2	Rotation of turbo–blower 2 does not drop within 120 sec after RUN–OFF.
4114	TURBO OVER CURRENT 2	Over current for turbo–blower 2
4115	TURBO TEMP. 2	Turbo–blower 2 overheated
4130	STEP TIME NOT SET	Step time is not specified for high speed pierce
4140	OSCILLATOR NOT READY	The READY signal is not returned from the laser controller.

Number	Message	Contents
4141	INITIAL LOADING	For YAG laser, an error occurred during initial loading of laser machining data to the oscillator.
4142	DATA RECEIVING ERROR	The laser controller has been issuing a data resend request for more than 10 seconds.
4143	OVER CURRENT ERROR	For YAG laser, the current data sent to the oscillator exceeds the allowable current.
4144	DATA SENDING ERROR	The READY and SEND signals do not match between the CNC and laser controller. Data cannot be sent.
4145	TOUCH DISPLAY	For YAG laser, see the touch display of the oscillator.
4146	POWER OVER ERROR	For YAG laser, the power calculated from the data sent to the oscillator exceeds the allowable value.
4148	REG NO. NOT COMMAND	For YAG laser, an output command was issued without specifying the execution register number.
4149	SHUTTER OPEN	RUN–ON was specified while the shutter was open.

(4) 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 – 8).
301	APC alarm: nth–axis communication	nth–axis (n=1 – 8) 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 – 8) 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 – 8) 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 – 8) 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 – 8) APC pulse error alarm. APC alarm.APC or cable may be faulty.
306	APC alarm: nth–axis battery voltage 0	nth–axis (n=1 – 8) 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 – 8) 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 – 8) APC battery voltage has reached a level where the battery must be renewed (including when power is OFF). APC alarm .Replace battery.

(5) 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 1–8) pulse coder has a fault. Refer to diagnosis display No. 202 and No. 204 for details.
351	SPC ALARM: n AXIS COMMUNICATION	n axis (axis 1–8) 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**

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

#6 (CSA) Check sum alarm has occurred.

#5 (BLA) Battery low alarm has occurred.

#4 (PHA) Phase data trouble alarm has occurred.

#3 (PCA) Speed count trouble alarm has occurred.

#2 (BZA) Battery zero alarm has occurred.

#1 (CKA) Clock alarm has occurred.

#0 (SPH) Soft phase data trouble alarm has occurred.

- **The details of serial pulse coder alarm No.351**

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

#7 (DTE) Data error has occurred.

#6 (CRC) CRC error has occurred.

#5 (STB) Stop bit error has occurred.

(6) Servo alarms

Number	Message	Contents
400	SERVO ALARM: n–TH AXIS OVERLOAD	The n–th axis (axis 1–8) overload signal is on. Refer to diagnosis display No. 201 for details.
401	SERVO ALARM: n–TH AXIS VRDY OFF	The n–th axis (axis 1–8) servo amplifier READY signal (DRDY) went off. Refer to procedure of trouble shooting.
404	SERVO ALARM: n–TH AXIS VRDY ON	Even though the n–th axis (axis 1–8) 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. Check that the servo interface module and servo amp are connected.
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.
407	SERVO ALARM: EXCESS ERROR	The difference in synchronous axis position deviation exceeded the set value.
410	SERVO ALARM: n–TH AXIS – EXCESS ERROR	The position deviation value when the n–th axis (axis 1–8) stops is larger than the set value. Refer to procedure of trouble shooting.
411	SERVO ALARM: n–TH AXIS – EXCESS ERROR	The position deviation value when the n–th axis (axis 1–8) moves is larger than the set value. Refer to procedure of trouble shooting.
413	SERVO ALARM: n–th AXIS – LSI OVERFLOW	The contents of the error register for the n–th axis (axis 1–8) exceeded $\pm 2^{31}$ power. 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 1–8) 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 1–8). 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 1–8) 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 1–8) 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) con tains a value out of the range from 1 to the number of axes, or an isolated value (for example, 4 not prceded by 3).was set in parame ter No. 1023 (servo axisnumber).

- **Details of servo alarm No.414**

The details of servo alarm No. 414 are displayed in the diagnosis display (No. 200 and No.204) as shown below.

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

#7 (OVL) An overload alarm is being generated.

#6 (LV) A low voltage alarm is being generated in servo amp.

#5 (OVC) A overcurrent alarm is being generated inside of digital servo.

#4 (HCA) An abnormal current alarm is being generated in servo amp.

#3 (HVA) An overvoltage alarm is being generated in servo amp.

#2 (DCA) A regenerative discharge circuit alarm is being generated in servo amp.

#1 (FBA) A disconnection alarm is being generated.

#0 (OFA) An overflow alarm is being generated inside of digital servo.

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

#6 (OFS) A current conversion error has occured in the digital servo.

#5 (MCC) A magnetic contactor contact in the servo amplifier has welded.

#4 (LDA) The LED indicates that serial pulse coder C is defective

#3 (PMS) A feedback pulse error has occured because the feedback cable is defective.

- **Details of servo alarms No. 400 and No.416**

The details of servo alarms No. 400 and No. 416 are displayed in the diagnosis display (No. 201) as shown below.

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

When OVL equal 1 in diagnostic data No.200 (servo alarm No. 400 is being generated):

#7 (ALD) 0 : Motor overheating
1 : Amplifier overheating

When FBAL equal 1 in diagnostic data No.200 (servo alarm No. 416 is being generated):

ALD	EXP	Alarm details
1	0	Built–in pulse coder disconnection (hardware)
1	1	Separately installed pulse coder disconnection (hardware)
0	0	Pulse coder is not connected due to software.

(7) Over travel alarms

(When this alarms are occurred, move the machine against direction of the alarms with manual mode, then reset the alarms.)

Number	Message	Contents
500	OVER TRAVEL : +n	Exceeded the n–th axis (axis 1–8) + side stored stroke limit I. (Parameter No.1320 or 1326 **Notes**)
501	OVER TRAVEL : –n	Exceeded the n–th axis (axis 1–8) – side stored stroke limit I. (Parameter No.1321 or 1327 **Notes**)
502	OVER TRAVEL : +n	Exceeded the n–th axis (axis 1–8) + side stored stroke limit II. (Parameter No.1322)
503	OVER TRAVEL : –n	Exceeded the n–th axis (axis 1–8) – side stored stroke limit II. (Parameter No.1323)
504	OVER TRAVEL : +n	Exceeded the n–th axis (axis 1–8) + side stored stroke limit III. (Parameter No.1324)
505	OVER TRAVEL : –n	Exceeded the n–th axis (axis 1–8) – side stored stroke limit III. (Parameter No.1325)
506	OVER TRAVEL : +n	Exceeded the n–th axis (axis 1–8) + side hardware OT.
507	OVER TRAVEL : –n	Exceeded the n–th axis (axis 1–8) – side hardware OT.

Note

Over travel alarms No. 504 and No. 505 are provided only with the T series.
Parameters 1326 and 1327 are effective when EXLM(stroke limit switch signal) is on.

(8) 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 cabinet for the control unit is overheated. Check the operation of the fan motor and replace the motor if necessary.

(9) System alarms (These alarms cannot be reset with reset key.)

Number	Message	Contents
900	ROM PARITY	ROM parity error (CNC/OMM/Servo) Replace the number of ROM.
910	RAM PARITY : (4N)	RAM parity error in the tape memory RAM module. Clear the memory or replace the module. After this operation, reset all data including the parameters.
911	RAM PARITY: (4N+1)	RAM parity error in the tape memory RAM module. Clear the memory or replace the module. After this operation, reset all data including the parameters.
912	RAM PARITY: (4N+2)	RAM parity error in the tape memory RAM module. Clear the memory or replace the module. After this operation, reset all data including the parameters.
913	RAM PARITY : (4N+3)	RAM parity error in the tape memory RAM module. Clear the memory or replace the module. After this operation, reset all data including the parameters.
914	SRAM PARITY (2N)	A RAM parity error occurred in RAM for part program storage or additional SRAM.
915	SRAM PARITY (2+1)	
916	DRAM PARITY	RAM parity error in DRAM module. Replace the DRAM module.
920	SERVO ALARM (1/2/3/4 AXIS)	Servo alarm (1st to 4th axis). A watchdog alarm or a RAM parity error in the servo module occurred. Replace the servo control module on the main CPU board.
922	SERVO ALARM (5/6/7/8 AXIS)	Servo alarm (5th to 8th axis). A watchdog alarm or a RAM parity error in the servo module occurred. Replace the servo control module on the option 2 board.
924	SERVO MODULE SETTING ERROR	The digital servo module is not installed. Check that the servo control module or servo interface module on the main CPU or option 2 board is mounted securely.
930	CPU INTERRUPUT	CPU error (abnormal interrupt) The main CPU board is faulty.
945	SERIAL SPINDLE COMMUNICATION ERROR	Communications error occured in the serial spindle. The optical fiber may be disconnected.
950	PMC SYSTEM ALARM	Fault occurred in the PMC.The PMC control module on the main CPU board or option 3 board may be faulty.
951	PMC–RC WATCH DOG ALARM	Fault occurred in the PMC–RC (watchdog alarm).Option 3 board may be faulty.
970	NMI OCCURRED IN PMP	RAM parity error or NMI occurred in the PMC–RB module. The main CPU board is faulty.
971	NMI OCCURRED IN SLC	An alarm condition occurred in the interface with an I/O unit. For PMC–RA1, PMC–RA2, and PMC–RB, check that the PMC control module on the main CPU board is conneted to the I/O unit securely. For PMC–RC, check that the PMC control module on the option 3 board is connected to the I/O unit is supplied with power and that the interface module is intact.
972	NMI OCCURRED IN OTHER MODULE	NMI occurred in a board other than the main CPU board. Option 1 to 3 may be faulty.
973	NON MASK INTERRUPT	NMI occurred for an unknown reason.
974	F–BUS ERROR	FANUC BUS is error. MAIN CPU board and option 1 to 3 boards may be faulty.
975	BUS ERROR (MAIN)	MAIN CPU board is BUS error. MAIN CPU board may be faulty.

B.2 LIST OF ALARMS (PMC)

(1) Alarm messages (PMC)

Message	Contents and solution
ALARM NOTHING	Normal status
ER00 PROGRAM DATA ERROR(ROM)	The sequence program in the ROM is not written correctly. (solution) Please exchange ROM for the sequence program.
ER01 PROGRAM DATA ERROR(RAM)	The sequence program in the debugging RAM is defective. (solution) Please clear the debugging RAM and input LADDER again. The debugging RAM is not installed though the RAM is selected. (solution) Please install the debugging RAM or install ROM for sequence program and select ROM with K17#3=0.
ER02 PROGRAM SIZE OVER	The size of sequence program exceeds the maximum size of LADDER(PMC–RC only). (solution) Please change MAX LADDER AREA SIZE at the SYSPRM screen and restart the system.
ER03 PROGRAM SIZE ERROR(OPTION)	The size of sequence program exceeds the option specification size. (solution) Please increase the option specification size. Or, reduce the size of sequence program.
ER04 PMC TYPE UNMATCH	The PMC model setting of the sequence 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.
ER06 PROGRAM MODULE NOTHING	Both ROM for sequence program and the debugging RAM do not exist (PMC–RC only)
ER07 NO OPTION (LADDER STEP)	There is no step number option of LADDER.
ER 16 RAM CHECK ERROR (PROGRAM RAM)	The debugging RAM cannot be read/written normally. (solution) Please exchange the debugging RAM.
ER17 PROGRAM PARITY	The parity error occurred on ROM for sequence program or the debugging RAM. (solution) ROM: The deterioration of ROM may be deteriorated Please exchange ROM for the sequence program RAM: Please edit the sequence program once on PMC Still the error occurs, exchange the debugging RAM.
ER18 PROGRAM DATA ERROR BY I/O	Transferring the sequence program from offline programmer was interrupted by the power off etc. (solution) Please clear the sequence program and transfer the sequence 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.

Message	Contents and solution
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.
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. When built–in I/O card is connected, this message is not displayed. (solution) When built–in I/O card is used: Please confirm whether the built–in I/O card is certainly connected with. 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 CNC and PMC. 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.

*When ER00 to ER23 occur, sequence program is not available.

Message	Contents and solution
WN02 OPERATE PANEL ADDRESS ERROR	The address setting data of the operator's panel for FS–0 is illegal. (solution) Please correct the address setting data.
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.
WN04 UNAVAIL EDIT MODULE	The LADDER editing module cannot be recognized.(PMC–RAx/RBxx=1 to 3) (solution) Please confirm the slot position installed. Please confirm the installed module.
WN06 TASK STOPPED BY DEBUG FUNC	Some user tasks are stopped by break point of the debugging function.
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.
WN17 NO OPTION (LANGUAGE)	There is no C language option.
WN18 ORIGIN ADDRESS ERROR	The LANGUAGE ORIGIN address of the system parameter is wrong (solution) Please set the address of symbol RC_CTLB_INIT in the map file to the LANGUAGE ORIGIN of the system parameter.
WN19 GDT ERROR (BASE,LIMIT)	The value of BASE, LIMIT or ENTRY of user defined GDT is illegal. (solution) Please correct the address in link control statement and build file.
WN20 COMMON MEM. COUNT OVER	The number of common memories exceeds 8. (solution) Please reduce the number of common memories to 8 or less. It is necessary to correct a link control statement,build file and the source file for the common memory.
WN21 COMMON MEM. ENTRY ERROR	GDT ENTRY of the common memory is out of range. (solution) Please correct the address of GDT ENTRY of the common memory in the link control statement.
WN22 LADDER 3 PRIORITY ERROR	The priority of LADDER LEVEL 3 is out of range. (solution) Please correct the value of LADDER LEVEL 3 in the link control statement within the range of 0 or 10–99 or –1.
WN23 TASK COUNT OVER	The number of user tasks exceeds 16. (solution) Please confirm TASK COUNT in the link control statement. When the number of tasks is changed, it is necessary to correct the link control statement, build file and the composition of the files to be linked.
WN24 TASK ENTRY ADDR ERROR	The selector of the entry address to the user task is out of range. (solution) Please correct the table of GDT in build file to the value within 32(20H)–95(5FH).
WN25 DATA SEG ENTRY ERROR	The entry address of the data segment is out of range. (solution) Please correct DATA SEGMENT GDT ENTRY in the link control statement and the table of GDT in build file within 32(20H)–95(5FH).
WN26 USER TASK PRIORITY ERROR	The priority of the user task is out of range. (solution) Please correct the TASK LEVEL in link control statement within the range of 10–99 or –1. Note: Only one task can have TASK LEVEL –1 (including LADDER LEVEL 3).

Message	Contents and solution
WN27 CODE SEG TYPE ERROR	The code segment type is illegal. The code segment of RENAMESEG in the binding control file is wrong. (solution) Please correct the entry of the code segment in the link control statement to correspond to the entry in the build file.
WN28 DATA SEG TYPE ERROR	The data segment type is illegal. The data segment of RENAMESEG in the binding control file is wrong. (solution) Please correct the entry of the code segment in the link control statement to correspond to the entry in the build file.
WN29 COMMON MEM SEG TYPE ERROR	The segment type of common memory is illegal. The segment of RENAMESEG in the building control file of the common memory is wrong. (solution) Please correct the entry of common memory in the link control statement to correspond to the entry in the build file.
WN30 IMPOSSIBLE ALLOCATE MEM.	The memories for the data and stack etc. cannot be allocated. (solution) Please confirm whether the value of code segment in build file and USER GDT ADDRESS in link control statement is correct or not. Or please reduce the value of MAX LADDER AREA SIZE of the system parameter and the size of the stack in link control statement at the least
WN31 IMPOSSIBLE EXECUTE LIBRARY	The library function cannot be executed. (solution) Please confirm the object model of the library. Or, system ROM of PMC must be replaced with one of later version.
WN32 LNK CONTROL DATA ERROR	Link control statement data is illegal. (solution) Please confirm whether the address of symbol RC_ CTLB_INIT in map file is set to LANGUAGE ORIGIN of the system parameter. Or, please make the link control statement again.
PC1nn CPU INTERPT xxxx yyyyyy STATUS LED ☆★	A CPU error (abnormal interrupt) occurred. nn : CPU exception handling code It is an exception code of i80386. For details, please refer to the manual of the CPU. 00 Division error such as a divisor is 0 in division instruction. 12 Stack exception such as violations of limit of stack segment. 13 General protection exception such as segment limit over. xxxx : Segment selector where system error occurred. The selector of 0103–02FB is used by C language. yyyyyy : Offset address where system error occurred. (Solution) When C language is not used or when the cause is not found even if it is checked C language, consult it.
PC130 RAM PARITY aa xxxx yyyyyy STATUS LED □★	The parity error occurred on the debugging RAM of PMC. aa : RAM PARITY ERROR information. xxxx : Segment selector where system error occurred. yyyyyy : Offset address where system error occurred
PC140 NMI BOC bb xxxx yyyyyy STATUS LED □★	The RAM parity error or NMI(Non Maskable Interrupt) generated in module of PMC engine. bb : RAM PARITY ERROR information. 1, 2, 4, 8 Parity error occurred on basic DRAM. 14,18 Parity error occurred on option DRAM. 20,60,A0,E0 Parity error occurred on SRAM. xxxx : Segment selector where system error occurred. yyyyyy : Offset address where system error occurred.

*Alarms of WN17 to WN33 are errors of user C program for PMC–RC.

Message	Contents and solution
PC150 NMI SLC aa cc STATUS LED ■★	The communication error occurred in the I/O Link. aa, cc : I/O Link error information. **Note 2)** This error may occur by the following causes. 1. When I/O Unit–MODEL A is used, base1, 2 or 3 is not connected though allocated. 2. The connection of cable is insufficient. 3. Defects of cable. 4. Defects of DI/DO units (I/O unit, Power Mate etc.) 5. Defects of PMC board (printed circuit board on host side where I/O Link cable is connected.) (solution) Investigate the cause of error. 1. Please confirm the allocation data (by ”EDIT”→”MODULE” screen) and compare with the actual connection. 2. Please confirm whether the cable is correctly connected.If you cannot find the cause with the ways above, it may be the defect of hardware. Please investigate a defective place by the following methods. 3. Please confirm the specification of the cable referring to”FANUC I/O Unit–MODEL A CONNECTION MAINTENANCE MANUAL (B–61813E)” or ”FANUC I/O Unit–MODEL B CONNECTION MANUAL (B–62163E)”. 4. Exchange the interface module of I/O Unit, the cable and the PMC board, etc. one by one and, confirm whether this error occurs again.The communication may fail by the noise etc. when this error still occurs after replacing all DI/DO units. Please investigate the cause of noise.
PC160 F–BUS ERROR xxxx yyyyyy STATUS LED ★□	The BUS error (access to disabled address) occurred. xxxx : Segment selector where system error occurred. yyyyyy : Offset address where system error occurred
PC199 ROM PARITY eeeeeeee STATUS LED ★☆	The parity error occur in PMC system ROM. eeeeeeee : ROM parity error information.

STATUS LED (green) are LED1, LED2 on PMC–RC. CAP–II is LED3 and LED4.
□ : Off■ : On ☆★ : Blinking

Notes
1. The system error on PMC–RA1, RA2, RA3, RB,RB2 and RB3 is displayed as a system error on the CNC side. (Refer to the “FANUC Series 16/18–MA Operator’s Manual(B–61874E)” or “FANUC Series 16/18–TA Operator’s Manual(B–61804E)”.)
2. Error information is needed to investigate on FANUC, please take notes of it.

(2) 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.

Message	Contents and solution
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.
IMPOSSIBLE WRITE	You try to edit sequence program on the ROM.
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.
PROGRAM MODULE NOTHING	You tried to edit though there was neither RAM for debugging nor ROM for sequence program.
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.

(3) Alarm messages (For I/O)

Message	Contents and solution
I/O OPEN ERROR nn	An error occurs when the reader/puncher interface was started. nn= –1 Because the interface is used with NC etc., the interface is not able to be opened by PMC side. (solution) After other functions finishes using the line, please execute again. 6 There is no option for the interface. 20 The interface cannot be opened. (solution) Please confirm the connection of the cable. Please confirm setting of the baud rate etc.
I/O WRITE ERROR nn	An output error occurred in the reader/puncher interface. nn= 20 The state of the interface is not correct. (solution) Please confirm the connection of the cable. Please confirm setting the baud rate etc. 22 Opponent side is not ready to receive. (solution) Please confirm the power supply on the opponent side. Or, please initialize the interface.
I/O READ ERROR nn	An input error occurred in the reader/puncher interface. nn= 20 The state of the interface is not correct. (solution) Please confirm the connection of the cable. Please confirm setting the baud rate etc. 21 The data is not sent from the opponent side. (solution) Please confirm the power supply on the opponent side. Please initialize the opponent side.
I/O LIST ERROR nn	An error occurred in directory read processing from FD Cassette. nn= 20 The state of the interface is not correct. (solution) Please confirm the connection of the cable. Please confirm setting of the baud rate etc.
COMPARE ERR xxxxxx=aa:bb CONT? (Y/N)	A compare error occurred. xxxxxx : The Address where the compare error occurred. aa : The data on PMC side. bb : The data on device side Enter'Y' to continue processing.
ADDRESS IS OUT OF RANGE (xxxxxx)	The data transferred to the address out of the PMC debugging RAM area. xxxxxx : Transferred address. (solution) Please confirm the address of the transferring data. LADDER : Please confirm the model setting. C language : Please confirm setting the address in the link control statement and build file.
ROM WRITER ERROR nnnnnn	An error occurred in the ROM writer.

C LIST OF MAINTENANCE PARTS

C.1 MAINTENANCE PARTS

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Maintenance Parts

Consumables here refer to the parts which are not reused after replacement. Rank : AA>A>BB>B>CC>C

Name		Drawing number	Vender	Remarks		Compatibility	Rank
Fan motor	For 2–slot case	A90L–0001–0378	MATSUSHITA	One piece required per 2 slots	2.4W		A
	For 1–slot case	A90L–0001–0385#A	SANYO	Two pieces are required at the 3rd slot track	1.7W		A
Battery		A98L–0031–0012	SANYO				A
Fuse	For AI	A60L–0001–0245#GP75	DAITO	F1(7.5A)			B
		A60L–0001–0075#3.2	DAITO	F3 (3.2A)			B
		A60L–0001–0046#5.0	DAITO	F4 (5AS)			B
	For BI	A60L–0001–0245#GP75	DAITO	F1 (7.5A)			B
		A60L–0001–0075#5.0	DAITO	F3 (5A)			B
		A60L–0001–0046#5.0	DAITO	F4 (5AS)			B
Small keyboard	MB	A86L–0001–0171#SM2	FUJITSU	Usable units A02B–0120–C041#MA A02B–0120–C042#MA A02B–0120–C121#MA			B
Standard keyboard	MB	A86L–0001–0172#HM2	FUJITSU	Usable units A02B–0120–C051#MA A02B–0120–C052#MA A02B–0120–C122#MA			B
Keyboard for horizontal 9.5″ LCD/MDI	MB	A86L–0001–0173#HM2	FUJITSU	Usable units A02B–0200–C061#MB A02B–0200–C065#MB			B
Key board for horizontal 14″ CRT/MDI	MB	A86L–0001–0174#HM2	FUJITSU	Usable units A02B–0120–C071#MA A02B–0200–C071#MB			B
Keyboard for vertical 9.5″ LCD/MDI and 14″ CRT/MDI	MB	A86L–0001–0175#VM2	FUJITSU	Usable units A02B–0120–C072#MA A02B–0200–C062#MB A02B–0200–C066#MB			B

Maintenance Parts (Parts to be repaired by us)

Name		Drawing number	Vender	Remarks	Compatibility	Rank
Control rack (without MMC–IV)	3–SLOT	A02B–0200–C005	EM			C
	4–SLOT	A02B–0200–C002	EM			C
	6–SLOT	A02B–0200–C003	EM			C
	8–SLOT	A02B–0200–C004	EM			C
Control rack (with MMC–IV)	4–SLOT	A02B–0200–C010	EM			C
	6–SLOT	A02B–0200–C011	EM			C
	8–SLOT	A02B–0200–C012	EM			C
Power supply unit	AI	A16B–1212–0900	FPL			B
	BI	A16B–1212–0870	FPL			B
Main CPU board		A16B–3200–0010	EM			B
Option 1 board	Remote buffer	A16B–2200–0913	EM			B
	DNC1	A16B–2200–0914	EM			B
Option 2 board	Without sub–CPU	A16B–2202–0401	EM			B
Option 3 board	PMC–RC	A16B–3200–0054	EM			B
I/O card (sink type output)	A(40/40)	A16B–2200–0958	MME	Without high–speed skip signal input		B
	B(80/56)	A16B–2200–0957	MME			B
	C(104/72)	A16B–2200–0956	MME			B
	D(156/120)	A16B–2200–0955	MME	Without high–speed skip signal input To be used as a pair.		B
	E(40/40)	A16B–2200–0953	MME	With high–speed skip signal input		B
	F(80/56)	A16B–2200–0952	MME			B
	G(104/72)	A16B–2200–0951	MME			B
	H(156/120)	A16B–2200–0950	MME	With high–speed skip signal input To be used as a pair.		B
	I	A16B–2200–0954	MME	High–speed skip signal input only		B
	Add–on board for increase DI/DO	A20B–9001–0480	EM	Use with main body of D and H		B

Name		Drawing number	Vender	Remarks	Compatibility	Rank
I/O card (source type output)	A(40/40)	A16B–2200–0988	EM	Without high–speed skip signal input		B
	B(80/56)	A16B–2200–0987	EM			B
	C(104/72)	A16B–2200–0986	EM			B
	D(40/40)	A16B–2200–0983	EM	With high–speed skip signal input		B
	E(80/56)	A16B–2200–0982	EM			B
	F(104/72)	A16B–2200–0981	EM			B
PMC control module	For PMC–RE	A20B–2900–0140	EM			B
	For PMC–RC3	A20B–2900–0143	EM			B
	For PMC–RB3/RC3, with SLC	A20B–2901–0960	EM	PMC processor is PMP 2A		B
High–speed DI, analog I/O module	Analog I/O + high–speed skip DI	A20B–2900–0280	EM			B
	High–speed skip DI	A20B–2900–0281	EM			B
14–bit A/D converter module		A20B–2900–0580	EM	FANUC Laser, AUTOSHOTα		B
DRAM/SRAM module		A20B–2901–0413	EM	For CAP–II		B
DRAM module	6MB	A20B–2901–0940	EM			B
	4MB	A20B–2901–0941	EM			B
	2MB	A20B–2901–0942	EM			B
Spindle control module	Analog	A20B–2901–0982	EM	For main CPU board		B
	Analog	A20B–2901–0986	EM	For option 2 board		B
Servo control module		A20B–2901–0060	EM			B
		A20B–2901–0061	EM	For learning–control function		B
FROM/SRAM module	FROM 4MB SRAM 512KB	A20B–2902–0080	EM			B
	FROM 4MB	A20B–2902–0081	EM			B
	FROM 2MB	A20B–2902–0082	EM			B
FROM/SRAM module	FROM 8MB SRAM 2MB	A20B–2902–0090	EM			B
	FROM 8MB	A20B–2902–0091	EM			B
	FROM 6MB	A20B–2902–0092	EM			B

Name		Drawing number	Vender	Remarks	Compatibility	Rank
CRT control module (Without MMC–IV)	For 14″CRT	A20B–2902–0270	EM	When MMC is not provided		B
	For 9″CRT	A20B–2902–0271	EM			B
	For 9.5”,8.4” LCD	A20B–2902–0272	EM			B
(With MMC–IV)	For 14″CRT	A20B–2902–0273	EM	When MMC is provided		B
	For 9.5”, 8.4” LCD	A20B–2902–0274	MME			B
Communication control module		A20B–2900–0361	EM			B
SRAM module	512KB	A20B–2900–0541	EM	For option 2 board		B
SRAM module	2MB	A20B–2900–0991	EM	For option 2 board		B
DRAM module	1MB	A20B–2902–0197	EM	For option 3 board		B
	512KB	A20B–2902–0198	EM			B
Back plane (Without MMC–IV)	3–SLOT	A20B–2000–0620	EM			B
	4–SLOT	A20B–2000–0640	EM			B
	6–SLOT	A20B–2000–0650	EM			B
	8–SLOT	A20B–2000–0610	EM			B
Back plane (With MMC–IV)	4–SLOT	A20B–2001–0490	EM			B
	6–SLOT	A20B–2001–0652	EM			B
	8–SLOT	A20B–2001–0662	EM			B
Optical I/O link adapter		A13B–0154–B001	EM			B

Maintenance Parts

Name		Drawing number	Vendor	Remarks	Compatibility	Rank
9″ CRT/MDI (Small key, monochrome)	MB	A02B–0120–C041#MA	EM	For system without MMC–IV		B
9″ CRT/MDI (Small key, color)	MB	A02B–0120–C042#MA	EM			B
9″ CRT/MDI (Standard key, monochrome)	MB	A02B–0120–C051#MA	EM			B
9″ CRT/MDI (Standard key, color)	MB	A02B–0120–C052#MA	EM			B
9″ PDP/MDI (Standard key)	MB	A02B–0120–C081#MA	EM			B
9″ separate type CRT unit	mono-chrome	A02B–0120–C111	EM			B
	color	A02B–0120–C112	EM			B
9″ separate type PDP unit	mono-chrome	A02B–0120–C113	EM			B
8.4″ separate type LCD unit	color	A02B–0200–C050	EM			B
Separate type MDI unit (small key)	MB	A02B–0120–C121#MA	EM	It is not relative whether with MMC–IV or not		B
Separate type MDI unit (standard key)	MB	A02B–0120–C122#MA	EM			B
9.5″ LCD/MDI unit color horizontal	MB	A02B–0200–C061#MB	EM	For system without MMC–IV		B
9.5″ LCD/MDI unit color vertical	MB	A02B–0200–C062#MB	EM			B
14″ CRT/MDI horizontal	TB	A02B–0120–C071#TA	MME			B
14″ CRT/MDI vertical	MB	A02B–0120–C072#MA	MME	For system without MMC–IV		B
9″ monochrome, CRT display		A61L–0001–0093	TOTOKU MATSUSHITA	Usable unit A02B–0120–C041#TA,#MA A02B–0120–C051#TA,#MA A02B–0120–C111	For system without MMC–IV	B

Name		Drawing number	Vendor	Remarks	Compatibility	Rank
9″monochrome, CRT display		A61L–0001–0093#A	TOTOKU	Usable unit A02B–0120–C043#TA	For system without MMC–IV	B
9″color, CRT display		A61L–0001–0095	TOSHIBA	Usable unit A02B–0120–C041#TA#MA A02B–0120–C052#TA#MA A02B–0120–C112		B
9″plasma display		A61L–0001–0116	FUJITSU	Usable unit A02B–0120–C081#TA#MA A02B–0120–C113		B
14″color,CRT display		A61L–0001–0094#A	MATSUSHITA HITACHI	Usable unit A02B–0120–C071#TA#MA #TF#WA A02B–0120–C072#TA#MA #TF#MC A02B–0120–C074#TA#TF		B
9.5″color, LCD display		A61L–0001–0138	NEC	Usable unit A02B–0200–C061#TB#TFB #MB A02B–0200–C062#TB#TFB #MB A02B–0200–C065#TB#TFB #MB A02B–0200–C066#TB#TFB #MB	It is not relative whether with MMC–IV or not	B
8.4″color, LCD display		A61L–0001–0139	SHARP	Usable unit A02B–0200–C050 A02B–0200–C051		B
14″LCD/MDI unit, color, horizontal	MB	A02B–0200–C071#MB	EM	For system with MMC–IV		B
14″CRT/MDI unit, color, vertical	MB	A02B–0200–C072#MB	EM			B
9.5″LCD/MDI unit, color, horizontal	MB	A02B–0200–C065#MB	EM	Refer to page 376 for only 9.5″LCD display		B
9.5″CRT/MDI unit, color, vertical	MB	A02B–0200–C066#MB	EM			B
8.4″ separate type LCD	Color	A02B–0200–C051	EM	Refer to page 375 for separate type MDI		B
14″ color CRT display		A61L–0001–0096	TOSHIBA	Usable units A02B–0200–C071#MB A02B–0200–C072#MB	For system with MMC–IV	B

D BOOT SYSTEM

D.1 OVERVIEW

The boot system load the CNC system software (flash RAM”DRAM), then starts it so that software can be executed.
The boot system provides the following maintenance functions for the CNC:

(1) Registering a file in flash memory
- Reads a file from a memory card, in MS–DOS format conforming to JEIDA V4.1, into flash memory.

(2) Checking a file (series and edition) in flash memory

(3) Deleting a file from flash memory

(4) Batch saving and restoration of files of parameters and programs backed up by battery (SRAM area), to and from a memory card

(5) Saving a file in flash memory to a memory card

(6) Formatting of a memory card

(7) Deleting a file from a memory card

This manual describes the activation of the boot system, as well as the screen displays and operation for the functions listed above.

Note
Memory card can be used as input/output device in FS16B however, be sure to off the power when the card is put and out.

D.1.1 STARTING THE BOOT SYSTEM

In ordinary system activation, the boot system automatically transfers files from flash memory to DRAM in the background.
The user is not aware of this operation. However, the boot system must be operated manually, from menu screen, when maintenance is to be carried out or when the flash memory does not contain a required file.

1 In system maintenance, for example, to replace a file in memory
Operation : Turn the power on by simultaneously pressing the two soft keys at the right end.

Hold down the two keys until the boot system screen appears.

2 When the flash memory does not contain a file required to start the CNC

Immediately after the CNC is turned on, the boot system starts transferring files from flash memory to DRAM. If, for some reason, a file required to start the CNC (NC basic) is not in flash memory or has been destroyed, the boot system is automatically started.

D.1.2 System Files and User Files

The boot system organizes files in flash memory into two main groups : system files and user files. These two file types have the following characteristics :

- **System files** — CNC and servo control software provided by FANUC
- **User files** — PMC sequence program (ladder), P–CODE macro program, and other user–created files

D.2 SCREEN CONFIGURATION AND OPERATING PROCEDURE

When the boot system is first started, the MAIN MENU screen is displayed. This screen is described below :

● MAIN MENU screen

```
(1)  SYSTEM MONITOR MAIN MENU          60M1-01

(2)  1. SYSTEM DATA LOADING
(3)  2. SYSTEM DATA CHECK
(4)  3. SYSTEM DATA DELETE
(5)  4. SYSTEM DATA SAVE
(6)  5. SRAM DATA BACKUP
(7)  6. MEMORY CARD FILE DELETE
(8)  7. MEMORY CARD FORMAT

(9)  9. END

(10) *** MESSAGE ***
     SELECT MENU AND HIT SELECT KEY.
     [ SELECT ][  YES  ][  NO  ][  UP  ][  DOWN  ]
```

1 : Screen title. The series and edition of the boot system appear at the right end.

2 : Function for writing data to flash memory.

3 : Function for checking the edition of a file in ROM.

4 : Function for deleting a file from flash memory.

5 : Function for making a backup copy of the data stored on the memory card.

6 : Function for making a backup copy of the data in SRAM.

7 : Function for deleting a file from a memory card.

8 : Function for formatting a memory card.

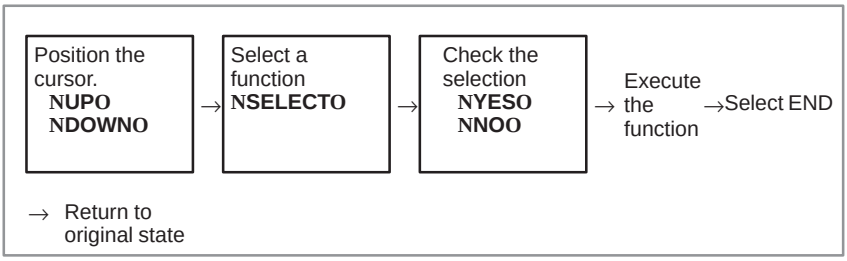
9 : Function for terminating the boot system and starting the CNC.

10 : Condensed guidance or error message

● Operating procedure

Press the **[UP]** or **[DOWN]** soft key to select the desired function. After positioning the cursor to the desired function, press the **[SELECT]** soft key. Before executing a function, the system my request confirmation from the operator by having him/her press the **[YES]** or **[NO]** soft key.

● Basic operation

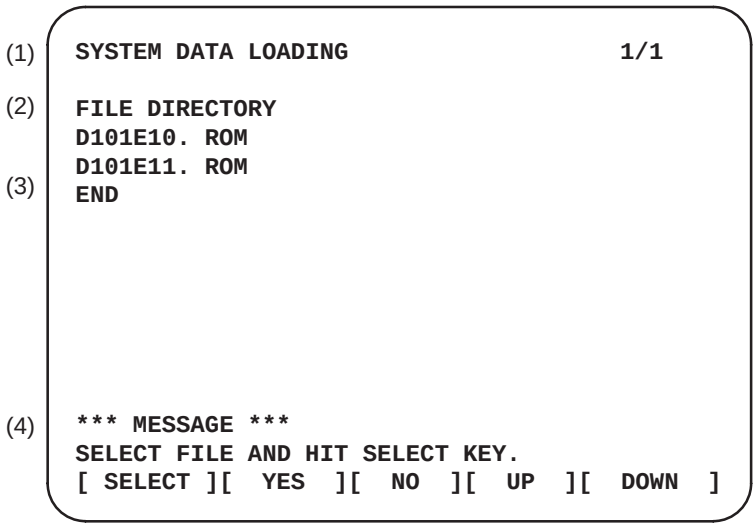


D.2.1 System Data Loading Screen

- **Description**

This screen is used to read a system or user file from a memory card into flash memory.

- **Screen configuration**



1 : Screen title. The page number (n) and total number of pages (m) are displayed, in n/m format, at the right end.

2 : Files on the memory card

3 : Option for returning to previous menu Message

4 : Message

- **Operating procedure**

1 Position the cursor to the file to be read from the memory card and written to flash memory. Then, press the **[SELECT]** soft key.

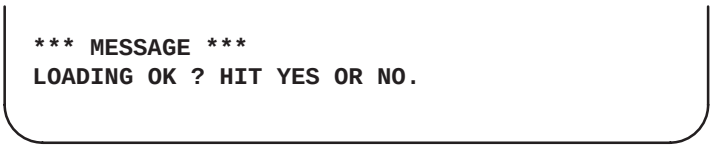
A single page can list up to eight file names. If the memory card contains nine or more files, the remaining files are displayed on another page.

To display the next page, press the ▷ soft key.

To display the previous page, press the ◁ soft key. The END option is displayed on the last page.

The END option is displayed on the last page.

2 After a file has been slected, the system asks whether that file is to be loaded.



3 To start loading, press the **[YES]** soft key. To cancel, press the **[NO]** key.

```
*** MESSAGE ***
LOADING FROM MEMORY CARD.
```

4 When loading terminates normally, the system displays the following message. Press the **[SELECT]** soft key. If an error occurs, see D.3.

```
*** MESSAGE ***
LOADING COMPELETE. HIT SELECT KEY.
```

- **Others**

1 Counter display while a file is being loaded

While a file is being loaded, the address of the data currently being accessed is displayed.

```
*** MESSAGE ***
LOADING FROM MEMORY CARD.
ADDRESS 001:          ← The counter appears under the
    (1)                 message fild.
```

1 : Number of 128–KB management unit in flash memory

2 File name in flash memory

The boot systme identifies a file in flash memory by the first four characters of the file name. If the name of the file to be read from the memory card and the name of a file already present in flash memory begin with the same four characters, delete the latter from flash memory. Then, load the desired file. The following table lists the names and contents of files.

Note
That these file names may be changed without notice.

File name	Contents	File type
NC BASIC	Basic	System file
DG SERVO	Servo	System file
GRAPHIC	Graphic	System file
NC□ OPTN	Optional	System file
PMC□****	PMC control software, etc.	System file
PCD ****	P–CODE macro file/ OMM	User file
CEX ****	C–language executor	User file
PMC - ****	Ladder software	User file
PMC@****	Ladder software for the loader	User file

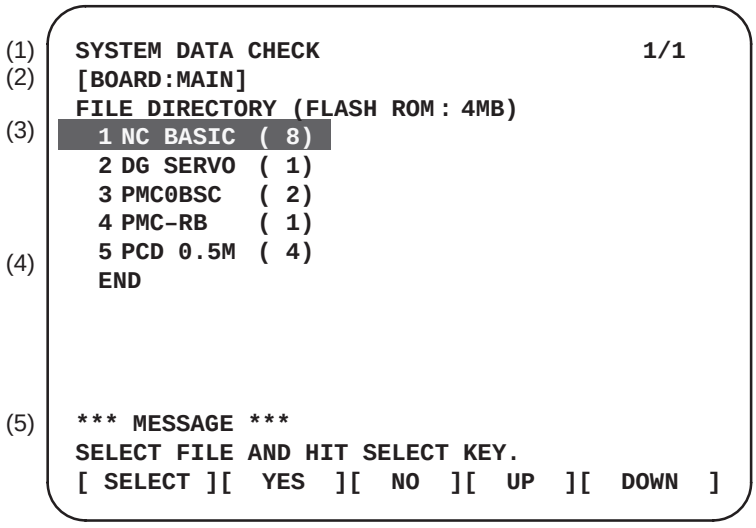
□ : A numeric character, * : An alphabetic character

D.2.2 System Data Check Screen

- **Description**

This screen is used to list files in flash memory, together with the corresponding numbers of 128–KB management units in each file and the series and edition of the software.

- **Screen configuration**



1 : Screen title

2 : Names of accessing board

3 : Names of files in flash memory The number of management units constituting each file appears in parentheses to the right of the file name.

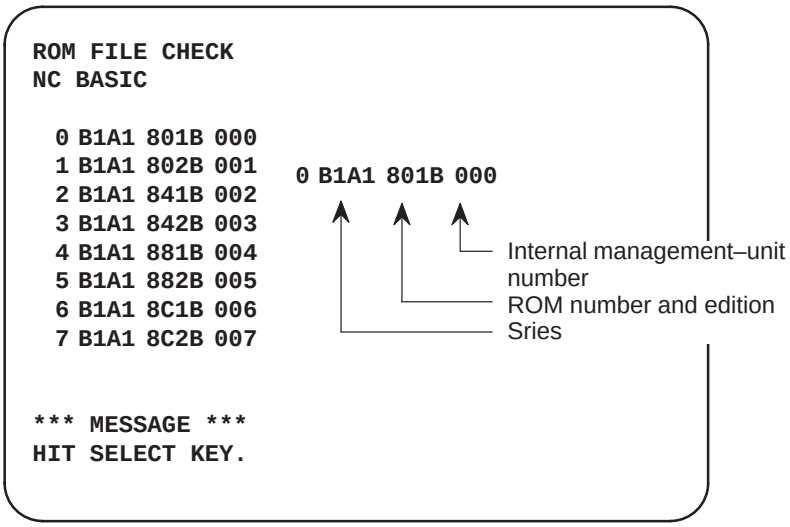
4 : Returning to the previous menu

5 : Message

- **Operating procedure**

1 Select the file whose details are required. For example, select “1 NC BASIC (8).”

2 The numbers of management units in the selected file are listed, together with the series and edition of the software in each management unit. After checking the listed data, select the **[SELECT]** soft key to return to the file selection screen.



- **Others**

Parity information for the system file and user file

The NC BASIC, DG SERVO, OPT LANG and other system files in flash memory contain parity information in each management unit. If the file name field or parity field on the check screen contains a non–ASC II character or an “@” , the flash ROM may have been destroyed or a damaged file may have been read. Re–read the data from the memory card.

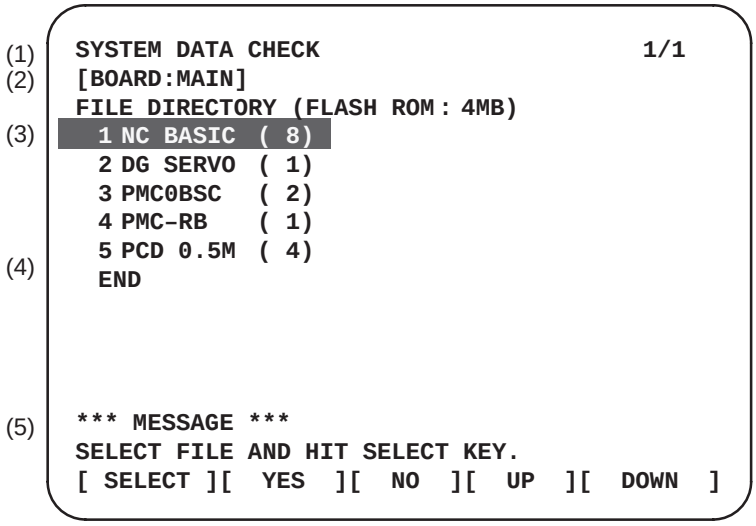
The PMC–RB, PCD 0.5M, and other user files do not contain parity information in each management unit. A non–ASCII character or an “@” may appear in the series/edition information. In this case, it does not indicate that the file has been damaged.

D.2.3 System Data Delete Screen

- **Description**

This screen is used to delete a user file from flash memory.

- **Screen configuration**



1 : Screen title
2 : Names of accessing board
3 : Names of files in flash memory The number of management units constituting each file appears in parentheses to the right of the file name.
4 : Returning to the previous menu
5 : Message

- **Operating procedure**

1 Position the cursor to the name of the file to be deleted. Press the **[SELECT]** soft key.
2 The system displays the following confirmation message :

```
*** MESSAGE ***
DELETE OK ? HIT YES OR NO.
```

3 To start the deletion, press the **[YES]** key. To cancel, press **[NO]**.

```
*** MESSAGE ***
DELETING ROM FILE IN FLASH MEMORY.
```

4 When deletion terminates normally, the system displays the following message. Press the **[SELECT]** key.

```
*** MESSAGE ***
DELETING COMPLETE. HIT SELECT KEY.
```

- **Others**

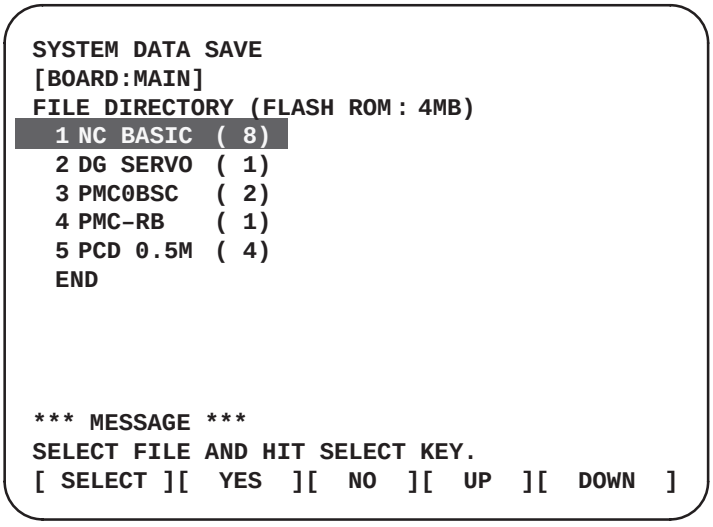
1 System files and user files on SYSTEM DATA DELETE screen The SYSTEM DATA DELETE screen guards against system files being accidentally deleted by the operator. User files, however, are not protected. Protected system files can be overwritten from the SYSTEM DATA LOADING screen.

D.2.4 SYSTEM DATA SAVE Screen

- **Description**

This screen is used to write a user file in flash memory to a memory card. Only user files can be saved from flash memory to a memory card. System files cannot be saved.

- **Screen configuration**



1 : Screen title

2 : Names of accessing board

3 : Names of files in flash memory The number of management units constituting each file appears in parentheses to the right of the file name.

4 : Returning to the previous menu

5 : Message

- **Operating procedure**

1 Position the cursor to the name of the file to be deleted. Press the **[SELECT]** soft key.

2 The system displays the following confirmation message :

```
*** MESSAGE ***
SAVE OK ? HIT YES OR NO.
```

3 To start saving, press the **[YES]** key. To cancel, press **[NO]**.

```
*** MESSAGE ***
WRITING FLASH ROM FILE TO MEMORY CARD.
SAVE FILE NAME : PMC_RB.000
```

4 When saving terminates normally, the system displays the following message. Press the **[SELECT]** key. The names of files written to the memory card are listed. Check the file names by, for example, making a note of the list.

```
*** MESSAGE ***
FILE SAVE COMPELETE. HIT SELECT KEY.
SAVE FILE NAME : PMC_RB.000
```

- **Others**

1 System files and user files on SYSTEM DATA SAVE screen

The SYSTEM DATA SAVE function provides a safeguard against free copying of the system files.

User files, however, are not protected.

2 Names of saved files

Files saved from flash memory to a memory card have the following names :

Flash memory		Memory card
PMC–RA	→	PMC_RA. XXX
PMC 0.5M	→	PCD_0.5M.XXX
PMC 1.0M	→	PCD_10M.XXX
PMC 1.5M	→	PCD_15M.XXX

XXX corresponds to the file extension of MS–DOS format files. A number from 000 to 031 is specified for XXX. For example, if the PMC–RA file in flash memory is saved to a memory card that does not yet contain any PMC–RA. * files, the saved file is named PMC–RA.000. If, however, that file is saved to a memory card that already contains a file named PMC–RA.000, the saved file is named PMC–RA.001. As files are added, the extension is incremented up to a maximum of PMC–RA.031. Any no–longer used numbers in the sequence of the extension numbers are used in as cending order. If two or more files having identical names but different extension numbers are normally saved to the memory card, check the file names displayed subsequently.

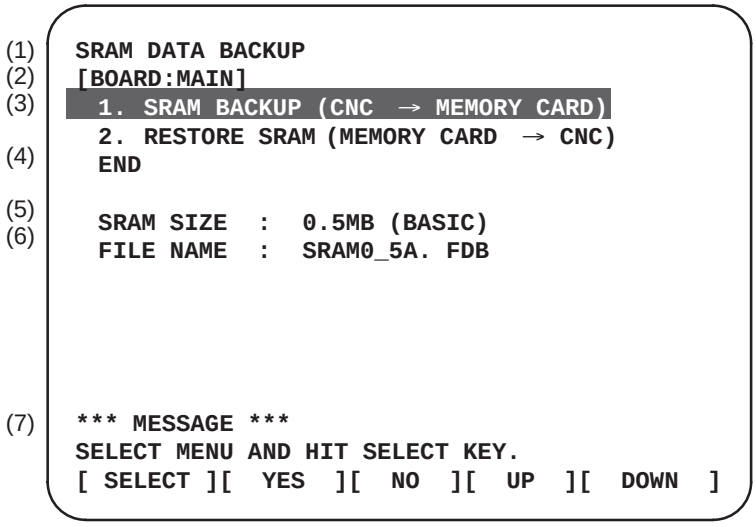
D.2.5 SRAM DATA BACKUP Screen

- **Description**

This screen is used to collectively save and restore parameters, programs, and other data, retained after the CNC power is turned off, to and from a memory card.

- **Screen configuration**

Select “4 SRAM DATA BACKUP” on the SYSTEM MONITOR MAIN MENU screen. The following screen is displayed.



1 : Screen title
2 : Names of accessing board
3 : Menu
4 : Returning to the previous menu
5 : Size of SRAM mounted on the CNC
6 : File name
7 : Message

- **Operating procedure**

[Backing up data]

1 Select “1. SRAM BACKUP.” The following confirmation message is displayed. Press **[YES]** to start backup.

```
*** MESSAGE ***
BACKUP SRAM DATA OK ? HIT YES OR NO.
```

2 The name of the file being written to the memory card is displayed in the FILE NAME: field.
The time required for writing depends on the amount of free space on the memory card.
Normally, writing SRAM BASIC (512KB) should take about two minutes.

```
SRAM SIZE  : 128K (BASIC)
FILE NAME  : SRAM128K. 000  → MEMORY CARD
                                  ↖ Name of the file being saved

*** MESSAGE ***
SRAM DATA WRITING TO MEMORY CARD.
```

3 Upon terminating normally, the system displays the following message. Press the **[SELECT]** soft key.

```
*** MESSAGE ***
SRAM BACKUP COMPLETE. HIT SELECT KEY.
```

[Restoring the data]

1 Select “2. RESTORE SRAM.” The system displays the following message. Press the **[YES]** key.

```
*** MESSAGE ***
RESTORE SRAM DATA OK ? HIT YES OR NO.
```

2 The system displays the following message during restoration.

```
*** MESSAGE ***
RESTORE SRAM DATA FROM MEMORY CARD.
```

3 Upon terminating normally, the system displays the following message. Press the **[SELECT]** soft key.

```
*** MESSAGE ***
RESTORE COMPLETE. HIT SELECT KEY.
```

- **Others**

1 Name of backup file

The name of the backup file written to the memory card by the SRAM backup function depends on the size of the SRAM installed in the CNC.

When the size of SRAM is 1MB or larger, backup files are created in units of 512 KB.

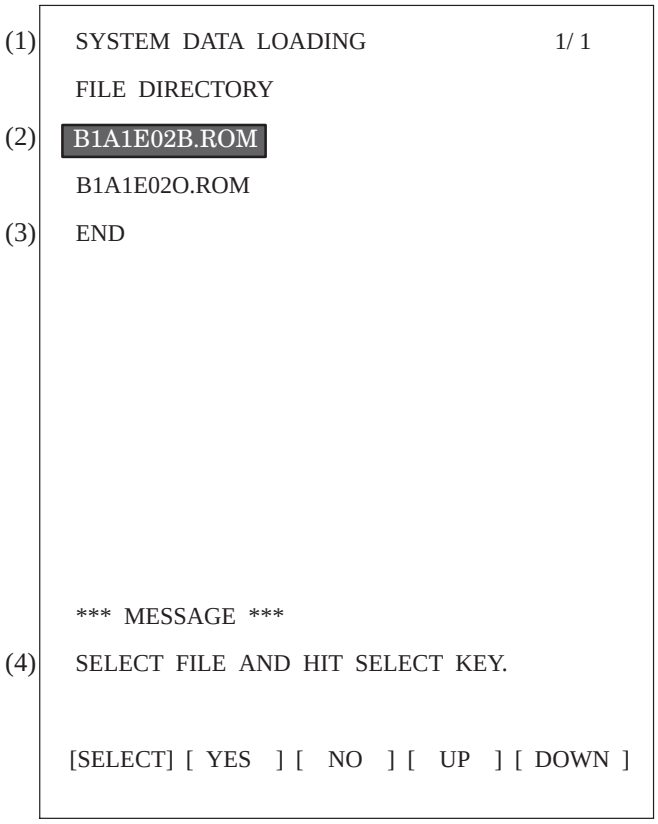
Number of files / SRAM size	1	2	3	4	5
0.5MB	SRAM0_5A.FDB				
1.0MB	SRAM1_0A.FDB	SRAM1_0B.FDB			
1.5MB	SRAM1_5A.FDB	SRAM1_5B.FDB	SRAM1_5C.FDB		
2.5MB	SRAM2_5A.FDB	SRAM2_5B.FDB	SRAM2_5C.FDB	SRAM2_5D.FDB	SRAM2_5E.FDB

D.2.6 MEMORY CARD FILE DELETE Screen

- **Description**

This screen is used to delete a file from a memory card.

- **Screen configuration**



(1) : Screen title. Tlhe current page number (n) and the total number of pages (m) are displayed, in n/m format, at the right end.
(2) : Files on the memory card
(3) : Option for returning to the previous menu
(4) : Message

- **Operating procedure**

1 Press the **[SELECT]** key to select the name of the file to be deleted from the memory card.
2 The system displays the following confirmation message. Press the **[YES]** key.

```
*** MESSAGE ***
DELETE OK ? HIT YES OR NO.
```

3 When deletion is completed correctly, following message appears. Press **[SELECT]**.

```
*** MESSAGE ***
DELETE COMPLETE. HIT SELECT KEY.
```

- **Others**

1 When the memory card contains nine or more files
Display the desired page, following the procedure given in the description of the SYSTEM DATA LOADING screen.

D.2.7 MEMORY CARD FORMAT Function

- **Description**

This function is used to format a memory card. Memory cards must be formatted before they can be used for the first time or before they can be re–used after their data has been destroyed or lost because of, for example, battery failure.

- **Operating procedure**

1 From the SYSTEM MONITOR MAIN MENU screen, select “7. MEMORY CARD FORMAT.”

2 The system displays the following confirmation message. Press the **[YES]** key.

```
*** MESSAGE ***
MEMORY CARD FORMAT OK ? HIT YES OR NO.
```

3 The system displays the following message during formatting :

```
*** MESSAGE ***
FORMATTING MEMORY CARD.
```

4 When a card has been formatted normally, the system display the
- following message.
- Press the **[SELECT]** key.

```
*** MESSAGE ***
FORMAT COMPLETE. HIT SELECT KEY.
```

D.2.8 LOAD BASIC SYSTEM

Function

- **Description**

The function is used to terminate the boot system and activate the CNC.

- **Operating procedure**

From the MAIN MENU screen, select “9. END.” The system displays the “ARE YOU SURE? HIT YES OR NO” message. To terminate the boot system and activate the CNC, press the **[YES]** soft key. Pressing the **[NO]** key cancels this operation.

```
*** MESSAGE ***
ARE YOU SURE ? HIT YES OR NO.

[ SELECT ][  YES  ][  NO  ][  UP  ][  DOWN  ]
```

1 After pressing the **[YES]** soft key

The system checks the NC BASIC system file in the flash ROM. The system displays the following message :

```
*** MESSAGE ***
CHECK CNC BASIC SYSTEM.

[ SELECT ][  YES  ][  NO  ][  UP  ][  DOWN  ]
```

When the NC BASIC system file is found to be normal, the system sends the system file to DRAM and starts the NC basic system. During loading, the system blinks the following message.

```
*** MESSAGE ***
  LOADING BASIC TO DRAM

[ SELECT ][  YES  ][  NO  ][  UP  ][  DOWN  ]
```

If the contents of the NC BASIC SYSTEM file are found to have been damaged or destroyed, the system returns to the processing selection state, in exactly the same way as when the **[NO]** soft key is pressed.

2 If the **[NO]** soft key is pressed, the system returns to the processing selection state as shown below :

```
*** MESSAGE ***
SELECT MENU AND HIT [SELECT] KEY.

[ SELECT ][  YES  ][  NO  ][  UP  ][  DOWN  ]
```

D.3 ERROR MESSAGES AND REQUIRED ACTIONS

The following table lists and explains error messages in alphabetical order.

	Message	Description and required action
D	DELETE ERROR. HIT SELECT KEY.	An attempt to delete a file from flash memory was unsuccessful. Retry the deletion. If the second attempt also fails, the flash memory may have been damaged or destroyed. Replace the flash memory module.
	DEVICE ERROR (CNC x)	An attempt to write data to flash memory was unsuccessful. Retry the write operation. If the second attempt also fails, the flash memory may have been damaged or destroyed. Repalce the flash memory module.
F	FILE SAVE ERROR. HIT SELECT KEY.	An attempt to write a file to a memory card was unsuccessful. Check that the memory card is not damaged. Note) Check that the memory card's battery is not exhusted, that its circuitry has not been damaged, and that it is securely inserted into its slot.
	FLASH MEMORY NO SPACE	There is insufficient free flash memory to store the selected file. Delete any unnecessary files from flash memory.
	FORMAT ERROR. HIT SELECT KEY.	A format of memory card was unsuccessful. Only SRAM type of memory card can be used. Check whether card's type is flash memory or not.
I	ILLEGAL FORMAT FILE	The selected file cannot be read into flash memory. The selected file or the header information for flash memory may have been damaged or destroyed.
L	LOADING ERROR. HIT SELECT KEY.	An error occurred while loading data into flash memory. Do not touch the memory card while loading data.
M	MAX EXTENSION OVER. HIT SELECT KEY.	The extension number added to a file name exceeds 031. Delete any unnecessary backup files from the memory card.
	MEMORY CARD BATTERY ALARM. HIT SELECT.	The memory card's battery is exhausted. Replace the battery.
	MEMORY CARD FULL. HIT SELECT KEY.	The memory card is full. Delete any unnecessary files from the memory card. Alternatively, replace the memory card with another card having sufficient free space.
	MEMORY CARD MOUNT ERROR. HIT SELECT KEY	The memory card could not be accessed. Check that the memory card is normal.
	MEMORY CARD NOT EXIST. HIT SELECT KEY.	The memory card is not inserted into its slot. Check that the memory card is pushed fully home.
	MEMORY CARD PROTEC-TED.HIT SELECT KEY.	Although writing to the memory card was selected, the write inhibit switch is set. Disable the write inhibit switch.
	MEMORY CARD RESET ERROR. HIT SELECT KEY.	Access to the memory card has failed. Check whether the memory card is defective.
S	SRAM DATA BACKUP ERROR. HIT SELECT KEY.	An attempt to write a backup file to a memory card failed. Check that the memory card is normal.

E NOTATION OF MDI KEYS

Series 16/18/160/180–MODEL B have 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.

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	

Name	English key	Symbolic key
INPUT key	INPUT	
ALTER key	ALTER	
INSERT key	INSERT	
DELETE key	DELETE	
PAGE UP key	⬆ PAGE	
PAGE DOWN key	PAGE ⬇	
HELP key	HELP	
RESET key	RESET	
CUSTOM/GRAPH key	CUSTOM GRAPH	

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Revision Record

FANUC Series 16–LB MAINTENANCE MANUAL (B–62595EN)

Edition	Date	Contents	Edition	Date	Contents
01	May, ’95	_____			