GE Fanuc Automation

Computer Numerical Control Products

Series 21i / 210i Model A

Maintenance Manual

B- 63085EN/01 March 1998

Warnings and notices for this publication

GFLE-003

Warning

In this manual we have tried as much as possible to describe all the various matters. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.

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

Notice

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

GE Fanuc Automation makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

The following are Registered Trademarks of GE Fanuc Automation

CIMPLICITY®
Genius®

The following are Trademarks of GE Fanuc Automation

Alarm Master
CIMSTAR
Field Control
Genet
Helpmate
LogicMaster
Modelmaster
PowerMotion
ProLoop
PROMACRO
Series Five
Series 90
Series One
Series Six
Series Three
VuMaster
Workmaster

DEFINITION OF WARNING, CAUTION, AND NOTE

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

WARNING

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

CAUTION

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

NOTE

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

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

PREFACE

Description of this manual

1.Display and operation

This chapter covers those items, displayed on the screen, 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 for conversational data.

4.Interface between the CNC 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.AC spindles

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

7.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, a list of maintenance parts, and boot system.
This manual does not provide a parameter list. If necessary, refer to the separate PARAMETER MANUAL (B–63090EN) .

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

Applicable models

Pruduct name	Abbreviation	
FANUC Series 21*i*–TA	21*i*–TA	T series
FANUC Series 210*i*–TA	210*i*–TA	
FANUC Series 21*i*–MA	21*i*–MA	M series
FANUC Series 210*i*–MA	210*i*–MA	

NOTE
Some function described in this manual may not be applied to some products.
For details, refer to the DESCRIPTIONS manual (B–63002EN)

Related manuals

The table below lists manuals related to MODEL A of Series 21*i*, Series, Series 210*i*.
In the table, this manual is marked with an asterisk(*).

Table 1 Related Manuals

Manual name	Specification number	
DESCRIPTIONS	B–63002EN	
CONNECTION MANUAL (HARDWARE)	B–63083EN	
CONNECTION MANUAL (FUNCTION)	B–63003EN–1	
OPERATOR'S MANUAL FOR LATHE	B–63084EN	
OPERATOR'S MANUAL FOR MACHINING	B–63094EN	
MAINTENANCE MANUAL	B–63085EN	*
PARAMETER MANUAL	B–63090EN	

Table of Contents

APPENDIX

1 DISPLAY AND OPERATION

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

1.1 FUNCTION KEYS AND SOFT KEYS

Operations and soft key display 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 :

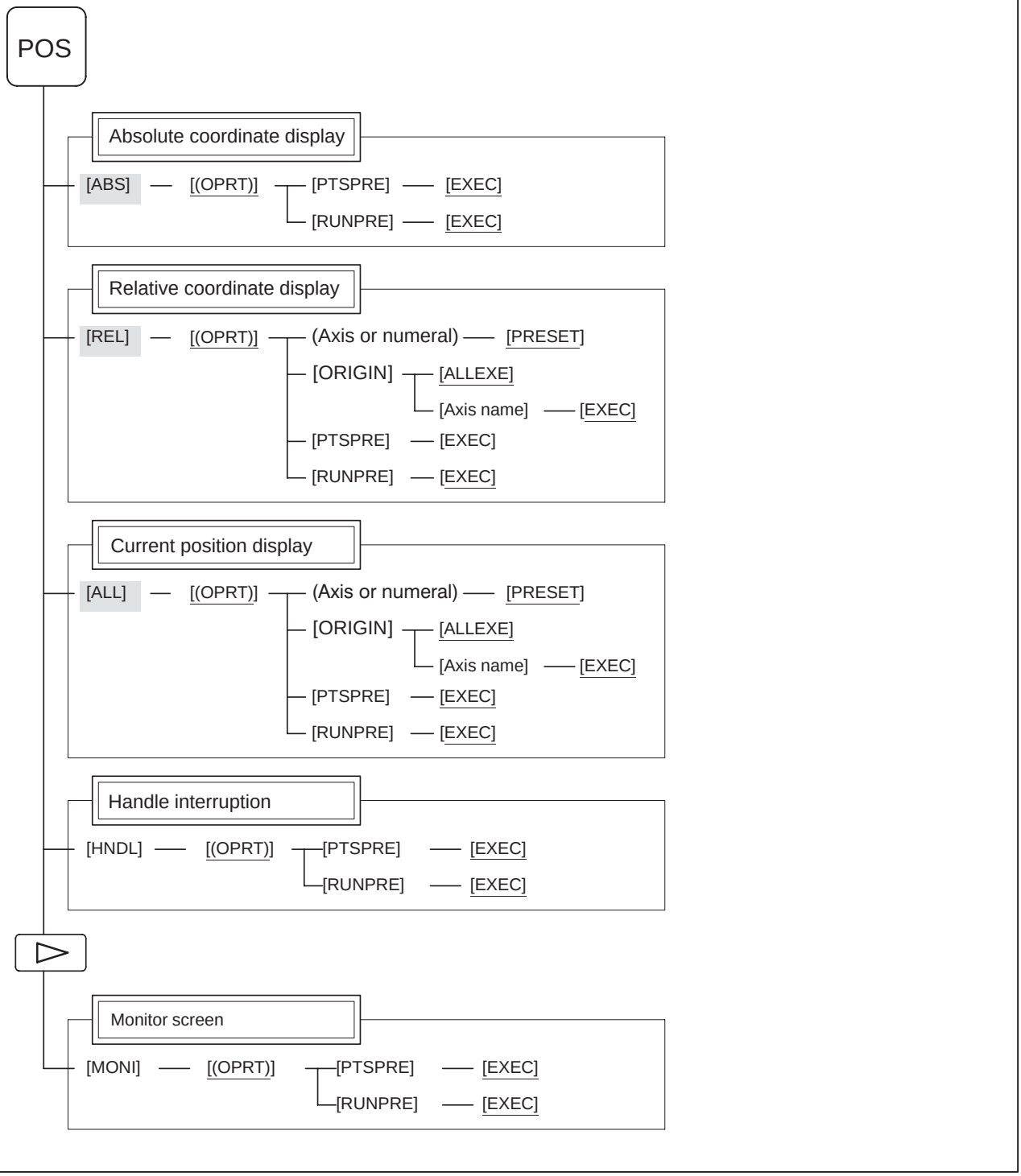
	:	Indicates screens
	:	Indicates a screen that can be displayed by pressing a function key(*1)
[ ]	:	Indicates a soft key(*2)
( )	:	Indicates input from the MDI panel.
[ ]	:	Indicates a soft key displayed in green (or highlighted).
	:	Indicates the continuous menu key (rightmost soft key)(*3).

*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 12 soft keys type is used.

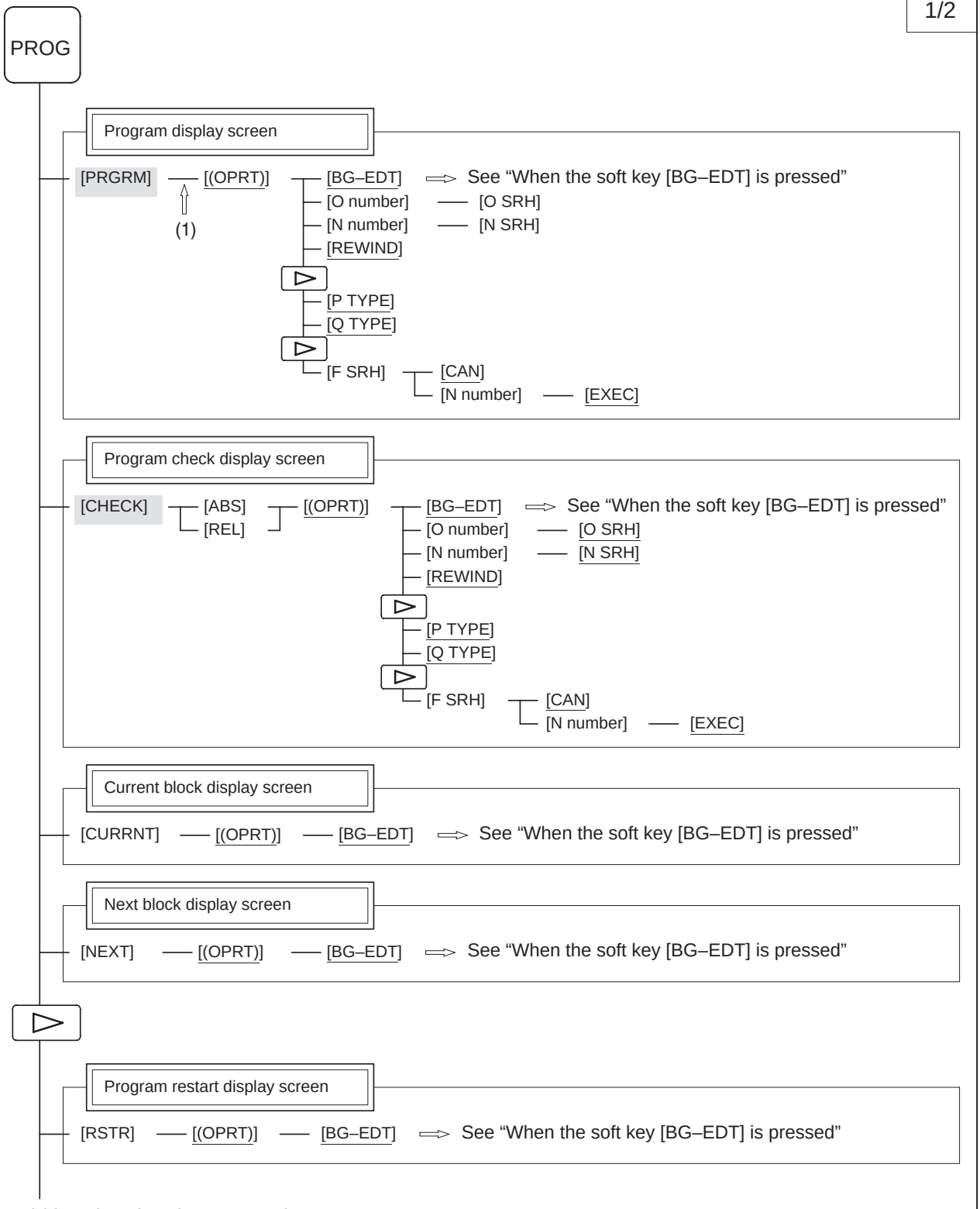
POSITION SCREEN Soft key transition triggered by the function key [POS]



PROGRAM SCREEN

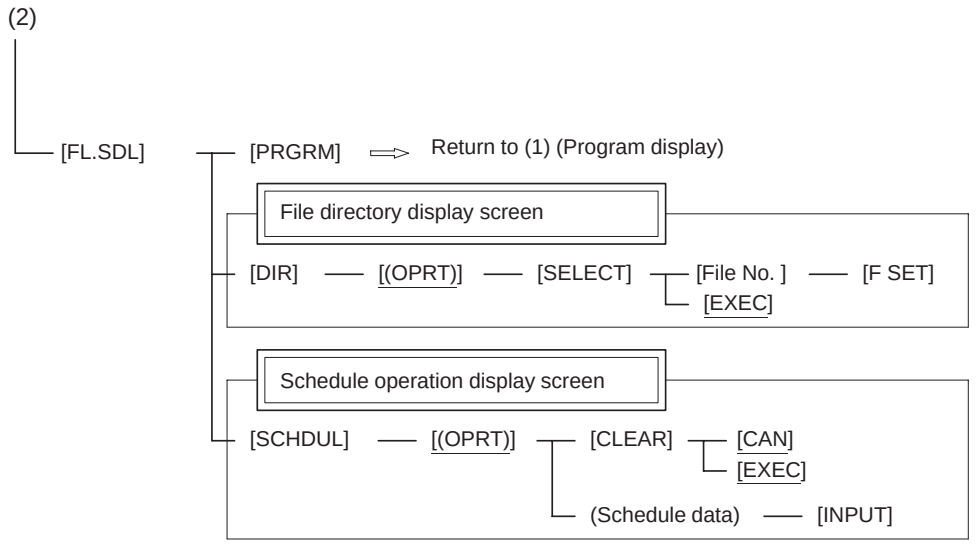
Soft key transition triggered by the function key in the MEM mode PROG

1/2



(2)(Continued on the next page)

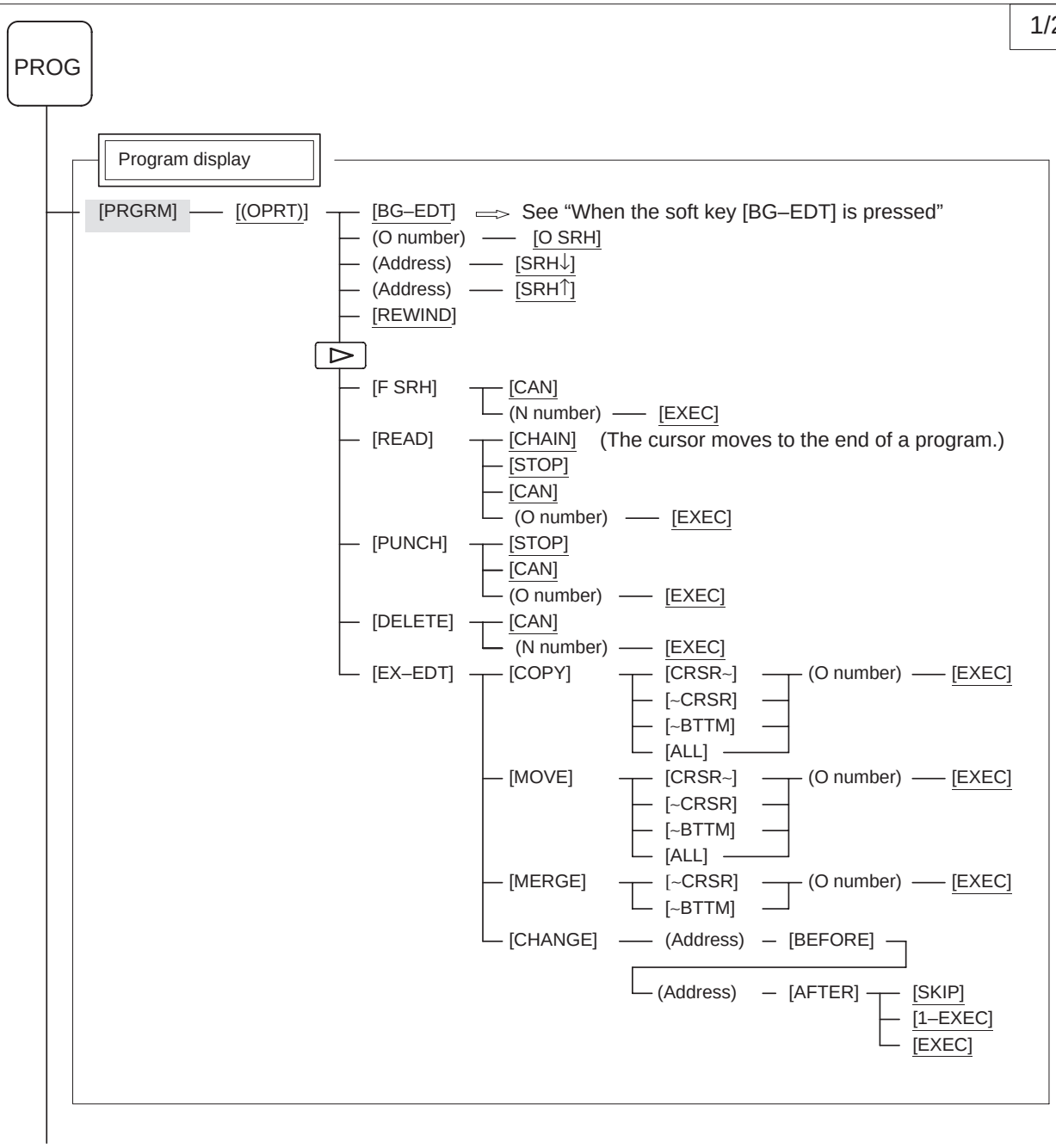
2/2


(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]

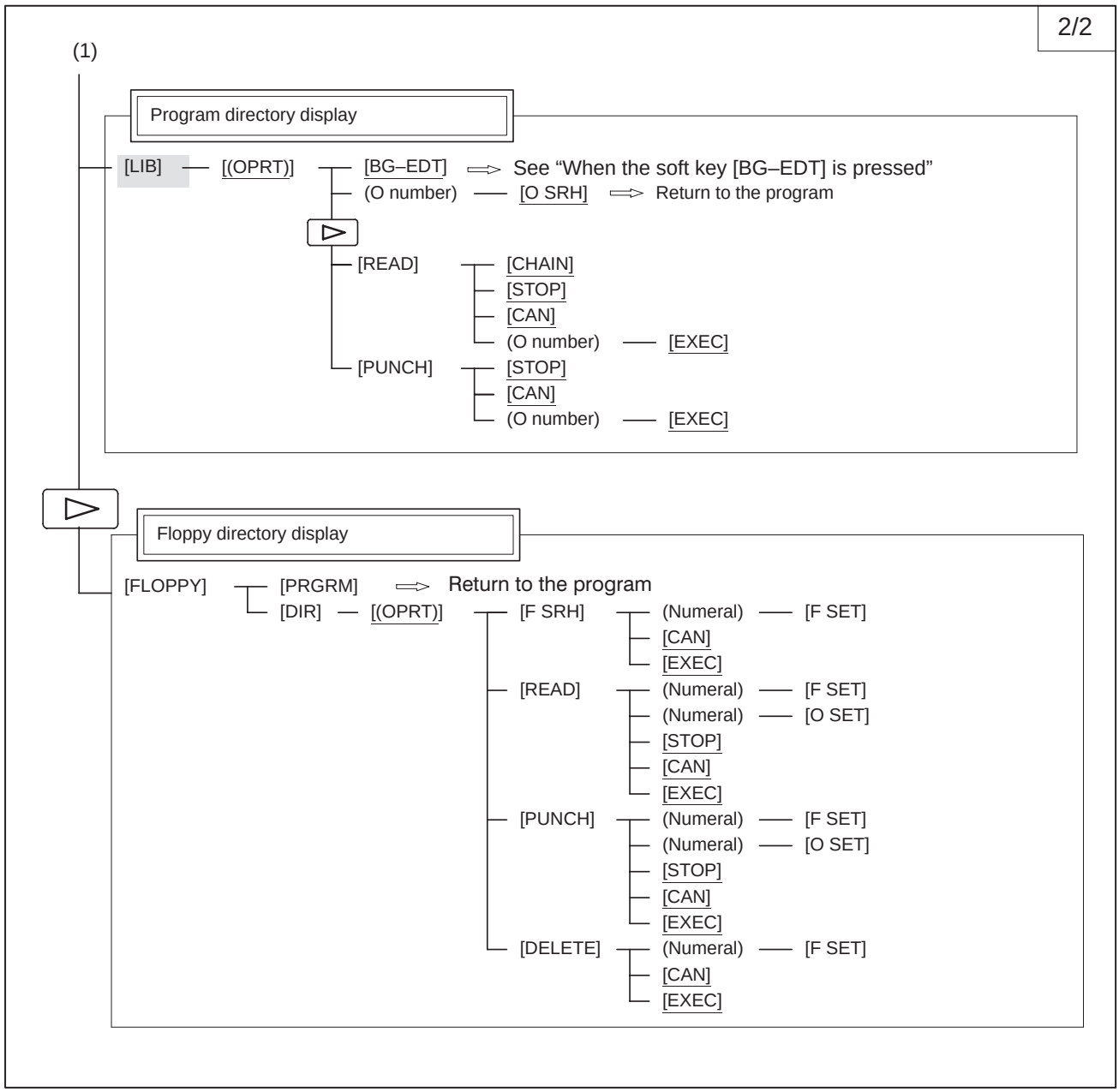
PROGRAM SCREEN

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

1/2

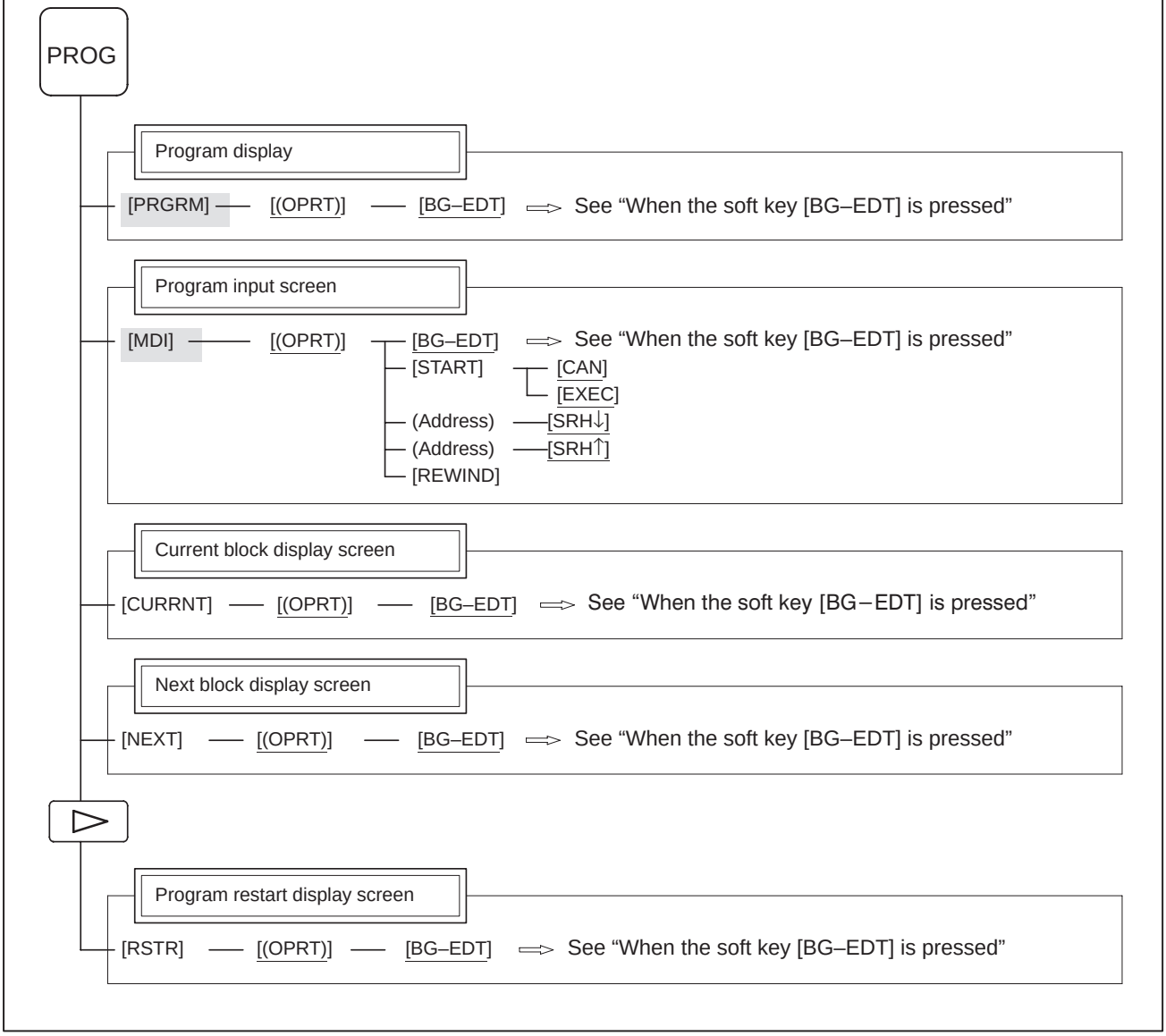


(1)(Continued on the next page)


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]
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

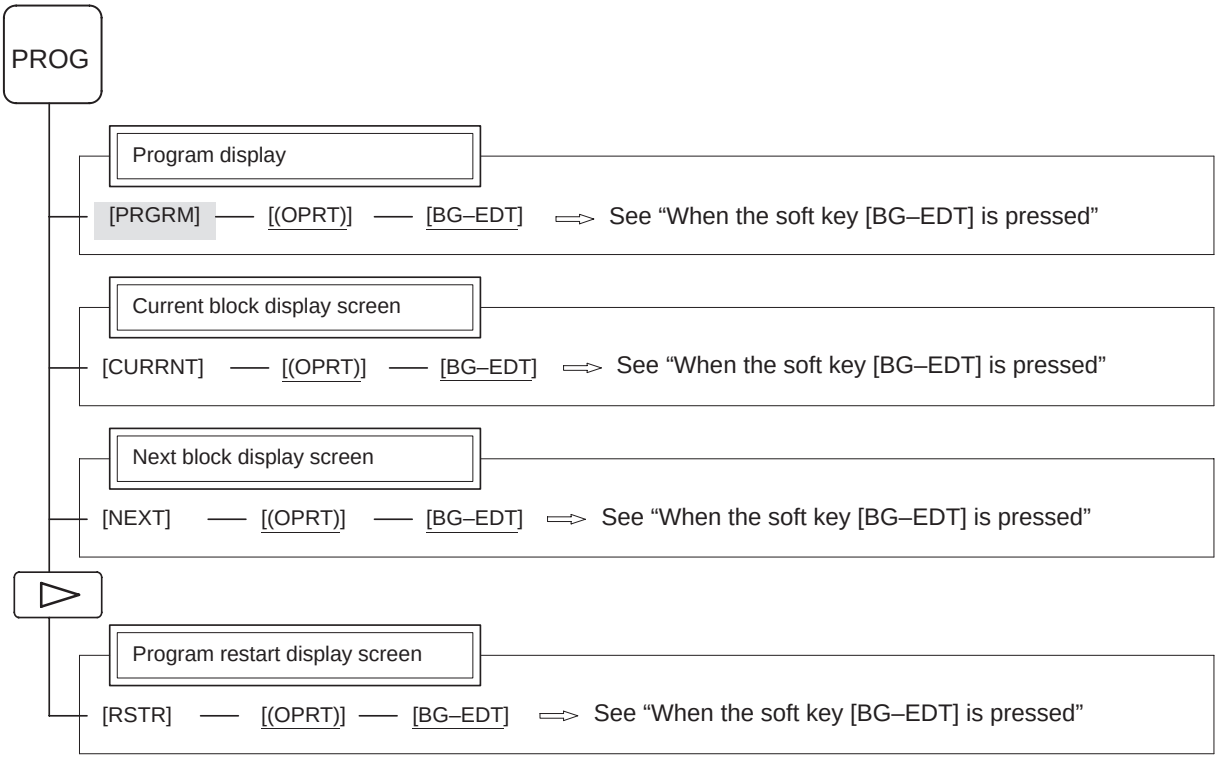
Soft key transition triggered by the function key in the MDI mode



PROGRAM SCREEN

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

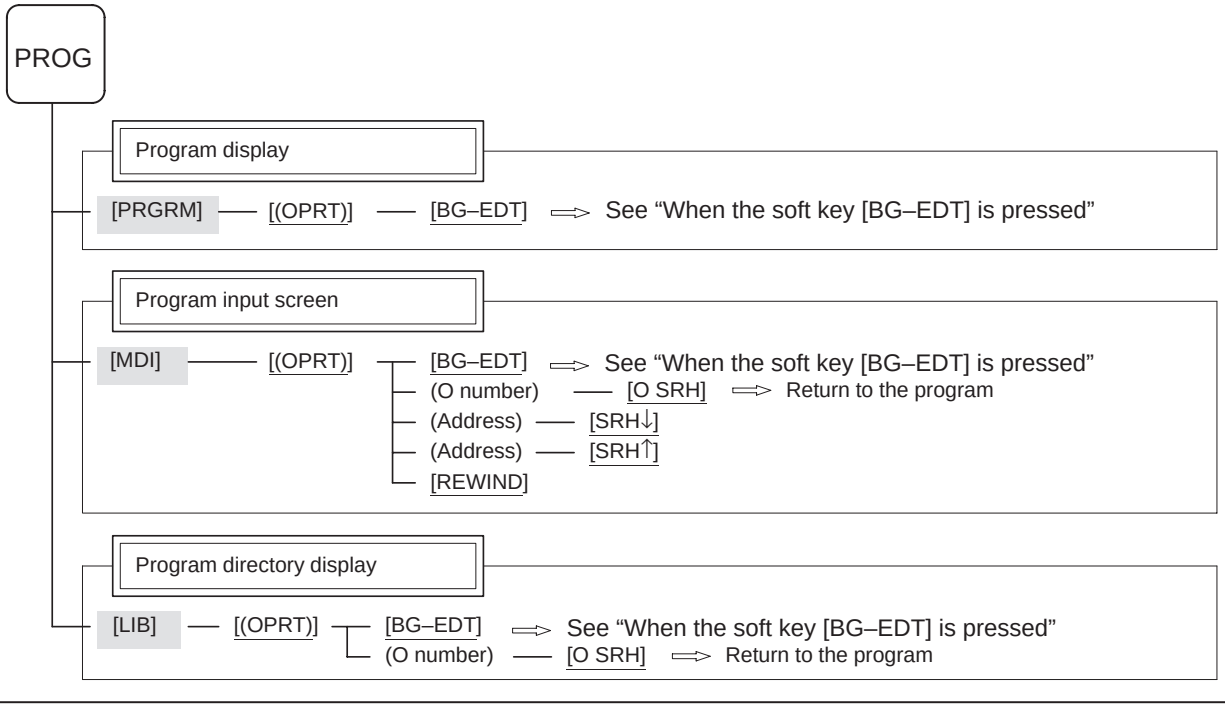
PROG



PROGRAM SCREEN

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

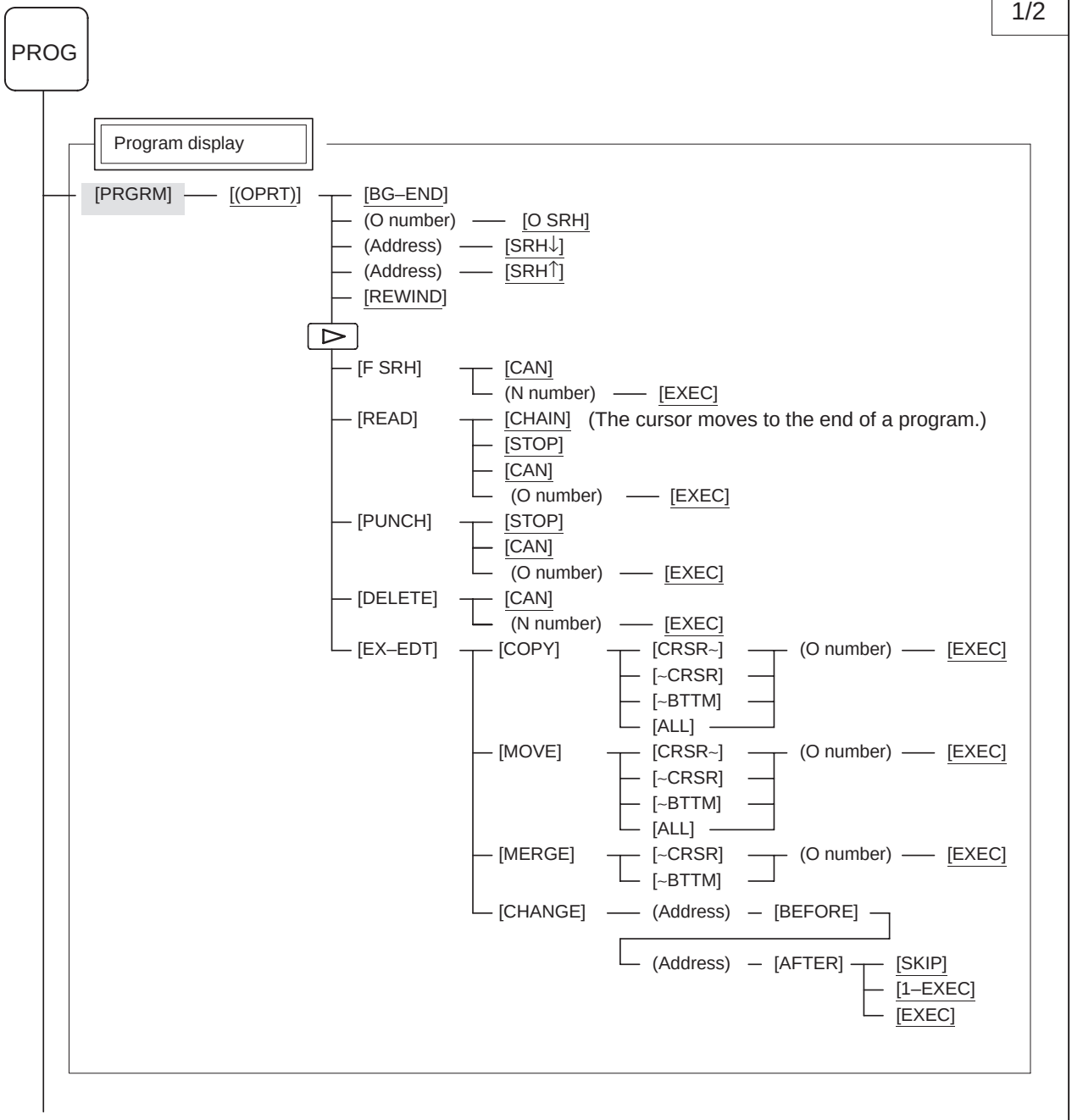
PROG



PROGRAM SCREEN

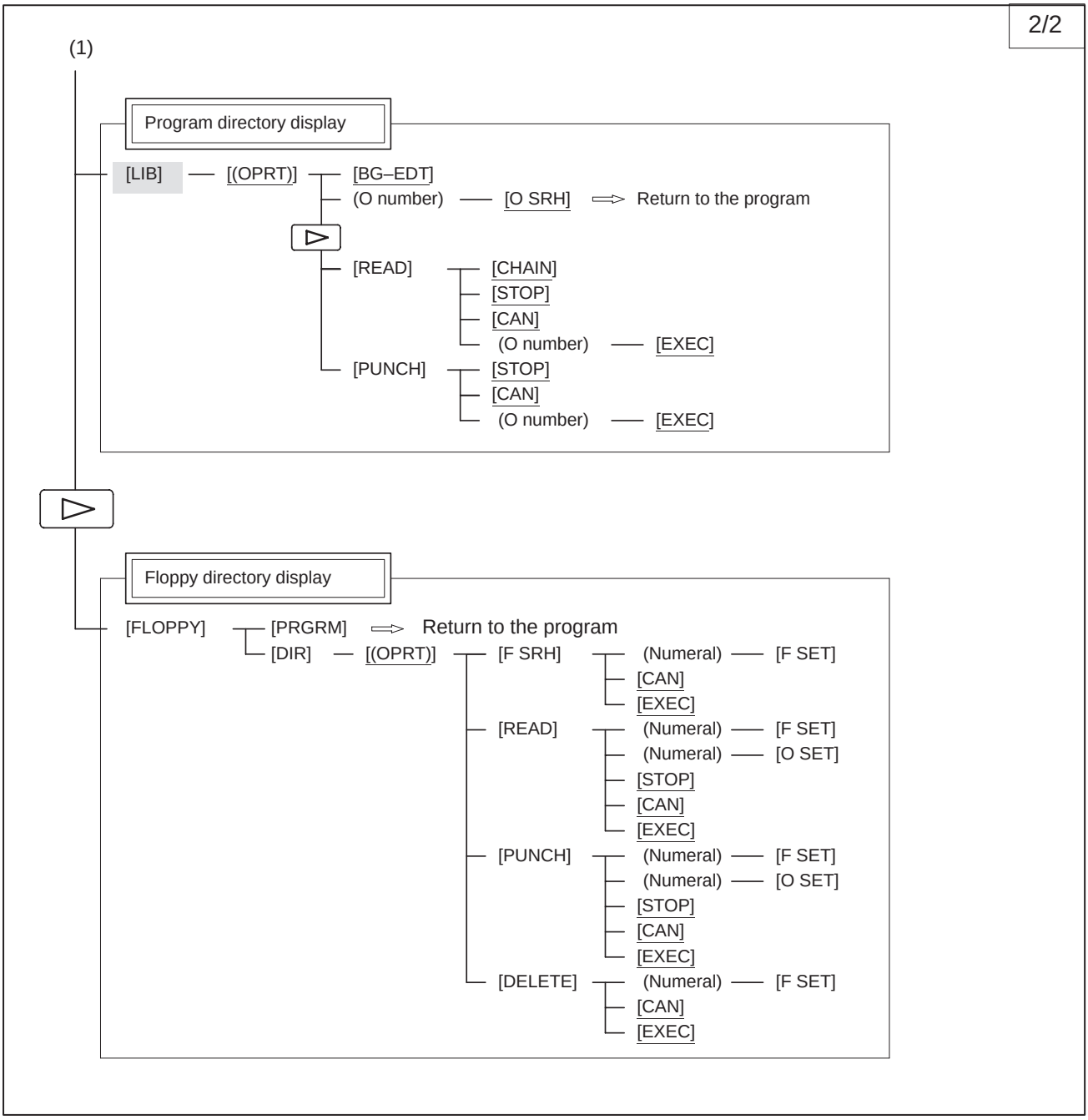
Soft key transition triggered by the function key PROG
(When the soft key [BG–EDT] is pressed in all modes)

1/2



(1)(Continued on the next page)

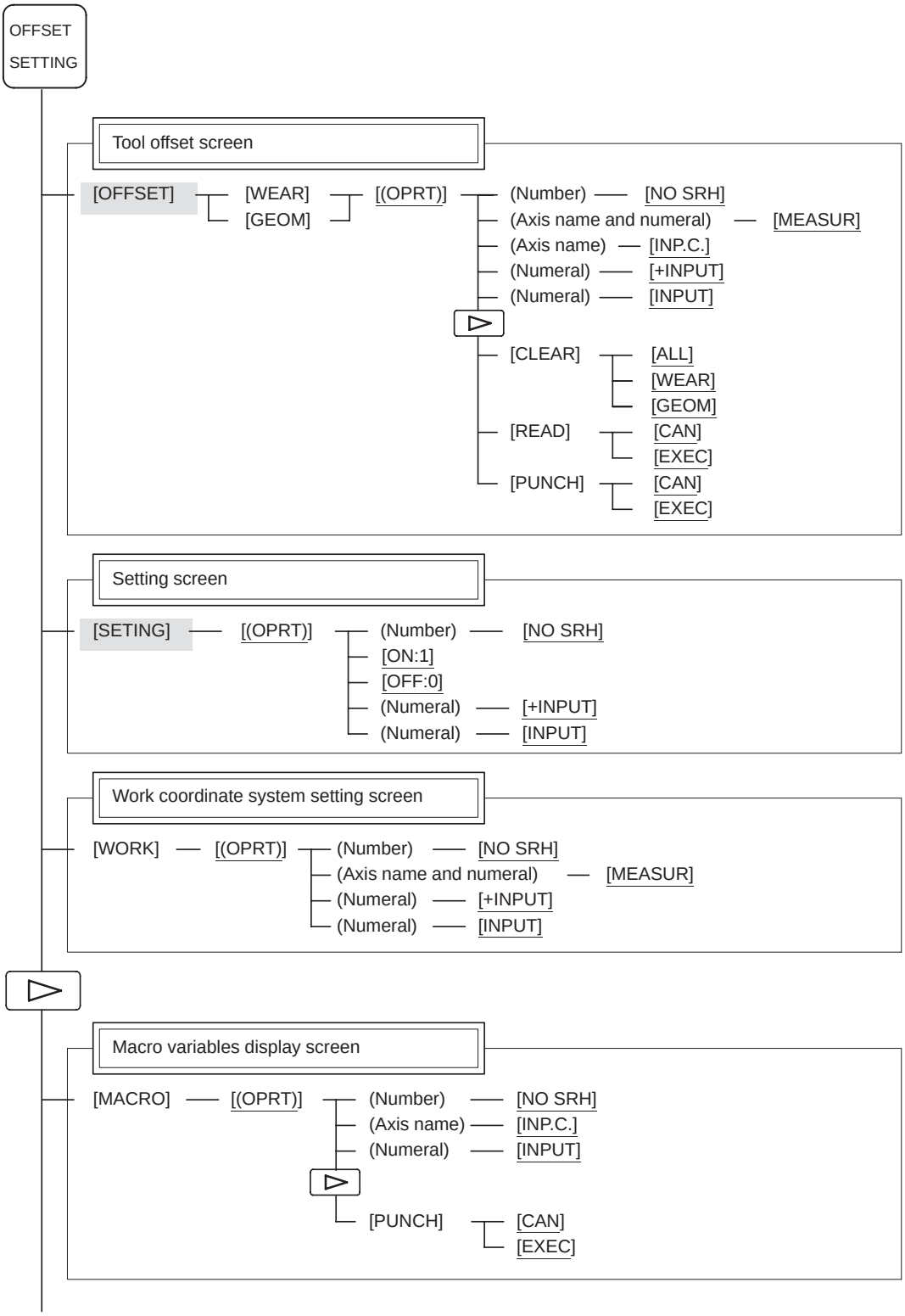
2/2


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

OFFSET/SETTING SCREEN (T series)

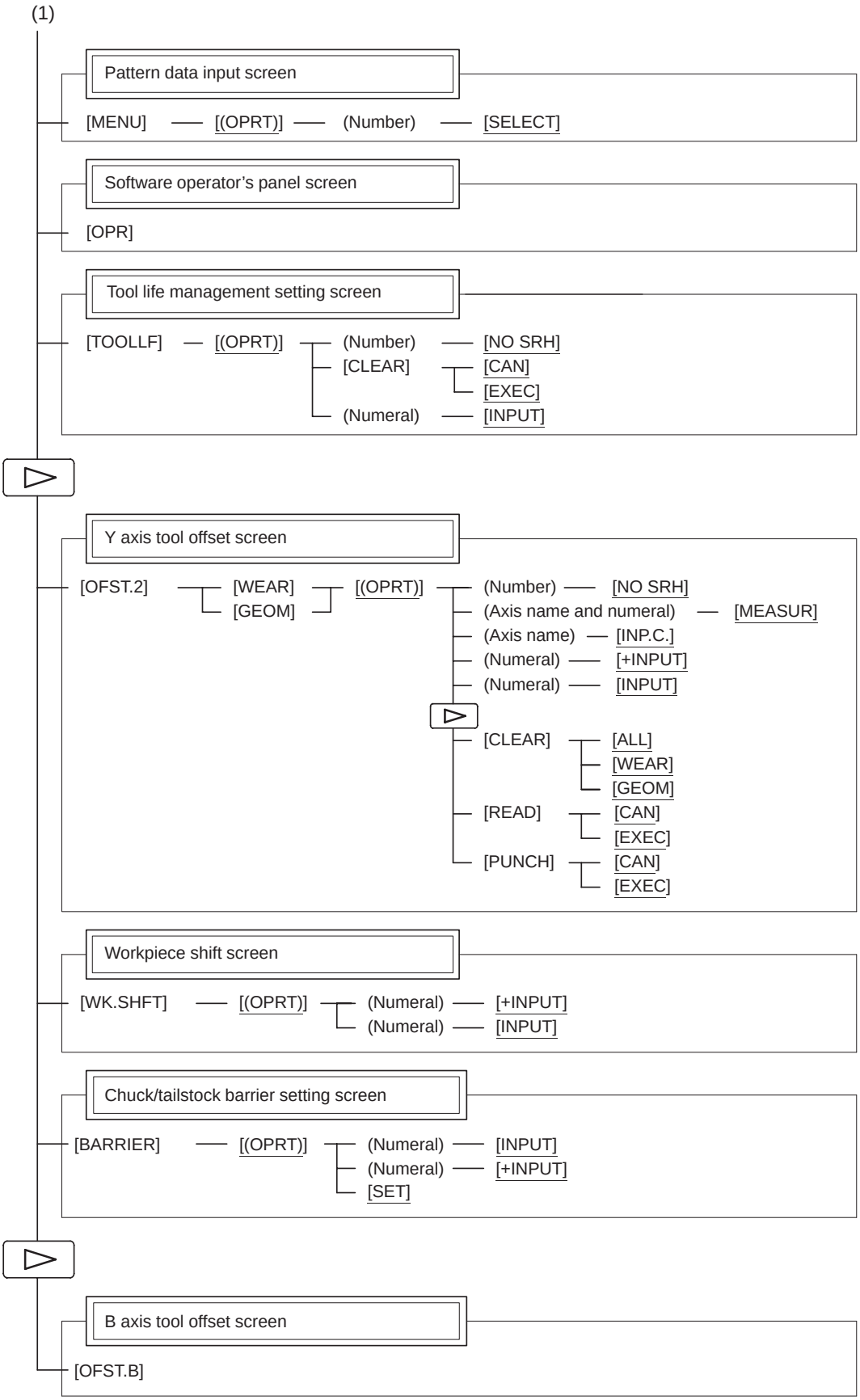
Soft key transition triggered by the function key OFFSET SETTING

1/2



(1)(Continued on the next page)

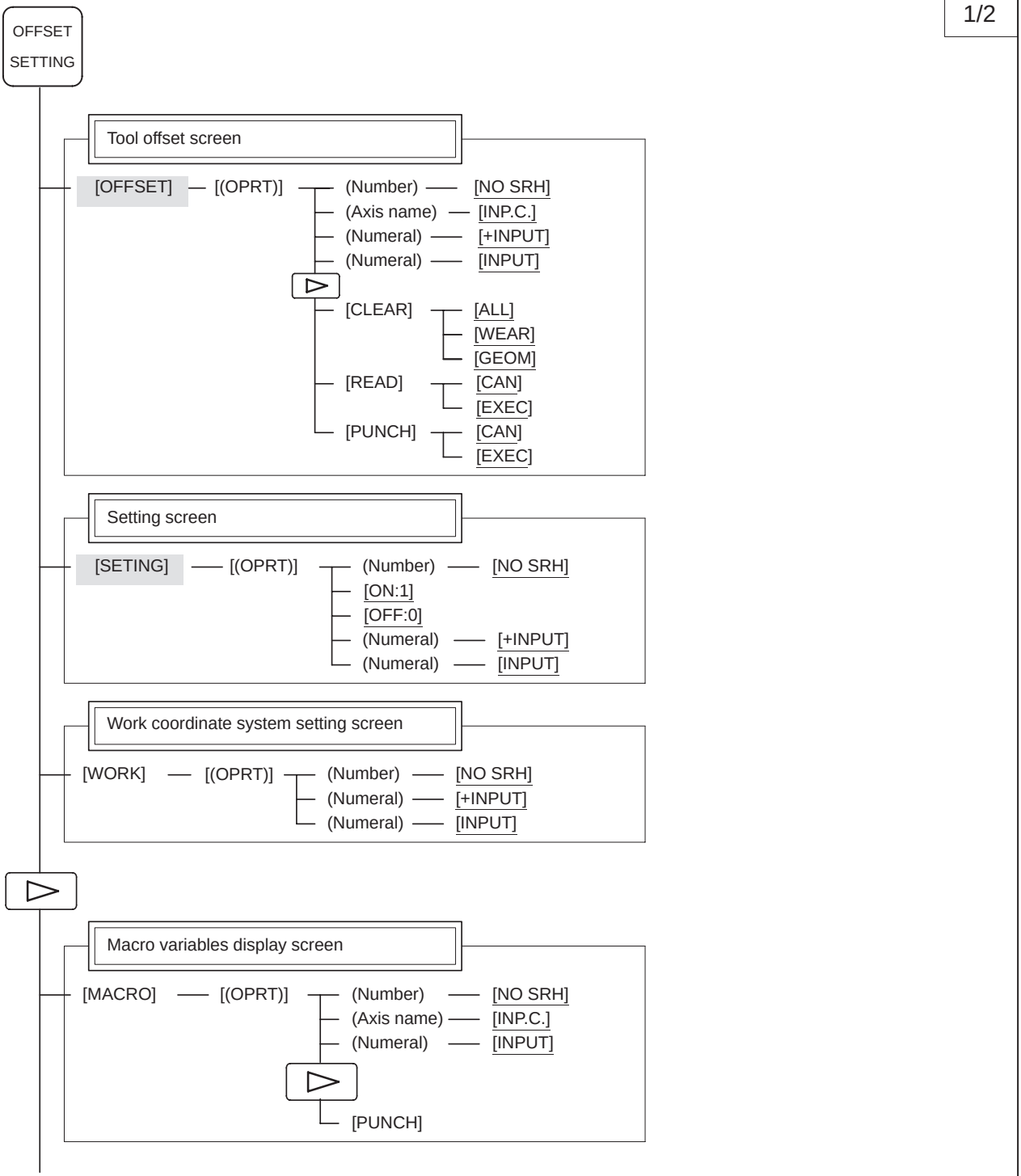
2/2


(1)
Pattern data input screen
[MENU] — [(OPRT)] — (Number) — [SELECT]
Software operator's panel screen
[OPR]
Tool life management setting screen
[TOOLLF] — [(OPRT)] — (Number) — [NO SRH]
[CLEAR] — [CAN]
[EXEC]
(Numeral) — [INPUT]
Y axis tool offset screen
[OFST.2] — [WEAR] — [(OPRT)] — (Number) — [NO SRH]
[GEOM]
(Axis name and numeral) — [MEASUR]
(Axis name) — [INP.C.]
(Numeral) — [+INPUT]
(Numeral) — [INPUT]
[CLEAR] — [ALL]
[WEAR]
[GEOM]
[READ] — [CAN]
[EXEC]
[PUNCH] — [CAN]
[EXEC]
Workpiece shift screen
[WK.SHFT] — [(OPRT)] — (Numeral) — [+INPUT]
(Numeral) — [INPUT]
Chuck/tailstock barrier setting screen
[BARRIER] — [(OPRT)] — (Numeral) — [INPUT]
(Numeral) — [+INPUT]
[SET]
B axis tool offset screen
[OFST.B]

OFFSET/SETTING SCREEN (M series)

Soft key transition triggered by the function key OFFSET SETTING

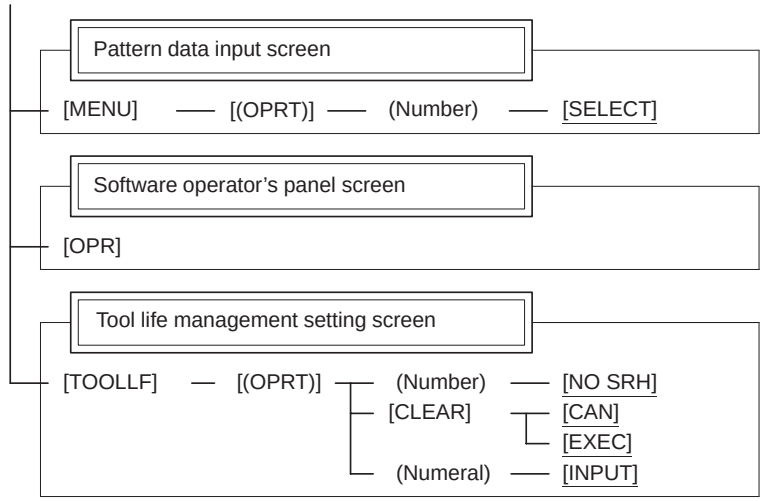
1/2



(1)(Continued on the next page)

2/2

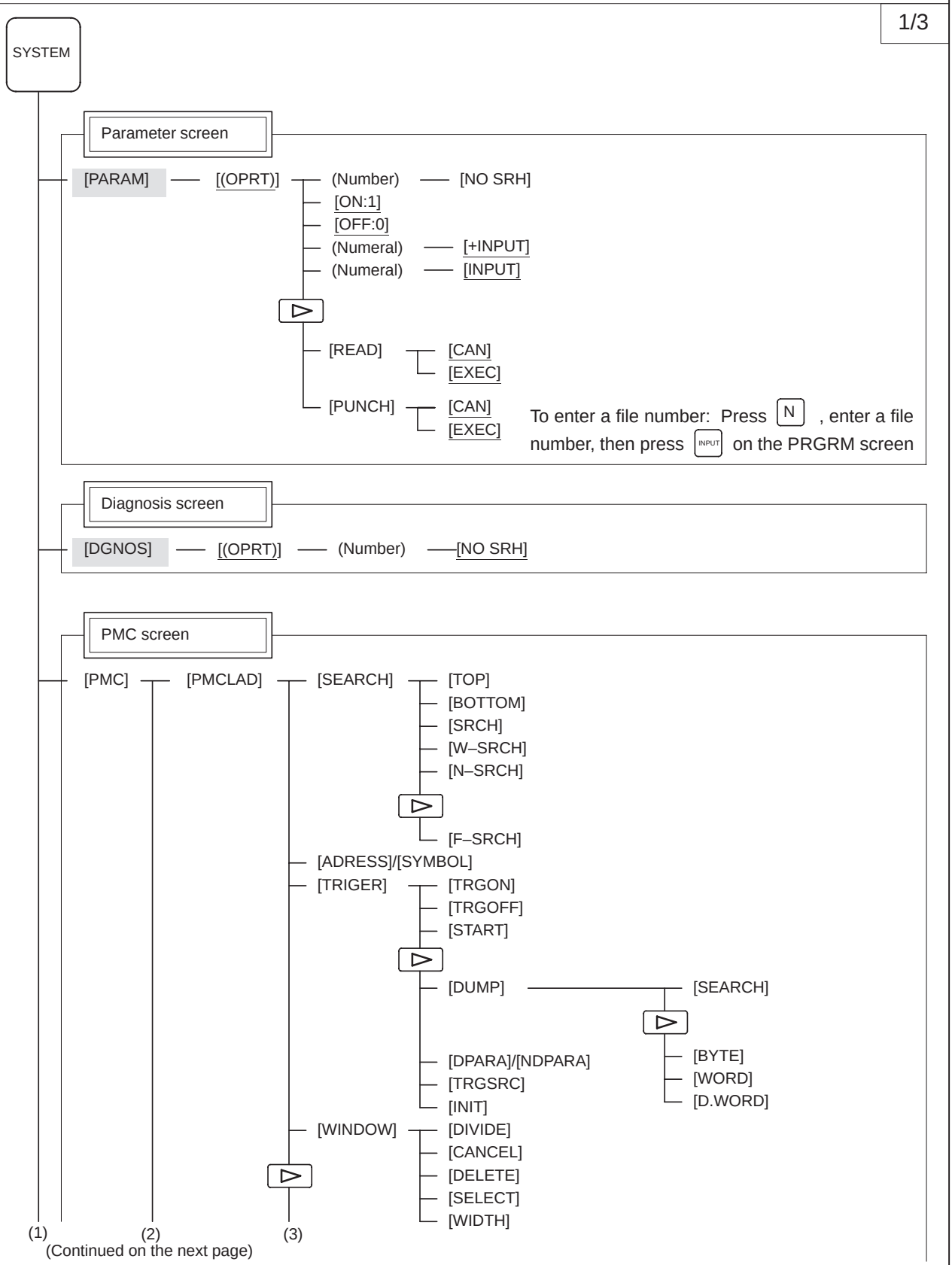
(1)


Pattern data input screen
[MENU] [(OPRT)] (Number) [SELECT]
Software operator's panel screen
[OPR]
Tool life management setting screen
[TOOLLF] [(OPRT)] (Number) [NO SRH]
[CLEAR] [CAN]
[EXEC]
(Numeral) [INPUT]

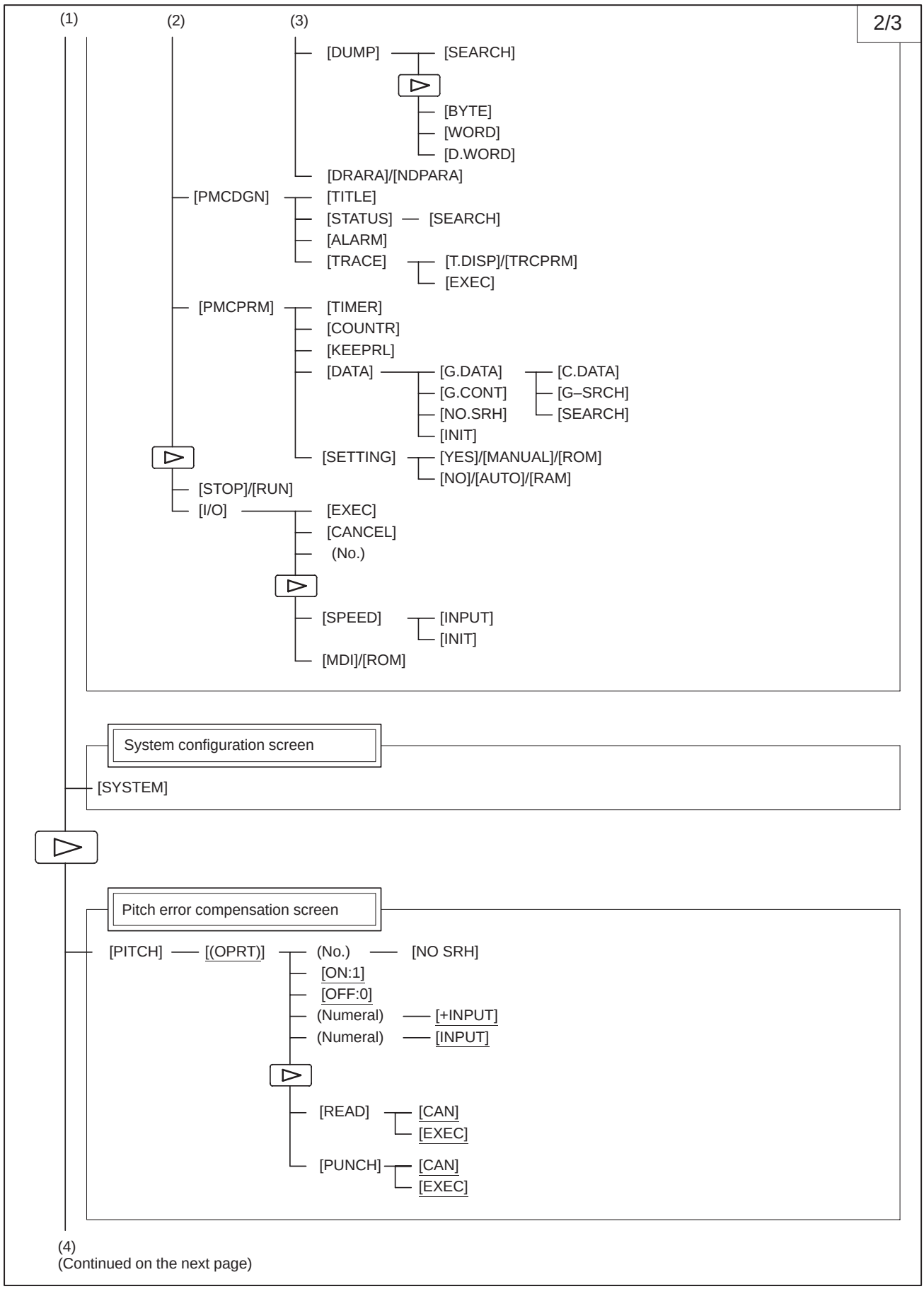
SYSTEM SCREEN

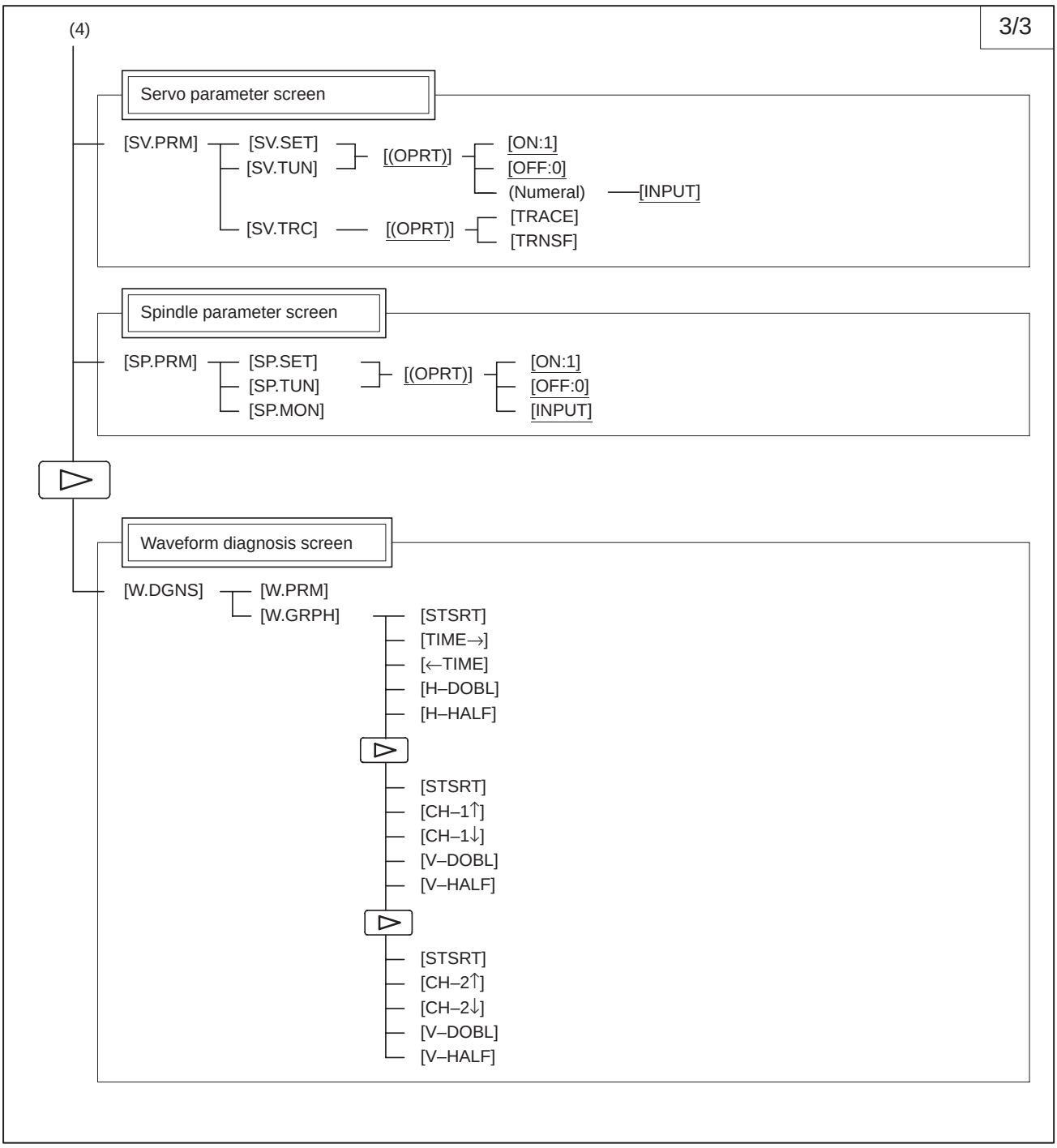
Soft key transition triggered by the function key SYSTEM

1/3

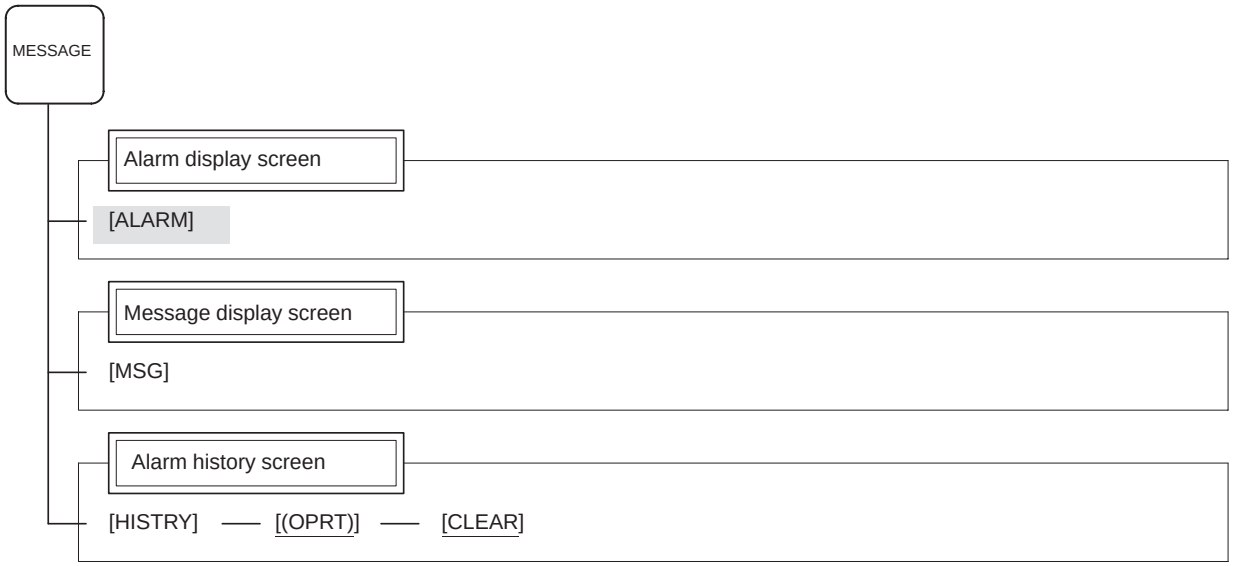


(Continued on the next page)

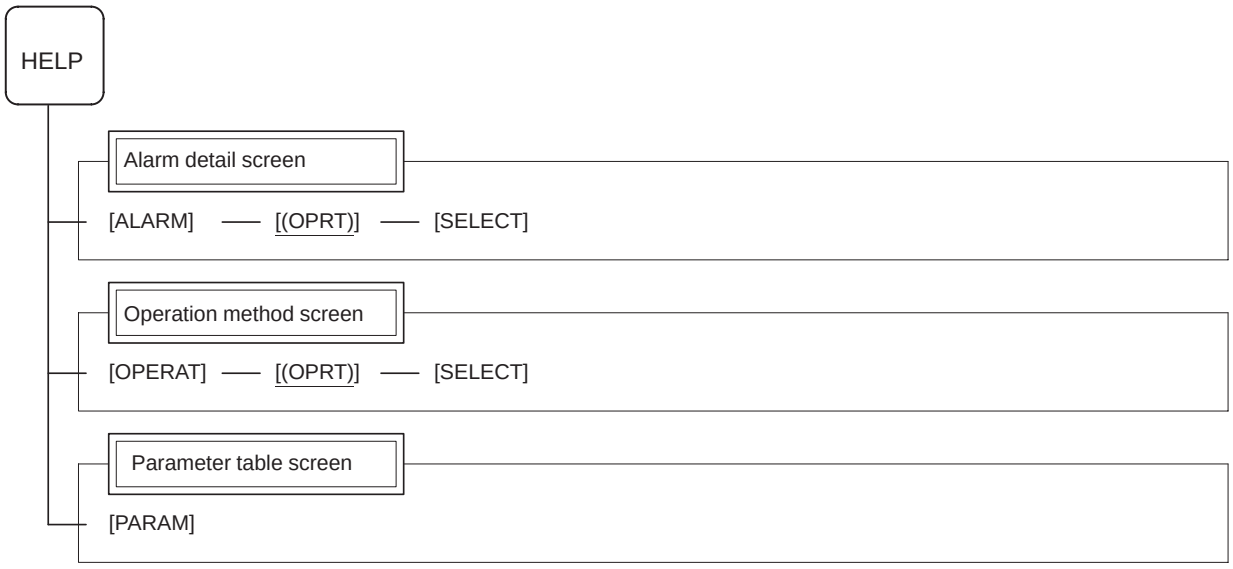

2/3
(1)
(2)
(3)
[DUMP]
[SEARCH]
[BYTE]
[WORD]
[D.WORD]
[DRARA]/[NDPARA]
[PMCDGN]
[TITLE]
[STATUS]
[SEARCH]
[ALARM]
[TRACE]
[T.DISP]/[TRCPRM]
[EXEC]
[PMCPRM]
[TIMER]
[COUNTR]
[KEEPRL]
[DATA]
[G.DATA]
[C.DATA]
[G.CONT]
[G–SRCH]
[NO.SRH]
[SEARCH]
[INIT]
[SETTING]
[YES]/[MANUAL]/[ROM]
[NO]/[AUTO]/[RAM]
[STOP]/[RUN]
[I/O]
[EXEC]
[CANCEL]
(No.)
[SPEED]
[INPUT]
[INIT]
[MDI]/[ROM]
System configuration screen
[SYSTEM]
Pitch error compensation screen
[PITCH]
[(OPRT)]
(No.)
[NO SRH]
[ON:1]
[OFF:0]
(Numeral)
[+INPUT]
(Numeral)
[INPUT]
[READ]
[CAN]
[EXEC]
[PUNCH]
[CAN]
[EXEC]
(4)
(Continued on the next page)


3/3
(4)
Servo parameter screen
[SV.PRM]
[SV.SET]
[SV.TUN]
[(OPRT)]
[ON:1]
[OFF:0]
(Numeral)
[INPUT]
[SV.TRC]
[(OPRT)]
[TRACE]
[TRNSF]
Spindle parameter screen
[SP.PRM]
[SP.SET]
[SP.TUN]
[SP.MON]
[(OPRT)]
[ON:1]
[OFF:0]
[INPUT]
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]

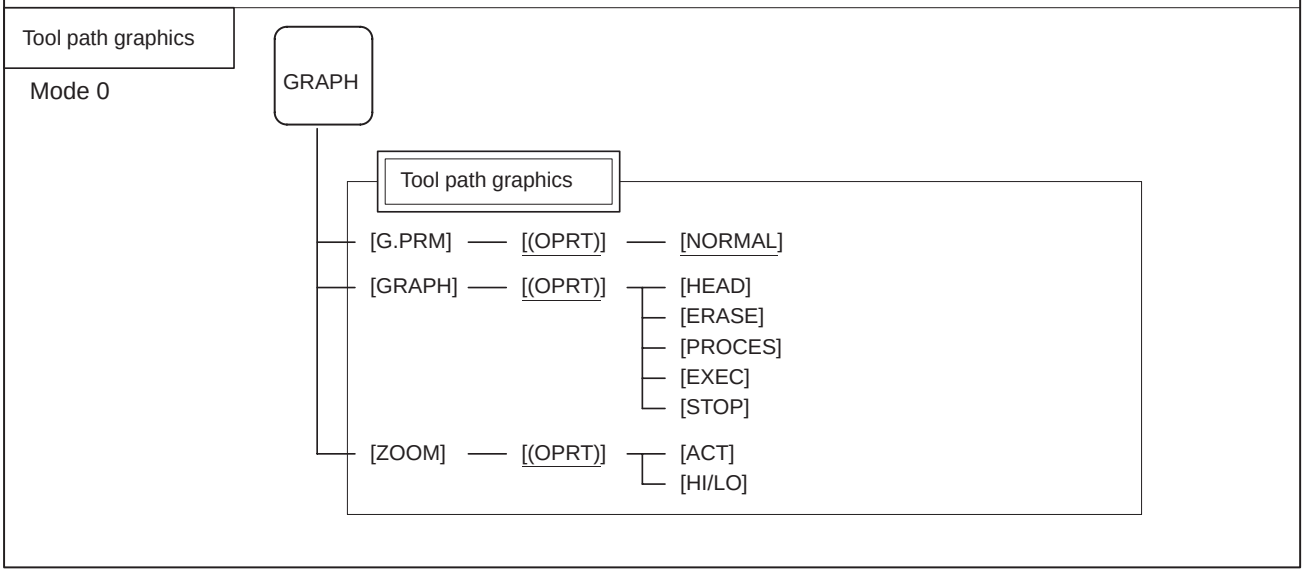


HELP SCREEN Soft key transition triggered by the function key [HELP]



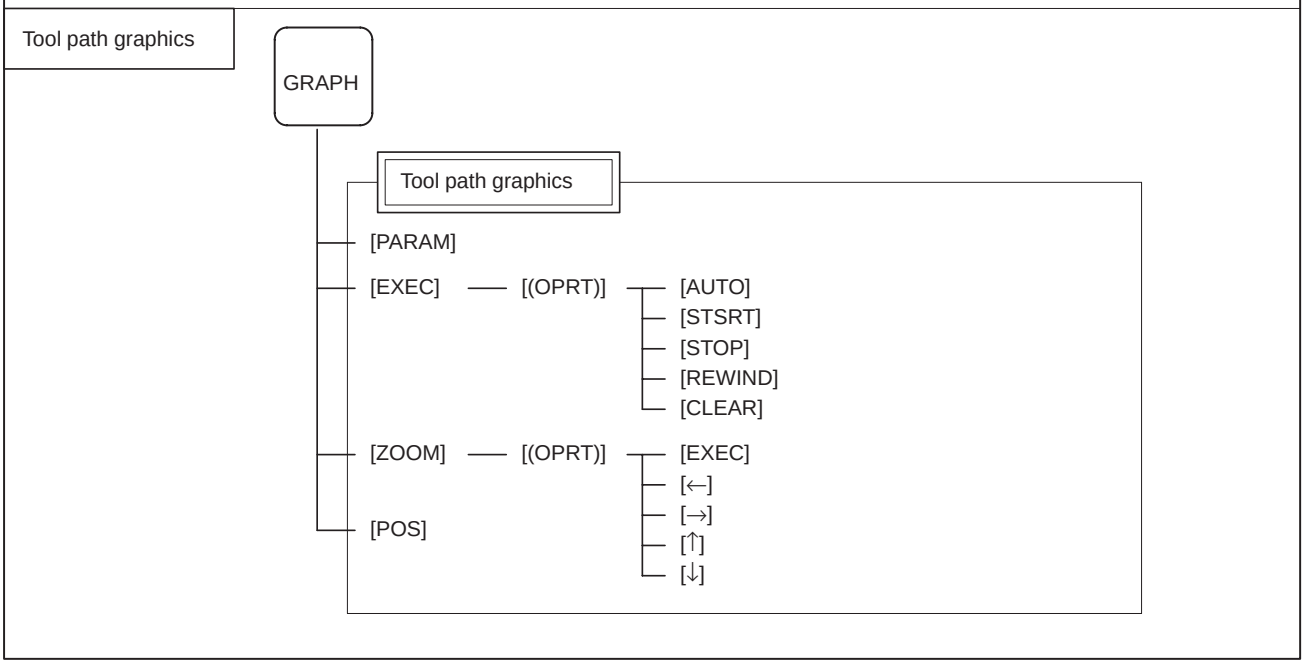
GRAPHIC SCREEN (T series)

Soft key transition triggered by the function key GRAPH



GRAPHIC SCREEN (M series)

Soft key transition triggered by the function key GRAPH

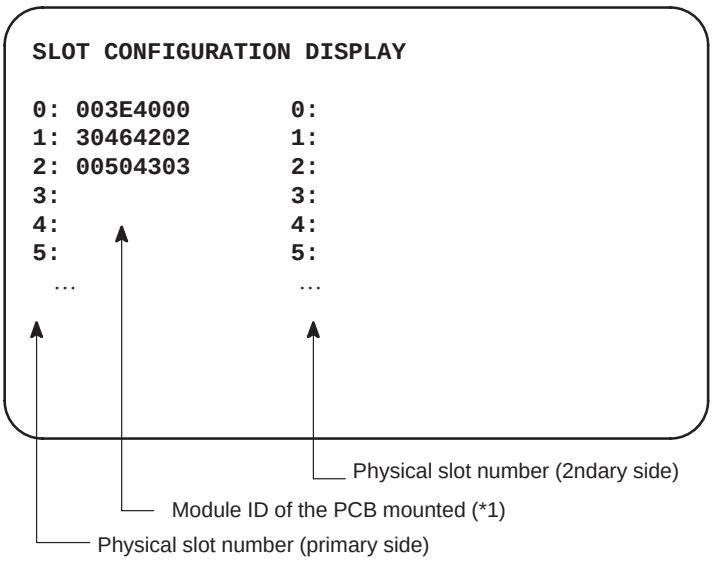


1.2 SCREEN DISPLAYED IMMEDIATELY AFTER POWER IS TURNED ON

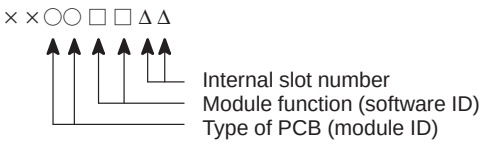
1.2.1 Slot Status Display

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



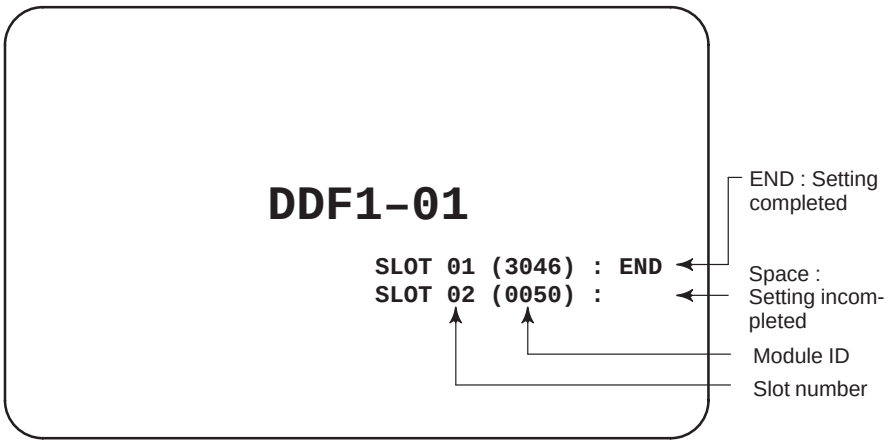
- **Module ID**

ID	Name
D7	Series 21*i* motherboard
DC	Series 210*i* motherboard
CD	Serial communication board: remote buffer/DNC2
	Serial communication board: DNC1
D3	Loader control board
AA	HSSB interface board
C9	PC function card

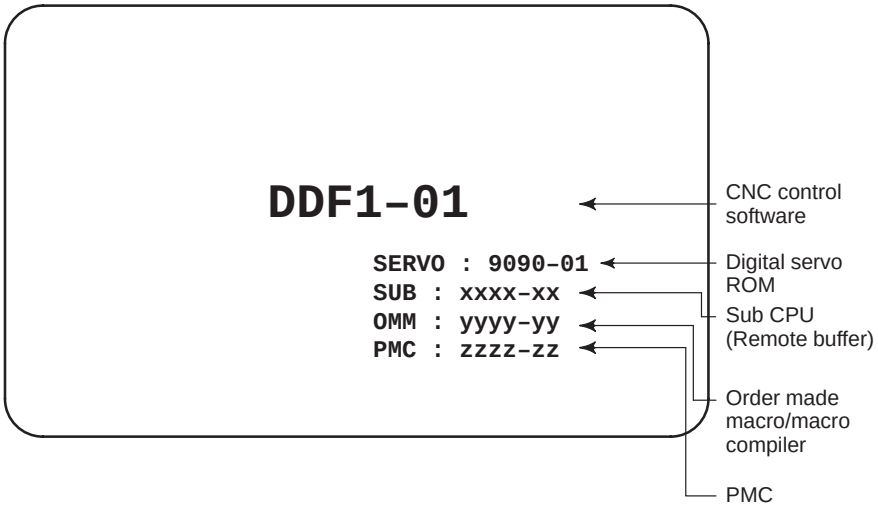
- **Software ID**

40 : Main CPU
4A : Remote buffer
53 : Loader control
5E : HSSB interface (with PC)

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

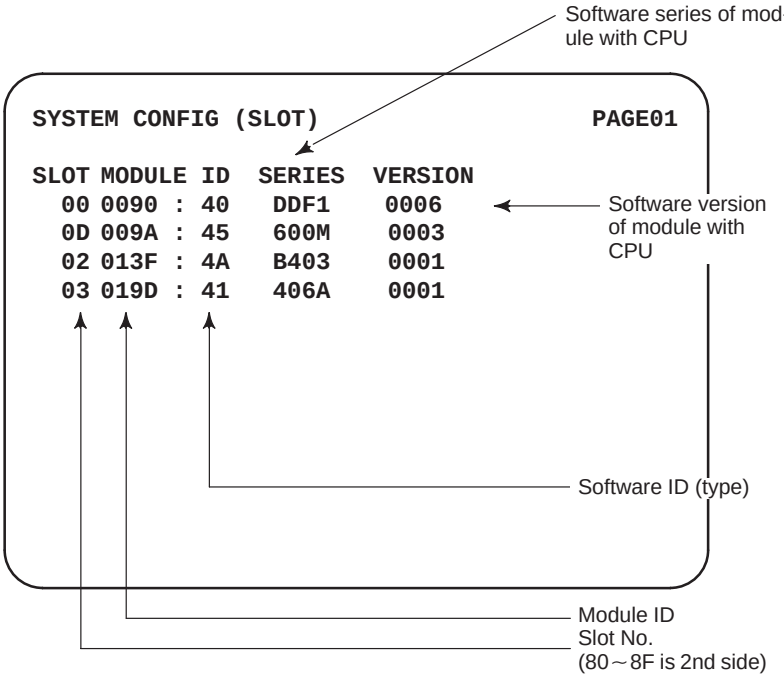
(1) Press SYSTEM key.

(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**



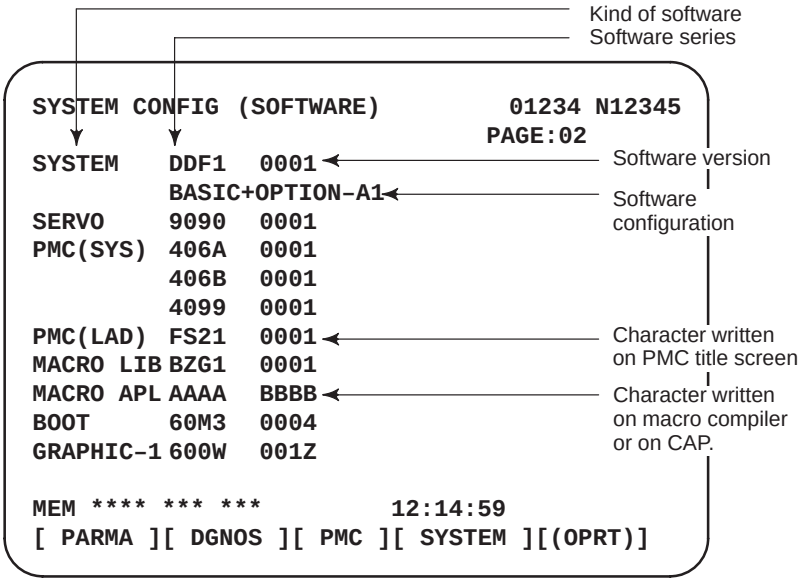
- **Module ID**

ID	Name
D7	Series 21*i* motherboard
DC	Series 210*i* motherboard
CD	Serial communication board: remote buffer/DNC2
	Serial communication board: DNC1
D3	Loader control board
AA	HSSB interface board
C9	PC function card

- **Software ID**

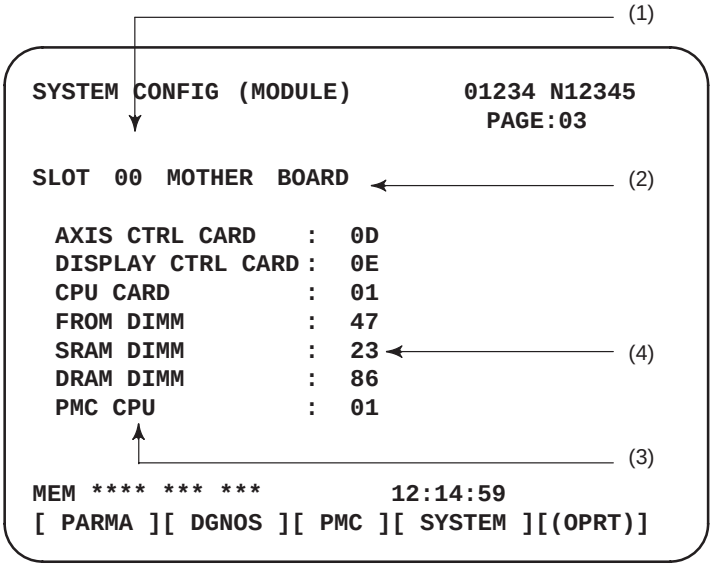
40 : Main CPU
4A : Remote buffer
53 : Loader control
5E : HSSB interface (with PC)

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) Name of card PCB or DIMM module

(4) Hardware ID of mounted card PCB or DIMM module
Refer to “2.4.3 Printed Circuit Boards of the Control Unit” for correspondence with each hardware ID and drawing number.

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

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

97/04/18 20:56:26
 506 OVERTRAVEL :  +X
97/04/18 19:58:11
 000 TURN OFF POWER
97/04/18 19:52:45
 000 TURN OFF POWER
97/04/18 19:48:43
 300 APC ALARM  : X–AXIS ZERO RETURN REQUEST
97/04/18 18:10:10
 507 OVERTRAVEL :  +B



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

1.4.3 Clearing Alarm History

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

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

1.4.4 Alarm Display

When an external alarm (No. 1000 to 1999) or a macro alarm (No. 3000 to 3999) is output, the alarm history function can record both the alarm number and message if so specified in the following parameter. If recording of the message is not set or if no message is input, only an external alarm or macro alarm is displayed.

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

[Data type] Bit

#3 (EAH) The alarm history function:

0 : Does not record the messages output with external alarms or macro alarms.

1 : Records the messages output with external alarms or macro alarms.

1.5 EXTERNAL OPERATOR MESSAGES RECORD

This function enables the saving of external operator messages as a record.
The record can be viewed on the external operator message history screen.

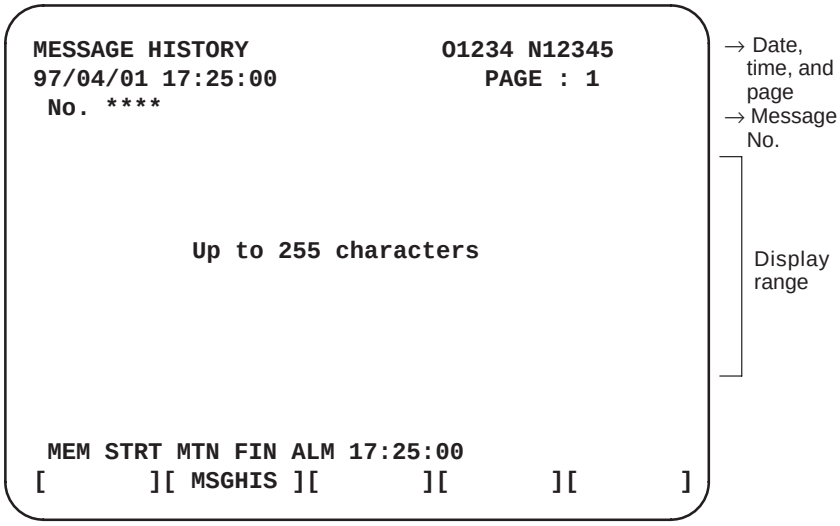
1.5.1 Screen Display

(1) Press the MESSAGE function key.

(2) Press the rightmost soft key ▷.

(3) Press the **[MSGHIS]** soft key.

(4) To display the previous or subsequent screen, press the PAGE ↑ or PAGE ↓ key.



1.5.2 Deletion of External Operator Messages Record

(1) The recorded external operator message can be deleted by setting the MMC bit (bit 0 of parameter 3113) to 1.
Pressing the **[CLEAR]** soft key erases all the records of the external operator message.

(2) The MS1 and MS0 bits (bits 7 and 6 of parameter 3113) specify the number of records to be displayed on the external operator message history screen. When the bits are changed, all external operator message records retained up to that point are erased.

1.5.3 Parameter

	#7	#6	#5	#4	#3	#2	#1	#0
3113	MS1	MS0						MHC

#0 (MHC) The records of an external operator message:

0 : Cannot be erased.
1 : Can be erased.

#6, #7 (MS0,MS1) These bits set the number of characters to be retained in each record of an external operator message, as well as the number of records, as shown in the following table:

MS1	MS0	Number of characters in each record	Number of records
0	0	255	8
0	1	200	10
1	0	100	18
1	1	50	32

* An external operator message of up to 255 characters can be specified. Combining the MS1 bit and MS0 bit (bits 7 and 6 of parameter No. 3113) selects the number of records by limiting the number of characters to be retained as the record of an external operator message.

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

#2 (OMH) The external operator message history screen is:

0 : Not displayed.
1 : Displayed.

NOTE
After setting this parameter, briefly turn the power off, then on again.

1.5.4 Notes

When the number of an external operator message is specified, the system starts updating the records of the specified message. The system continues to perform update until another external operator message is specified or until an instruction to delete the records of the external operator message is specified.

1.6 OPERATION HISTORY

This function displays the key and signal operations performed by the operator upon the occurrence of a fault or the output of an alarm, together with the corresponding alarms.
This function records the following data:

(1) MDI key operations performed by the operator

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

(3) Details of alarms

(4) Time stamp (date and time)

1.6.1 Parameter Setting

	#7	#6	#5	#4	#3	#2	#1	#0
3106	OHS			OPH				

[Data type] Bit

#4 (OPH) The operation history screen is:

0 : Not displayed.

1 : Displayed.

#7 (OHS) The operation history is:

0 : Sampled.

1 : Not sampled.

3122	Interval at which the clock time is recorded in the operation history

[Data type] Word

[Units of data] Minutes

[Valid data range] 0 to 1439

The clock time is recorded to the operation history at specified intervals. If zero is set as the interval, ten minutes is assumed. The time is recorded only when data is recorded within the corresponding interval.

1.6.2 Screen Display

- **Displaying the operation history**

(1) Press the SYSTEM function key.

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

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

```
OPERATION HISTORY                    O1234 N12345
                                       Page : 123
  No.DATA        No.DATA        No.DATA
  01 97/06/03    11 F0000.7↑    21 F0001.0↓
  02 08:40:00    12 F0000.5↑    22 <POS>
  03 <DELETE>    13 F0001.0↑    23 <PROG>
  04 F0000.6↑    14 F0000.5↓    24 <RESET>
  05 MEM         15 P/S0010     25 EDIT
  06 G0009.0↑    16 97/06/03    26 O
  07 G0009.1↑    17 09:27:49    27 1
  08 G0009.2↑    18 <PROG>      28 2
  09 ST↑         19 <RESET>     29 3
  10 ST↓         20 F0000.7↓    30 4

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

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

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

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

To display the interface between two pages, press cursor key ➡ or ⬅. The screen is scrolled by one row. On a 14–inch CRT screen, pressing the cursor key scrolls the screen by half a page.

These soft keys can also be used:

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

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

Data displayed on the operation history screen

(1) MDI keys

Address and numeric keys are displayed after a single space.
Soft keys are displayed in square brackets ([]).
Other keys (RESET/INPUT, for example) are displayed in angle brackets (<>).
A key pressed at power–on is displayed in reverse video.
For two–path control, the operations of path 2 are displayed in the same way, but preceded by S_.

1) Function key: [POS] , [PROG] , [OFFSET SETTING] , etc.

2) Address/numeric key: A to Z, 0 to 9, ; (EOB), +, –, (, etc.

3) Page/cursor key: [PAGE↑], [↓], [←]

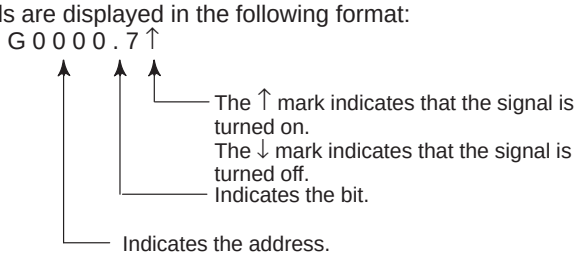
4) Soft key: [SF1], [SF2], etc.

5) Other key: [RESET] , [CAN] , etc.

6) Key pressed at power–on: [RESET]

(2) Input and output signals

General signals are displayed in the following format:



Some signals are indicated by their symbol names.

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

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

Input signal					Name displayed
MD1	ND2	MD4	REF	DNC1	
0	0	0	0	0	MDI
1	0	0	0	0	MEM
1	0	0	0	1	RMT
0	1	0	0	0	NOMODE
1	1	0	0	0	EDT
0	0	1	0	0	H/INC
1	0	1	0	0	JOG
1	0	1	1	0	REF
0	1	1	0	0	TJOG
1	1	1	0	0	THND

Input signal		Name displayed
ROV1	ROV2	
0	0	R 100%
1	0	R 50%
0	1	R 25%
1	1	R F0%

(3) NC alarms

NC alarms are displayed in reverse video.
P/S alarms, system alarms, and external alarms are displayed together with their numbers.
For other types of alarms, only the alarm type is displayed. (No details are displayed.)
For two–path control, the operations of path 2 are displayed in the same way, but preceded by S_.

Example) P/S0050, SV_ALM, S_APC_ALM

(4) Time stamp (date and time)

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

1) Date and time of power–on
2) Date and time of power–off
3) Date and time when an NC alarm occurs
4) The clock time is recorded at predetermined intervals, together with each new calendar day.

1) The power–on time is displayed as shown below:
   97/01/20 ==== Year/Month/Day
   09:15:30 ==== Hour:Minute:Second
2) The power–off time and the time when an NC alarm occurred are displayed in reverse video.
   97/01/20 ==== Year/Month/Day
   09:15:30 ==== Hour:Minute:Second
   If a system alarm occurs, the date and time are not recorded.
3) At predetermined intervals, the clock time is displayed in reverse video. Set the interval in minutes in parameter No. 3122. If zero is set, the time is stamped at ten–minute intervals.
   09:15:30 ==== Hour:Minute:Second
   Each new calendar day is displayed in reverse video.
   97/01/20 ==== Year/Month/Day

NOTE
The clock time is recorded for a specified interval only when data is stored within that interval.

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

(1) P ress the SYSTEM function key.

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

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

```
OP_HIS SIGNAL SELECT              O1000 N02000

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

1.6.3 Setting The Input Signal or Output Signal to Be Recorded in The Operation History

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

```
OP_HIS SIGNAL SELECT            O1000 N02000

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

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

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

Example) G0004 INPUT

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

(4) Select the bit to be recorded.

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

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

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

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

(7) To delete a selected signal address, position the cursor to the corresponding position then press the **[DELETE]** and **[EXEC]** soft keys. In the SIGNAL column, asterisks ******** are displayed in place of the deleted data. In the ADDRES column, the corresponding position is cleared.

If the **[DELET]** key is pressed by mistake, it can be cancelled by pressing the **[CAN]** key.

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

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

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

1. M/T addresses

MT→PMC

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

PMC→CNC

	#7	#6	#5	#4	#3	#2	#1	#0
G000	○	○	○	○	○	○	○	○
⋮								
G003	○	○	○	○	○	○	○	○
G004	○	○	○	○	FIN	○	○	○
G005	○	○	○	○	TFIN	SFIN	○	MFIN
G006	○	○	○	○	○	*ABS	○	SRN
G007	RLSOT	EXLM	*FLUP	○	○	ST	STLK	○
G008	ERS	RRW	*SP	*ESP	○	○	○	*IT
G009	○	○	○	○	○	○	○	○
⋮								
G013	○	○	○	○	○	○	○	○
G014	○	○	○	○	○	○	○	○
G015	○	○	○	○	○	○	○	○
⋮								
G018	○	○	○	○	○	○	○	○
G019	RT	○	○	○	○	○	○	○

	#7	#6	#5	#4	#3	#2	#1	#0
G020	○	○	○	○	○	○	○	○
⌇								
G042	○	○	○	○	○	○	○	○
G043	○	×	○	×	×	○	○	○
G044	○	○	○	○	○	○	MLK	BDT1
G045	BDT9	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
G046	DRN	KEY4	KEY3	KEY2	KEY1	○	SBK	○
G047	○	○	○	○	○	○	○	○
⌇								
G060	○	○	○	○	○	○	○	○
G061	○	○	○	○	○	○	○	RGTA
G062	○	○	○	○	○	○	○	○
⌇								
G099	○	○	○	○	○	○	○	○
G100	○	○	○	○	+J4	+J3	+J2	+J1
G101	○	○	○	○	○	○	○	○
G102	○	○	○	○	–J4	–J3	–J2	–J1
G103	○	○	○	○	○	○	○	○
⌇								
G105	○	○	○	○	○	○	○	○
G106	○	○	○	○	MI4	MI3	MI2	MI1
G107	○	○	○	○	○	○	○	○
G108	○	○	○	○	MLK4	MLK3	MLK2	MLK1
G109	○	○	○	○	○	○	○	○
G110	○	○	○	○	+LM4	+LM3	+LM2	+LM1
G111	○	○	○	○	○	○	○	○
G112	○	○	○	○	–LM4	–LM3	–LM2	–LM1
G113	○	○	○	○	○	○	○	○
G114	○	○	○	○	*+L4	*+L3	*+L2	*+L1

	#7	#6	#5	#4	#3	#2	#1	#0
G115	○	○	○	○	○	○	○	○
G116	○	○	○	○	*–L4	*–L3	*–L2	*–L1
G117	○	○	○	○	○	○	○	○
G118	○	○	○	○	*+ED4	*+ED3	*+ED2	*+ED1
G119	○	○	○	○	○	○	○	○
G120	○	○	○	○	*–ED4	*–ED3	*–ED2	*–ED1
G121	○	○	○	○	○	○	○	○
⌇								
G125	○	○	○	○	○	○	○	○
G126	○	○	○	○	SVF4	SVF3	SVF2	SVF1
G127	○	○	○	○	○	○	○	○
⌇								
G129	○	○	○	○	○	○	○	○
G130	○	○	○	○	*IT4	*IT3	*IT2	*IT1
G131	○	○	○	○	○	○	○	○
G132	○	○	○	○	+MIT4	+MIT3	+MIT2	+MIT1
G133	○	○	○	○	○	○	○	○
G134	○	○	○	○	–MIT4	–MIT3	–MIT2	–MIT1
G135	○	○	○	○	○	○	○	○
⌇								
G255	○	○	○	○	○	○	○	○

PMC→MT

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

CNC→PMC

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

1.6.4 Inputting and Outputting the Operation History Data

Recorded data can be output to an input/output unit connected via a reader/punch interface. An output record can be input from the input/output unit.
Set the input/output unit to be used in setting parameters No. 0020 and 0100 to 0135.
To output the data, set a code in the ISO bit of a setting parameter (bit 1 of parameter No. 0020).

- **Output**

(1) Select EDIT mode.

(2) Press the SYSTEM key, then select the operation history display screen.

(3) Press the soft keys **[(OPRT)]**, ▷, **[PUNCH]**, and **[EXEC]** in this order.

The data output to the FANUC Floppy Cassette or FANUC FA Card is stored under file name OPERATION HISTORY.

- **Input**

(1) Select EDIT mode.

(2) Press the SYSTEM key, then select the operation history display screen.

(3) Press the soft keys **[(OPRT)]**, ▷, **[READ]**, and **[EXEC]** in this order.

- **Output data format**

1. MDI/soft key
2. Signal
3. Alarm
4. For extension (date or time)

The header and recorded operation data are output, in this order. The operation history data is divided into four parts by identifier words. Data other than the identifier words depends on the type.

T(identifier word)

T0	:	Header
T50	:	MDI/soft key
T51	:	Signal
T52	:	Alarm
T53	:	For extension (date or time)

1) Header

T	0	C	O	P	E	R	A	T	I	O	N	

	H	I	S	T	O	R	Y	;	

C: Data word

2) MDI/soft key

T	5	0	P	0 to 1	H	*	*	;	

P0: Usually
P1: At power–on
H **: Key code (See the following table.)

3) Signal

T	5	1	P	0 to 6	N	0 to 255	H	*	*	,	*	*	;	

New data Old data

P0: X0000 and above
P2: G0000 and above
P4: Y0000 and above
P6: F0000 and above
N***: DI/DO number
H **: Signal information data (hexadecimal)

4) Alarm

T	5	2	P	0 to 10	N	*	*	*	*	;	

P0: P/S No. 100
P1: P/S No. 000
P2: P/S No. 101
P3: P/S No. 0001 to 254
P4: Overtravel alarm
P5: Overheat alarm
P6: Servo alarm
P7: System alarm
P8: APC alarm
P9: Spindle alarm
P10: P/S alarm No. 5000 to 5999
P15: External alarm
N****: Alarm number (for P/S alarm, system alarm, and external alarm only)

5) For extension (date or time)

Date

T	5	3	P	0 to 1	E	0	D	*	*	*	*	*	*	*	*	;	

Time

T	5	3	P	0 to 1	E	1	D	*	*	*	*	*	*	;		

P0: Usually
P1: At power–on
E0: Date
E1: Time
D*..*: Data Example) October 29, 1997

D	1	9	9	7	1	0	2	9	

Key codes (MDI/soft key)
(00H to 7FH)

	0	1	2	3	4	5	6	7
0			Space	0	@	P		
1			!	1	A	Q		
2			”	2	B	R		
3			#	3	C	S		
4			$	4	D	T		
5			%	5	E	U		
6			&	6	F	V		
7			’	7	G	W		
8			(	8	H	X		
9			)	9	I	Y		
A	; (EOB)		*	:	J	Z		
B			+		K	[		
C			’	<	L	¥		
D			–	=	M	]		
E			.	>	N			
F			/	?	O	–		

(80H to FFH)

	8	9	A	B	C	D	E	F
0		Reset *						F0 *
1		MMC *						F1 *
2		CNC *						F2 *
3								F3 *
4	Shift	Insert *						F4 *
5		Delete *						F5 *
6	CAN	Alter *						F6 *
7								F7 *
8	Cur→ *	Input *					POS *	F8 *
9	Cur← *						PROG *	F9 *
A	Cur↓ *	Help *					OFFSET SETTING *	
B	Cur↑ *						SYSTEM *	
C							MESSAGE *	
D							CUSTOM GRAPH *1*	
E	Page↓ *						CUSTOM *	FR *
F	Page↑ *							FL *

*1:On the small–sized keypad, ED corresponds to the CUSTOM GRAPH key. On a standard keyboard, ED corresponds to the GRAPH key and EE to the CUSTOM key.

* : Command key

1.6.5 Notes

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

(2) An input signal having an on/off width of up to 16 msec is not recorded in the history. Some signals are not recorded in the history. See Appendix 1.

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

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

(5) The operation history function cannot execute sampling when the OHS bit (bit 7 of parameter No. 3106) is set to 1.

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

(7) The time needed to input and output 6000 operation records at a rate of 4800 baud is as follows:

Output: About 5 minutes
Input: About 2 minutes and 30 seconds

This file corresponds to a paper tape of about 180 m in length.

1.7 HELP FUNCTION

1.7.1 General

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

1.7.2 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/CUSTOM screen is displaying)

- **Display of help screen**

```
HELP (INITIAL MENU)            O1234 N12345

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









[ALARM]  [OPERAT]  [PARAM]  [     ]  [     ]
```

- **Help for alarm**

(1) When an alarm is generated, press soft key **[ALARM]**, 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




[ALARM]  [OPERAT]  [PARAM] [     ] [ (OPRT) ]
```

(2) Pressing soft key **[OPERAT]**,(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




[ALARM] [OPRERAT] [PARAM] [     ] [(OPRT)]
```

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

Pressing PAGE key ↑ PAGE or PAGE ↓ 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 **[PARAM]**, then a parameter table is displayed.

```
HELP (PARAMETER TABLE)           O1234 N12345
                                       1/4 ← Current page/ Total page
·SETTING                        (NO.0000~ )
·READER/PUNCHER INTERFACE       (NO.0100~ )
·AXIS CONTROL/SETTING UNIT      (NO.1000~ )
·COORDINATE SYSTEM              (NO.1200~ )
·STROKE LIMIT                   (NO.1300~ )
·FEED RATE                      (NO.1400~ )
·ACCEL/DECELERATION CTRL        (NO.1600~ )
·SERVO RELATED                  (NO.1800~ )
·DI/DO                          (NO.3000~ )




[ ALARM ][OPERAT][ PARAM ][      ][SELECT]
```

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

1.8 DISPLAYING DIAGNOSTIC PAGE

1.8.1 Displaying Diagnostic Page

(1) Press SYSTEM key.

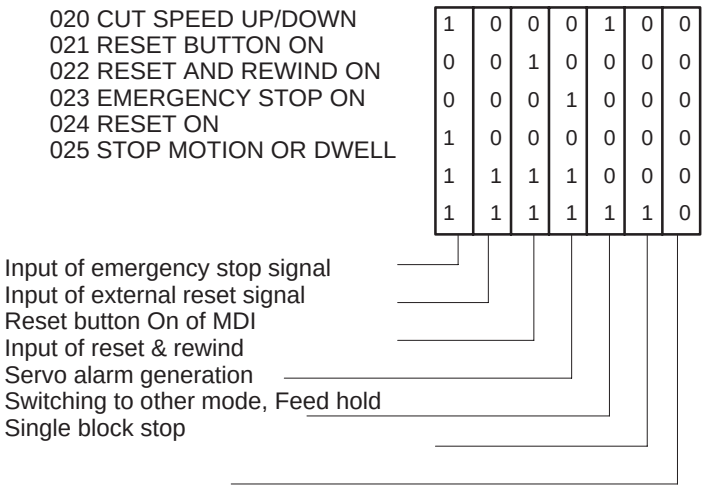
(2) Press soft key **[DGNOS]**, then a diagnostic screen is displayed.

1.8.2 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
016 BACKGROUND ACTIVE	Background is being used.

- **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 serial pulse coder**

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

#0(SPH): Serial pulse coder or feedback cable is faulty.
Counting of feedback cable is erroneous.

#1(CKA): Serial pulse coder is faulty.
Internal block stopped.

#2(BZA): Battery voltage became 0.
Replace the battery and set the reference position.

#3(RCA): Serial pulse coder is faulty.
Counting of feedback cable is erroneous.

#4(PHA): Serial pulse coder or feedback cable is erroneous.

#5(BLA): Battery voltage is low (warning)

#6(CSA): Hardware of serial pulse coder is abnormal

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

#4(PRM): Parameter detected by the Digital servo is invalid.

#5(STB): Communication failure of serial pulse coder.
Transferred data is erroneous.

#6(CRC): Communication failure of serial pulse coder.
Transferred data is erroneous.

#7(DTE): Communication failure of serial pulse coder.
There is no response for communication.

- **Details of digital servo alarm**

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

#0(OFA): Overflow alarm

#1(FBA): Disconnection alarm

#2(DCA): Discharge alarm

#3(HVA): Overvoltage alarm

#4(HCA): Abnormal current alarm

#5(OVC): Over current alarm

#6(LV): Insufficient voltage alarm

#7(OVL): Overload alarm

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

#3(PMS): Feedback is not correct due to faulty serial pulse coder C or feedback cable.

#4(LDA): Serial pulse coder LED is abnormal

#5(MCC): Contacts of MCC of servo amplifier is melted.

#6(OFS): Abnormal current value result of A/D conversion of digital

This data indicates the cause of servo alarm No. 417, detected by the NC. If the alarm is detected by the servo, the PRM bit (bit 4 of DGN No. 0203) is set to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
0280		AXS		DIR	PLS	PLC		MOT

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

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

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

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

#6 (AXS): In parameter No. 1023 (servo axis number), a value that falls outside the range of 1 to the number of controlled axes is specified. (For example, 4 is specified instead of 3.) Alternatively, the values specified in the parameter are not consecutive.

- **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

- **Reference position shift function**

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

[Data type] Two–word axis

[Units of data] 0.001 mm (metric output), 0.0001 inch (inch output)

[Valid data range] 0 to ±99999999

- **Cause of the APZ bit (bit 4 of parameter 1815) brought to 0**

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

#0(PR1): The setting of the following parameters has been changed: Parameters 1821, 1850, 1860, 1861.

#1(PR2): The setting of the ATS bit (bit 1 of parameter 8302) has been changed.

#2(BZ1): The detected APC battery voltage is 0 V (Inductosyn).

#3(BZ2): The detected APC battery voltage is 0 V (separate position detector).

#4(NOF): The Inductosyn output no offset data.

#5(ALP): Before the α pulse coder detects a full single rotation, reference position establishment by parameters was attempted.

#6(DTH): A controlled axis detach signal/parameter was input.

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

#0(AL1): An APC alarm was issued.

#1(AL2): A disconnection was detected.

#2(AL3): The detected APC battery voltage is 0 V (serial pulse coder).

#3(AL4): An abnormal rotation speed (RCAL) was detected.

#4(GSG): The G202 signal was brought from 0 to 1.

#5(XBZ): The detected APC battery voltage is 0 V (serial separate position detector).

#6(DUA): While the dual position feedback function was being used, the difference in error between the semi–closed loop side and the closed loop side became too large.

- **Diagnostic data related to the Inductosyn absolute position detector**

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

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

The remainder resulting from the division is displayed.

[Data type] Two–word axis

[Units of data] Detection units

DGN	381	Offset data from the Inductosyn

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

[Data type] Two–word axis

[Units of data] Detection units

- **Serial spindle**

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0400				SAI	SS2	SSR	POS	SIC

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

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

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

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

#3(SS2) 0 : Spindle serial doesn't control 2nd spindle.
1 : Spindle serial control 2nd spindle.

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

DGN	0401	Serial spindle alarm state of 1st spindle
DGN	0402	Serial spindle alarm state of 2nd spindle

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

#0 (CRE): A CRC error occurred. (Warning)

#1 (FRE): A framing error occurred. (Warning)

#2 (SNE): The transmission/reception target is invalid.

#3 (CER): An error occurred during reception.

#4 (CME): No response was returned during automatic scanning.

#5 (SCA): A communication alarm occurred on the spindle amplifier side.

#7 (SSA): A system alarm occurred on the spindle amplifier side.
(These problems cause spindle alarm 749. Such problems are mainly caused by noise, disconnection, or instantaneous power–off).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0409					SPE	S2E	S1E	SHE

Refer to this diagnosis when alarm 750 has generated.

#0 (SHE) 0 : Serial communication module is correct on CNC side.
1 : An error occurred in serial communication module on CNC side

#1 (S1E) 0 : 1st spindle started normally in spindle serial control.
1 : 1st spindle did not start normally in spindle serial control.

#2 (S2E) 0 : 2nd spindle started normally in spindle serial control.
1 : 2nd spindle did not start normally in spindle serial control.

#3 (SPE) In spindle serial control serial spindle parameters
0 : Satisfy start condition of spindle unit
1 : Do not satisfy start condition of spindle unit

DGN	0410	Load meter of 1st spindle [%]
DGN	0411	Speed meter of 1st spindle [%]
DGN	0412	Load meter of 2nd spindle [%]
DGN	0413	Speed meter of 2nd spindle [%]
DGN	0414	Position error in 1st spindle synchronous control mode
DGN	0415	Position error in 2nd spindle synchronous control mode
DGN	0416	Absolute value of synchronization error between 1st and 2nd spindles
DGN	0417	Feedback information of 1st spindle position coder
DGN	0418	Position error of 1st spindle position loop mode
DGN	0419	Feedback information of 2nd spindle position coder

DGN	0420	Feedback information of 2nd spindle position coder

- **Diagnostic data related to rigid tapping**

DGN	450	Spindle position error during rigid tapping

[Data type] Word

[Unit of data] Detection units

DGN	451	Spindle distribution during rigid tapping

[Data type] Word

[Unit of data] Detection units

DGN	454	Accumulated spindle distribution during rigid tapping

[Data type] Two–word

[Unit of data] Detection units

DGN	455	Instantaneous difference for the move command, calculated in terms of the spindle, during rigid tapping (signed, accumulated value)

[Data type] Two–word

[Unit of data] Detection units

DGN	456	Instantaneous difference for the travel error, calculated in terms of the spindle, during rigid tapping (signed)

[Data type] Word

[Unit of data] Detection units

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

[Data type] Word

[Unit of data] Detection units

- **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

- **Open CNC**

DGN 510

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

This data indicates the internal Open CNC information (not available to general users).

DGN 511

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

This data indicates the internal Open CNC information (not available to general users).

DGN 512

#7	#6	#5	#4	#3	#2	#1	#0
PA1	PA0	BNK		THH	THL		PRA

This data indicates the cause of a system alarm that has occurred in Open CNC.

#0(PRA) 1 : A RAM parity error occurred in shared RAM.

#2(THL) 0 : The temperature of the harddisk of Open CNC is too low.
1 : Normal

#3(THH) 0 : The temperature of the harddisk of Open CNC is too high.
1 : Normal

#4 0 : Normal
1 : An NMI has occurred in HSSB.

#5(BNK) If bit 0 (PRA) is set to 1,
0 : An alarm occurred in the lower half of shared RAM.
1 : An alarm occurred in the upper half of shared RAM.

#6 (PA0) If bit 0 (PRA) is set to 1,
1 : An alarm occurred at an even–numbered address.

#7 (PA1) If bit 0 (PRA) is set to 1,
1 : An alarm occurred at an odd–numbered address.

- **Diagnostic data related to a small–diameter peck drilling cycle (M series only)**

DGN	520	Total number of retractions during cutting after G83 is specified

Executing the G83 command clears the value to zero.

DGN	521	Total number of retractions made by receiving the overload signal during cutting after G83 is specified

Executing the G83 command clears the value to zero.

DGN	522	Position on the drill axis from which retraction is started

The units are the same as the minimum input increment.

DGN	523	Difference between the position on the drill axis from which the previous retraction was started and the position from which the current retraction is started

The units are the same as the minimum input increment.

- **Diagnostic data related to simple synchronous control**

DGN	540	Difference in the position error between the master and slave axes in simple synchronas control
DGN	541	Difference in the position error between the master and slave axes in simple synchronas control

DGN 540 indicates the difference in the position error between the master and slave axes when a single axis pair is subjected to simple synchronous control. DGN 541 is used when two or more pairs are subjected to simple synchronous control. The position error is indicated for the master axis.

DGN 540 and 541 indicate values in detection units. They are displayed only with the M series.

- **Diagnostic data related to the dual position feedback function**

0550	Closed loop error

[Data type] 2–word axis

[Unit of data] Detection units

[Valid data range] –99999999 to +99999999

0551	Semi–closed loop error

[Data type] 2–word axis

[Unit of data] Detection units

[Valid data range] –99999999 to +99999999

0552	Error between semi–closed and closed loops

[Data type] word axis

[Unit of data] Detection units

[Valid data range] –32768 to +32767

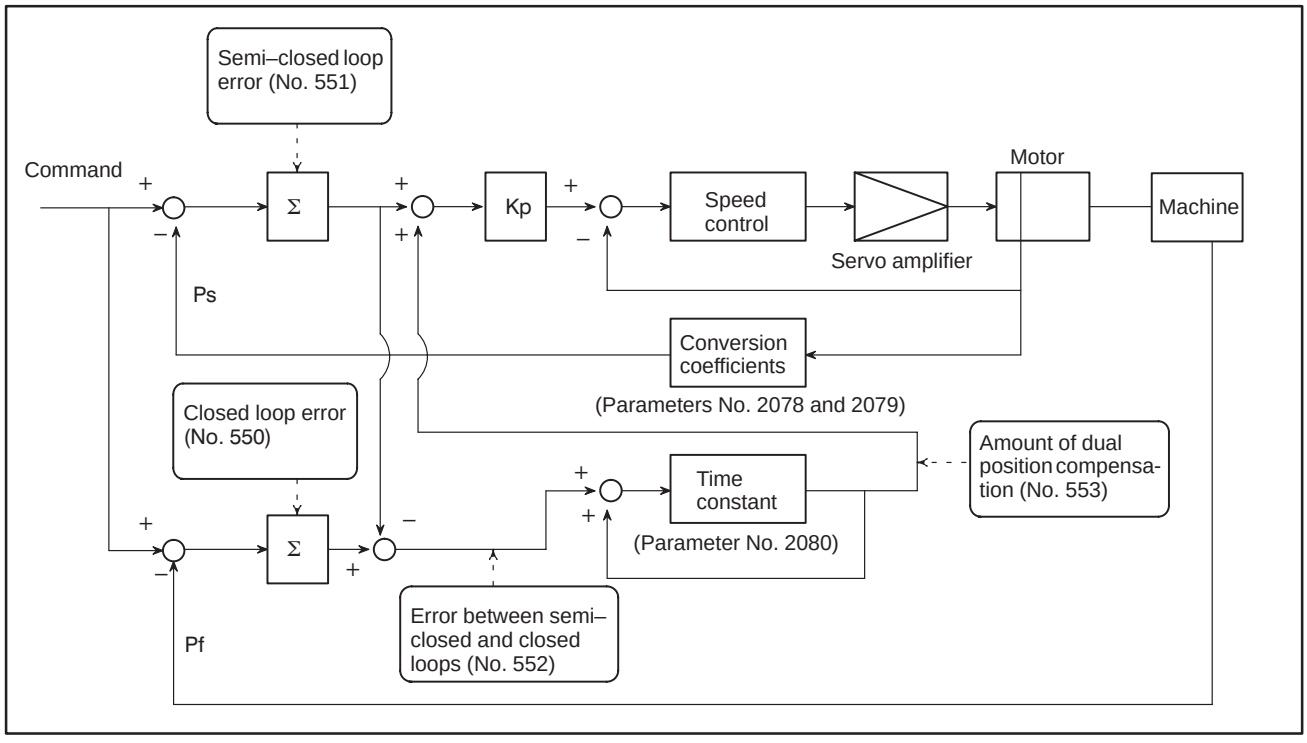
0553	Amount of dual position compensation

[Data type] 2–word axis

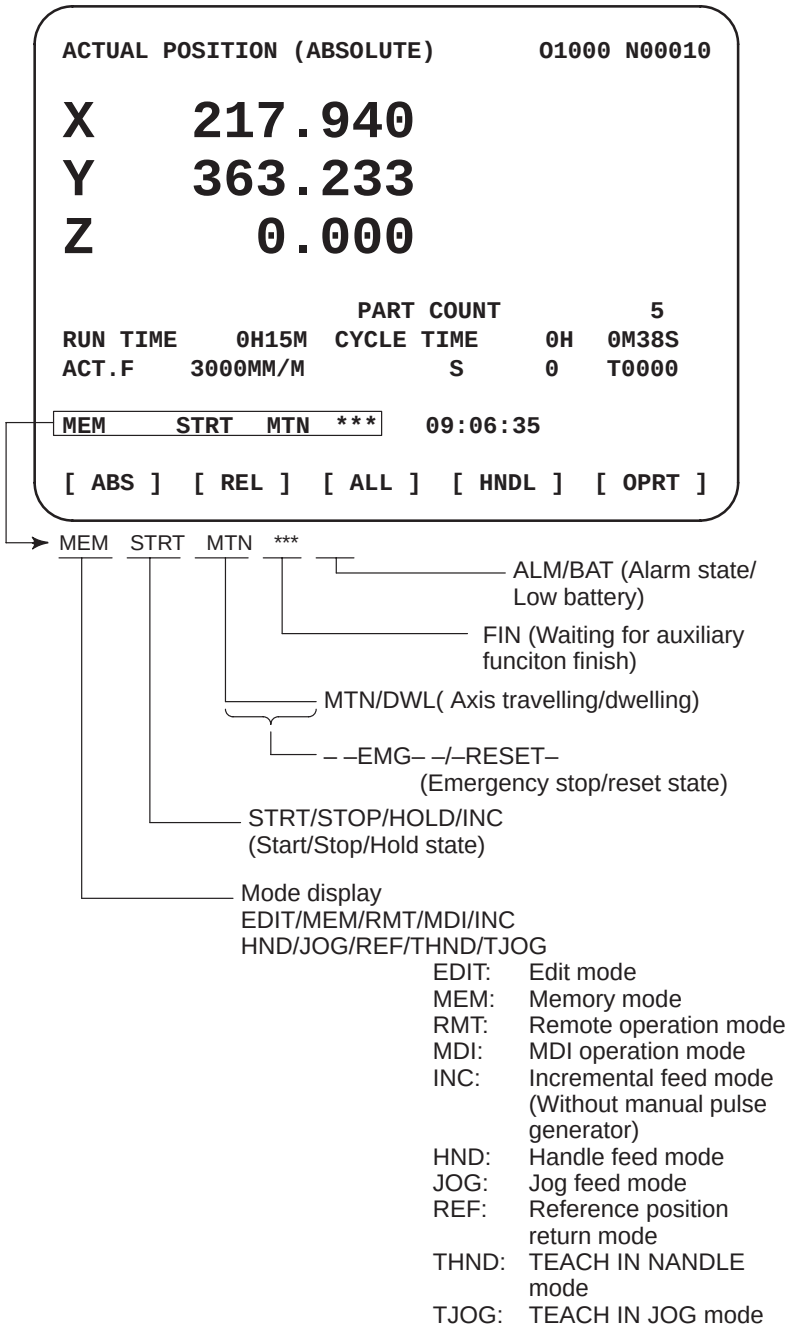
[Unit of data] Detection units

[Valid data range] –99999999 to +99999999

The data items displayed on the diagnosis screen are obtained at the following positions:



1.9 CNC STATUS DISPLAY



1.10 WAVE FORM DIAGNOSTIC FUNCTION

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

The following two types of waveform diagnosis functions are supported:

(1) One–shot type

The one–shot type waveform diagnosis function can graphically display, as a waveform, any variation in those data items listed below. The start of data sampling can be triggered by the rising or falling edge of a machine signal. This function facilitates the adjustment of the servo and spindle motors.

a. Error, pulse distribution amount, torque, speed, current, and thermal simulation data for the servo motor of each axis
b. Composite speed for the first, second, and third axes
c. Spindle motor speed and load meter value
d. On/off state of a machine signal specified with a signal address

(2) Storage type

The storage type waveform diagnosis function enables the storing of any variation in the data items listed below and, if a servo alarm occurs, the graphical display (as a waveform) of the stored data. The end of data sampling can be triggered by the rising or falling edge of a machine signal. This function facilitates the estimation of erroneous locations. Stored data can be output via the reader/punch interface.

a. Error, pulse distribution amount, torque, speed, current, and thermal simulation data for the servo motor for each axis

NOTE
1 To output stored waveform data, the optional reader/punch interface must have been installed.
2 The waveform diagnosis function is enabled when bit 0 (SGD) of parameter No. 3112 is set to 1. Note, however, that a graphics card is necessary to display waveforms.

1.10.1 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.

3120	Time between servo alarm and sampling stop (storage type)

[Data type] Word

[Unit of data] ms

[Valid data range] 1 to 32760

1.10.2 Waveform Diagnostic Parameter Screen

1.Press the [SYSTEM] key to display a system screen such as aparameter.

2. Press the continuous 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.

Set the necessary data items. Position the cursor to the item to be set, enter the corresponding data, then press [INPUT]. Data items for which ***** is displayed cannot be set. To assist in data setting, the frame on the right side of the screen displays help information for that data to which the cursor is positioned. Help information which cannot fit into a single frame is split into several pages, which the user can scroll through using the page keys [↑] and [↓].

```
WAVE DIAGNOSE (PARAMETER)          O1234 N12345

GRP CONDITION 100

SAMPLING TIME *****MS

TRIGGER *******

            (CH-1)    (CH-2)

DATA NO.        11        22
UNIT          1000        10
SIGNAL     *******   *******
>                                    S      0  T0000
EDIT **** *** ***          08:20:52
[W.PRM]  [W.GRPH]  [ W.MEM ]  [     ]  [     ]
```

```
GRP CONDITION

(ONE-S TYPE)
0:START
1:START&TRG ↑
2:START&TRG ↓
  (MEMORY TYPE)
100: DATA OF
     MEMORY
            1/3
```

- **Waveform diagnosis parameters (one–shot type)**

(1) Display start condition

0 : Starts data sampling upon the **[START]** key being pressed, samples data for the specified period, then draws a waveform.
1 : Starts data sampling upon the detection of the first rising edge of the trigger signal after the **[START]** key is pressed, samples data for the specified period, then draws a waveform.
2 : Starts data sampling upon the detection of the first falling edge of the trigger signal after the [**START**] key is pressed, samples data for the specified period, then draws a waveform.

(2) Sampling period: Set the period during which data will be sampled.

Valid data range: 10 to 32760
Units: ms

(3) Trigger: Set the PMC address and bit for the signal used to trigger the start of data sampling, when 1 or 2 is set for the start condition.

Example) G0007.2: ST signal

(4) Data number: The table below lists the numbers of the data items for which a waveform can be displayed (n = 1 to 4).

Data No.	Description	Units
00	Does not display a waveform.	–
0n	Servo error (8 ms) for the n–th axis (positional deviation)	Pulses (detection units)
1n	Pulse distribution for the n–th axis (move command)	Pulses (input increments)
2n	Torque for the n–th axis (actual current)	% (relative to maximum current)
3n	Servo error (2 ms) for the n–th axis (positional deviation)	Pulses (detection units)
5n	Actual speed for the n–th axis	RPM
6n	Command current for the n–th axis	% (relative to maximum current)
7n	Thermal simulation data for the n–th axis	% (OVC alarm ratio)
90	Composite speed for the first, second, and third axes	Pulses (input increments)
99	On/off state of a machine signal specified with a signal address	None
10n	Actual spindle speed for the n–th axis	% (relative to maximum rotation speed)
11n	Load meter for the spindle for the n–th axis	% (relative to maximum output)
161	Difference in position error calculated on the spindle basis	Pulses (detection unit)

(5) Data units: Weight of data when 1 is specified. The data units are automatically specified for each data item and need not be set unless the units must be changed for some reason.

[Valid data range] 1 to 1000

[Unit] 0.001

(6) Signal address: PMC address and bit number. Set in the same way as that for trigger, when the data number is 99.

- **Waveform diagnosis parameters (storage type)**

(1) Display start condition

100 : Draws a waveform for the stored data.

(2) Sampling period: Invalid

(3) Trigger: Invalid

(4) Data number: The table below lists the numbers of the data items for which a waveform can be displayed (n = 1 to 4). Numbers for which no data is stored cannot be specified.

Data No.	Description	Units
00	Does not display a waveform.	–
0n	Servo error (8 ms) for the n–th axis (positional deviation)	Pulses (detection units)
1n	Pulse distribution for the n–th axis (move command)	Pulses (input increments)
2n	Torque for the n–th axis (actual current)	% (relative to maximum current)
5n	Actual speed for the n–th axis	RPM
6n	Command current for the n–th axis	% (relative to maximum current)
7n	Thermal simulation data for the n–th axis	% (OVC alarm ratio)

(5) Data units: Weight of data when 1 is specified. The data units are automatically specified for each data item and need not be set unless the units must be changed for some reason.

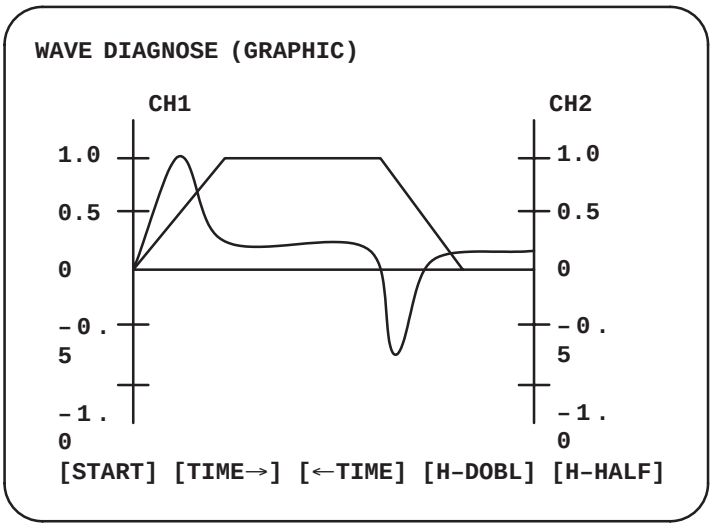
[Valid data range] 1 to 1000

[Unit] 0.001

(6) Signal address: Invalid

1.10.3 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]

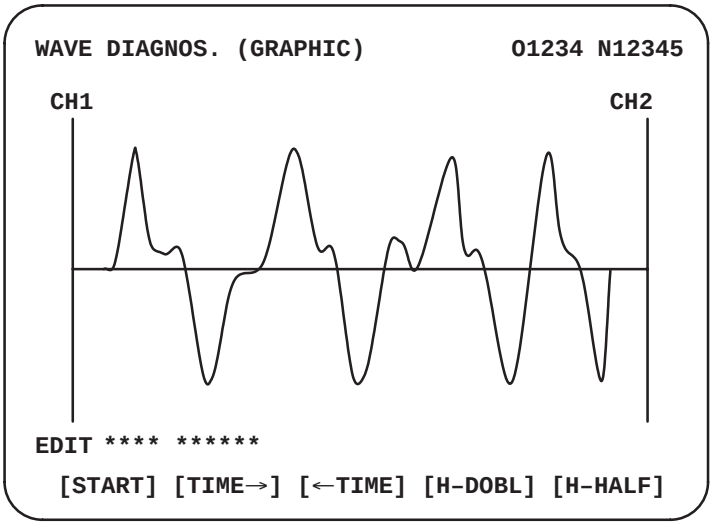
1) **[START]** : Starts Graphic data
2) **[TIME→]** : Shift the waveform of channel 1 and 2 rightward
3) **[←TIME]** : Shift the waveform of channel and 2 leftward
4) **[H–DOBL]** : Double the time scale of the waveform of channel 1 and 2
5) **[H–HALF]** : Half the time scale of the waveform of channel 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

● Drawing a waveform for one–shot type waveform diagnosis

The one–shot type waveform diagnosis function draws a waveform for a specified data item in real time as the data is sampled. The sampled data, however, is not stored and thus cannot be output later.

To sample data for one–shot type waveform diagnosis, press the **[START]** key on the WAVE DIAGNOS. (GRAPHIC) screen. Then, data is sampled when the specified start condition is satisfied. Data sampling continues for the specified period.

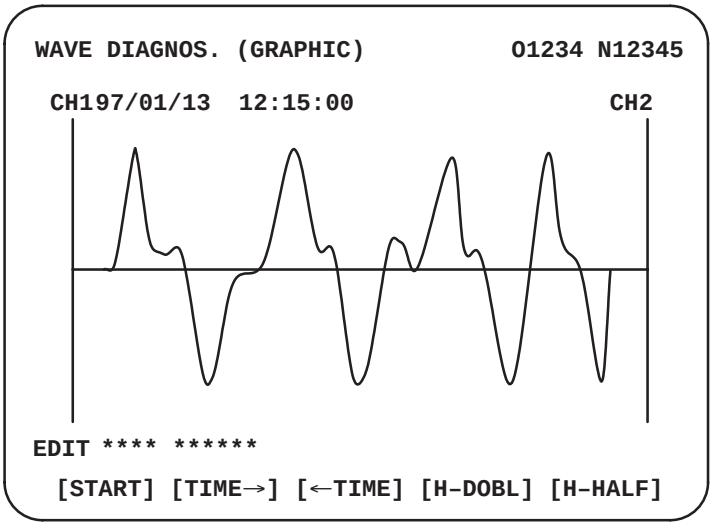
Pressing the [**SATART**] soft key starts data sampling. While sampling is being performed, SAMPLING blinks at the top of the screen. Once data sampling has been completed, a waveform is automatically displayed.



- **Drawing a waveform for storage type waveform diagnosis**

To use storage type waveform diagnosis, set 100 for the display start condition. The maximum data width for storage type waveform diagnosis is 32760 ms. Data must be sampled before starting drawing. The next page explains sampling in detail.

Pressing the **[START]** soft key loads stored data. While the data is being loaded, SAMPLING blinks at the top of the screen. Once the data has been loaded, a waveform is displayed. The date on which the data was stored is displayed at the top left of the screen. If the **[START]** soft key is pressed while data is being stored, storage is stopped and the waveform for the data stored up to that point is displayed. The WAVE DIAGNOS. (MEMORY) screen indicates whether data is being stored.



1.10.4 Data Sampling for Storage Type Waveform Diagnosis

(1) Press the SYSTEM function key. Pressing the menu continuation key [▷] displays the **[W.DGNS]** soft key. Press this soft key to display the WAVE DIAGNOS. (PARAMETER) screen.

(2) Press the **[W.MEM]** soft key to display the WAVE DIAGNOS. (MEMORY) screen. The operation selection soft keys appear.
The configuration of the operation selection soft keys is as follows:

```
WAVE DIAGNOS. (MEMORY)          O1234 N12345

   CONDITION:  100    TRIGGER:  G0123.4

   DATA KINDS         SAMPLING AXIS
   POS ERROR          XYZA
   MOTION CMD         XYZA
   CURRENT (%)        XYZA
   SPEED (RPM)        NONE
   TORQUE CMD         NONE
   HEAT SIMLT         XYZA
                SMPL  TIME :      2. 0SEC
                DATE    : MEMORY

EDIT **** *** ***           08:20:52
  [SELECT] [      ] [      ] [      ] [START]
```

(3) The configuration of the operation selection soft keys is as follows:

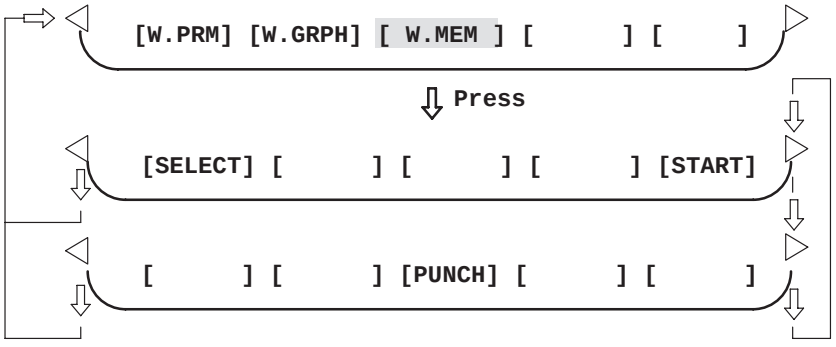


Fig. 1.10.4 Soft keys

(4) Using the cursor, set the necessary data items. To set the sampling axes, position the cursor to the data item to be set, enter the names of the axes for which data will be sampled for that data item, then press **[SELECT]** or INPUT. The axis names are displayed to the right of the data items.

Example) XYZ + **[SELECT]** or INPUT

Once the sampling axes have been selected, the sampling period for each axis is displayed. Subsequently pressing the **[START]** soft key starts data sampling.

CAUTION
1 Data items for which ***** is displayed cannot be set.
2 To change the sampling axes, enter new axis names then press the [SELECT] soft key. Pressing the [SLELCT] soft key without entering an axis name results in no sampling axis being set.
3 If the sampling axes are changed during data sampling, data sampling is stopped. In this case, press the [START] soft key to restart data sampling for the new sampling axes.
4 Initially, no sampling axis is set.

- **Storage data parameters**

(1) Storage stop condition

100: Stops data storage upon the issue of a servo alarm.

101: Stops data storage upon the issue of a servo alarm or the detection of the rising edge of the trigger signal.

102: Stops data storage upon the issue of a servo alarm or the detection of the falling edge of the trigger signal.

The maximum stored data width is 32760 ms. If the storage stop condition is not satisfied within 32760 ms, data is overwritten, starting with the oldest data.

Parameter No. 3120 can be used to delay data storage being stopped by a specified period (ms), after the issue of a servo alarm.

(2) Trigger: Set the PMC address and bit for the signal used to trigger the stopping of data storage, when 101 or 102 is set for the stop condition.

Example) G0007.2: ST signal

(3) Data type: The following table lists the types of data for which a waveform can be displayed.

Data type	Description	Units
POS ERROR	Servo error (8 ms) for the n–th axis	Pulses (detection units)
MOTION CMD	Pulse distribution for the n–th axis	Pulses (input increments)
CURRENT (%)	Torque for the n–th axis	% (relative to maximum current)
SPEED (RPM)	Actual speed for the n–th axis	RPM
TORQUE CMD	Command current for the n–th axis	% (relative to maximum current)
HEAT SIMLT	Thermal simulation data for the n–th axis	% (OVC alarm ratio)

(4) Sampling axis: The axes along which data will be sampled are displayed.

(5) Sampling period: The sampling period for each axis is displayed.

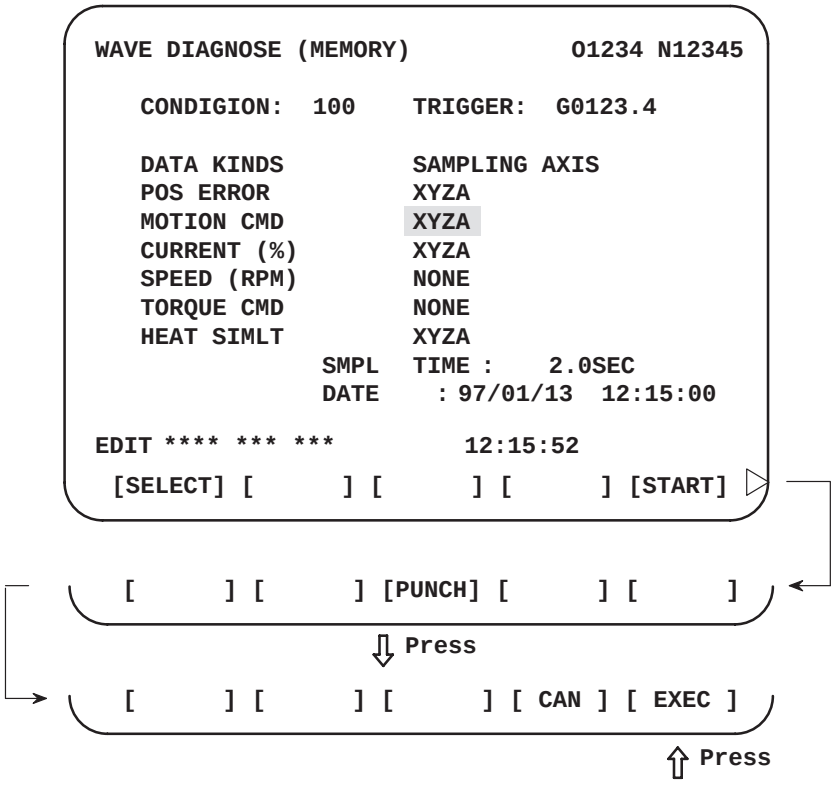
(6) Date of storage: While data is being sampled, MEMORY blinks in this field. When data sampling stops, the date at that point appears in this field.

1.10.5 Outputting Waveform Diagnosis Data (Storage Type)

Waveform diagnosis data of servo alarm format can be output to an I/O device, as follows:

1) Select EDIT mode.
2) Press the SYSTEM key, then display the WAVE DIAGNOS. (MEMORY) screen.
3) Press the **[W.MEM]**, ▷ , **[PUNCH]**, and **[EXEC]** soft keys, in this order.

For details of input/output to/from the FANUC Floppy Cassette or FA Card, see "Output to FANUC Floppy Cassette or FA Card," below.



- **Output to FANUC Floppy Cassette or FA Card**

1) Select EDIT mode.
2) Press the SYSTEM key, then display the WAVE DIAGNOS. (MEMORY) screen.
3) Open the write protect tab on the floppy disk or card.
4) Press the **[W.MEM]**, ▷ , **[PUNCH]**, and **[EXEC]** soft keys, in this order.

   The waveform diagnosis data is output to a file named WAVE DIAGNOS, to which the number of the last file is assigned.

   If a file named WAVE DIAGNOS already exists in the floppy disk or on the card, P/S alarm 86 is issued. A floppy disk or card can contain only one file for waveform diagnosis data. If the existing WAVE DIAGNOS file contains unnecessary waveform diagnosis data of servo alarm format, delete that file before attempting to output new data. The procedure for deleting a file is described later.

- **Directory display**

The directory in the cassette or card is displayed by means of the following procedure:

1) Select EDIT mode.
2) Press the PROG function key to select the program screen.
3) Press the continuous menu key ▷, then press [FLOPPY].
4) Press page key ↓.

The directory is displayed.

- **Deleting a file**

A file stored on a cassette or card is deleted by means of the following procedure:

1) Select EDIT mode.
2) Press the PROG function key to select the program screen.
3) Set the write protect switch on the cassette or card to enable writing.
4) Press [FLOPPY].
5) Press [DELETE].
6) Enter the file number, then press [F SET].
7) Press [EXEC].
   The file corresponding to the specified file number is deleted. The number of each file subsequent to the deleted file is decremented by one.

- **Output format**

In the servo alarm format, the header, date and time, selected axes, and waveform diagnosis data are output in this order. Data items are identified by nine identifier words. Output data other than the identifier words varies with the data type.

T(identifier word)

T0 : Header
T60 : Positional deviation
T61 : Move command
T62 : Actual current
T63 : Actual speed
T64 : Command current
T65 : Thermal simulation
T68 : Selected axes
T69 : Date and time

1) Header

T	0	C	W	A	V	E		D	I	A	G	N	O	S	;

C: Data word

2) Data word

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

D *..*: Data Example: 12:14 59 seconds on June 23, 1997

T	6	9	D	1	9	9	7	0	6	2	3	,	1	2	1	4	5	9	;

3) Selected axes

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

P0: Positional deviation
P1: Actual speed
P2: Move command
P3: Command current
P4: Actual current
P5: Thermal simulation
D*.. *: Axis number (1 to 8)

4) Waveform diagnosis data

T	6	0	D	*	*	,	*	*	,	*	*	,	~	*	*	,		
T	6	1	D	*	*	,	*	*	,	*	*	,	~	*	*	,		
T	6	2	D	*	*	,	*	*	,	*	*	,	~	*	*	,		
T	6	3	D	*	*	,	*	*	,	*	*	,	~	*	*	,		
T	6	4	D	*	*	,	*	*	,	*	*	,	~	*	*	,		
T	6	5	D	*	*	,	*	*	,	*	*	,	~	*	*	,		

D *..*: Waveform diagnosis data x number of axes

NOTE
1 Records are classified into header records and data records.
2 ”%” is used as an end–of–record code.
3 Each record starts with an identifier and ends with an end–of–block code.
4 Either the ISO or EIA code system is used.
5 The output code type is specified with parameter ISO (bit 1 of No. 0100). For ISO code, parameter NCR (bit 3 of No. 0100) is used to specify whether the end–of–block code is <LF> only, or a sequence of <LF> <CR> <CR>.
6 Parameter NFD (bit 7 of No. 01X1, where X is the channel number) is used to specify whether a feed code is output before and after the data.
7 No identifier word is output for a data item for which no axis is selected.
8 The above file corresponds to a paper tape of about 200 m in length.

1.10.6 Notes

(1) Once the storage is full, the oldest data is overwritten.

(2) Stored–type waveform diagnostic data is not lost, even when the power is turned off.

(3) The waveform diagnostic function is disabled when parameter SGD (bit 0 of No. 3112) is set to 0.

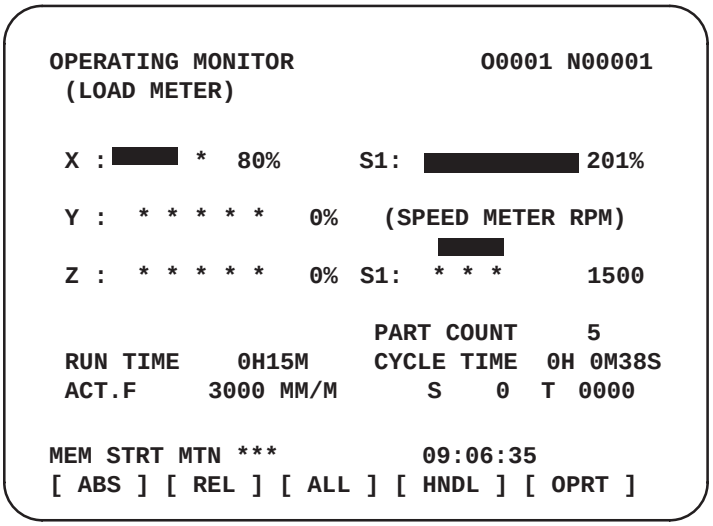
(4) Set the correct date and time using the setting screen.

1.11 OPERATING MONITOR

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

1.11.1 Display Method

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



NOTE

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

1.11.2 Parameters

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

[Data type] Bit

#5(OPM) Operating monitor display is:

0 : Disabled
1 : Enabled

#6(OPS) The speed meter on the operating monitor screen displays:

0 : Spindle motor speed
1 : Spindle speed

3151	Axis number for which the first servo motor load meter is displayed
3152	Axis number for which the second servo motor load meter is displayed
3153	Axis number for which the third servo motor load meter is displayed
3154	Axis number for which the fourth servo motor load meter is displayed

[Data type] Byte

[Valid data range] 0, 1, ... number of controlled axes

These parameters specify the numbers of the axes for which load meters for servo motors are to be displayed. Up to four load meters can be displayed. Set 0 for those axes for which no load meter is to be displayed.

1.12 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 SETTING	Offset number→[NO.SRH]→Offset value→ INPUT
Inputting setting data	OFF		MDI	OFFSET 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 SETTING	POS (Display of relative coordinate)<AXIS>→ [ORIGIN] → OFFSET SETTING →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 SETTING	(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 SETTING	[(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 SETTING	[▷]→[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 SETTING	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/ HAN-DLE	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		M/T : [RESET] AND [DELETE] Loader is controlled : [CAN] AND [5]
Parameter/offset clear		○	At Power ON		M/T : [RESET] Loader is controlled : [RESET] AND [5] (Parameter only)
Clearing a program		○	At Power ON		M/T : [DELETE] Loader is controlled : [RESET] AND [5]
Program under edition at power off(PS101)			–		[PROG] AND [RESET]
PMC RAM *			At Power ON		Main CPU : [X] AND [0] (O) Loader is controlled : [X] AND [5]

* PMC ladder program is not cleard in FROM.

1.13 WARNING SCREEN DISPLAYED WHEN AN OPTION IS CHANGED

- **Warning screen**

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

```
   WARNING

YOU SET THE PARAMETER NO.□□□□#□

THE FOLLOWING DATA WILL BE CLEARED.

* PART PROGRAM MEMORY

PLEASE PRESS <DELETE> OR <CAN> KEY.
<DELETE> : CLEAR ALL DATA
<CAN>    : CANCEL
```

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

- **Allocation error screen**

When an option which uses the SRAM area is added, the system software may require more SRAM than is currently installed in the system. In this case, an allocation error screen appears the first time the system is turned on after the addition of the option, thus restoring the state existing before the addition.

```
   FILE ALLOCATION ERROR

S-RAM CAPACITY IS NOT SUFFICIENT.
ADDITIONAL S-RAM IS NECESSARY.

PLEASE PRESS <CAN> KEY :
RETURN TO THE STATE BEFORE
OPTION PARAMETER IS CHANGED.
```

NOTE

When the currently installed SRAM is not sufficient, additional SRAM can be mounted. Newly installed SRAM must be cleared before it can be used.

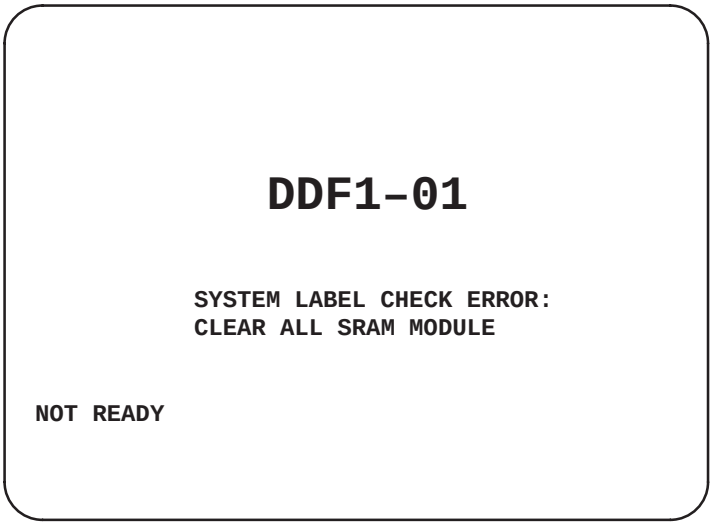
Operation:When turning on the power, hold down the following keys:

O + DELETE for M/T series

When installing additional SRAM, however, perform all clear.

1.14 WARNING SCREEN DISPLAYED WHEN SYSTEM SOFTWARE IS REPLACED (SYSTEM LABEL CHECK ERROR)

System software can be replaced only with compatible system software. Otherwise, the first time the CNC is turned on after the system software is replaced, the following screen will be displayed and the system will not be activated:



In this case, perform memory all clear (by holding down the RESET and DELETE MDI keys then turning on the power) or reinstall the original system software.

1.15 MAINTENANCE INFORMATION SCREEN

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

- MDI alphabetical input is allowed.
- The recording screen can be scrolled in units of lines.
- Edited maintenance information can be read and punched.
- The screen can be saved in flash ROM.

1.15.1 Screen Display and Operation

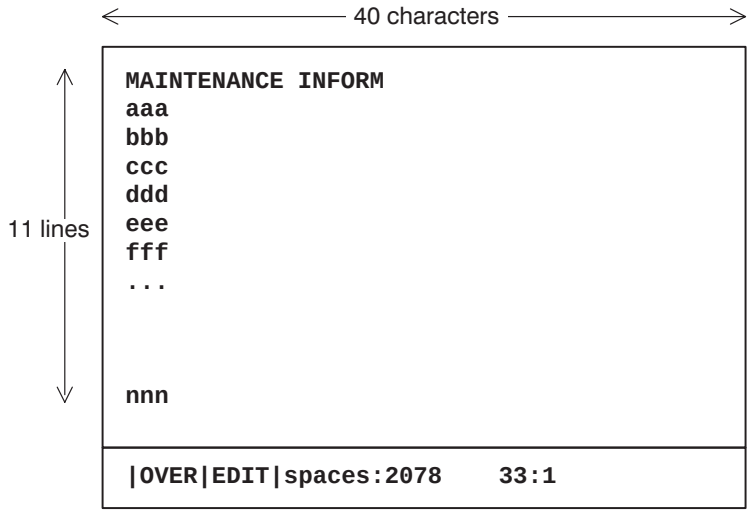
- **Screen display**

1. Press the SYSTEM function key.
2. Press the continuous menu key ▷ several times. **[M–INFO]** soft key appears.
3. Press the **[M–INFO]** soft key. The maintenance information screen appears.

When selected, the maintenance screen shows the latest information.

The recording screen has an input area of 40 characters by 11 lines.

The status (mode, number of empty character spaces, cursor line, column number) is displayed at the bottom of the screen.



Status display

- OVER/INSERT : -- OVER : Overwrite mode ; INSERT: Insert mode
- EDIT/VIEW :----EDIT : Editing allowed ; VIEW : Editing inhi bited
- Number of empty character spaces
- Current cursor line
- Current cursor column

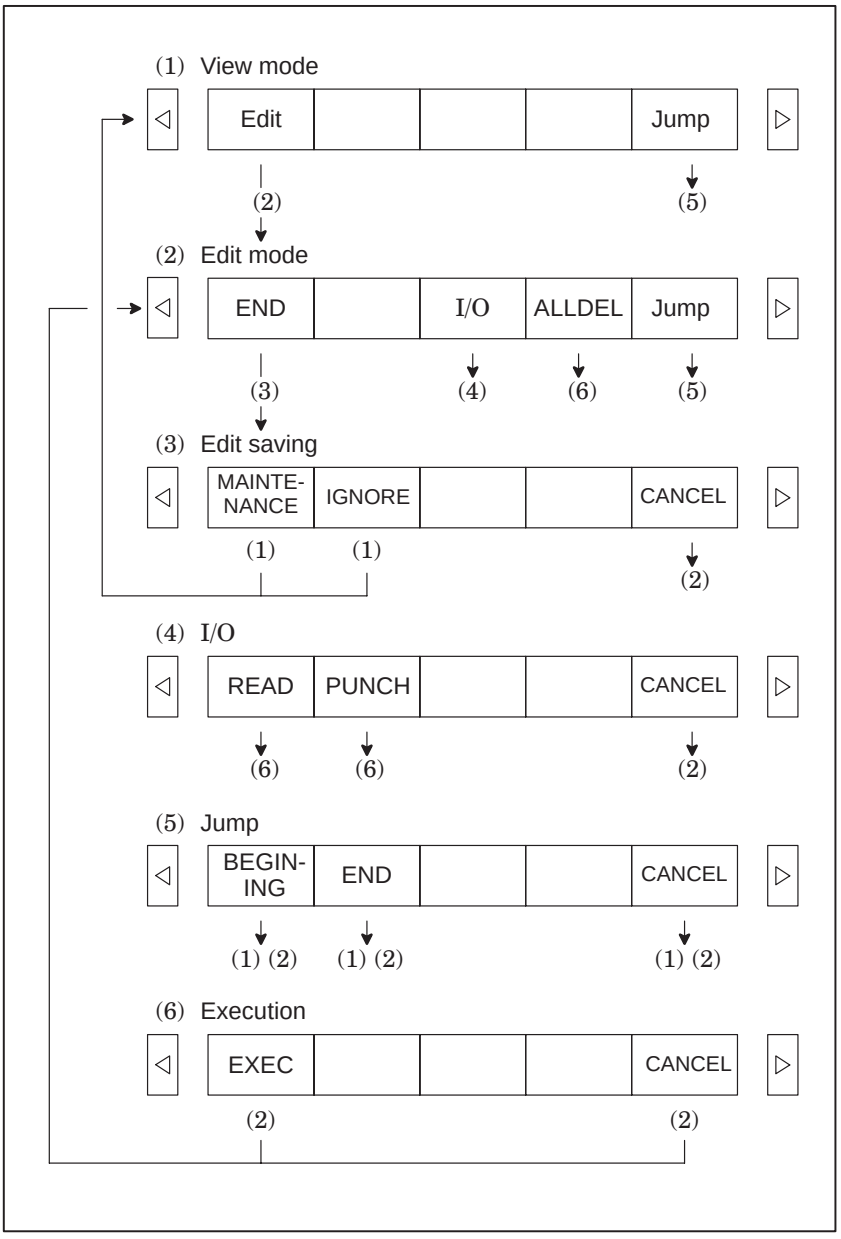
● Screen operation

The maintenance information screen has view mode and edit mode, which are selected by pressing the **[END]** or **[EDIT]** soft key.
Initially, view mode is selected. To start editing, select edit mode by pressing the [(OPRT)] and **[EDIT]** keys. When the editing is completed, press the **[END]** key. Then, select **[STORE]** or **[IGNORE]**. Unless **[STORE]** is selected, the edited data will be lost at next power–up.
To scroll the screen showing the recorded information, press a cursor key or page key on the MDI panel.
The following keys are used for editing (character input) and viewing:

Operation table

Mode	Key	Description
View	Soft keys [EDIT] [JUMP]	Allows editing. Displays the beginning or the end.
	Cursor key	Scrolls the screen up or down.
	Page key	Scrolls the screen up or down in units of whole screens.
Edit	Soft keys	
	[END]	Ends editing. Select whether to store the edited data.
	[ALLDEL]	Clears all maintenance information. (This key is enabled when the MDC bit (bit 3 of parameter 3118) is set to 1.)
	[I/O]	Reads or punches the maintenance information.
	[JUMP]	Moves the cursor to the beginning or end.
	Cursor key	Moves the cursor position up or down.
	Page key	Scrolls the screen up or down in units of whole screens.
	Alphanumeric/special character keys	Allows alphabetical, numeric, or special character input.
	INSERT key	Selects either insert mode or overwrite mode.
	DELETE key	Deletes a single character.
	CAN key	Deletes a single character before the cursor position.
	INPUT key	Starts a new line.

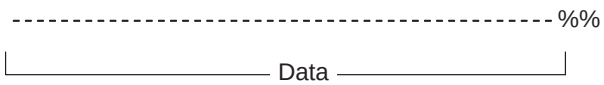
Operation of the soft keys


(1) View mode
Edit
Jump
(2)
(5)
(2) Edit mode
END
I/O
ALLDEL
Jump
(3)
(4)
(6)
(5)
(3) Edit saving
MAINTE-NANCE
IGNORE
CANCEL
(1)
(1)
(2)
(4) I/O
READ
PUNCH
CANCEL
(6)
(6)
(2)
(5) Jump
BEGIN-ING
END
CANCEL
(1) (2)
(1) (2)
(1) (2)
(6) Execution
EXEC
CANCEL
(2)
(2)

1.15.2 Maintenance Information Input/Output

The maintenance information can be read and punched.
When the maintenance information is input from or output to a memory card, a file name MAINTINF.DAT is used.

(1) Format



(2) Reading

When a MAINTINF.DAT file generated in the format shown above is read, the data is added at the end of the existing maintenance information.

NOTE
1 A TAB code is converted to one to four blanks, depending on the input position.
2 80h to 90h and E0h to EBh are assumed as prefix codes of double–byte characters. Reading these codes alone is inhibited.
3 Control codes (00H to 1FH) except TAB and LF are discarded in reading.
4 %% cannot be input.

(3) Punching

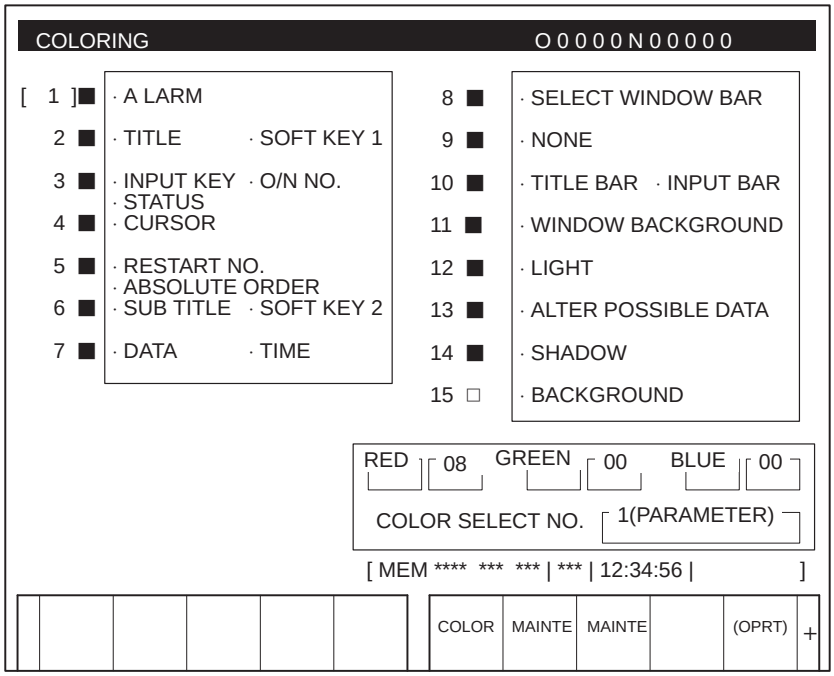
All maintenance information is output in the format shown above.

1.16 COLOR SETTING SCREEN

When VGA screen display is selected (NVG bit (bit 7 of parameter 3119) is set to 0), the color scheme of the VGA screen can be set on the color setting screen.

1.16.1 Screen Display

1. Press the SYSTEM function key.
2. Press the continuous menu key ▷ several times. The **[COLOR]** soft key appears.
3. Press the **[COLOR]** soft key. The color setting screen appears.



1.16.2 Color Setting

- **Changing a color (color palette value)**

1. Press the [(OPRT)] soft key. The following operation soft keys appear.

	RED	GREEN	BLUE	BRIGHT	DARK	+

2. Move the cursor to the color number corresponding to the color palette value to be changed.

   The current color palette values of individual color elements are displayed.
3. Select a desired color element by pressing the **[RED]**, **[GREEN]**, or **[BLUE]** operation soft key.

   Two or more color elements can be simultaneously selected.

Each time the **[RED]**, **[GREEN**], or **[BLUE]** operation soft key is pressed, the selection is made or canceled.

(If the **[RED]**, **[GREEN]**, and **[BLUE]** operation soft keys are not displayed, press the rightmost soft key.)

4. Press the **[LIGHT]** or **[DARK]** operation soft key to change the luminance of the selected color element.

- **Storing colors (color palette values)**

A specified color palette value can be stored.

	STORE	CALL	COLOR1	COLOR2	COLOR3	+

1. Select a desired storage area by pressing the **[COLOR1]**, **[COLOR2]**, or **[COLOR3]** operation soft key.

   (If the **[COLOR1]**, **[COLOR2]**, and **[COLOR3]** operation soft keys are not displayed, press the rightmost soft key.)

   COLOR1 — Standard color data parameters (6561 to 6595)
   COLOR2 ┐ Internal RAM
   COLOR3 ┘

2. Press the **[STORE]** operation soft key. The following operation soft keys appear.

				CAN	EXEC	+

3. To store the current color palette values in the selected area, press the **[EXEC]** operation soft key. To cancel the storage, press the **[CAN]** operation soft key or the leftmost key.

- **Calling colors (color palette values)**

	STORE	CALL	COLOR1	COLOR2	COLOR3	+

1. Select a color palette storage area by pressing the **[COLOR1]**, **[COLOR2]**, or **[COLOR3]** operation soft key.

   (If the **[COLOR1]**, **[COLOR2]**, and **[COLOR3]** operation soft keys are not displayed, press the rightmost soft key.)

2. Press the **[CALL]** operation soft key. The following operation soft keys appear.

				CAN	EXEC	+

3. To call the color palette values from the selected area, press the **[EXEC]** operation soft key. If no color palette value is stored, this step cannot be executed.

   To stop calling, press the **[CAN]** operation soft key or the leftmost key.

1.16.3 Parameters

	#7	#6	#5	#4	#3	#2	#1	#0
3119	NVG							

[Data type] Bit

NVG When a color display unit is used, the VGA screen display is:

0 : Selected.

1 : Not selected. (Conventional display)

6561	Standard color data of graphic color 1
6562	Standard color data of graphic color 2
6563	Standard color data of graphic color 3
6564	Standard color data of graphic color 4
6565	Standard color data of graphic color 5
6566	Standard color data of graphic color 6
6567	Standard color data of graphic color 7
6568	Standard color data of graphic color 8
6569	Standard color data of graphic color 9
6570	Standard color data of graphic color 10
6571	Standard color data of graphic color 11
6572	Standard color data of graphic color 12
6573	Standard color data of graphic color 13
6574	Standard color data of graphic color 14
6575	Standard color data of graphic color 15
6581	Standard color data of text color 1
6582	Standard color data of text color 2
6583	Standard color data of text color 3
6584	Standard color data of text color 4
6585	Standard color data of text color 5
6586	Standard color data of text color 6
6587	Standard color data of text color 7
6588	Standard color data of text color 8
6589	Standard color data of text color 9

6590	Standard color data of text color 10
6591	Standard color data of text color 11
6592	Standard color data of text color 12
6593	Standard color data of text color 13
6594	Standard color data of text color 14
6595	Standard color data of text color 15

[Data type] Two–word

[Unit of data] Six–digit number rrggbb (rr: Red component value, gg: Green component value, bb: Blue component value)
When five digits or less are specified, the missing high–order digits are assumed as zeros.

[Valid data range] Each color component value: 00 to 15 (Equivalent to the color level on the color setting screen)
When 16 or a higher value is specified, 15 is assumed.

(Example) When specifying a color having red component value 1, green component value 2, and blue component value 3, set the parameter value as 10203.

1.16.4 Notes

(1) At power–up, the color scheme of the screen is determined by the setting in the COLOR1 area (parameters). If no data is stored in the COLOR1 area, the last color scheme before power–down is applied.

(2) The standard color data specified in parameters must not be changed by direct MDI key input. When changing the parameter data, set and store the new data on the color setting screen.

(3) When a wrong value is specified in a standard color data parameter, the screen may not be displayed. If this occurs, turn the power on again, while pressing the DELETE and RESET keys. This clears the whole stored color scheme and restores the FANUC standard color scheme instead.

1.17 CONTRAST ADJUSTMENT

Depending on the eye level and the viewing angle of the operator, the LCD may be hard to read. This problem can be solved by adjusting the contrast. The contrast of a monochrome LCD can be adjusted.

1. Press the OFFSET SETTING function key.
2. Press the [SETTING] chapter selection soft key.
   The LCD contrast item is displayed on the setting (handy) screen.

```
SETTING(HANDY)
PARAMETER WRITE = 1(0:DISABLE 1: ENABLE)
TV CHECK        = 0(0:OFF 1:ON)
PUNCH CODE      = 0(0:EIA 1:ISO)
INPUT UNIT      = 0(0:MM  1:INCH)
I/O CHANNEL     = 0(0–3:CHANNEL NO.)
SEQUENCE NO.    = 0(0:OFF 1:ON)
TAPE EORMAT     = 0(0:NO CNV 1:F15)
SEQUENCE STOP   = 0(PROGRAM NO.)
SEQUENCE STOP   = 0(SEQUENCE NO.)

[ CONTRAST ]( + = [ ON:1 ] – = [ OFF:0 ])
>_
MDI **** *** *** BAT 00:00:00
[NO.SRH] [ ON:1 ] [OFF:0] [+INPUT] [INPUT]
```

3. Move the cursor to ”CONTRAST”.
4. Adjust the contrast by pressing the operation soft key [ON:1] or [OFF:0].

1.18 POWER MOTION MANAGER

When the Power Motion series is used as an additional axis (slave) of the CNC, the power motion manager allows the slave data to be displayed and set by the CNC.
The power motion manager enables the following display and setting:

(1) Current position display (absolute/machine coordinates)
(2) Parameter display and setting
(3) Diagnosis display
(4) System configuration screen display
(5) Alarm display

The Power Motion series that can be used as the slave is a β amplifier with I/O Link.

1.18.1 Parameter

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

[Data type] Bit

#0(SLV) When the power motion manager is selected, the screen shows the data of:
0 : A single slave.
1 : Up to four slaves by dividing the screen into four segments.

#1, #2(MD1, MD2) The slave parameters are input from and output to the following devices:

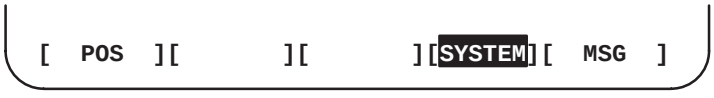
MD2	MD1	I/O device
0	0	Part program storage
0	1	Memory card

The parameters are input or output in the program format, no matter which I/O device is selected.

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

1.18.2 Screen Display

1. Press the SYSTEM function key.
2. Press the continuous menu key ▷ several times. The [PMM] soft key appears.
3. Press the [PMM] soft key. The system configuration screen, which is the initial screen of the power motion manager, appears. The screen has the following soft keys (function selection soft keys).



The currently active soft key is displayed in reverse video. Pressing a soft key enables the corresponding function, as indicated below:

POS: Current position display
SYSTEM: System information
MSG: Alarm list

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

4. To terminate the power motion manager, repeatedly press the return menu key ◁ until the function selection keys are displayed as shown above. Then, press the return menu key once more. The soft keys of the CNC system appear, and the power motion manager terminates. The system configuration screen of this function is displayed as the termination screen.

Alternative termination method is to select another function while this function is enabled. To do this, press an MDI function key (POS , PROG , MESSAGE , etc.).

NOTE
After another screen is displayed by pressing a function key, pressing the SYSTEM function key, restores the initial status of this function. That is, the soft keys shown above are restored. The data that was being input is canceled.

- **System configuration screen**

This screen displays the system software information of the slave. The screen is displayed first when the power motion manager function is selected. This screen is automatically displayed also at the termination of the function.

1. Press the [SYSTEM] function selection soft key. The following soft keys are displayed together with the screen displayed when SYSTEM was last selected. The currently active soft key is displayed in reverse video.

```
[ PARAM ][ DGNOS ][      ][SYSTEM][     ]
```

2. Press the [SYSTEM] soft key again. The system configuration screen appears. While this screen is displayed, the [SYSTEM] soft key is left displayed in reverse video.

```
POWER MOTION MANAGER
SYSTEM CONFIGURATION
1.GROUP0 / β

SYSTEM  <SERIES/VERSION>            88A1 01

[ PARAM ][ DGNOS ][       ][ SYSTEM ][       ]
```

Sample screen: Series and edition of the servo unit β series system list

- **Parameter screen**

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

1. Press the [SYSTEM] function selection soft key. The following soft keys appear.

```
[ PARAM ][ DGNOS ][      ][SYSTEM][      ]
```

2. Press the [PARAM] soft key. The parameter screen appears.

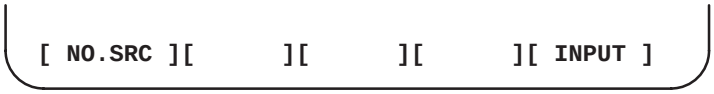
```
POWER MOTION MANAGER
PARAMETER
1.GROUP0 / β
0000        00001000   0010        11110000
0001        00010101   0011        01010000
0002        11111011   0012        00000000
0003        00000000   0013        00000000
0004        00000000   0014        10110001
0005        10100001   0015        00000000
0006        00000000   0016        00000000
0007        10000000   0017        10000010
0008        00000000   0018        00000000
0009        00000000   0019        00000000

[ PARAM ][ DGNOS ][       ][ SYSTEM ][       ]
```

The screen displays just the bit and decimal data. For details of the parameters, refer to the connection manual of the corresponding Power Motion unit.

● Searching for a parameter

A search can be made for the parameter to be displayed.

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

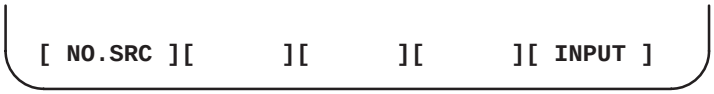


3. Enter a desired number in the key–in field by using MDI numeric keys. Then, press the [NO.SRC] soft key. The search starts.

● Setting a parameter

A parameter of a slave Power Motion unit can be directly set from the CNC.

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

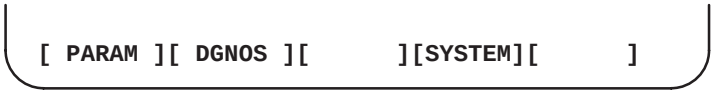


3. Move the cursor to the parameter to be set.
4. Enter desired data in the key–in buffer by using MDI numeric keys. Then, press the [INPUT] soft key. Alternatively, press the MDI INPUT key.

● Diagnosis screen

This screen shows the current status of the slave.

1. Press the [SYSTEM] function selection soft key. The following soft keys appear:



2. Press the [DGNOS] soft key. The diagnosis screen appears. The displayed data is basically the same as the data displayed on the parameter screen.

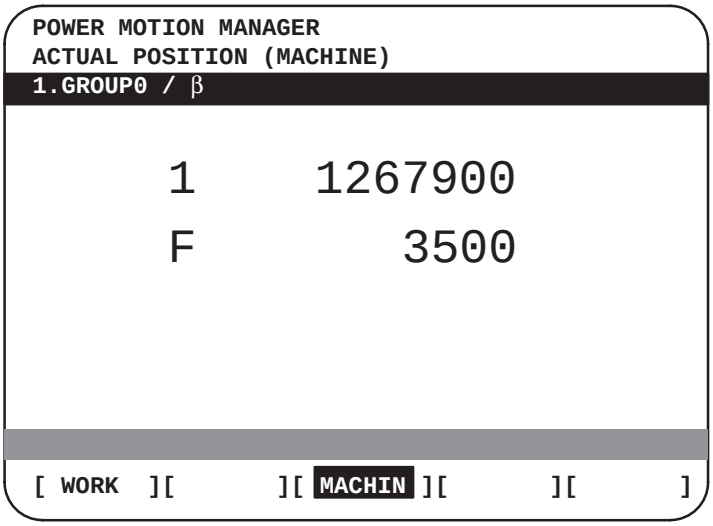
   For details of the diagnosis information, refer to the connection manual of the corresponding Power Motion unit.

● Current position display

The screen shows the current position on the workpiece coordinate system or machine coordinate system.

1. Press the [POS] function selection soft key. The following soft keys appear:

2. To see the absolute coordinate screen, press the [WORK] soft key. To see the machine coordinate screen, press the [MACHIN] soft key.

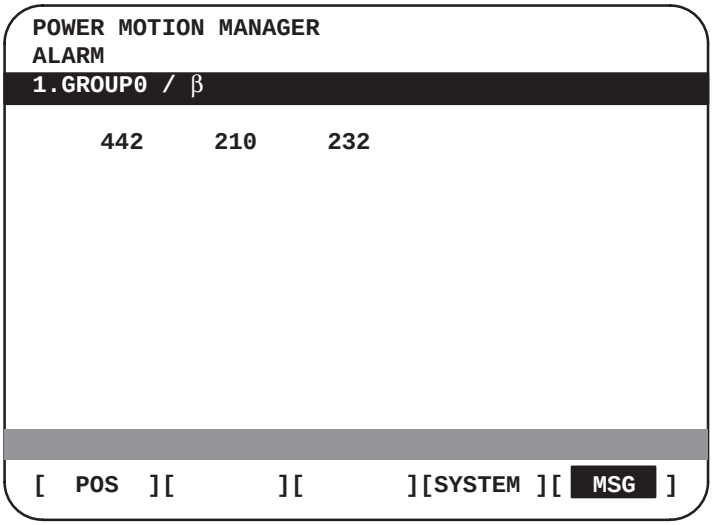


1: Coordinate F: Actual speed

- **Alarm screen**

If an alarm is issued during operation, the group number of the slave causing the alarm is indicated at the right end of the message field on the screen. Check the details on the alarm screen. For example, (13) means that the first and third power motion units are in the alarm state.

1. Press the [MSG] function selection soft key. Just the error code is displayed on the screen.



Up to forty codes can be displayed on the screen.

For details of the alarm, refer to the connection manual of the corresponding Power Motion unit.

- **Operating the active slave**

The active slave is subjected to the ZOOM function, which will be described later, and parameter overwrite. The title of the active slave is displayed in a color different from the display color of the other slave titles.

The active slave can be selected by pressing the [↓NEXT] or [↑BACK] soft key, which is displayed after the continuous menu key ▷ is pressed several times.

[↓NEXT]: Displays the screen of the Power Motion unit connected after the currently active slave. The equipment other than the Power Motion unit is ignored.

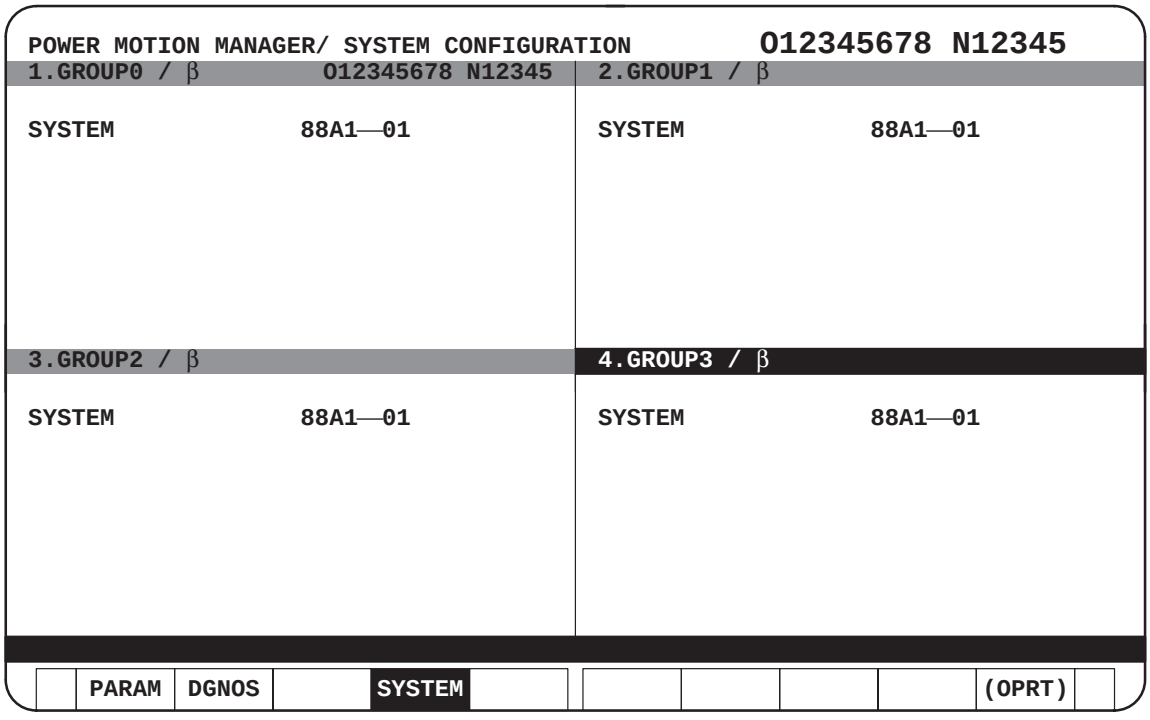
[↑BACK]: Displays the screen of the Power Motion unit connected before the currently active slave.

- **Single–slave display/ Four–slave display**

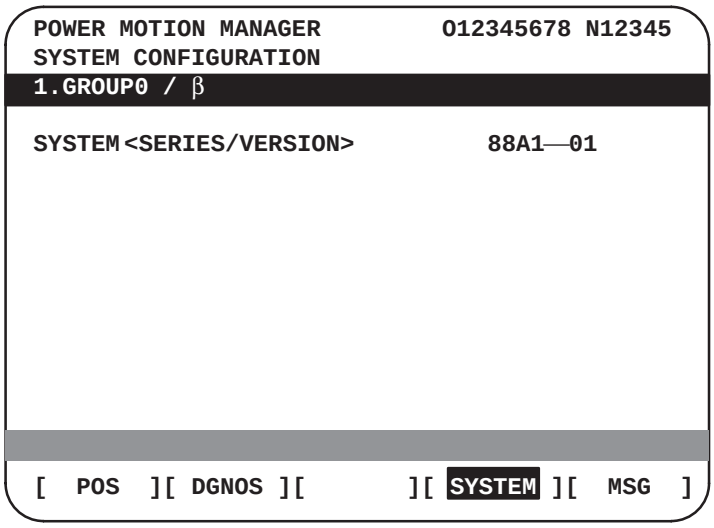
Whether the screen displays the data of just a single unit or of four units in four segments is specified in the SLV bit (bit 0 of parameter 960).

To switch the four–slave display to the single–slave display, press the [ZOOM] soft key, which is displayed after the continuous menu key ▷ is pressed several times. The single–slave display shows the data of the active slave. To switch the single–slave display to the four–slave display showing the data of four slaves including the active slave, press the [ZOOM] key.

When five or more slaves are connected, the four–slave display has two or more pages. To see the slave data that is not displayed on the current page, press soft key [↓NEXT].



The figure above shows a sample four–slave display screen on a display unit with twelve soft keys. A unit with seven soft keys can also display the four–slave display screen.



The figure above shows a sample single–slave display screen on a display unit with seven soft keys. A unit with twelve soft keys can also display the single–slave display screen.

- **Guidance message**

While the following soft keys are being displayed, a guidance message is displayed in the message field.

```
[ POS ][ ][ ][SYSTEM][ MSG ]
```

```
[ WORK ][ ][MACHIN ][ ][ ]
```

```
[ PARAM ][ DGNOS ][ ][SYSTEM][(OPRT) ]
```

When the soft keys are displayed as shown above, ”SELECT ACTIVE SLAVE [>]” is displayed.

```
[ ↓NEXT ][ ↑BACK ][ ZOOM ][ ][ ]
```

When the soft keys are displayed as shown above, ”SELECT ACTIVE SLAVE [↓] [↑]” is displayed.

- **Key–in field**

When the [(OPRT)] soft key is pressed, the message line may turn into a key–in field as required. The numeric data input by using MDI keys is displayed after the prompt (>).

On the parameter and diagnosis screens, the key–in field appears when just a numeric value is input. The soft key [(OPRT)] need not be pressed.

1.18.3 Parameter Input/Output

- **Saving parameters**

Parameters can be saved in CNC memory or a memory card as a data file of program format. Specify the first digit of the registration program number in parameter 8760. Programs with predetermined numbers are created for individual slaves. When the parameters are saved in CNC memory, a program having the specified program number is created. When the parameters are saved in a memory card, a file is created, to which the file name consists of the specified program number and an extension PMM.

Example: When parameter 8760 is set to 8000

The program number for group n is 8000 + n*10.

The group number n is indicated in the title area of each slave.

CAUTION
In case that the parameters are saved in a memory card, If the specified program number already exists on memory card, the corresponding program is overwritten with new data.

Specify a desired input device in the MD1 and MD2 bits (bits 1 and 2 of parameter 960). Connect a memory card. Alternatively, check the free area of CNC memory. Then, follow the steps given below:

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

```
[ NO.SRC ][      ][      ][      ][ INPUT ]
```

3. Press the continuous menu key [▷] . The following soft keys appear:

```
[      ][ READ  ][ PUNCH  ][      ][      ]
```

4. Press the [READ] soft key. The following soft keys appear:

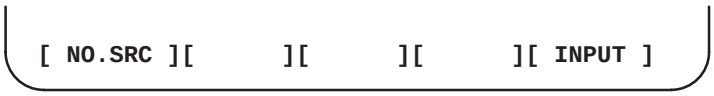
```
[      ][      ][      ][CANCEL ][  EXEC  ]
```

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

- **Writing parameters**

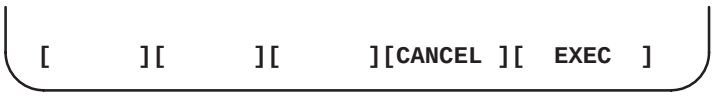
The data file of parameters saved in CNC memory or a memory card as a program is written into the slave determined by the program number. The program number and memory device are determined as described in ”Saving parameters.”

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



3. Press the next–menu key. The following soft keys appear:

4. Press the [PUNCH] soft key. The following soft keys appear:



5. Press the [EXEC] soft key.

During output, “INPUT” blinks in the message field.

The screen cannot be changed to another screen during parameter input/output.

When the RESET key is pressed, or when an alarm status is detected in communication, the input/output stops.

1.18.4 Notes

- **Connecting an I/O Link**

When the Power Motion series is used as a slave of an I/O Link, the CNC assigns I/O addresses. The salve data is input and output in units of 16 bytes. Therefore, 128 input/output points are necessary. Up to eight slaves can be connected.

The module name is OC021 (16–byte input) or OC020 (16–byte output). BASE is always 0, and SLOT is always 1.

- **Ignoring the power motion manager function**

After the data necessary for each slave connected is set and checked, the communication of the power motion manager (PMM) can be stopped to send a command from the CNC ladder to the slave.

When the PMN bit (bit 3 of parameter 960) is set to 1, all communication between CNC and the slave via the I/O Link is open to the ladder.

While the bit is held 1, the screen shows just the title, function name, and other items that are independent of the communication. The following message appears to indicate that communication has stopped.

COMMUNICATION PROHIBITED BY P960#3

- **Data input/output by I/O Link**

When the power motion manager is used, the function for data input/output by I/O Link cannot be used.

- **Alarm**

(1) CNC

When a CNC alarm status is detected, the screen is automatically switched to the CNC alarm screen. Check the details of the alarm. If necessary, display and select the power motion manager screen again by pressing function key SYSTEM .

(2) Slave

A guidance message is usually displayed in the message field. If a slave alarm is detected, the corresponding slave group number is displayed at the right end.

Display the alarm screen to check the details.

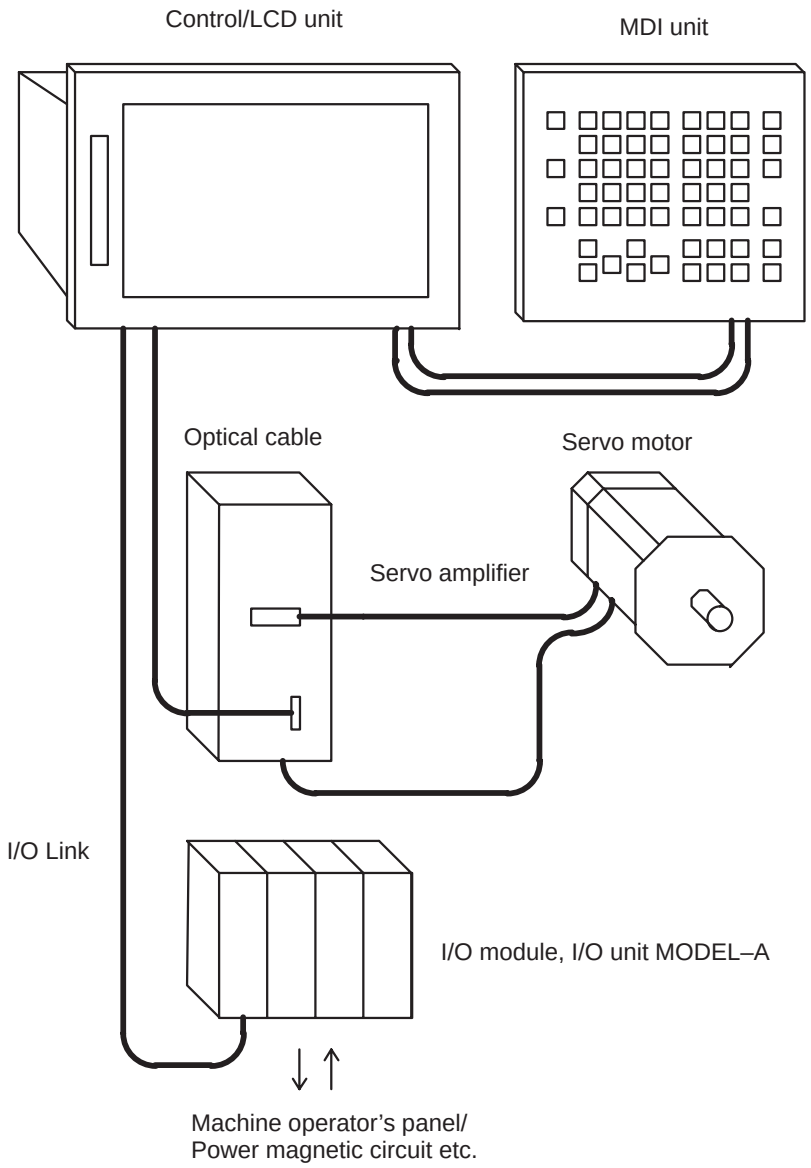
- **Data protection key**

When the data protection key of the CNC is turned on, parameters cannot be input to CNC memory.

2 HARDWARE

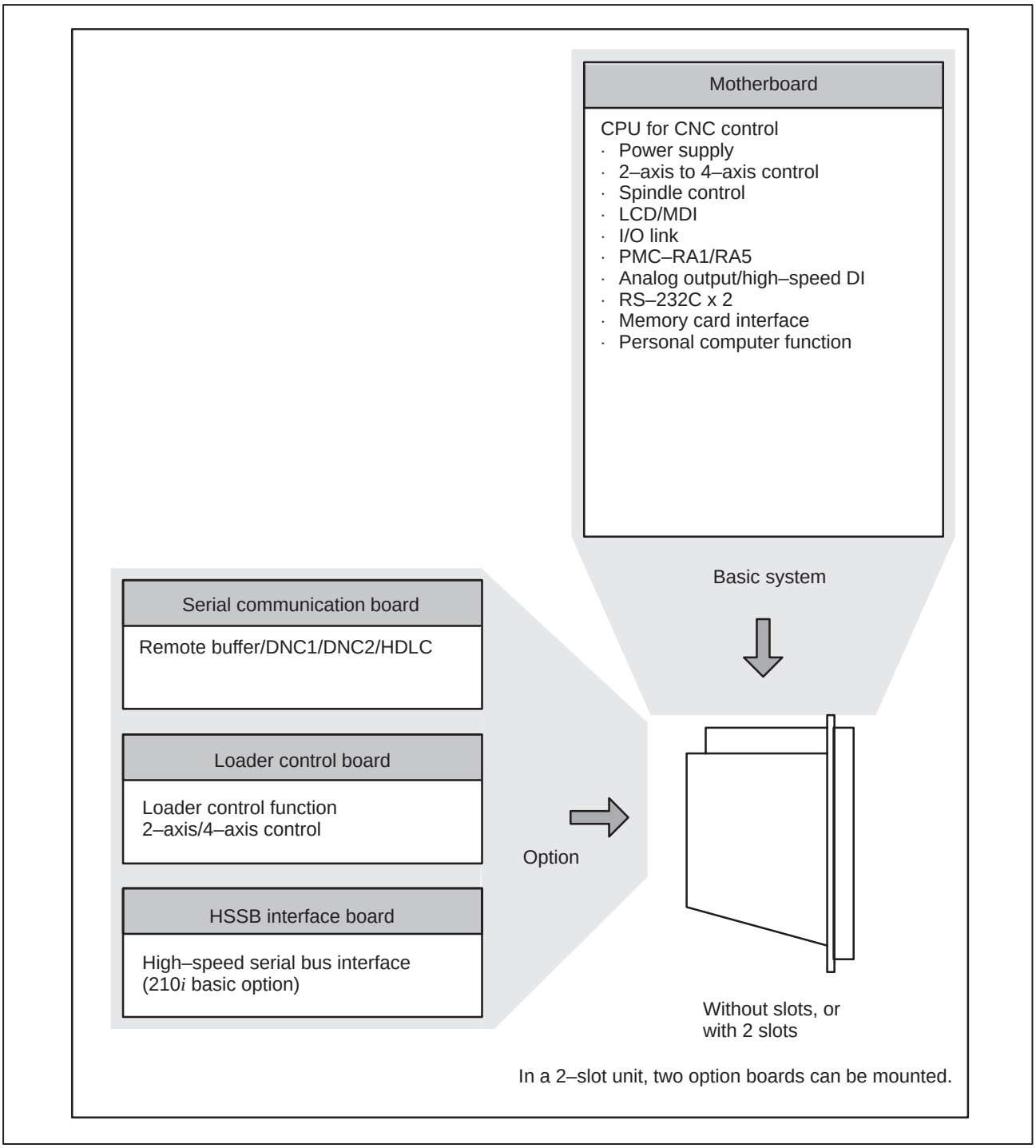
This chapter describes structure of CNC control section, connection of units and the functions of PCBs and modules mounted on PCBs.

2.1 STRUCTURE



2.2 OVERVIEW OF HARDWARE

2.2.1 Series 21*i*/210*i*



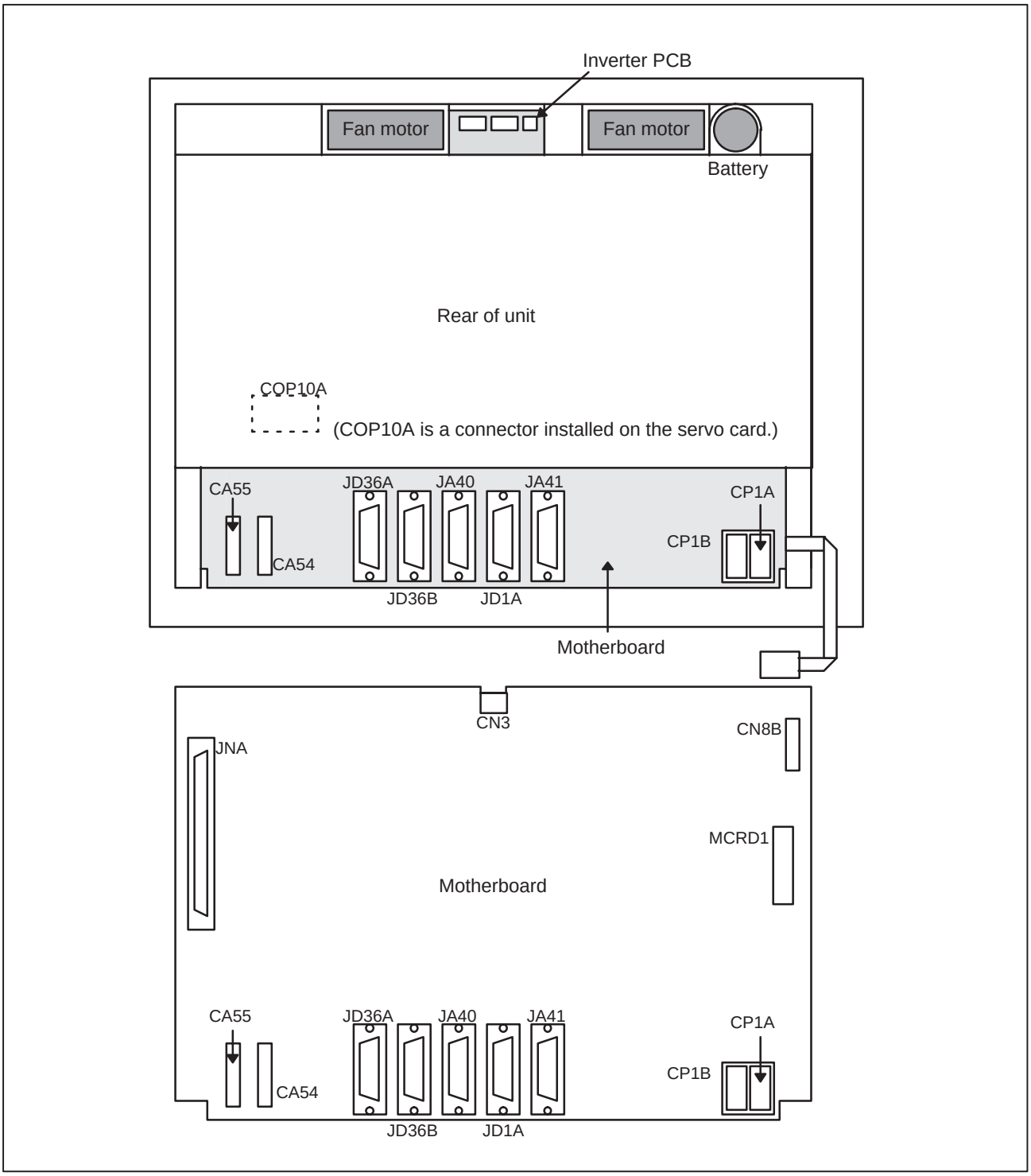
2.3 CONFIGURATION OF PRINTED CIRCUIT BOARD CONNECTORS AND CARDS

2.3.1 FS21*i* Motherboard

- **Specification**

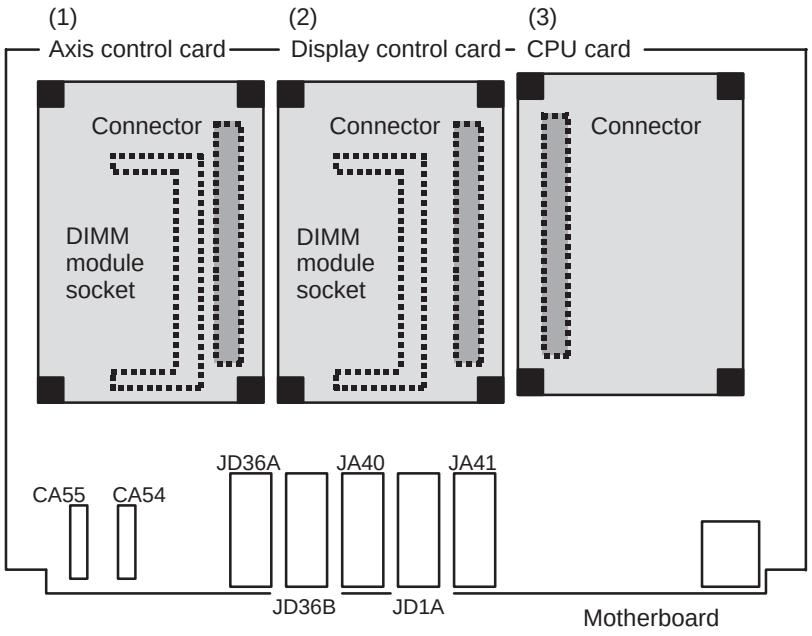
Name	Specification
Series 21*i* PMC–RA1	A20B–8100–0137
Series 21*i* PMC–RA5	A20B–8100–0136

- **Connector mounting location**



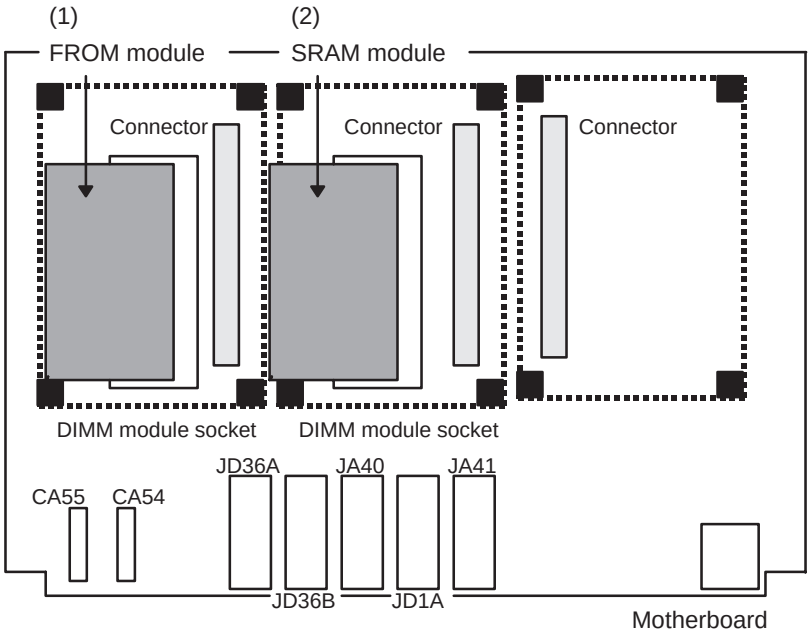
Connector number	Application
COP10A	Servo motor (FSSB)
CA55	MDI
CA54	Servo check
JD36A	RS–232C serial port
JD36B	RS–232C serial port
JA40	Analog output/high–speed DI
JD1A	I/O link
JA41	Serial spindle/position coder
CP1B	DC24V–OUT
CP1A	DC24V–IN
JNA	F–bus interface
CN8B	Video signal interface
MCRD1	PCMCIA interface

● Card mounting location



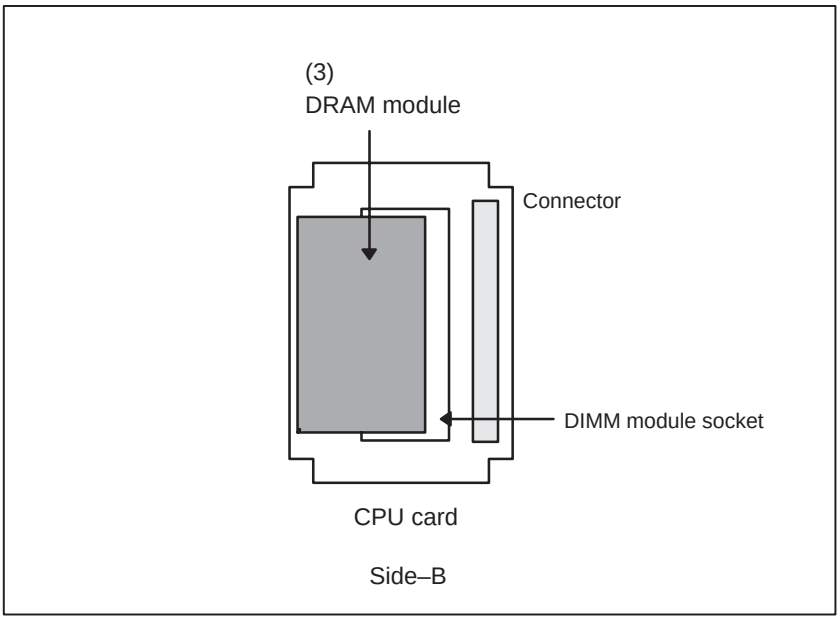
No.	Name	Specification	Function	Remarks
(1)	Axis control card	A20B–3300–0030	Axis control	4 axes
		A20B–3300–0031		2 axes
(2)	Display control card	A20B–3300–0020	Text display/ graphic display	10.4”, color
		A20B–3300–0021		8.4”, color
		A20B–3300–0023		9.5”, monochrome
		A20B–3300–0024		7.2”,monochrome, with graphics
		A20B–3300–0025		7.2”,monochrome, without graphics
(3)	CPU card	A20B–3300–0026	CNC control	9.5”,monochrome, without graphics
		A20B–3300–0070		486DX2

- **DIMM module mounting location**



No.	Name	Specification	Function	Remarks
(1)	FROM module	A20B–3900–0012	CNC system Servo system	8M
		A20B–3900–0013		6M
		A20B–3900–0014		4M
		A20B–3900–0015		2M
(2)	SRAM module	A20B–3900–0052	SRAM for the system	512K
		A20B–3900–0053		256K

- **DIMM module mounting location (continued)**



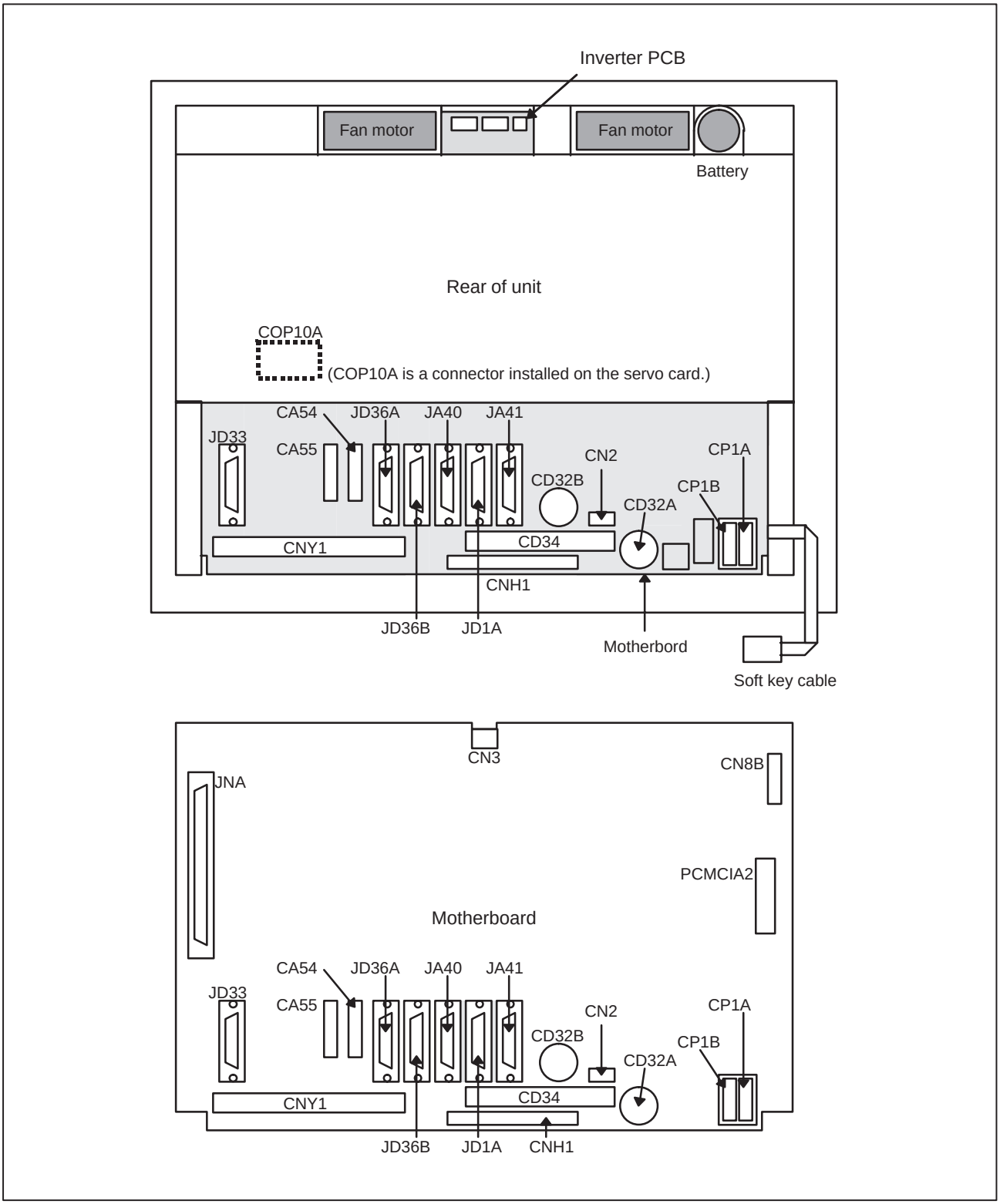
No.	Name	Specification	Function	Remarks
(3)	DRAM module	A20B–3900–0041	CNC system RAM	8M
		A20B–3900–0042		4M
		A20B–3900–0030		2M

2.3.2 FS210*i* Motherboard with the PC Function

- **Specification**

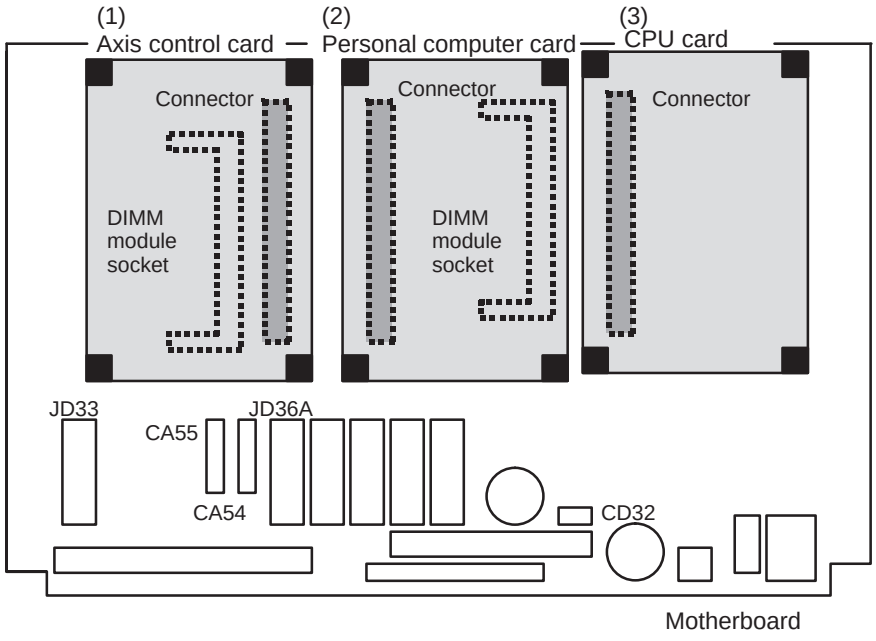
Name	Specification
Series 210*i* PMC–RA1	A20B–8100–0148
Series 210*i* PMC–RA5	A20B–8100–0147

- **Connector mounting location**



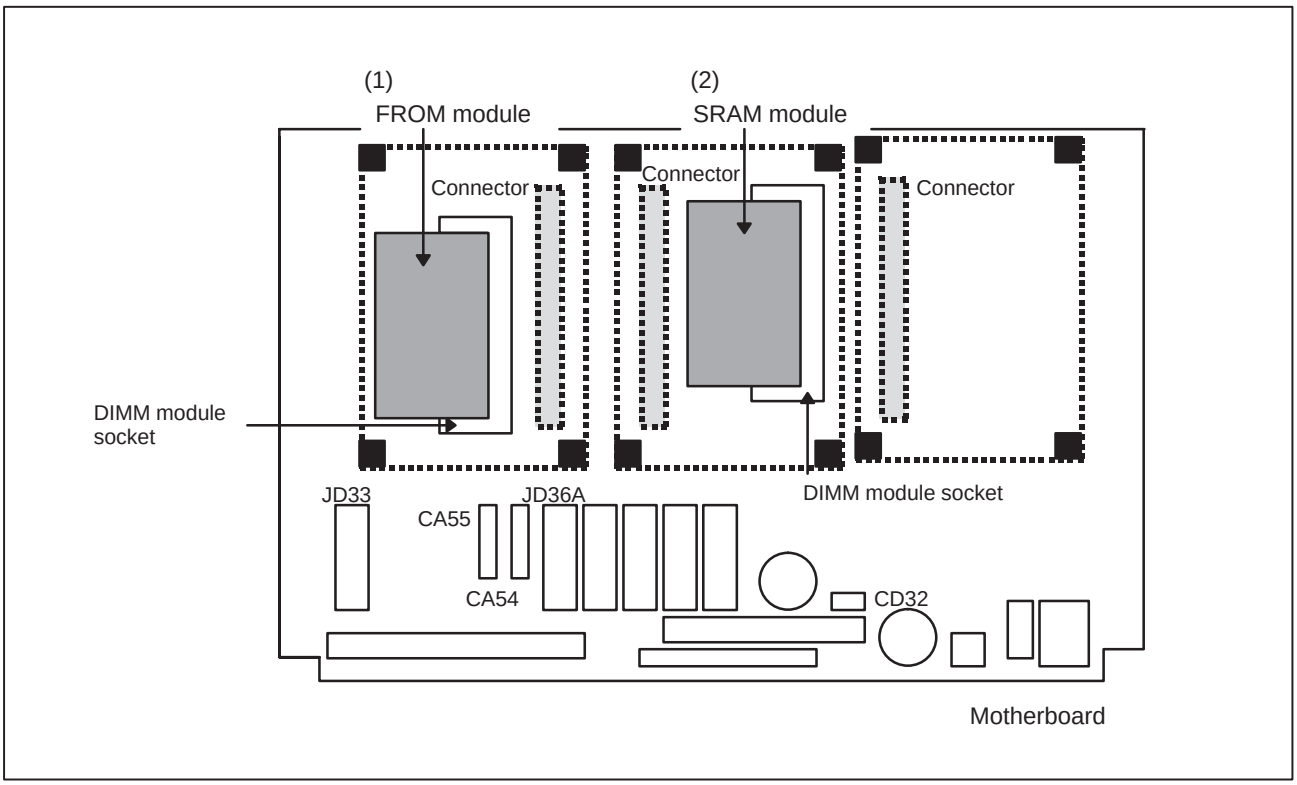
Connector number	Application
JD33	RS–232C on the PC side
COP10A	Servo motor (FSSB)
CA55	MDI
CA54	Servo check
JD36A	RS–232C serial port
JD36B	RS–232C serial port
JA40	Analog output/high–speed DI
JD1A	I/O link
JA41	Serial spindle/position coder
CP1B	DC24V–OUT
CP1A	DC24V–IN
CNY1	PC expansion
CD34	FDD signal
CNH1	HDD
CN2	FDD power supply
CD32A	Full keyboard
CD32B	Mouse
JNA	F–bus interface
CN8B	Video signal interface
PCMCIA2	PCMCIA interface

● Card mounting location



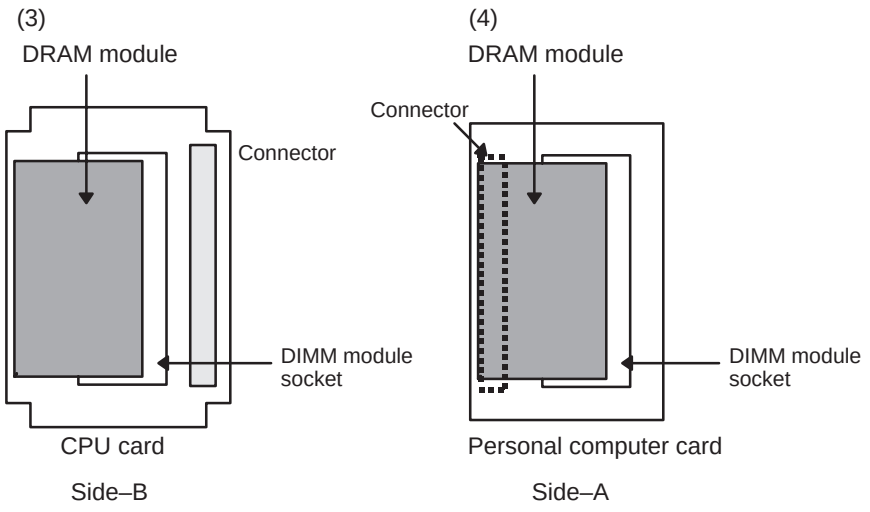
No.	Name	Specification	Function	Remarks
(1)	Axis control card	A20B–3300–0030	Axis control	4 axes
		A20B–3300–0031		2 axes
(2)	Personal computer card	A15L–0001–0052 #A	Personal computer function	486DX2
(3)	CPU card	A20B–3300–0070	CNC control	486DX

- **DIMM module mounting location**



No.	Name	Specification	Function	Remarks
(1)	FROM module	A20B–3900–0012	CNC system Servo system	8M
		A20B–3900–0013		6M
		A20B–3900–0014		4M
		A20B–3900–0015		2M
(2)	SRAM module	A20B–3900–0052	SRAM for the system	512K
		A20B–3900–0053		256K

- **DIMM module mounting location (continued)**



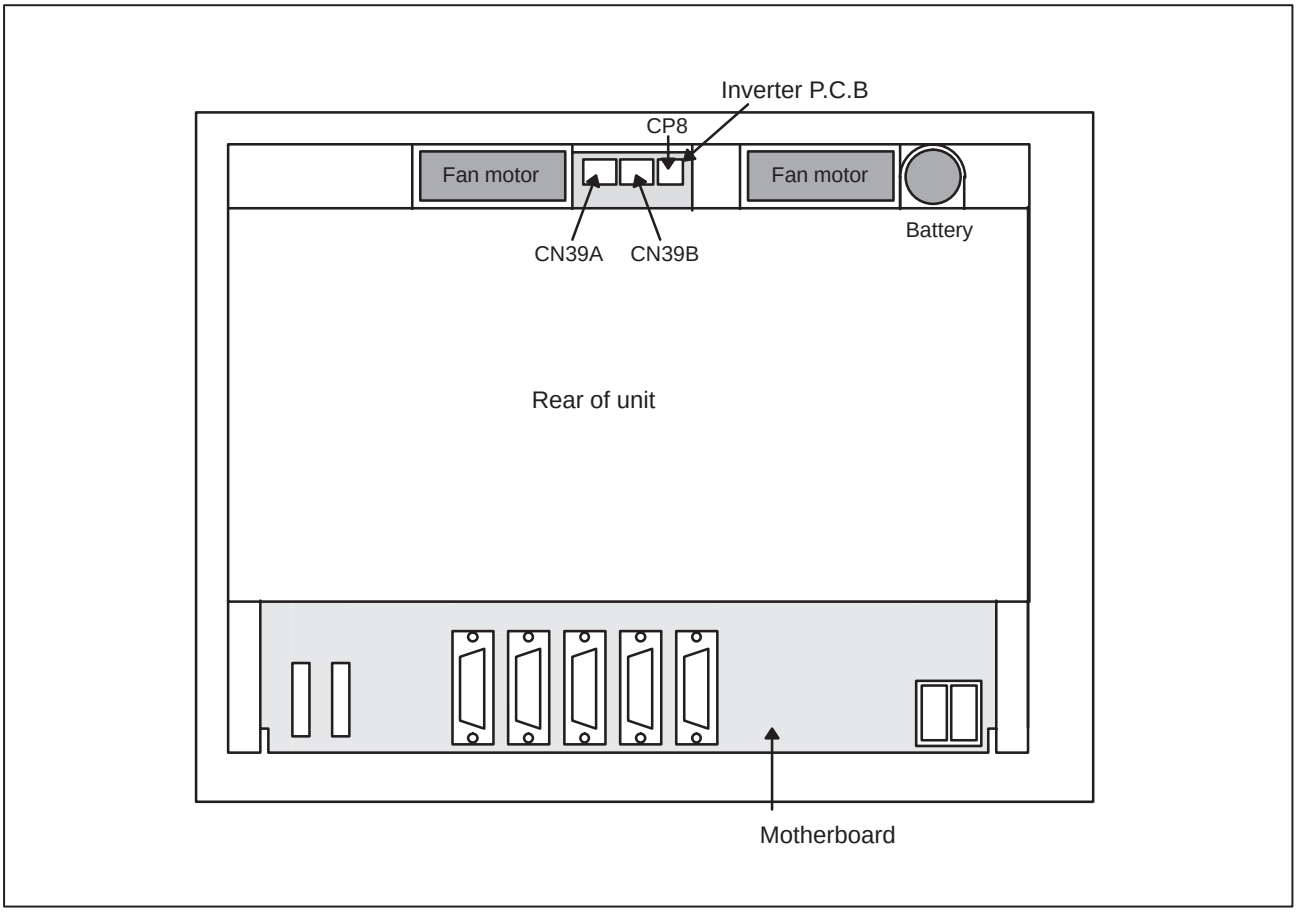
No.	Name	Specification	Function	Remarks
(3)	DRAM module	A20B–3900–0041	CNC system RAM	8M
		A20B–3900–0042		4M
		A20B–3900–0030		2M
(4)	DRAM module	A76L–0500–0008		8M
		A76L–0500–0009		16M

2.3.3 Inverter P.C.B

- **Specification**

Name		Specification
Inverter	10.4”, color, for 2 slots	A20B–2002–0500
	8.4”, color, for 2 slots	A20B–2002–0501
	7.2”, 9.5”, monochrome, for 2 slots	A20B–2002–0480

- **Connector mounting location**



- **Connector mounting location (single printed circuit board)**

Connector number	Application
CN39A	Power supply for fans
CN39B	
CP8	Battery
CP1	Power supply for LCD backlight
CN3	Power supply for inverter PCB

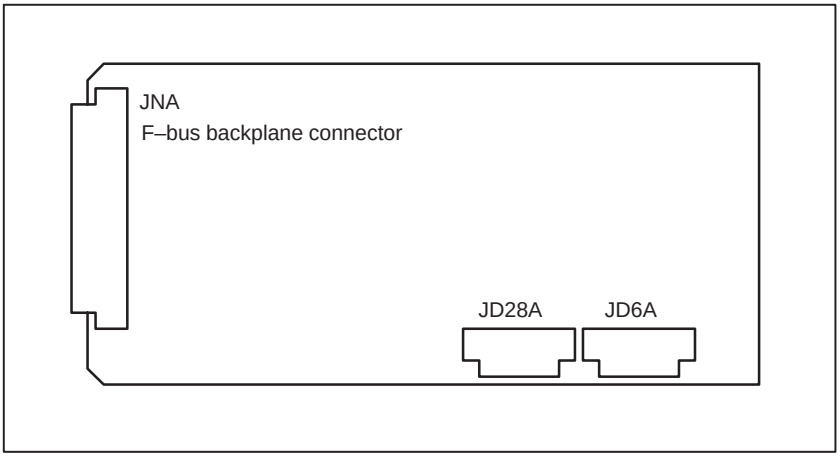
2.3.4 Serial Communication Board

- **Specification**

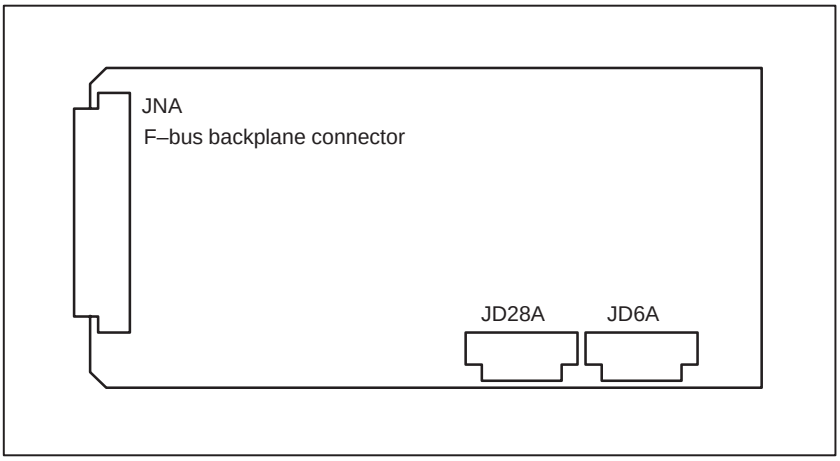
Name		Specification
Serial communication board A	Remote buffer/DNC2	A20B–8100–0152
Serial communication board B	DNC1	A20B–8100–0153

- **Connector mounting location**

1) Serial communication board A
Remote buffer/DNC2



2) Serial communication board B
DNC1



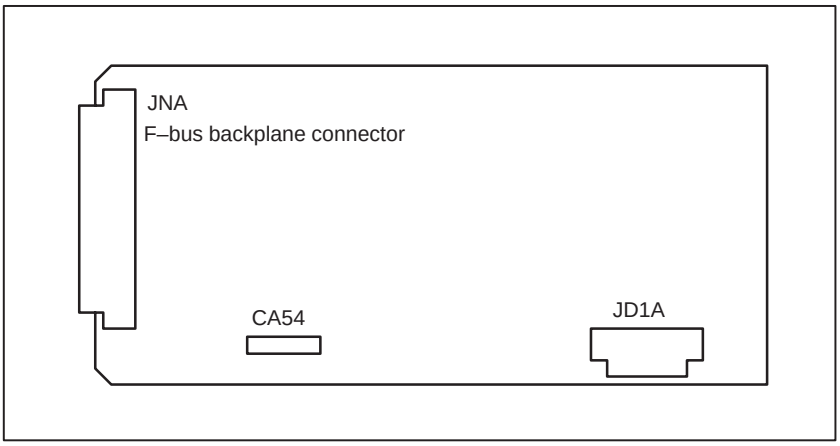
Connector number	Application
JD28A	RS–232C serial port
JD6A	RS–422 serial port

2.3.5 Loader Control Board

- **Specification**

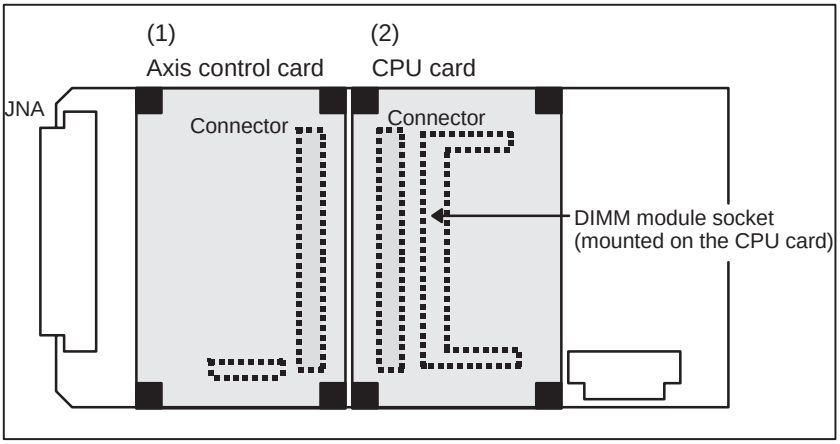
Name	Specification
Loader control board	A20B–8100–0190

- **Connector mounting location**



Connector number	Application
CA54	Servo check
JD1A	I/O link

- **Card mounting location**



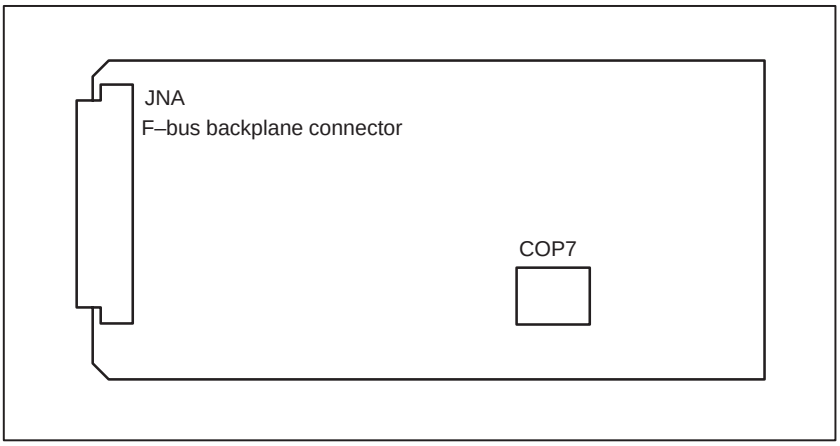
No.	Name	Specification	Function	Remarks
(1)	Axis control card	A20B–3300–0030	Axis control	4 axes
		A20B–3300–0031		2 axes
(2)	CPU card	A20B–3300–0070	CNC control	486DX2

2.3.6 HSSB Interface Board

- **Specification**

Name	Specification
HSSB interface board	A20B–8001–0640

- **Connector mounting location**



Connector number	Application
COP7	High–speed serial bus interface

- **Card mounting location**

No card is mounted on the HSSB interface board.

2.4 LIST OF UNITS AND PRINTED CIRCUIT BOARDS

2.4.1 Basic Unit

Model	Name		Drawing number	Remarks	
FS21*i*/ 210*i*/ (With HSSB)	Basic unit A1, 8.4”, color	Without slots	A02B–0247–B501	With soft keys (5+2)	RA1
	Basic unit A2, 8.4”, color	With 2 slots	A02B–0247–B502	With soft keys (5+2)	RA1
	Basic unit A3, 10.4”, color	Without slots	A02B–0247–B511	With soft keys (10+2)	RA1
	Basic unit A4, 10.4”, color	With 2 slots	A02B–0247–B512	With soft keys (10+2)	RA1
	Basic unit A5, 7.2”, monochrome	Without slots	A02B–0247–B531	With soft keys (5+2)	RA1
	Basic unit A6, 7.2”, monochrome	With 2 slots	A02B–0247–B532	With soft keys (5+2)	RA1
	Basic unit A7, 9.5”, monochrome	Without slots	A02B–0247–B541	With soft keys (10+2)	RA1
	Basic unit A8, 9.5”, monochrome	With 2 slots	A02B–0247–B542	With soft keys (10+2)	RA1
	Basic unit A11, 8.4”, color	Without slots	A02B–0247–B505	With soft keys (5+2)	RA5
	Basic unit A12, 8.4”, color	With 2 slots	A02B–0247–B506	With soft keys (5+2)	RA5
	Basic unit A13, 10.4”, color	Without slots	A02B–0247–B515	With soft keys (10+2)	RA5
	Basic unit A14, 10.4”, color	With 2 slots	A02B–0247–B516	With soft keys (10+2)	RA5
	Basic unit A15, 7.2”, monochrome	Without slots	A02B–0247–B535	With soft keys (5+2)	RA5
	Basic unit A16, 7.2”, monochrome	With 2 slots	A02B–0247–B536	With soft keys (5+2)	RA5
	Basic unit A17, 9.5”, monochrome	Without slots	A02B–0247–B545	With soft keys (10+2)	RA5
	Basic unit A18, 9.5”, monochrome	With 2 slots	A02B–0247–B546	With soft keys (10+2)	RA5
FS210*i* with PC function	Basic unit B1, 10.4”, color	Without slots	A02B–0247–B571	Without soft keys	RA1
	Basic unit B2, 10.4”, color	With 2 slots	A02B–0247–B572	Without soft keys	RA1
	Basic unit B3, 10.4”, color	Without slots	A02B–0247–B551	With soft keys (10+2)	RA1
	Basic unit B4, 10.4”, color	With 2 slots	A02B–0247–B552	With soft keys (10+2)	RA1
	Basic unit B5, 10.4”, color	Without slots	A02B–0247–B561	With touch panel	RA1
	Basic unit B6, 10.4”, color	With 2 slots	A02B–0247–B562	With touch panel	RA1
	Basic unit B11, 10.4”, color	Without slots	A02B–0247–B575	Without soft keys	RA5
	Basic unit B12, 10.4”, color	With 2 slots	A02B–0247–B576	Without soft keys	RA5
	Basic unit B13, 10.4”, color	Without slots	A02B–0247–B555	With soft keys (10+2)	RA5
	Basic unit B14, 10.4”, color	With 2 slots	A02B–0247–B556	With soft keys (10+2)	RA5
	Basic unit B15, 10.4”, color	Without slots	A02B–0247–B565	With touch panel	RA5
	Basic unit B16, 10.4”, color	With 2 slots	A02B–0247–B566	With touch panel	RA5

2.4.2 MDI Unit

Model	Name		Drawing number	Remarks
FS21*i*	Separate–type MDI, small keys For 8.4”/7.2” LCD (horizontal type)	T	A02B–0236–C120#TBR	English keys
			A02B–0236–C120#TBS	Symbolic keys
		M	A02B–0236–C120#MBR	English keys
			A02B–0236–C120#MBS	Symbolic keys
	Separate–type MDI, standard keys For 8.4”/7.2” LCD (horizontal/vertical type)	T	A02B–0236–C121#TBR	English keys
			A02B–0236–C121#TBS	Symbolic keys
		M	A02B–0236–C121#MBR	English keys
			A02B–0236–C121#MBS	Symbolic keys
	Separate–type MDI, standard keys For 10.4”/9.5” LCD (horizontal type)	T	A02B–0236–C125#TBR	English keys
			A02B–0236–C125#TBS	Symbolic keys
		M	A02B–0236–C125#MBR	English keys
			A02B–0236–C125#MBS	Symbolic keys
	Separate–type MDI, standard keys For 10.4”/9.5” LCD (vertical type)	T	A02B–0236–C126#TBR	English keys
			A02B–0236–C126#TBS	Symbolic keys
		M	A02B–0236–C126#MBR	English keys
			A02B–0236–C126#MBS	Symbolic keys
	Separate–type MDI for CAP–II For 10.4”/9.5” LCD (horizontal type)	T	A02B–0236–C125#TFBR	English keys
			A02B–0236–C125#TFBS	Symbolic keys
	Separate–type MDI, standard keys For 10.4”/9.5” LCD (vertical type)	T	A02B–0236–C126#TFBR	English keys
			A02B–0236–C126#TFBS	Symbolic keys
FS210*i*	Separate–type MDI, standard keys For 10.4” LCD (vertical type)	T	A02B–0236–C127#TBR	English keys
			A02B–0236–C127#TBS	Symbolic keys
		M	A02B–0236–C127#MBR	English keys
			A02B–0236–C127#MBS	Symbolic keys
	Separate–type FA full keyboard For 10.4” LCD (vertical type)		A02B–0236–C130#EC	English keys
			A02B–0236–C130#JC	Japanese keys

2.4.3 Printed Circuit Boards of the Control Unit

Type	Name		Drawing number	Remarks
Master PCB	Motherboard	Without personal computer	A20B–8100–0136	21*i* PMC–RA5
			A20B–8100–0137	21*i* PMC–RA1
		With personal computer	A20B–8100–0147	210*i* PMC–RA5
			A20B–8100–0148	210*i* PMC–RA1
Card PCB	CPU card		A20B–3300–0070	486DX2
	Display control card	A	A20B–3300–0020	10.4”, color
		B	A20B–3300–0021	8.4”, color
		C	A20B–3300–0023	9.5”, monochrome
		D	A20B–3300–0024	7.2”, monochrome, graphic
		E	A20B–3300–0025	7.2”, monochrome
		F	A20B–3300–0026	9.5”, monochrome
	Axis control card		A20B–3300–0030	4 axes
			A20B–3300–0031	2 axes
	Personal computer card		A15L–0001–0052#A	486DX2
DIMM module	DRAM module		A20B–3900–0041	8M
			A20B–3900–0042	4M
			A20B–3900–0030	2M
	SRAM module		A20B–3900–0052	512K
			A20B–3900–0053	256K
	FROM module		A20B–3900–0012	8M
			A20B–3900–0013	6M
			A20B–3900–0014	4M
			A20B–3900–0015	2M

Type	Name		Drawing number	Remarks
Option PCB	Serial communication board	A	A20B–8100–0152	Remote buffer/ DNC2
		B	A20B–8100–0153	DNC1
	Loader control board		A20B–8100–0190	
	HSSB interface board (on CNC side)		A20B–8001–0640	
Back panel	Back panel		A20B–2100–0220	2 slots
Distributed I/O	I/O card for operator's panel	Matrix DI	A20B–2002–0470	
		One to one DI	A20B–2002–0520	With MPG
			A20B–2002–0521	Without MPG
	I/O card for connector panel	Basic	A20B–2100–0150	
		Expansion	A20B–2002–0400	With manual pulsegenerator
			A20B–2002–0401	Withoutmanual pulsegenerator
Others	Inverter	For units with no slots/ 2 slots	A20B–2002–0500	10.4", color
			A20B–2002–0501	8.4", color
			A20B–2002–0480	Monochrome
	External I/O board for loader control		A20B–2002–0620	
	Touch pad control board		A20B–8001–0620	

2.4.4 Others

Name	Drawing number	Remarks
Linear Scale interface unit (basic 4 axes)	A02B–0236–C201	

2.5 REPLACING THE MOTHERBOARD

WARNING

Only those personnel who have received approved safety and maintenance training may perform this replacement work.

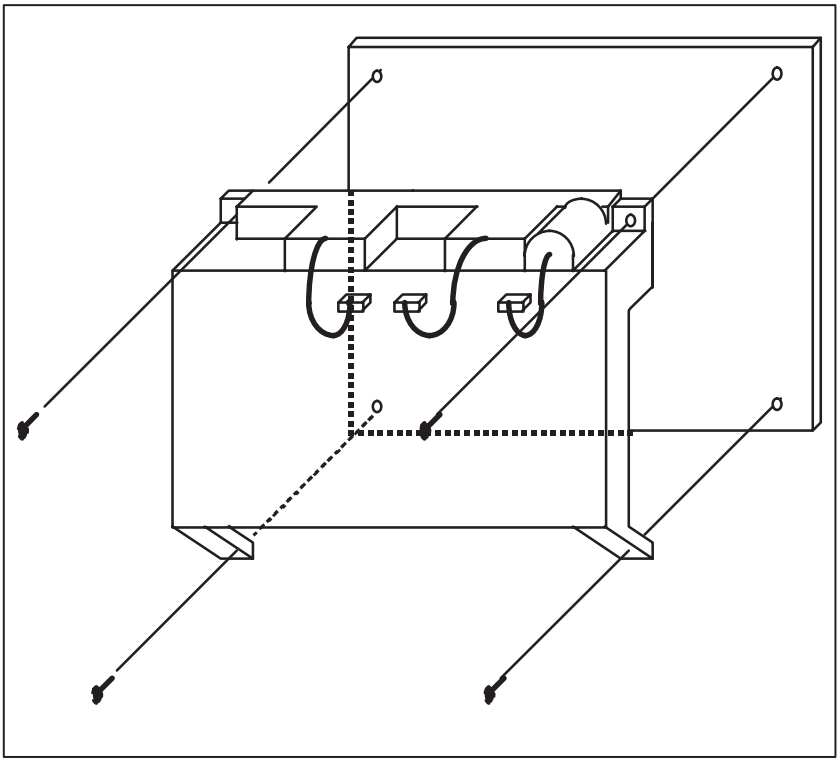
When opening the cabinet and replacing the board, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover). Touching the uncovered high–voltage circuits presents an extremely dangerous electric shock hazard.

CAUTION

Before starting replacement work, back up the contents (such as parameters and programs) of the SRAM memory of the CNC. Otherwise, the contents of the SRAM memory may be lost during replacement work.

- **Replacement procedure**

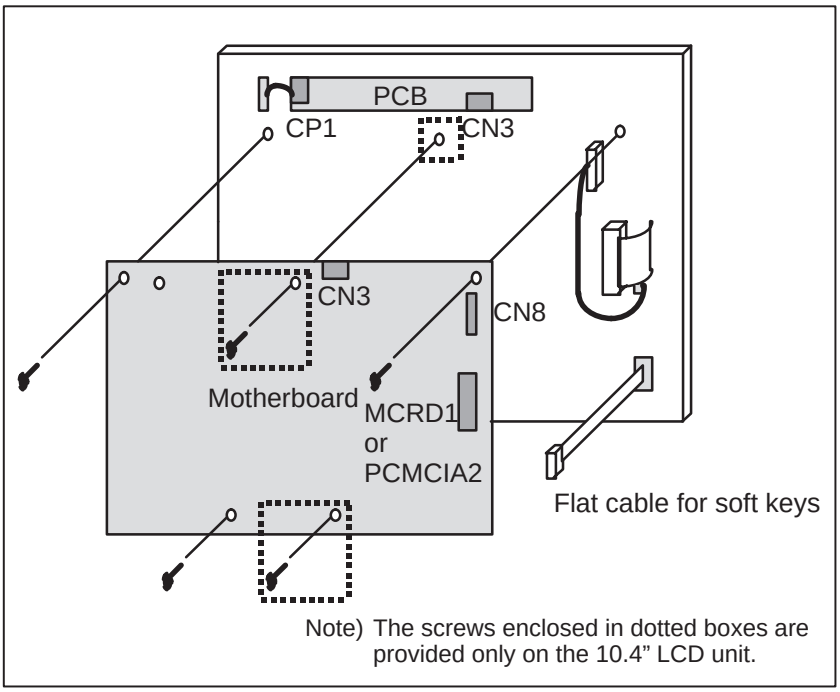
1) Unplug the connectors for the fans and memory backup battery from the top of the CNC unit, then remove the yellow cover.



CAUTION

With a CNC unit that has an indicator for the touch pad, the connectors CN1 and CD37 connected to the left side of the unit, as viewed from the rear of the unit, must be unplugged before removing the yellow cover.

2) Unplug the connectors MCRD1 (or PCMCIA2), CN3, and CN8 from the printed circuit board, then replace the motherboard.



Note) The screws enclosed in dotted boxes are provided only on the 10.4” LCD unit.

2.6 MOUNTING AND DEMOUNTING CARD PCBS

WARNING

Only those personnel who have received approved safety and maintenance training may perform this replacement work.

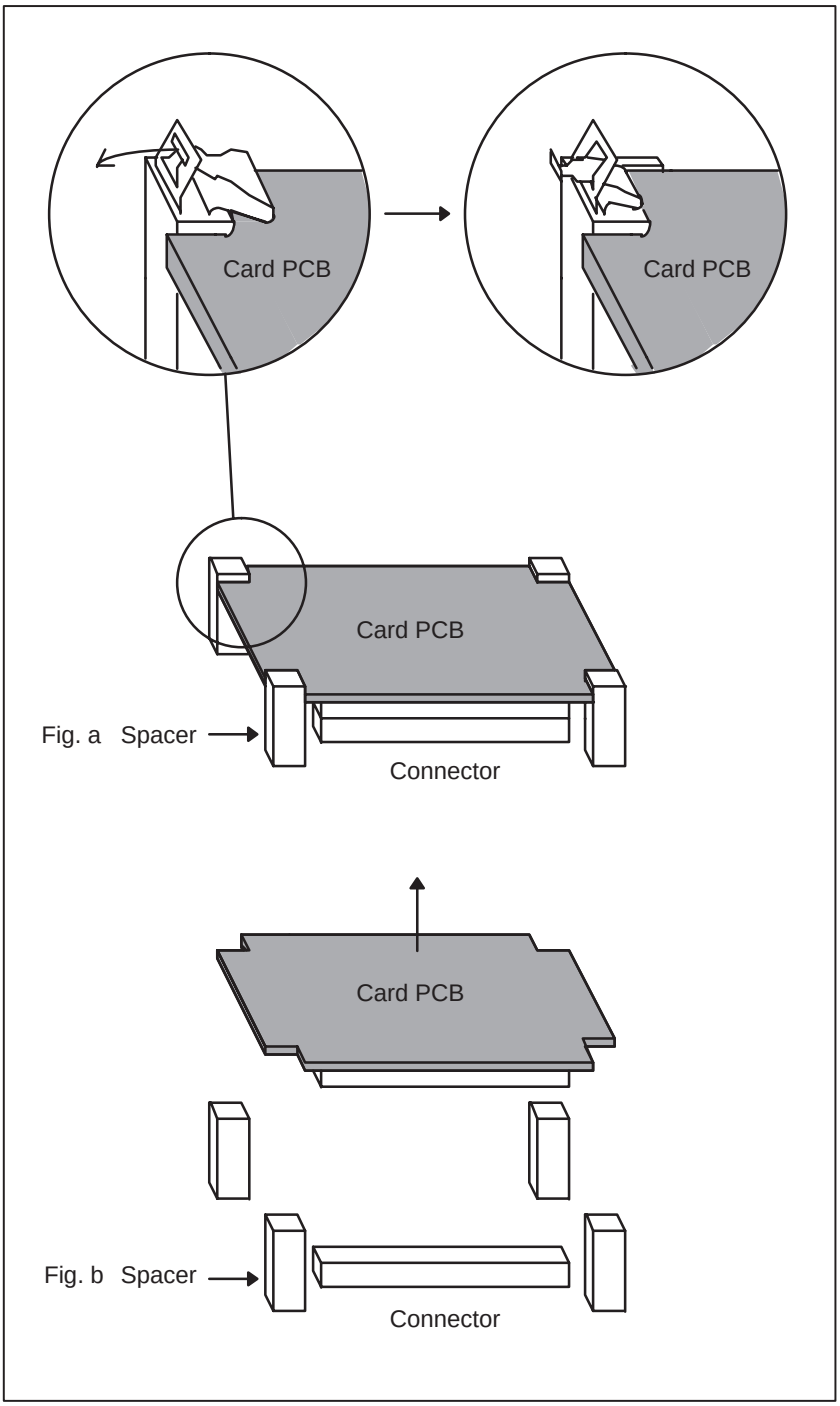
When opening the cabinet and replacing a card PCB, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover). Touching the uncovered high–voltage circuits presents an extremely dangerous electric shock hazard.

CAUTION

Before starting replacement work, back up the contents (such as parameters and programs) of the SRAM memory of the CNC. Otherwise, the contents of the SRAM memory may be lost during replacement work.

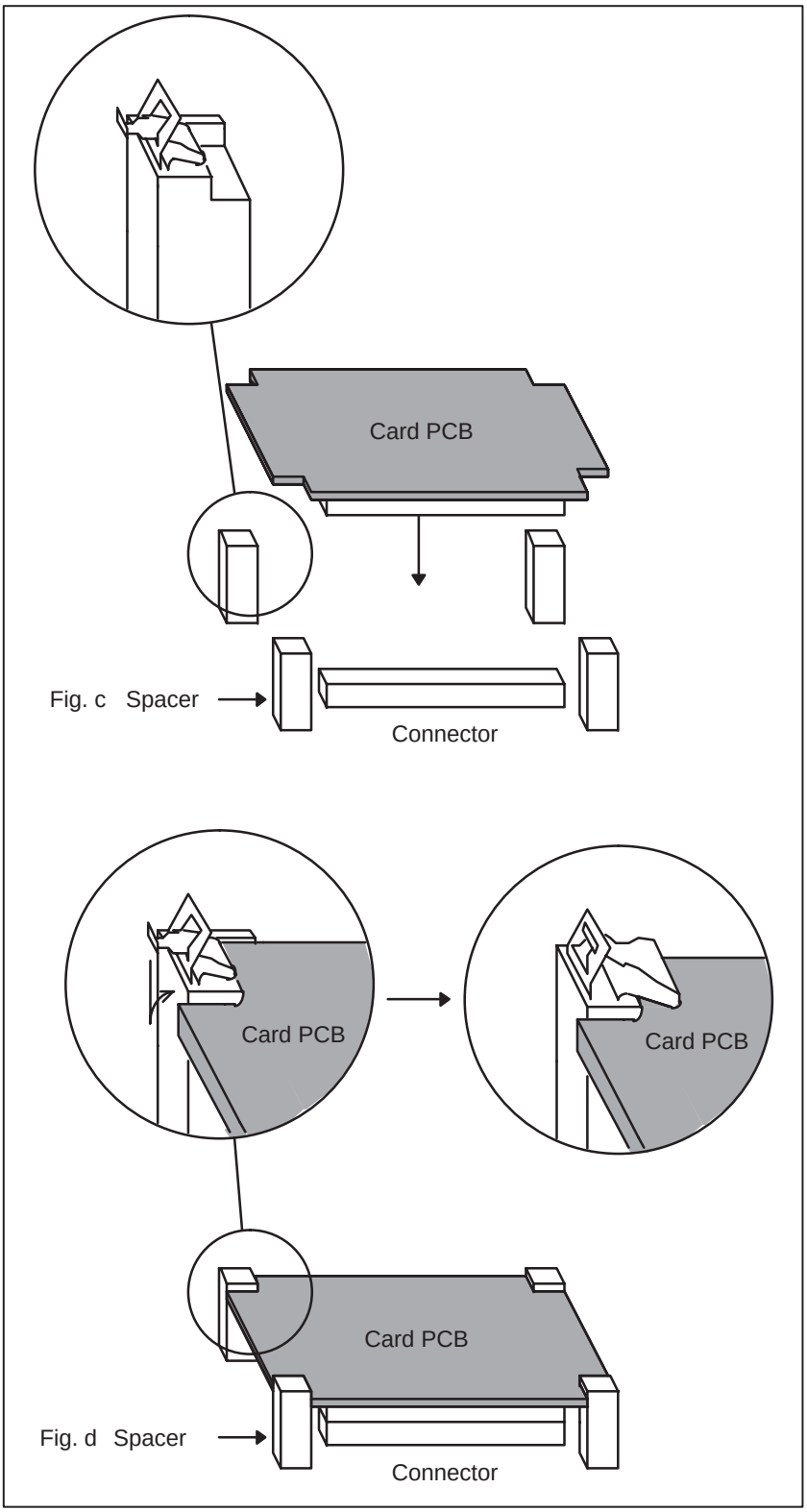
2.6.1 Demounting a Card PCB

1) Pull outward the claw of each of the four spacers used to secure the card PCB, then release each latch. (See Fig. a.)
2) Extract the card PCB upward. (See Fig. b.)



2.6.2 Mounting a Card PCB

1) Check that the claw of each of the four spacers is latched outward, then insert the card PCB into the connector. (See Fig. c.)
2) Push the claw of each spacer downward to secure the card PCB. (See Fig. d.)



2.7 MOUNTING AND DEMOUNTING DIMM MODULES

WARNING

Only those personnel who have received approved safety and maintenance training may perform this replacement work.

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

CAUTION

Before starting replacement work, back up the contents (such as parameters and programs) of the SRAM memory of the CNC. Otherwise, the contents of the SRAM memory may be lost during replacement work.

Before replacing an SRAM module, be sure to back up the contents of the SRAM module.

2.7.1 Demounting a DIMM Module

1) Open the claw of the socket outward. (See Fig. a.)
2) Extract the module slantly upward. (See Fig. b.)

2.7.2 Mounting a DIMM module

1) Insert the module slantly into the module socket, with side B facing upward. (See Fig. b.)
2) Push the module downward until it is locked. (See Fig. c.)

Fig. a

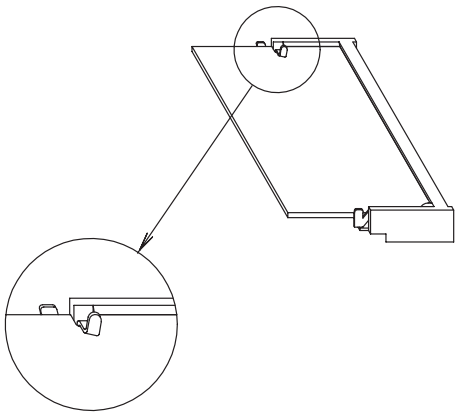


Fig. b

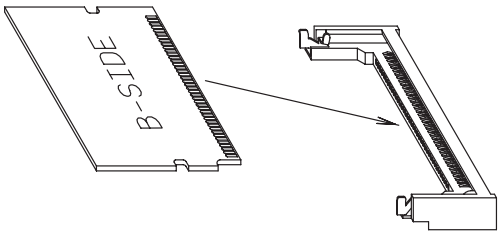
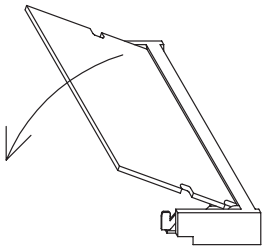


Fig. c



2.8 REPLACING FUSE ON CONTROL UNIT

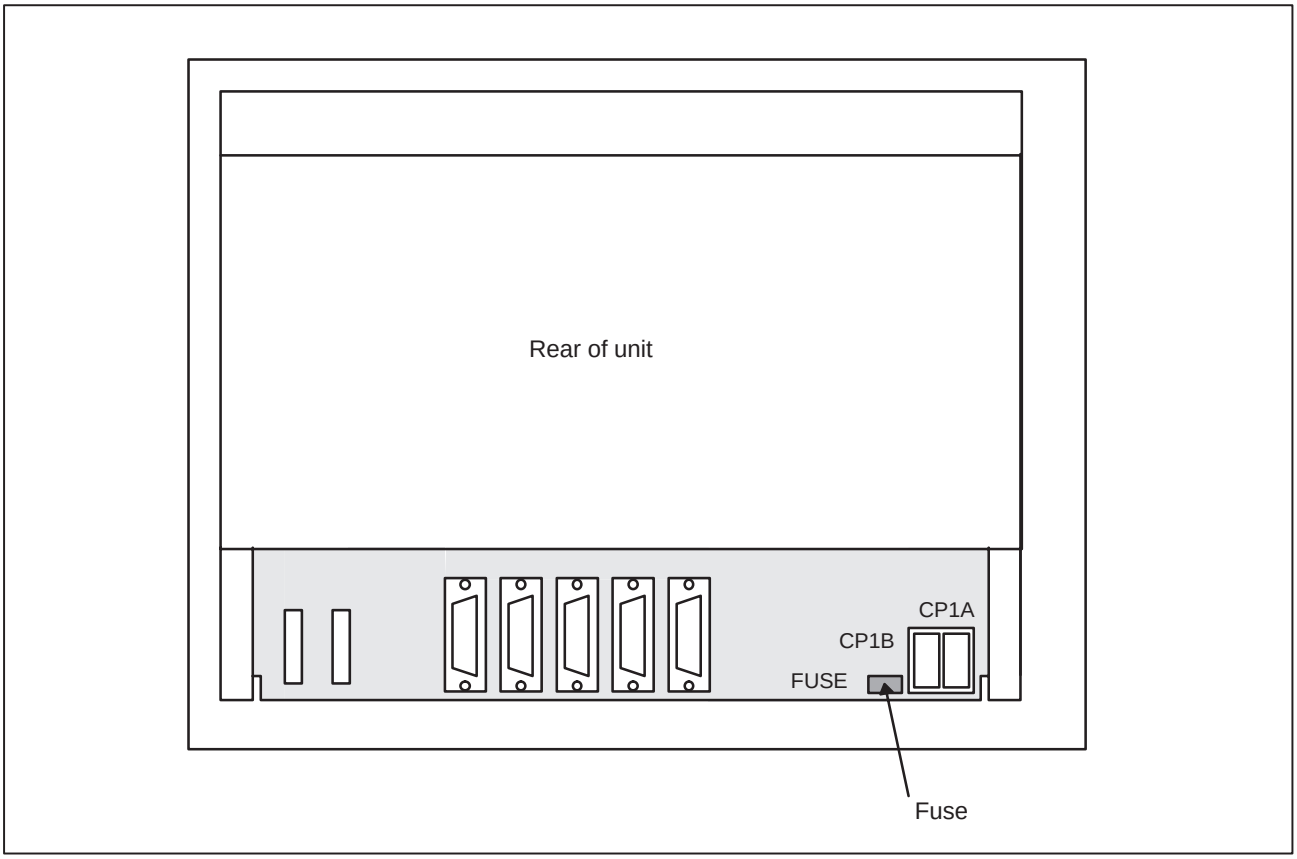
WARNING

Before replacing a blown fuse, locate and remove the cause of the blown fuse.

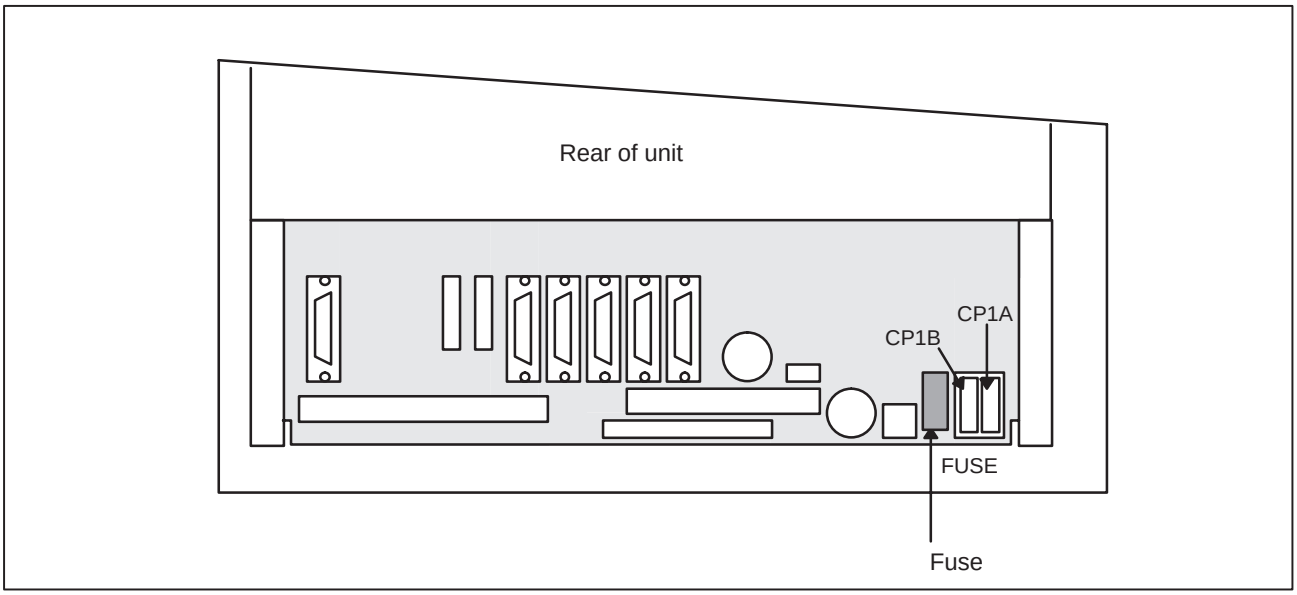
For this reason, only those personnel who have received approved safety and maintenance training may perform this replacement work.

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

- **Fuse mounting location of the FS21*i***



- **Fuse mounting location of the FS210*i* with the PC function**



- **Ordering codes of fuses**

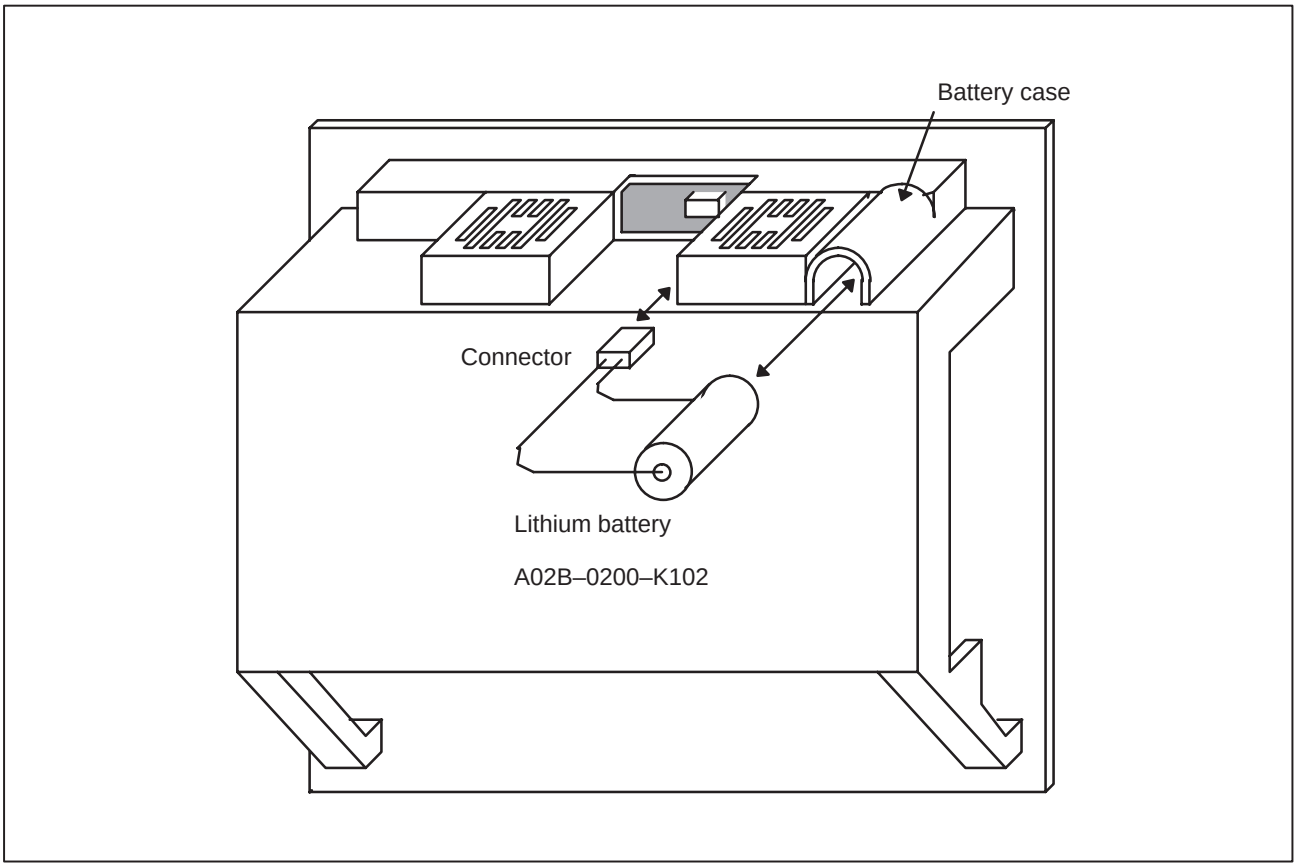
Basic unit	Ordering code	Rating	Parts specification
FS21*i*	A02B–0236–K100	5A	A60L–0001–0290#LM50
FS210*i*	A02B–0236–K101	7.5A	A60L–0001–0046#7.5

2.9 REPLACING BATTERY

- **Replacement procedure**

When a lithium battery is used
Prepare a new lithium battery (ordering code: A02B–0200–K102 (FANUC specification: A98L–0031–0012)).

1) Turn on the power to the CNC. After about 30 seconds, turn off the power.
2) Remove the old battery from the top of the CNC control unit.
   First, unplug the battery connector, then take the battery out of its case.
   The battery case of a control unit without option slots is located at the top end of the unit as shown in the figure of the previous page. The battery case of a control unit with 2 slots or 4 slots is located in the central area of the top of the unit (between fans).
3) Insert a new battery and reconnect the connector.



WARNING
Using other than the recommended battery may result in the battery exploding. Replace the battery only with the specified battery (A02B–0200–K102).

CAUTION

Steps 1) to 3) should be completed within 30 minutes (or within 5 minutes for the 210*i* with the PC function). Do not leave the control unit without a battery for any longer than the specified period. Otherwise, the contents of memory may be lost.

If steps 1) to 3) may not be completed within 30 minutes, save all contents of the CMOS memory to the memory card beforehand. Thus, if the contents of the CMOS memory are lost, the contents can be restored easily.

For the method of operation, refer to the maintenance manual.

Dispose used batteries as described below.

(1) Small quantities (several batteries)
Discharge the batteries and dispose of them as ordinary unburnable waste.

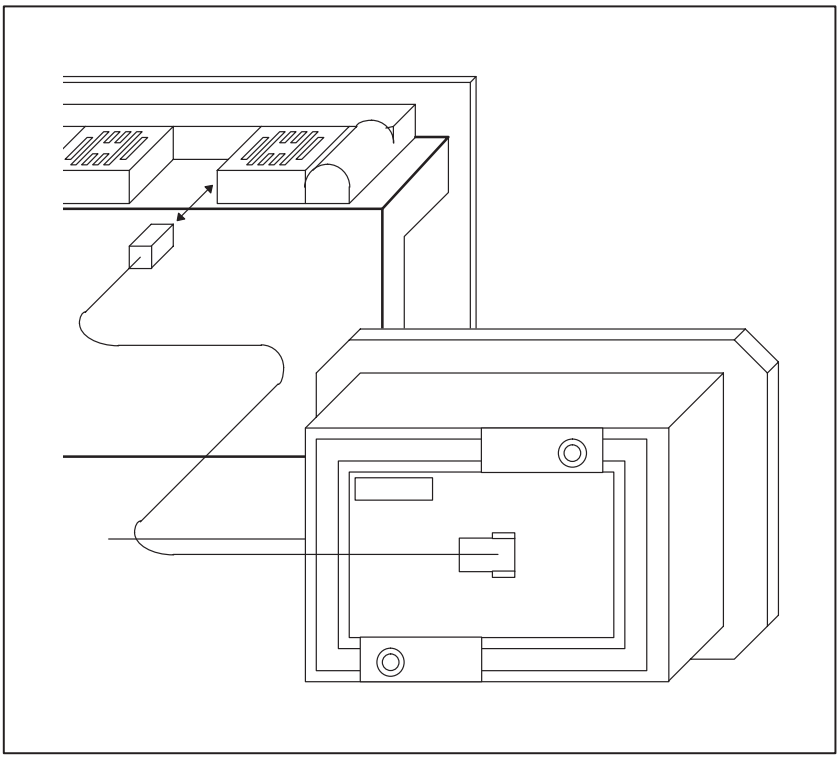
(2) Large quantities
Contact FANUC for the method of disposal.

When using commercial alkaline dry cells (size D)

- **Method of connection**

Power from the external batteries is supplied through the connector to which the lithium battery is connected.

The lithium battery, provided as standard, can be replaced with external batteries in the battery case (A02B–0236–C281) according to the battery replacement procedure described above.



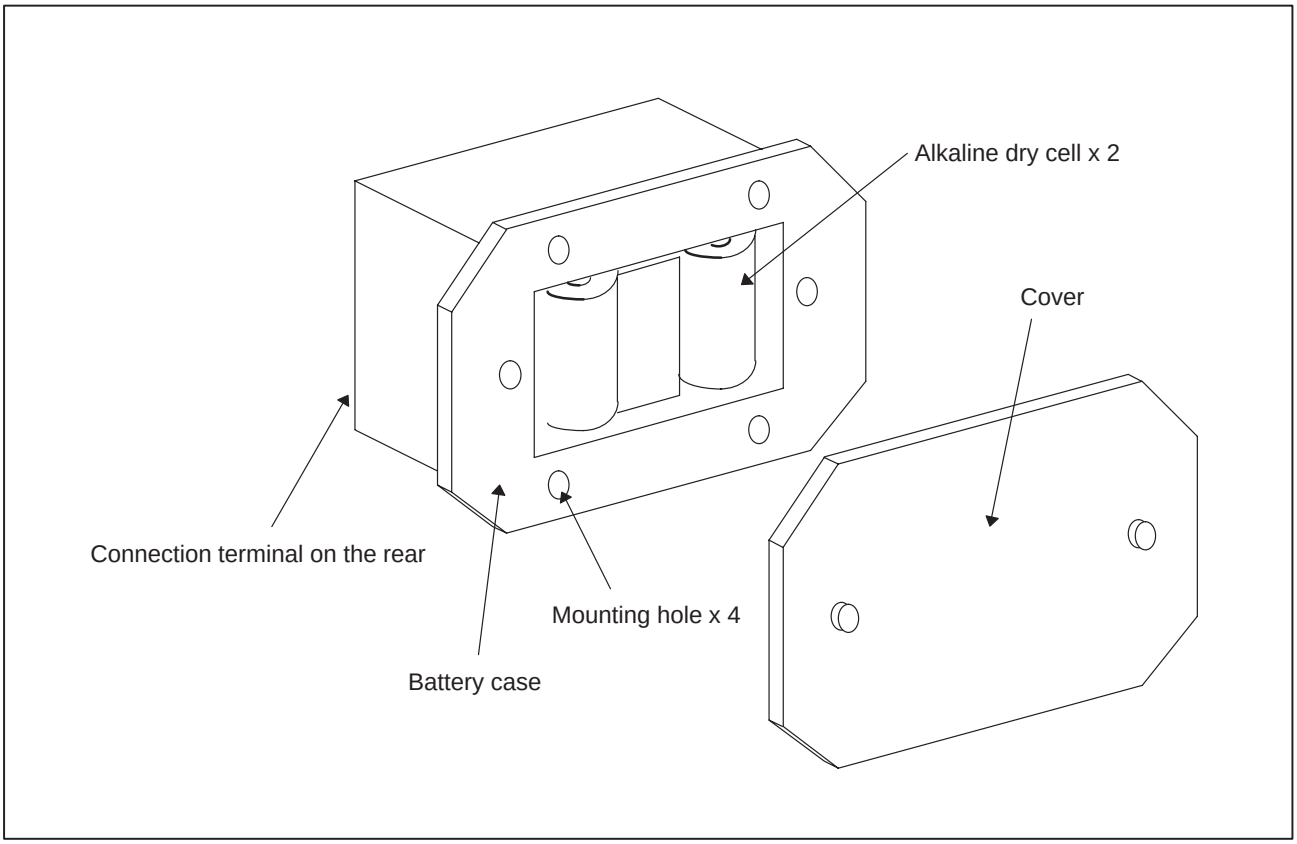
CAUTION

1 Install the battery case (A02B–0236–C281) in a location where the batteries can be replaced even when the power to the control unit is on.
2 The battery cable connector is attached to the control unit by means of a simple lock system. To prevent the connector from being disconnected due to the weight of the cable or tension within the cable, fix the cable section within 50 cm of the connector.

Replacing commercial alkaline dry cells (size D)

1) Prepare two alkaline dry cells (size D) commercially available.
2) Turn on the power to the Series 21*i*/210*i*.
3) Remove the battery case cover.
4) Replace the cells, paying careful attention to their orientation.
5) Reinstall the cover onto the battery case.

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



2.10 REPLACING FAN MOTORS

WARNING

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

- **Fan ordering information**

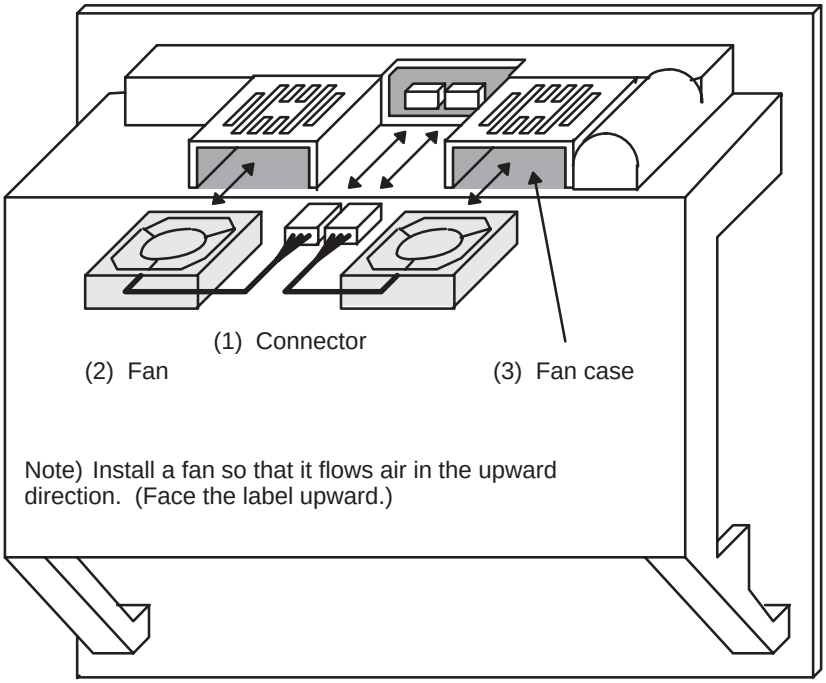
	Ordering code	Required quantity
For units with no expansion slots	A90L–0001–0441	2
For units with 2 expansion slots	A90L–0001–0423#105	2

Replacement procedure

- **For units with no expansion slots and units with 2 expansion slots**

1. Before replacing a fan motor, turn off the power to the CNC.
2. Unplug the connector of a fan motor to be replaced ((1) of Fig. a). The connector is latched. So, when unplugging the connector, hold down the latch placed at the lower part of the connector with a flat–blade screwdriver.
3. Detach the latch securing the fan motor, then demount the fan motor ((2) of Fig. a).
4. Insert a new fan motor into the fan case ((3) of Fig. a), then reconnect the connector.

Fig. a



Note) Install a fan so that it flows air in the upward direction. (Face the label upward.)

2.11 REPLACING LCD BACKLIGHT

WARNING

Only those personnel who have received approved safety and maintenance training may perform this replacement work.

When opening the cabinet and replacing a unit, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover).

Touching the uncovered high–voltage circuits presents an extremely dangerous electric shock hazard.

CAUTION

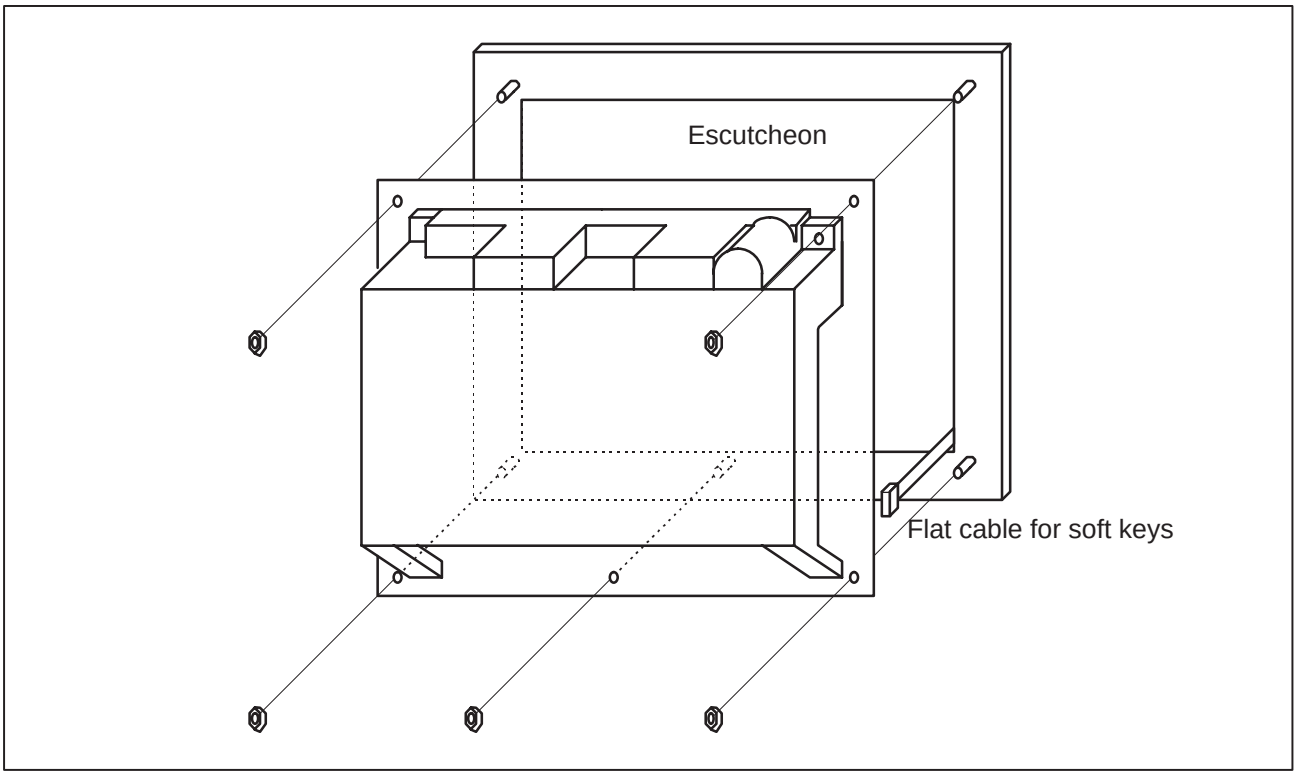
Before starting replacement work, back up the contents (such as parameters and programs) of the SRAM memory of the CNC. Otherwise, the contents of the SRAM memory may be lost during replacement work.

- **Backlight ordering information**

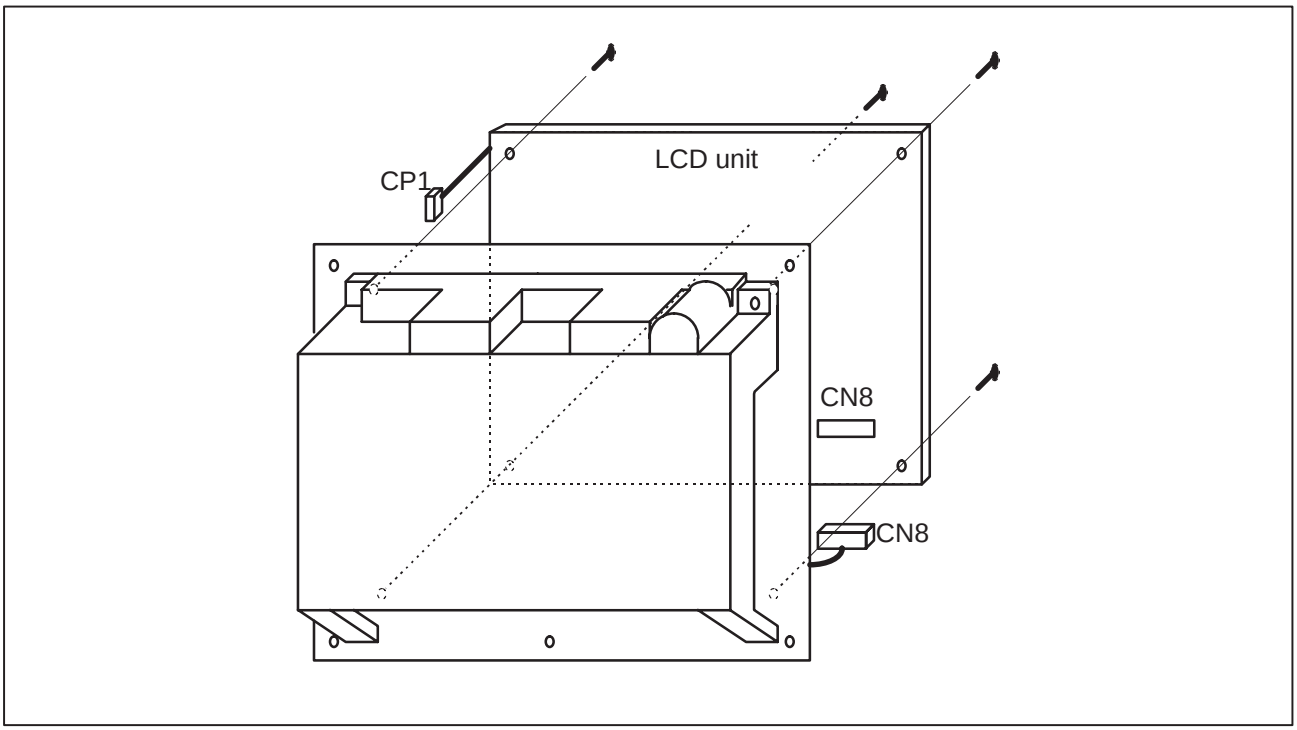
Backlight		Ordering code
For 7.2” LCD unit	Manufactured by Hitachi	A61L–0001–0142#BL
	Manufactured by Sharp	A61L–0001–0142#BLS
For 8.4” LCD unit		A61L–0001–0162#BL
For 9.5” LCD unit		A61L–0001–0154#BL
For 10.4” LCD unit		A61L–0001–0163#BL

- **Replacement procedure**

1) Detach the escutcheon from the CNC.

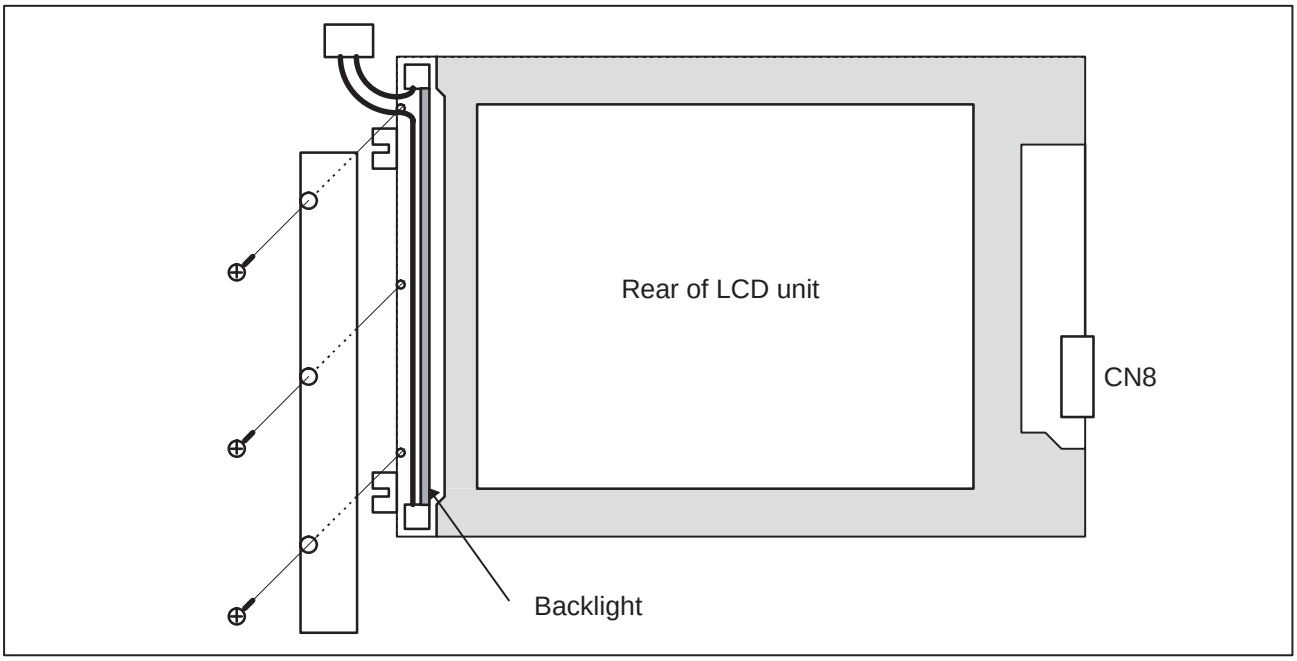


2) As shown below, unplug the connectors CP1 and CN8 to detach the LCD unit from the CNC unit.



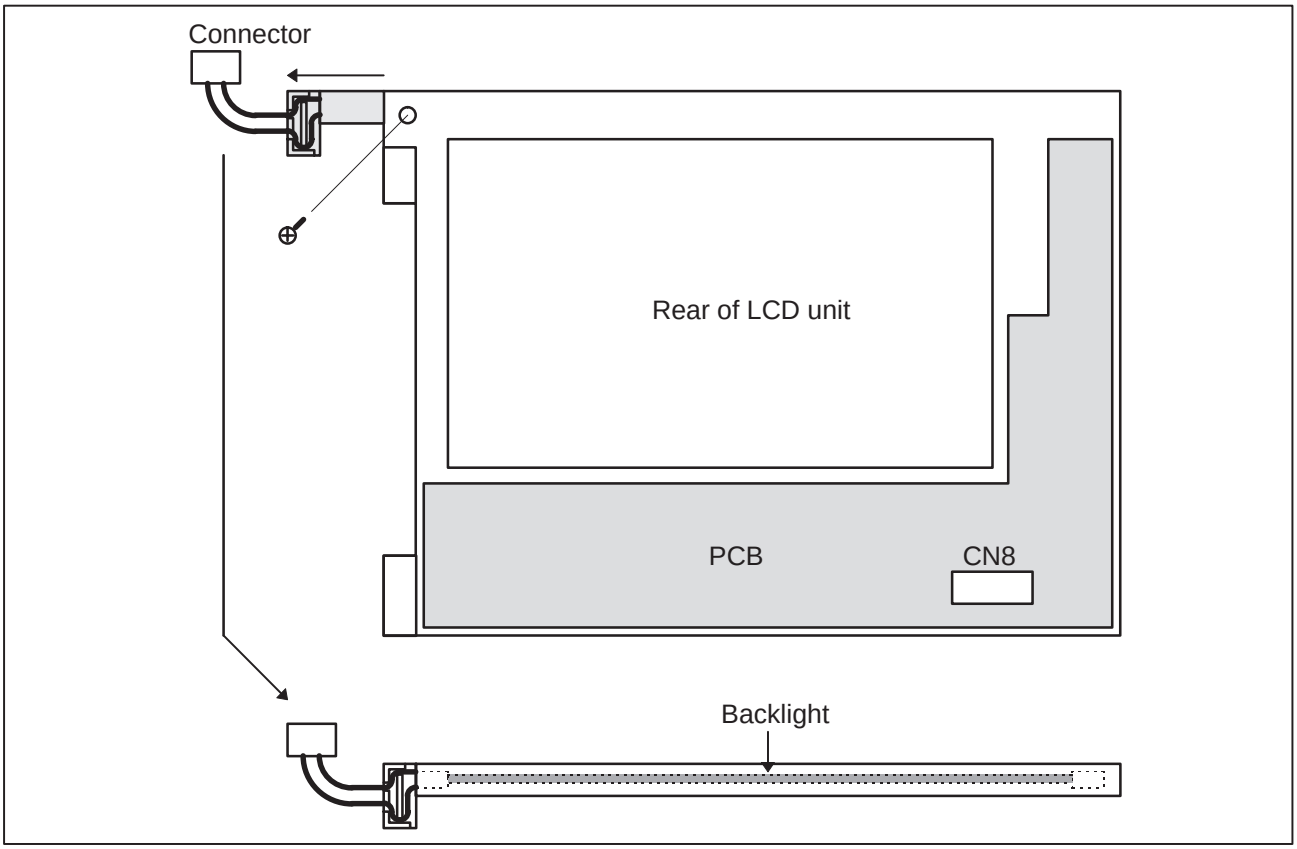
3)–1 For the 8.4” LCD unit (color)

Remove the three screws from the left part on the rear of the LCD unit, and remove the cover. Then, the backlight is exposed. Replace the backlight with a new one.



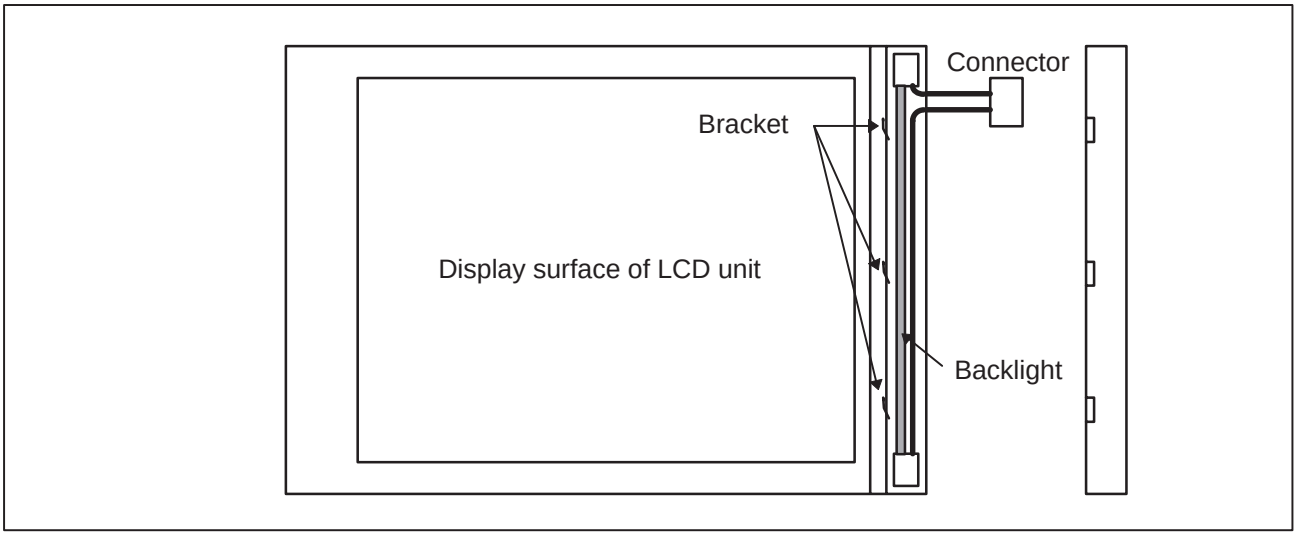
3)–2 For the 10.4” LCD unit (color)

As shown below, remove the screw, and pull out the case containing the backlight. Replace the backlight with a new one.



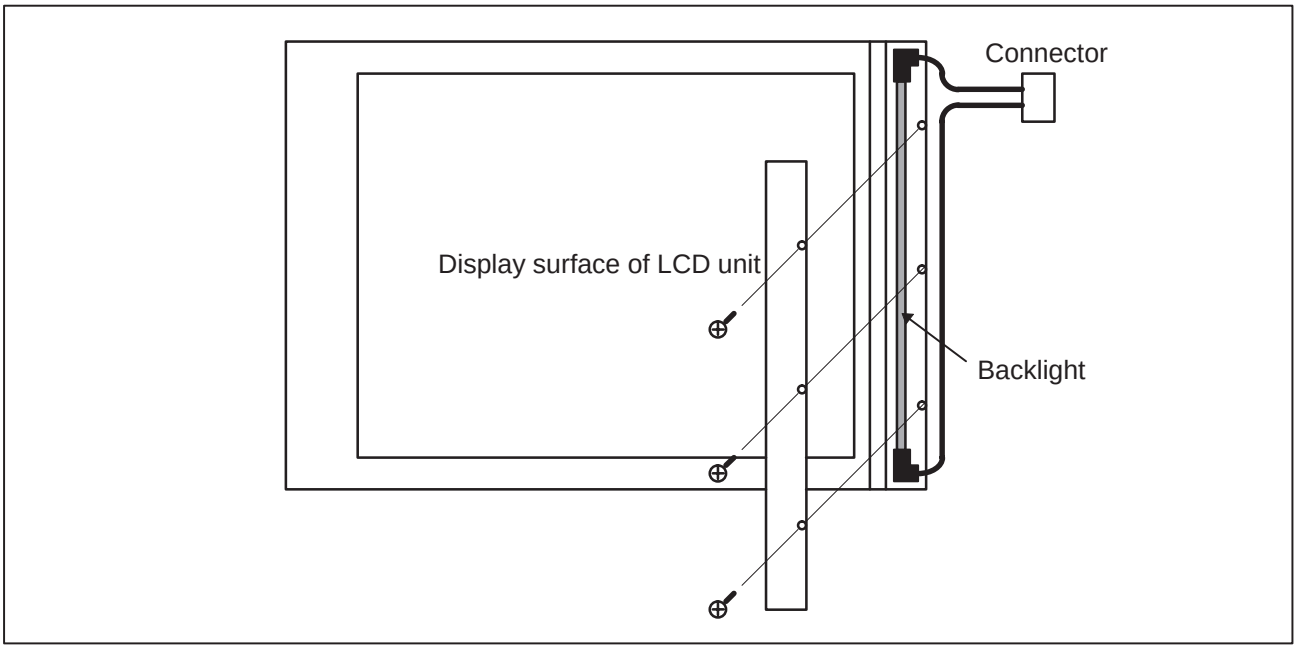
3)–3 For the 7.2” and 9.5” LCD units (monochrome) manufactured by Hitachi

Remove the three brackets from the left part on the front of the LCD unit, and remove the cover. Then, the backlight is exposed. Replace the backlight with a new one.



3)–4 For the 7.2” LCD unit (monochrome) manufactured by Sharp

Remove the three screws from the left part on the front of the LCD unit, and remove the cover. Then, the backlight is exposed. Replace the backlight with a new one.



4) Upon completion of replacement, reassemble the unit by reversing the steps 1 through 3 above.

2.12 MAINTENANCE OF HEAT EXCHANGER OF HEAT PIPE TYPE

The performance of the heat exchanger degrades due to a buildup of dirt. Clean the heat exchanger periodically. The cleaning interval depends on the installation environment. So, clean the heat exchanger at appropriate intervals according to the level of dirt built up.

WARNING

High voltage is applied to the heat exchanger of heat pipe type. Before maintaining the heat exchanger of heat pipe type, always turn off the power to the CNC.

When opening the cabinet and replacing a heat exchanger of heat pipe type, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover).

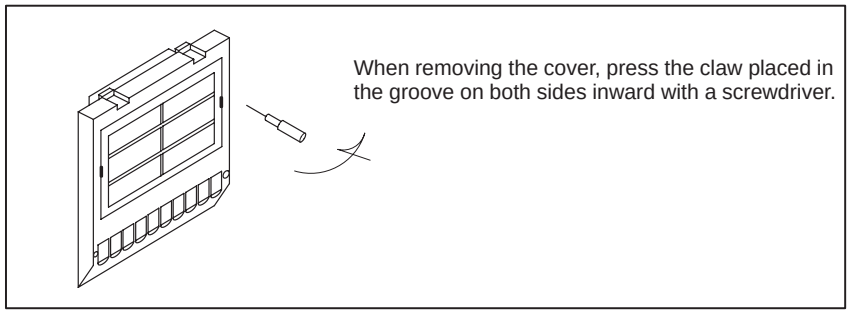
Touching the uncovered high–voltage circuits presents an extremely dangerous electric shock hazard.

Cleaning and replacing the air filter

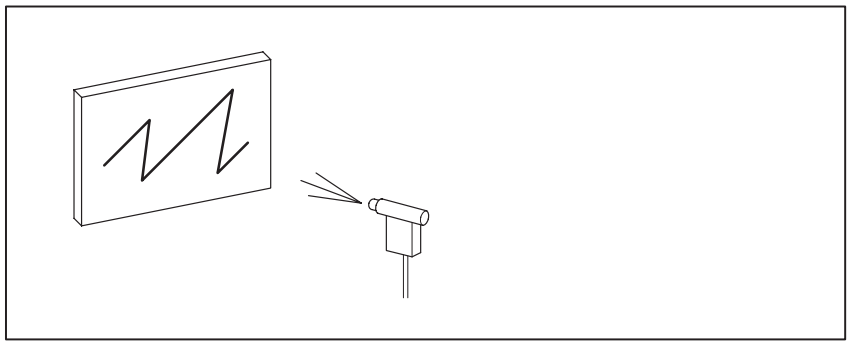
Procedure for cleaning and replacing the air filter

1 Before cleaning and replacing the air filter, turn off the fan power supply.

2 Remove the filter cover, then demount the filter.



3. Blow air against both sides of the filter to remove dust.



4 When the filter is dirty extremely, wash it with a solution of water and neutral detergent, and rinse it with fresh water, then allow it dry naturally.
Alternatively, replace it with a new filter (use only the specified filter).

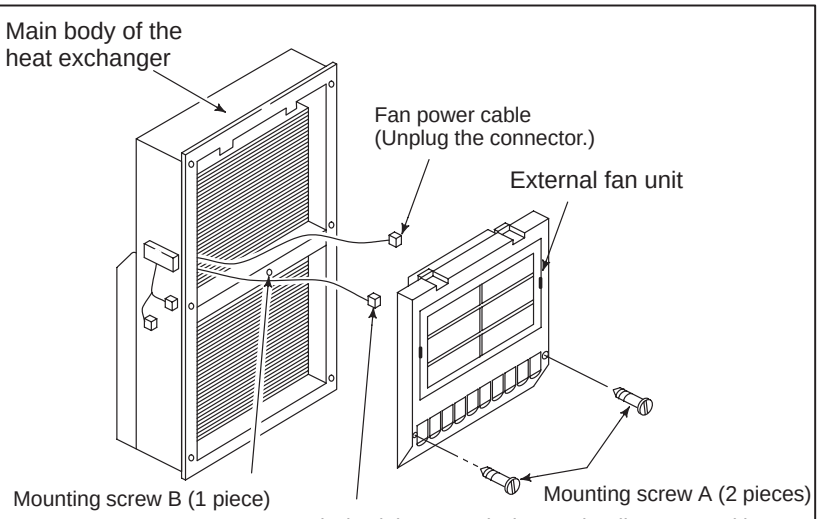
5 Set the cleaned or new filter. Next, align the claws with the grooves, then press them to reinstall the cover. Check that the cover is not removed when it is pulled toward you.

Cleaning the heat exchanger

Procedure for cleaning the heat exchanger

1 Before cleaning the heat exchanger, turn off the fan power supply.

2 Demount the external fan unit from the main body of the heat exchanger.

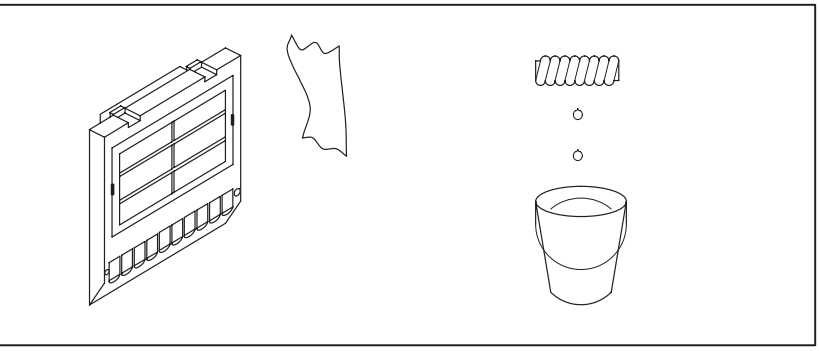


Remove the two mounting screws (A) used for mounting the external fan unit, then demount the unit by sliding it downward. Next, disconnect the fan power cable and ground wire. Remove mounting screw (B).

- **Cleaning the fan unit**

Procedure for cleaning the fan unit

1 Remove any buildup of dust, dirt, and mist from the fan motor and fan mounting case with a dry waste cloth. If dirt such as mist cannot be removed easily, use a waste cloth moistened with a solution of water and neutral detergent after squeezing it softly. In this case, be careful not to allow a solution of water and neutral detergent to enter the electric circuitry such as the rotor of the fan motor.



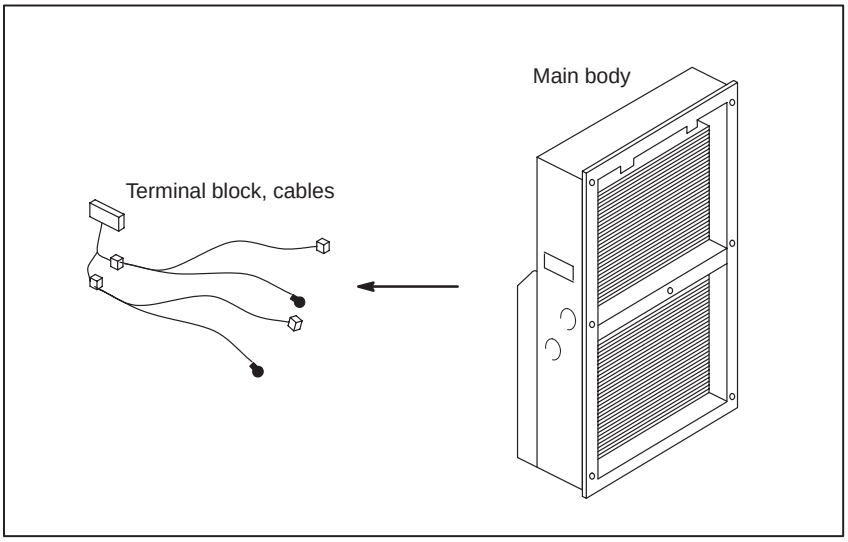
- **Cleaning the fan of the heat exchanger**

Procedure for cleaning the fan of the heat exchanger

1 Demount the heat exchanger from the unit, then remove dust and mist from the fan by blowing air or by using a dry waste cloth or brush.

When the fan is dirty extremely

1 Detach the internal fan unit, terminal block, and cables from the main body.



2 Clean the fan by using a brush and a solution of water and neutral detergent. At this time, be careful not to bend a vane.

3 After cleaning, dry the heat exchanger and fan unit sufficiently.

- **Reassembly**

Procedure for reassembly after cleaning

After cleaning the fan unit and heat exchanger, follow the steps below.

1 Reinstall the terminal block and cables at the original locations.

2 Reinstall the fan unit at the original location. At this time, reconnect the fan power cable and ground wire correctly.

2.13 ENVIRONMENTAL CONDITIONS OUTSIDE CABINET

The control units and various peripheral units provided by FANUC are designed to be accommodated in closed cabinets. Usable cabinets are as follows:

- Cabinets manufactured by machine tool builders to accommodate a control unit and peripheral units
- Cabinets for a flexible turnkey system provided by FANUC
- Teach pendant manufactured by machine tool builders to accommodate an indicator, MDI unit, and operator's panel
- Similar cabinets

These cabinets must be installed under the following environmental conditions:

	Condition	Without PC function	With PC function
Ambient temperature	Operating	0°C to 45°C	5°C to 40°C
	Storage, transportation	–20°C to 60°C	
Temperature variation		1.1°C/minute maximum	0.3°C/minute maximum
Humidity	Usually	75% or less (relative humidity) No condensation	10% to 75% (relative humidity) No condensation
	Short term (within 1 month)	95% or less (relative humidity) No condensation	10% to 90% (relative humidity) No condensation
Vibration	Operating	0.5 G or less	
	Non–operating	1.0 G or less	
Atmosphere		Normal machining factory environment. (A separate study is required when the cabinets are used in an environment exposed to relatively high levels of dust, coolant, and organic solvents.)	

2.14 POWER CONSUMPTION OF EACH UNIT

<table>
<tr><th></th><th>Name</th><th>Power consumption (W)</th></tr>
<tr><td></td><td>Basic (including an LCD unit and fans). (When the PC function is provided, a hard disk drive and floppy disk drive are included.)</td><td>Without the PC function: 33
With the PC function: 45</td></tr>
<tr><td rowspan="4">Optional board</td><td>Loader control board</td><td>10</td></tr>
<tr><td>Serial communication board (remote buffer/DNC2, DNC1)</td><td>6</td></tr>
<tr><td>HSSB interface board</td><td>3</td></tr>
<tr><td colspan="2">For the CNC unit, a 2–slot rack for mounting option boards are available. From the option boards listed above, two or four boards can be selected. However, ensure that the total power consumption does not exceed the values indicated below.
<table>
<tr><th>Type of rack</th><th>Total power consumption</th></tr>
<tr><td>2–slot rack</td><td>26</td></tr>
</table></td></tr>
<tr><td rowspan="4"></td><td>ISA expansion unit</td><td>(35)(NOTE)</td></tr>
<tr><td>Operator’s panel for distributed I/O</td><td>12</td></tr>
<tr><td>Distributed I/O basic unit</td><td>8</td></tr>
<tr><td>Distributed I/O basic unit</td><td>5</td></tr>
</table>

NOTE
The power consumption depends on the ISA expansion board used.

2.15 COUNTERMEASURES AGAINST NOISE

The CNC is becoming increasingly smaller as the surface mount technology and custom LSI technology advance.

In many cases, as the CNC becomes more compact, the mounting locations of its constituent units become closer to a noise source in the power magnetics cabinet.

In general, noise is generated by electrostatic coupling, electromagnetic induction, or a grounding loop, and is induced into the CNC.

The CNC incorporates sufficient countermeasures against external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and many unknown factors are involved. So, to improve the operation stability of a CNC machine tool system, noise generation must be minimized, and the induction of generated noise into the CNC must be suppressed.

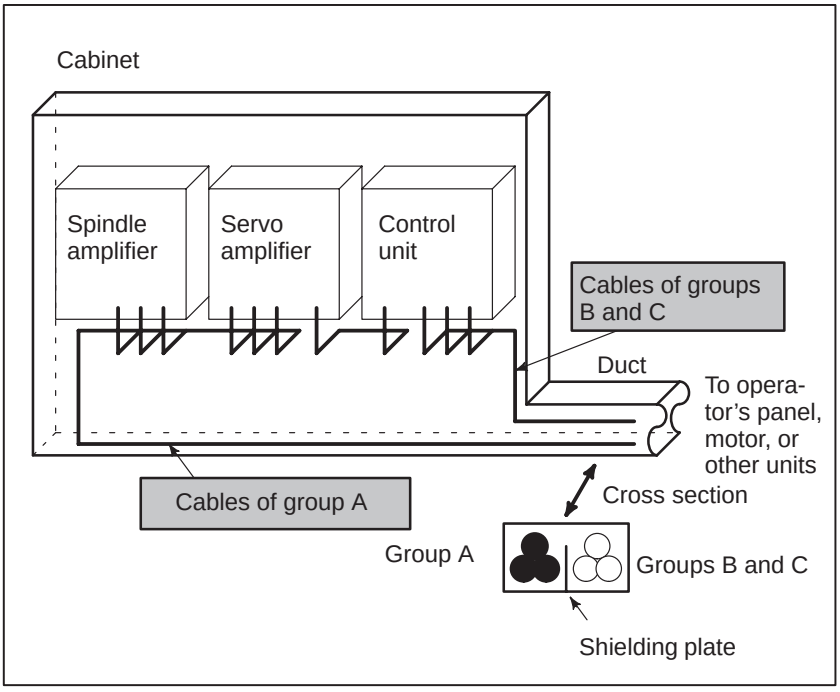
For design of equipment including a power magnetics cabinet, take these countermeasures on the machine side against noise into consideration.

2.15.1 Separation of Signal Lines

The cables used with a CNC machine tool are classified as indicated below. Handle the cables of each group according to the descriptions in the ”Action” column.

Group	Signal	Action
A	Primary side AC power line	Bind the cables of this group separately from the cables of groups B and C(*1), or electromagnetically shield the cables of this group from the cables of groups B and C(*2). According to the descriptions of noise suppressors in Section 2.15.4, attach a spark killer or diode to the solenoid and relay.
	Secondary side AC power line	
	AC/DC power lines (including servo motor and spindle motor power lines)	
	AC/DC solenoid	
	AC/DC relay	
B	DC solenoid (24 VDC)	Attach a diode to the DC solenoid and relay. Bind the cables of this group separately from the cables of group A, or electromagnetically shield the cables of this group from the cables of group A. Separate the cables of this group from the cables of group C as far as possible. Shielding is recommended.
	DC relay (24 VDC)	
	DI–DO cable between I/O unit power magnetics cabinets	
	DI–DO cable between I/O unit machines	
C	CNC–I/O unit cable	Bind the cables of this group separately from the cables of group A, or electromagnetically shield the cables of this group from the cables of group A. Separate the cables of this group from the cables of group B as far as possible. Shielding according to Section 2.15.5 is required.
	Cables for position loopback and velocity loopback	
	CNC–spindle amplifier cable	
	Position coder cable	
	Manual pulse generator cable	
	CNC–MDI cable(*3)	
	RS–232C and RS–422 cables	
	Battery cable	
	Other cables whose shielding is specified	

NOTE
1 Separate binding is to separate the bound cables of one group at least 10 cm from the bound cables of another group.
2 Electromagnetic shielding is to shield the bound cables of one group from the bound cables of another group with a grounded metal (iron) plate.
3 If the CNC–MDI cable is not longer than 30 cm, shielding is not required.



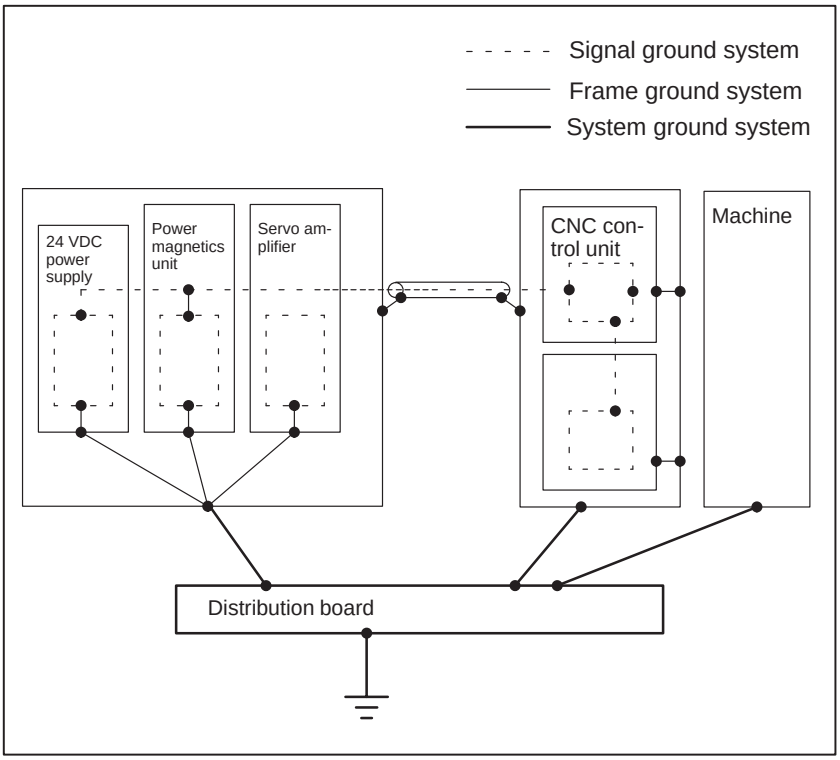
2.15.2 Grounding

With a CNC machine tool, three ground systems are used.

(1) Signal ground system (SG)
Signal ground (SG) provides a reference voltage (0 V) for the electric signal system.

(2) Frame ground system (FG)
The purposes of frame ground (FG) are to ensure safety and to provide shielding from external and internal noises. Specifically, the frames of equipment, unit cases, panels, inter–unit interface cables, and so forth are shielded.

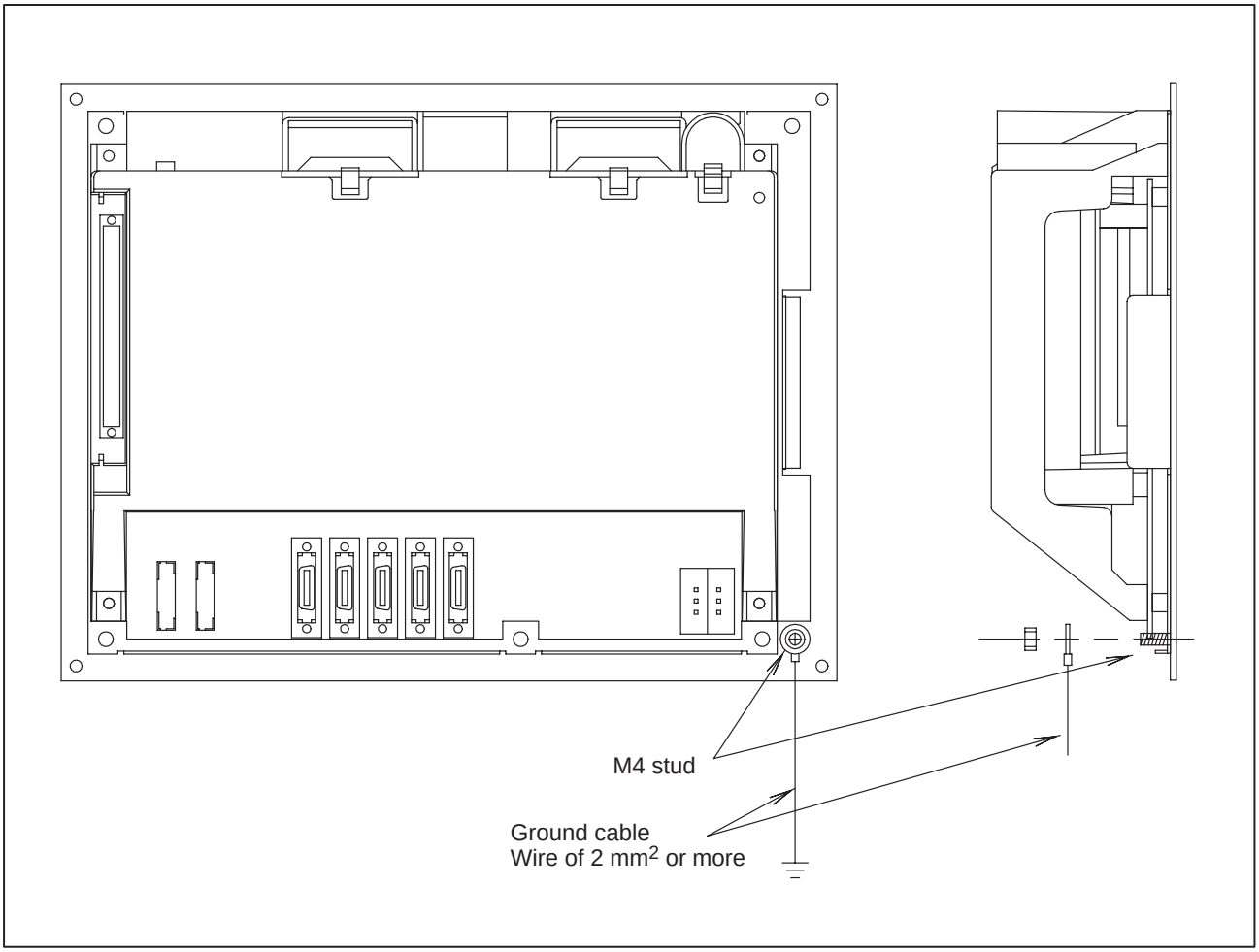
(3) System ground system
The system ground system is designed to connect the frame ground system (FG) provided between equipment and units to ground.



Notes on ground system wiring

- Connect system ground (0 V) to frame ground (FG) at only one point of the CNC control unit.
- The ground resistance of system ground must not exceed 100 ohms (class–3 grounding).
- A cable for system grounding must have a cross sectional area sufficient for flowing accidental currents that can flow to system ground in case of an accident such as a short–circuit. (In general, a cable for system grounding must have a cross sectional area equal to or greater than that of an AC power cable.)
- As a cable for system grounding, use a cable integrated with an AC power cable so that power is not supplied when the ground wire is disconnected.

2.15.3 Signal Ground (SG) Connection of Control Unit



Connect the 0 V line inside the control unit to the ground plate of the cabinet through the signal ground (SG) terminal (shown above).

2.15.4 Noise Suppressor

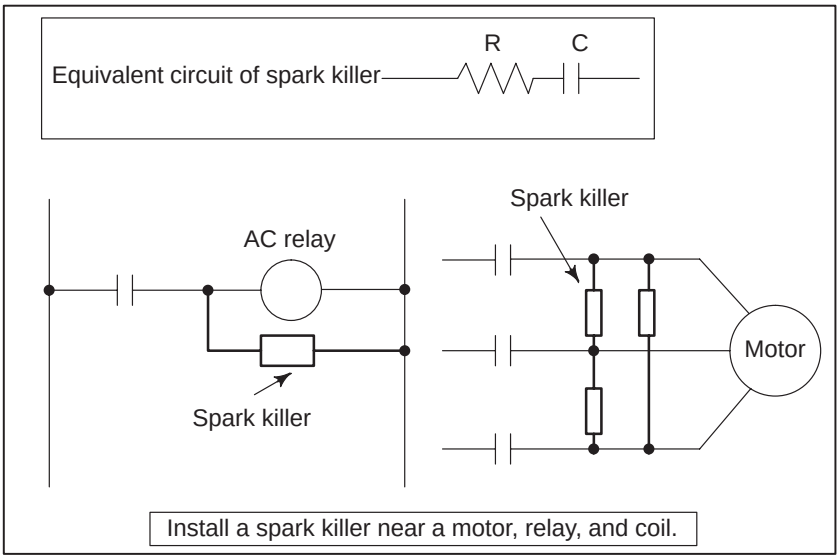
With a power magnetics cabinet, components such as an AC/DC solenoid and AC/DC relay are used. When turned on and off, these components generate a high–energy pulse voltage due to coil inductance.

Such a pulse voltage is induced into cables, for example, and can interfere with electric circuitry.

Notes on spark killer selection

- Select a CR–type spark killer (for use with AC circuitry) (A varistor has a function for clamping the peak voltage of a pulse voltage, but cannot suppress a spike–like voltage. For this reason, the use of a CR–type spark killer is recommended.)
- As the CR values of a spark killer, use the following with the steady–state coil current (I (A)) and DC resistance used as references:
  1) Resistance (R): Coil DC resistance
  2) Electrostatic capacitance (C): $\frac{I^2}{10}$ to $\frac{I^2}{20}$ (μF)

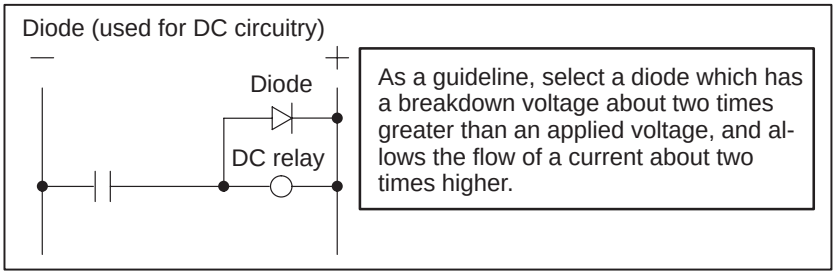
     I: Coil steady–state current (A)



Install a spark killer near a motor, relay, and coil.

NOTE

Use a CR–type noise suppressor. A varistor has a function for clamping the peak voltage of a pulse voltage, but cannot suppress a spike–like voltage.



2.15.5 Cable Clamping and Shielding

According to the figure below, clamp all cables that require shielding and are run to the CNC, servo amplifier, spindle amplifier, and so forth. This clamping method not only secures cables, but also shields cables. Cable clamping and shielding are a key to stable system operation. Always perform cable clamping and shielding according to the method described here.

As shown below, peel off a part of the outer sheath of each cable so that the shield cover is exposed, then press and retain the exposed part of the shield against the ground plate with a clamp.

Install a ground plate manufactured by the machine tool builder, as shown below.

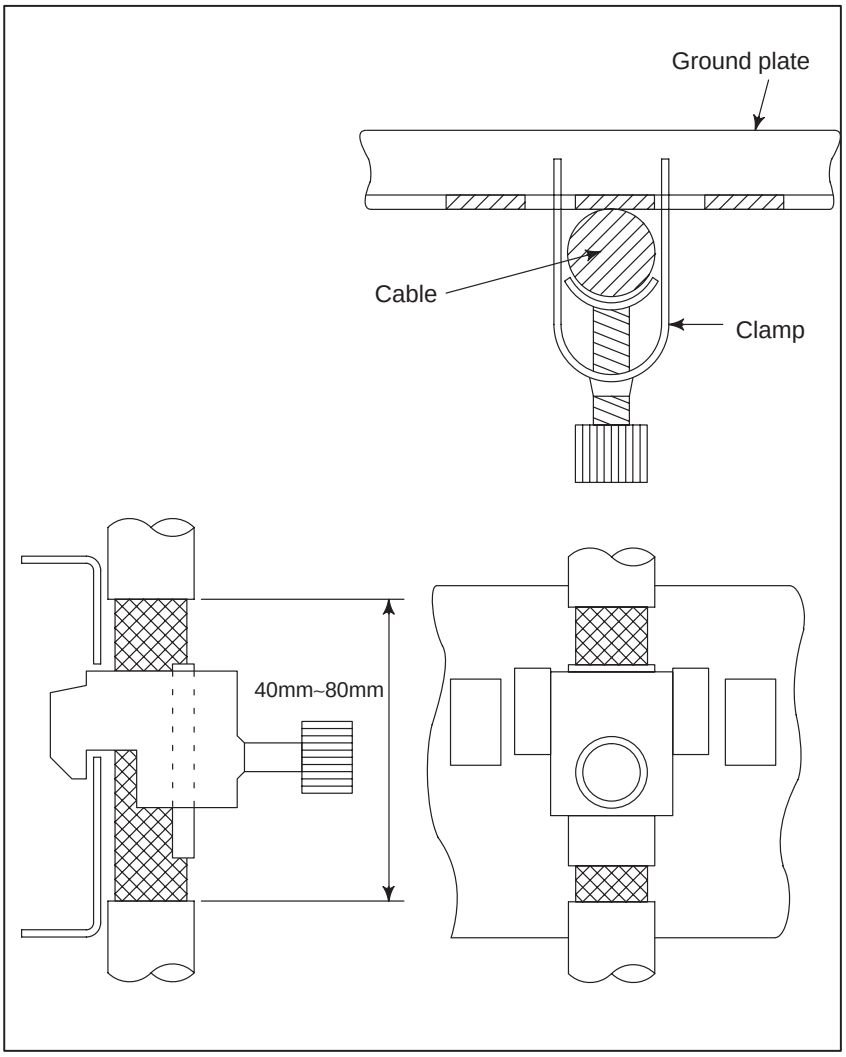


Fig. 2.15.5(a) Cable clamp (1)

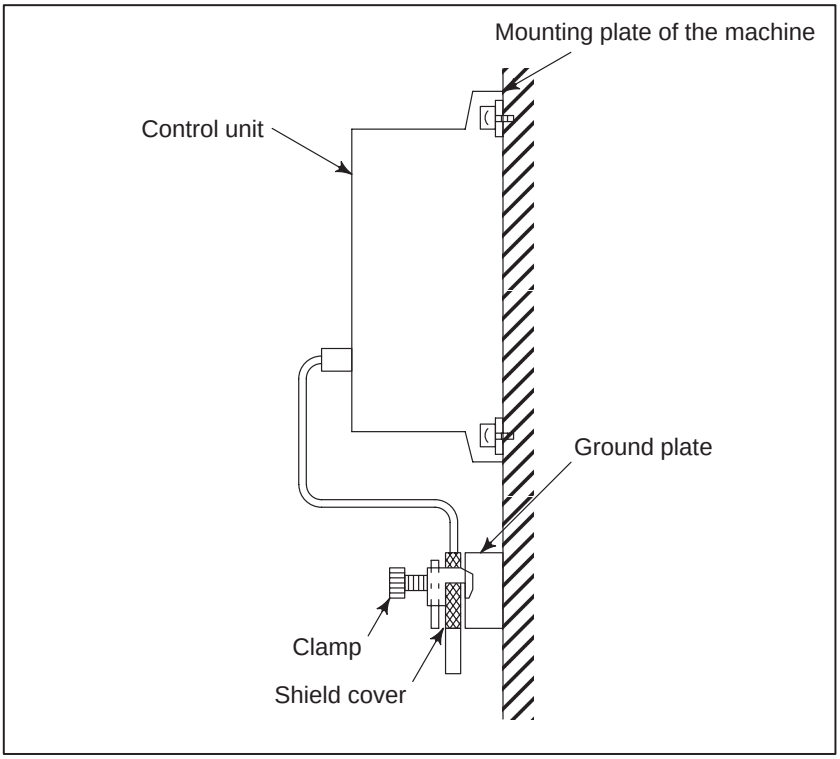


Fig. 2.15.5(b) Cable clamp (2)

Prepare a ground plate as shown below.

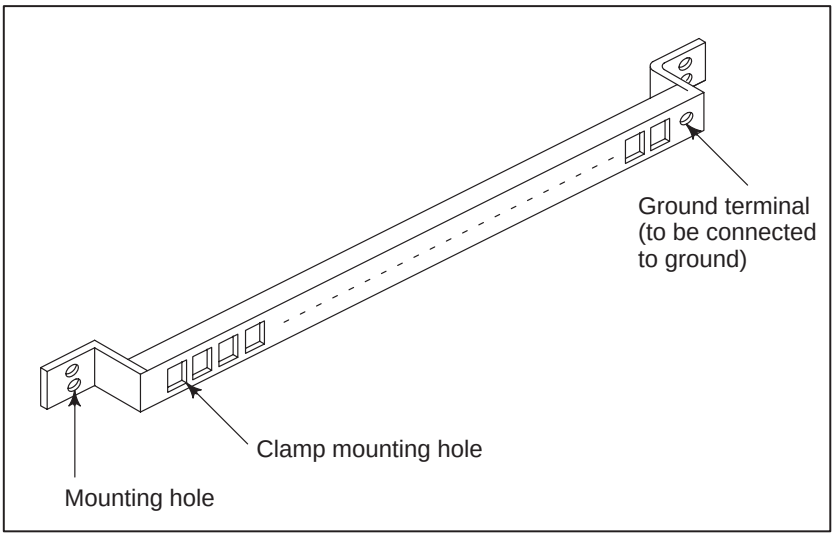


Fig. 2.15.5(c) Ground plate

For a ground plate, use an iron plate that is as thick as 2 mm or more and is plated with nickel.

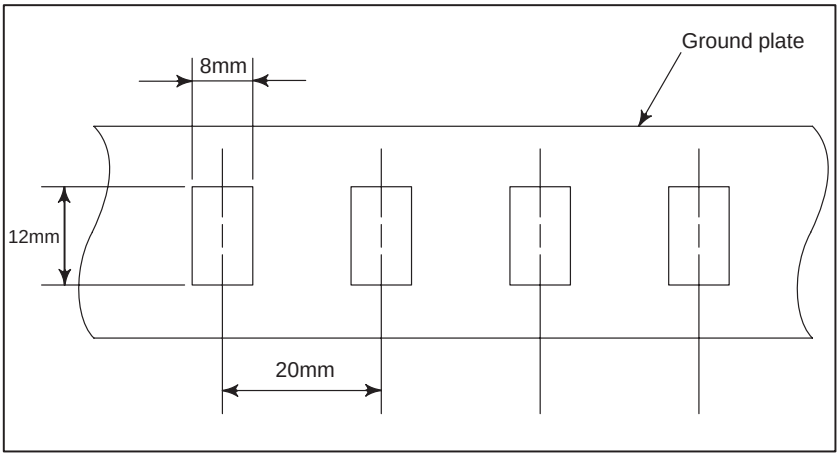


Fig. 2.15.5(d) Ground plate hole diagram

Reference: Outline drawing of the clamp

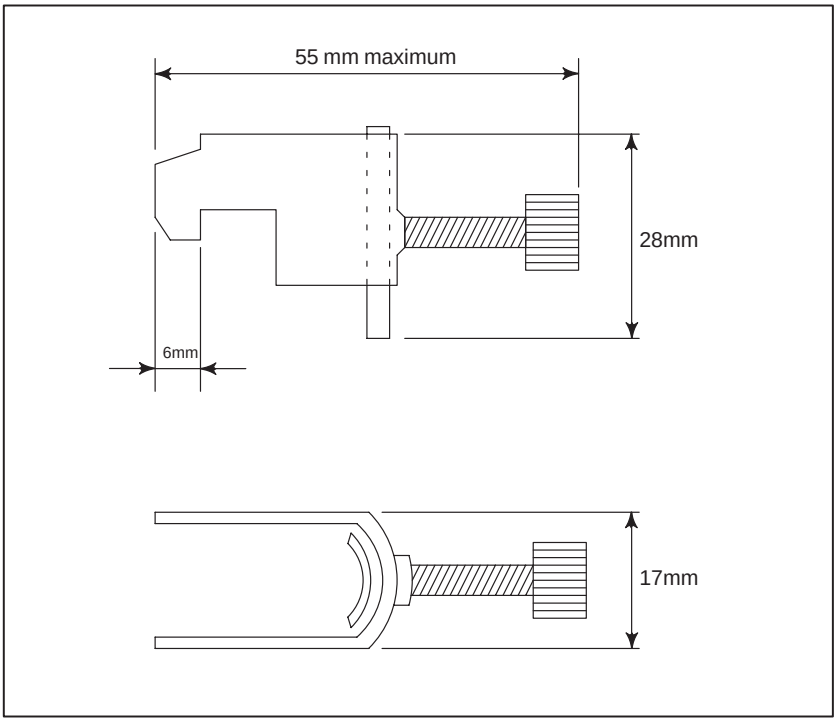


Fig. 2.15.5(e) Outline drawing of clamp

Ordering code of the clamp: A02B–0124–K001 (set of 8 clamps)

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) 1 2 3 4 EOB 4 5 6 7 EOB 9 9 9 9 INPUT

   This key sequence sets data as follows:

0		1234
0	⇒	4567
0		**9999**
0		0

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

   This key sequence sets data as follows:

0		1234
0	⇒	0
0		**9999**
0		0

   3) To set the same data sequentially, press =.

   (Ex.) 1 2 3 4 EOB a EOB a INPUT

   This key sequence sets data as follows:

0		1234
0	⇒	1234
0		**1234**
0		0

   4) Bit parameters can be set as follows:

   (Ex.) 1 1 EOB a EOB a INPUT

   This key sequence sets data as follows:

0 0 0 **0** 0 0 0 0		0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0	⇒	0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0		0 0 0 **1** 1 0 0 0
0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0

8. After the required parameters are set, set **PARAMETER WRITE** to 0.

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 (JD36A of mother board)
1 : Channel 1 (JD36A of mother board)
2 : Channel 2 (JD36B of mother board)
3 : Channel 3 (JD38A of serial communication board)

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

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

#3 (ASI)☆ 0 : EIA or ISO code is used for input/output data.
1 : ASCII code is used.

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

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

#0 (NE8) ☆ 0 : Programs of 8000s are edited.

1 : Programs of 8000s can be protected.

#4 (NE9) ☆ 0 : Programs of 9000s are edited.

1 : Programs of 9000s 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 (JD36A of mother board)

1 : Channel 1 (JD36A of mother board)

2 : Channel 2 (JD36B of mother board)

3 : Channel 3 (JD38A of serial communication board)

5)

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

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

☆ 1 : No. of stop bits is 2.

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

1 : ASCII code is used.

#7 (NFD) 0 : Feed is output when punching out.

1 : Feed is not output when punching out.

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, FANUC Handy File
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 **[(OPRT)]** and 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.
6. Alarm 300 is issued if the system employs an absolute pulse coder. In such a case, perform reference position return again.

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 [4] **[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 5 **[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	

#1 (RAL) When programs are registered:

☆ 0 : All programs are registered.

1 : Only one program is registered.

#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.

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

#0 (NE8)

☆ 0 : Programs of 8000s can be edited.

1 : Programs of 8000s are protected.

#4 (NE9)

☆ 0 : Programs of 9000s can be edited.

1 : Programs of 9000s 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 [6] **[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.

3.3 DATA INPUT/OUTPUT ON THE ALL IO SCREEN

To input/output a particular type of data, the corresponding screen is usually selected. For example, the parameter screen is used for parameter input from or output to an external input/output unit, while the program screen is used for program input or output. However, programs, parameters, offset data, and macro variables can all be input and output using a single common screen, that is, the ALL IO screen.

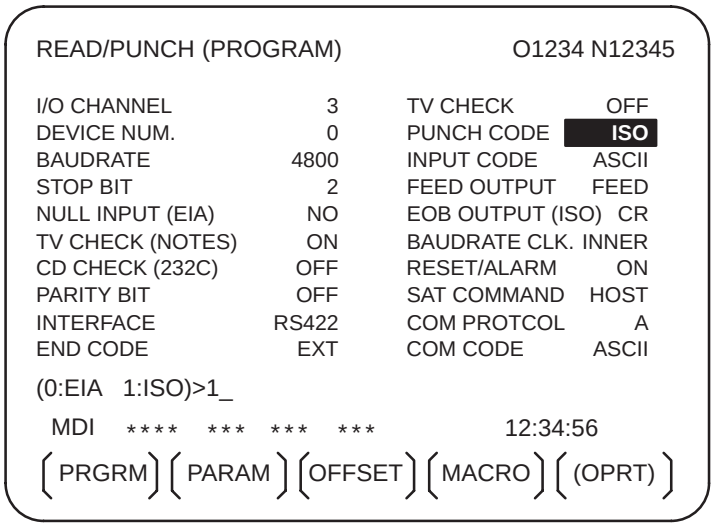


Fig. 3.3 ALL IO screen (when channel 3 is being used for input/output)

3.3.1 Setting Input/Output–Related Parameters

Input/output–related parameters can be set on the ALL IO screen. Parameters can be set, regardless of the mode.

Setting input/output–related parameters

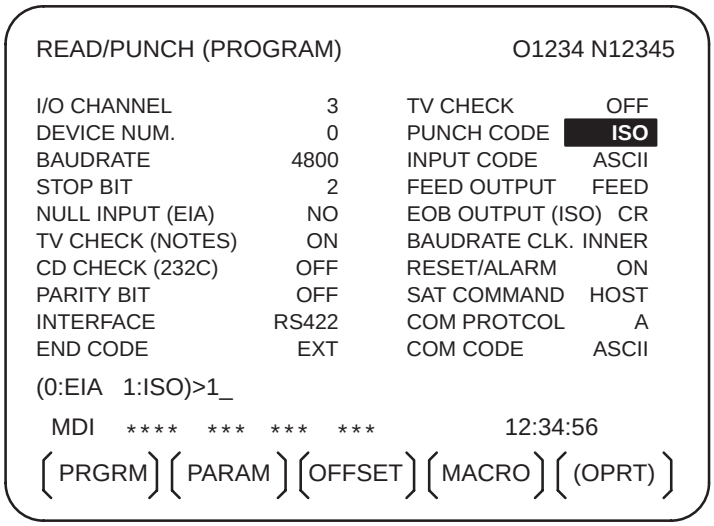
Procedure

1 Press function key [SYSTEM] .

2 Press the rightmost soft key [▷] (continuous menu key) several times.

3 Press soft key **[ALL IO]** to display the ALL IO screen.

NOTE
1 If program or floppy is selected in EDIT mode, the program directory or floppy screen is displayed.
2 When the power is first turned on, program is selected by default.



NOTE
Baud rate clock, CD check (232C), reset/alarm report, and the parity bit for parameter No. 134, as well as the communication code, end code, communication protocol, interface, and SAT command for parameter No. 135 are displayed only when channel 3 is being used for input/output.

4 Select the soft key corresponding to the desired type of data (program, parameter, and so forth).

5 Set the parameters corresponding to the type of input/output unit to be used. (Parameter setting is possible regardless of the mode.)

3.3.2 Inputting and Outputting Programs

A program can be input and output using the ALL IO screen.
When entering a program using a cassette or card, the user must specify the input file containing the program (file search).

File search

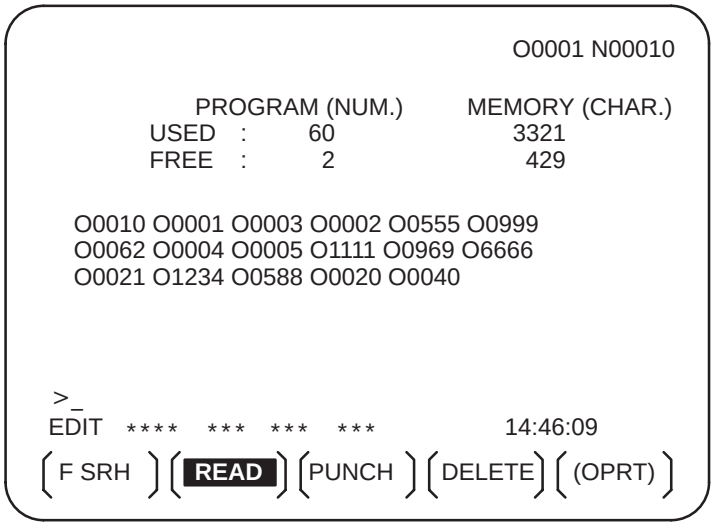
Procedure

1 Press soft key **[PRGRM]** on the ALL IO screen, described in Section 3.3.1.

2 Select **EDIT** mode. A program directory is displayed.

3 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.

- A program directory is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



4 Enter address N.

5 Enter the number of the file to be found.

- N0

  The first floppy file is found.
- One of N1 to N9999

  Among the files numbered from 1 to 9999, a specified file is found.
- N–9999

  The file immediately after that used most recently is found.
- N–9998

  When –9998 is specified, the next file is found. Then, each time a file input/output operation is performed, N–9999 is automatically inserted. This means that subsequent files can be sequentially found automatically.

This state is canceled by specifying N0, N1 to N9999, or N–9999, or upon a reset.

〔 〕〔 〕〔 〕〔CAN〕〔EXEC〕

6 Press soft keys **[F SRH]** and **[EXEC]**.
The specified file is found.

Inputting a program

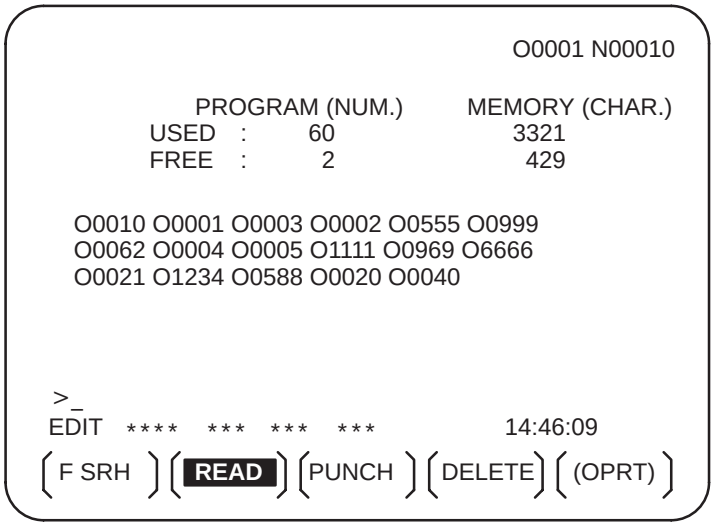
Procedure

1 Press soft key **[PRGRM]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode. A program directory is displayed.

3 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.

- A program directory is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



4 To specify a program number to be assigned to an input program, enter address O, followed by the desired program number.
If no program number is specified, the program number in the file or on the NC tape is assigned as is.

〔 〕〔 〕〔STOP〕〔 CAN 〕〔EXEC〕

5 Press soft key **[READ]**, then **[EXEC]**.
The program is input with the program number specified in step **4** assigned.
To cancel input, press soft key **[CAN]**.
To stop input prior to its completion, press soft key **[STOP]**.

Outputting programs

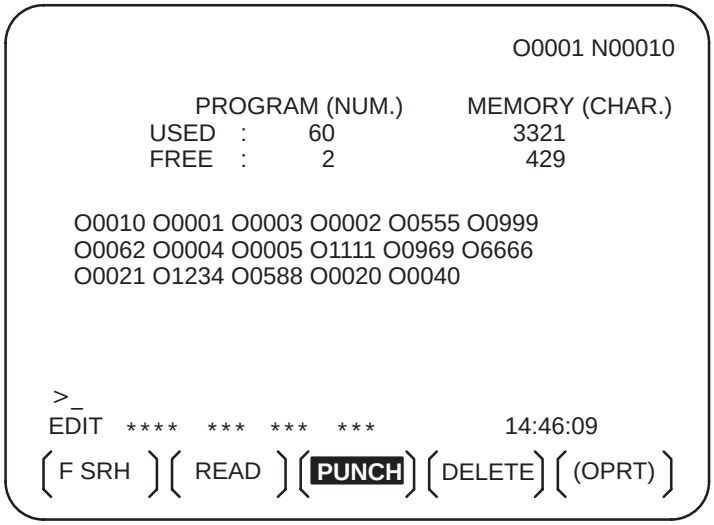
Procedure

1 Press soft key **[PRGRM]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode. A program directory is displayed.

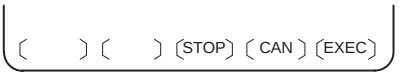
3 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.

- A program directory is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



4 Enter address O.

5 Enter a desired program number.
If –9999 is entered, all programs in memory are output.
To output a range of programs, enter OΔΔΔΔ, O□□□□. The programs numbered from ΔΔΔΔ to □□□□ are output.
When bit 4 (SOR) of parameter No. 3107 for sorted display is set to 1 on the program library screen, programs are output in order, starting from those having the smallest program numbers.



6 Press soft key **[PUNCH]**, then **[EXEC]**.
The specified program or programs are output. If steps **4** and **5** are omitted, the currently selected program is output.
To cancel output, press soft key **[CAN]**.
To stop output prior to its completion, press soft key **[STOP]**.

Deleting files

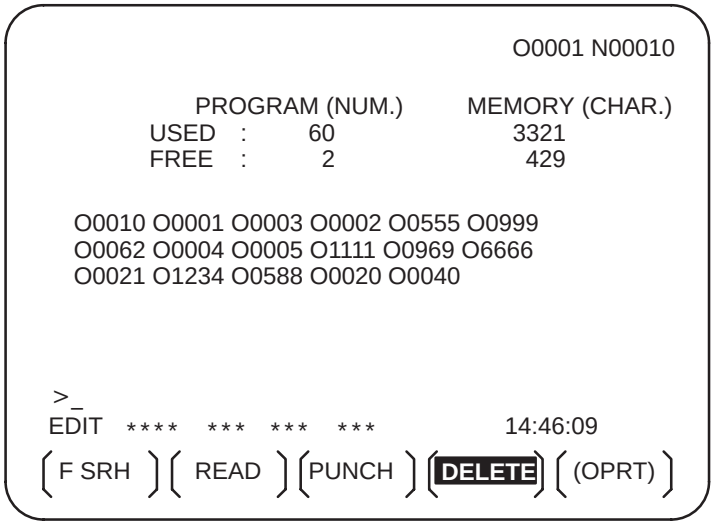
Procedure

1 Press soft key **[PRGRM]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode. A program directory is displayed.

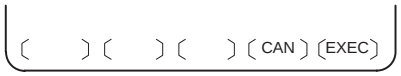
3 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.

- A program directory is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



4 Press soft key **[DELETE]**.

5 Enter a file number, from 1 to 9999, to indicate the file to be deleted.



6 Press soft key **[EXEC]**.
The k–th file, specified in step 5, is deleted.

3.3.3 Inputting and Outputting Parameters

Parameters can be input and output using the ALL IO screen.

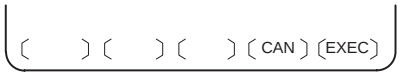
Inputting parameters

Procedure

1 Press soft key **[PARAM]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode.

3 Press soft key **[(OPRT)]**. Soft keys change as shown below.



4 Press soft key **[READ]**, then **[EXEC]**.
The parameters are read, and the ”INPUT” indicator blinks at the lower–right corner of the screen. Upon the completion of input, the ”INPUT” indicator is cleared from the screen.
To cancel input, press soft key **[CAN]**.

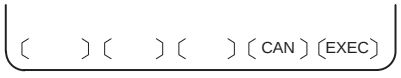
Outputting parameters

Procedure

1 Press soft key **[PARAM]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode.

3 Press soft key **[(OPRT)]**. Soft keys change as shown below.



4 Press soft key **[PUNCH]**, then **[EXEC]**.
The parameters are output, and the ”OUTPUT” indicator blinks at the lower–right corner of the screen. Upon the completion of output, the ”OUTPUT” indicator is cleared from the screen.
To cancel output, press soft key **[CAN]**.

3.3.4 Inputting and Outputting Offset Data

Offset data can be input and output using the ALL IO screen.

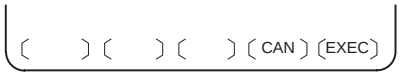
Inputting offset data

Procedure

1 Press soft key **[OFFSET]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode.

3 Press soft key **[(OPRT)]**. Soft keys change as shown below.



4 Press soft key **[READ]**, then **[EXEC]**.
The offset data is read, and the ”INPUT” indicator blinks at the lower–right corner of the screen.
Upon the completion of input, the ”INPUT” indicator is cleared from the screen.
To cancel input, press soft key **[CAN]**.

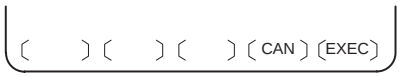
Outputting offset data

Procedure

1 Press soft key **[OFFSET]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode.

3 Press soft key **[(OPRT)]**. Soft keys change as shown below.



4 Press soft key **[PUNCH]**, then **[EXEC]**.
The offset data is output, and the ”OUTPUT” indicator blinks at the lower–right corner of the screen. Upon the completion of output, the ”OUTPUT” indicator is cleared from the screen.
To cancel output, press soft key **[CAN**].

3.3.5 Outputting Custom Macro Common Variables

Custom macro common variables can be output using the ALL IO screen.

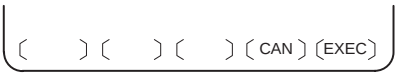
Outputting custom macro common variables

Procedure

1 Press soft key **[MACRO]** on the ALL IO screen, described in Section 3.3.1.

2 Select EDIT mode.

3 Press soft key **[(OPRT)]**. Soft keys change as shown below.



4 Press soft key **[PUNCH]**, then **[EXEC]**.
The custom macro common variables are output, and the ”OUTPUT” indicator blinks at the lower–right corner of the screen. Upon the completion of output, the ”OUTPUT” indicator is cleared from the screen.
To cancel output, press soft key **[CAN]**.

NOTE
To input a macro variable, read the desired custom macro statement as a program, then execute the program.

3.3.6 Inputting and Outputting Floppy Files

The ALL IO screen supports the display of a directory of floppy files, as well as the input and output of floppy files.

Displaying a file directory

Procedure

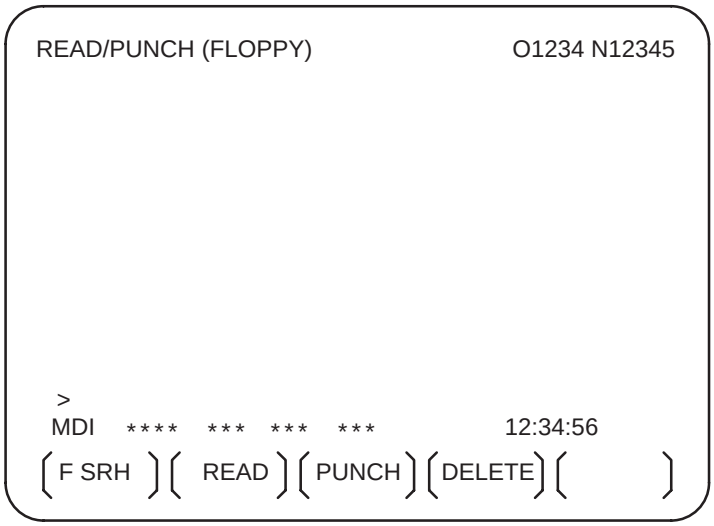
1 Press the rightmost soft key ▷ (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

2 Press soft key **[FLOPPY**].

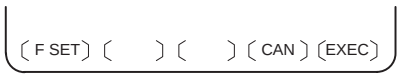
3 Select EDIT mode. The floppy screen is displayed.

4 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.

- The floppy screen is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.

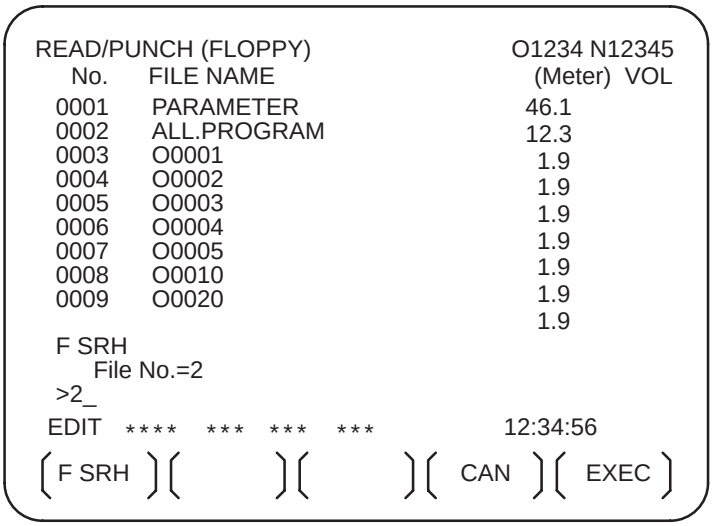


5 Press soft key **[F SRH]**.



6 Enter the number of the desired file, then press soft key **[F SET]**.

7 Press soft key **[EXEC]**. A directory is displayed, with the specified file uppermost. Subsequent files in the directory can be displayed by pressing the page key.



A directory in which the first file is uppermost can be displayed simply by pressing the page key. (Soft key **[F SRH]** need not be pressed.)

Inputting a file

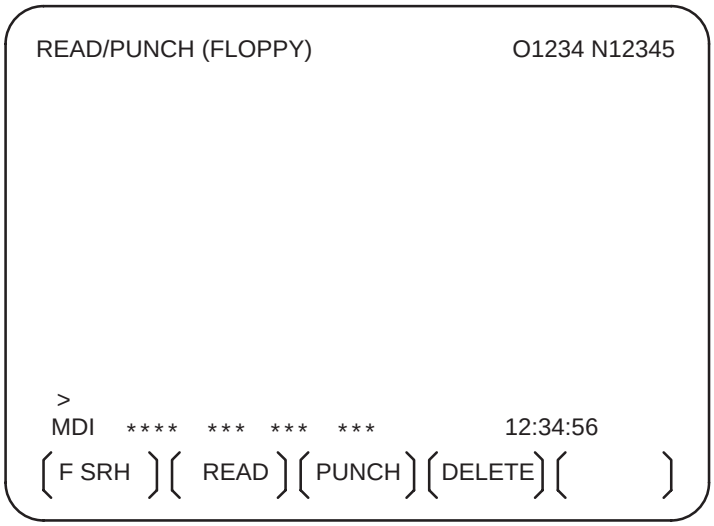
Procedure

1 Press the rightmost soft key [▷] (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

2 Press soft key **[FLOPPY]**.

3 Select EDIT mode. The floppy screen is displayed.

4 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.
The floppy screen is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



5 Press soft key **[READ]**.

6 Enter the number of a file or program to be input.

- Setting a file number: Enter the number of the desired file, then press soft key **[F SET]**.
- Setting a program number: Enter the number of the desired program, then press soft key **[O SET]**.

7 Press soft key **[EXEC]**.
The specified file or program is read, and the ”INPUT” indicator blinks at the lower–right corner of the screen. Upon the completion of input, the ”INPUT” indicator is cleared from the screen.

Outputting a file

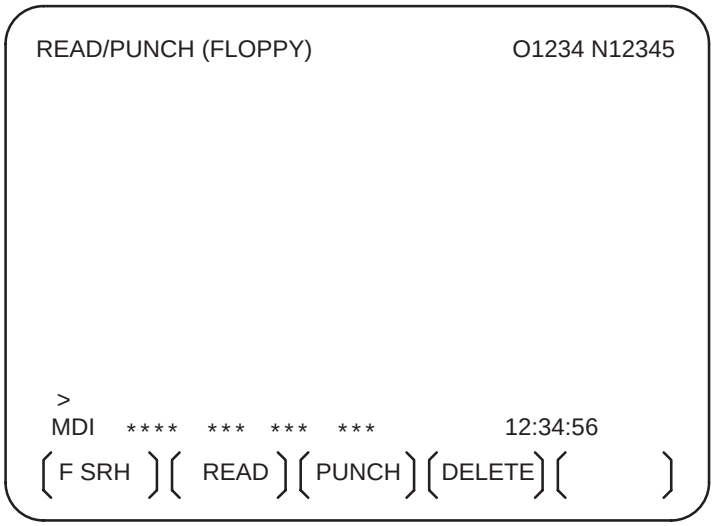
Procedure

1 Press the rightmost soft key [▷] (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

2 Press soft key **[FLOPPY]**.

3 Select EDIT mode. The floppy screen is displayed.

4 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.
The floppy screen is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



5 Press soft key **[PUNCH]**.

6 Enter the number of the program to be output, together with a desired output file number.

- Setting a file number: Enter the number of the desired file, then press soft key **[F SET]**.
- Setting a program number: Enter the number of the desired program, then press soft key **[O SET]**.

7 Press soft key **[EXEC]**.
The specified program is output, and the ”OUTPUT” indicator blinks at the lower–right corner of the screen. Upon the completion of output, the ”OUTPUT” indicator is cleared from the screen.
If no file number is specified, the program is written at the end of the currently registered files.

Deleting a file

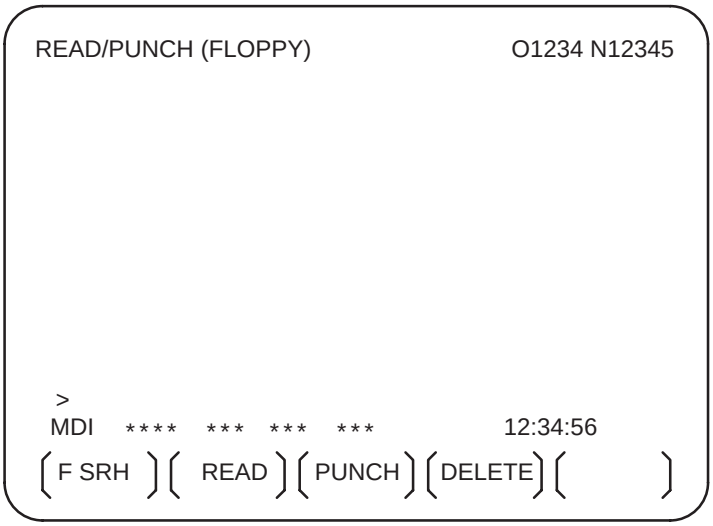
Procedure

1 Press the rightmost soft key [▷] (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

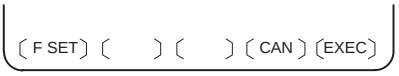
2 Press soft key **[FLOPPY]**.

3 Select EDIT mode. The floppy screen is displayed.

4 Press soft key **[(OPRT)]**. The screen and soft keys change as shown below.
The floppy screen is displayed only in EDIT mode. In all other modes, the ALL IO screen is displayed.



5 Press soft key **[DELETE]**.

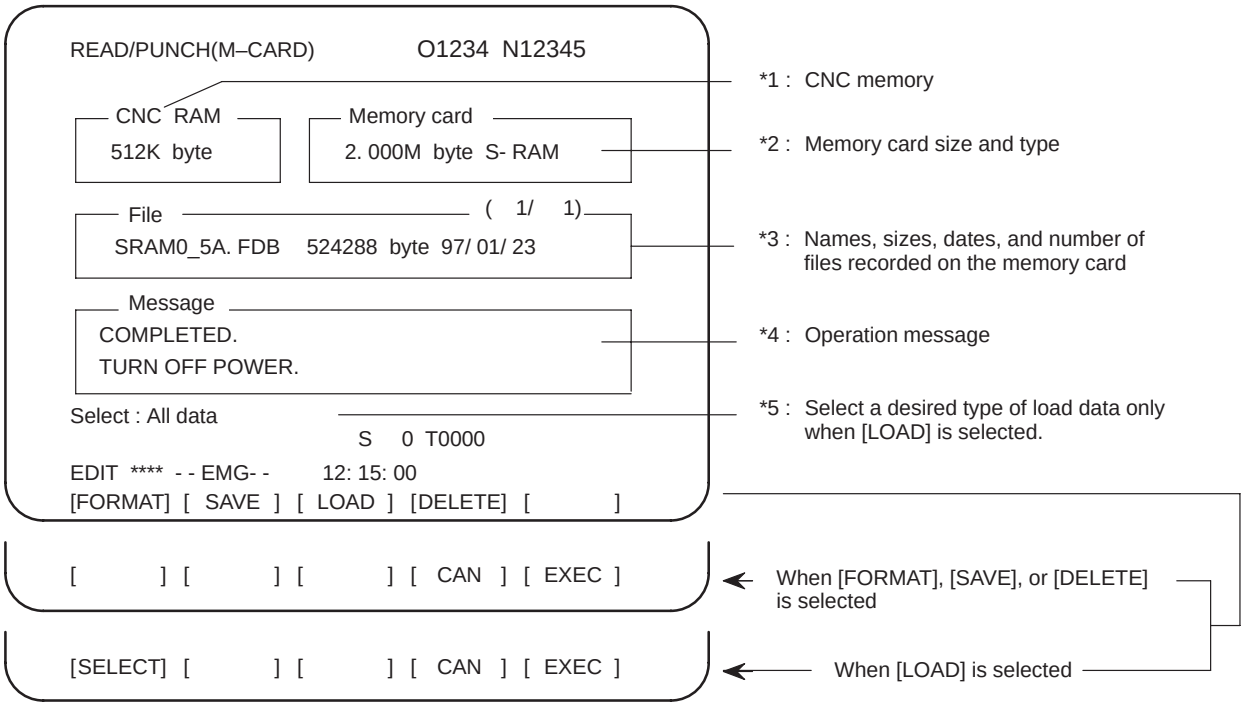


6 Enter the number of the desired file, then press soft key **[F SET]**.

7 Press soft key **[EXEC]**. The specified file is deleted. After the file has been deleted, the subsequent files are shifted up.

3.3.7 Memory Card Input/Output

Data held in CNC memory can be saved to a memory card in MS–DOS format. Data held on a memory card can be loaded into CNC memory. A save or load operation can be performed using soft keys while the CNC is operating.
Loading can be performed in either of two ways. In the first method, all saved memory data is loaded. In the second method, only selected data is loaded.



- The CNC memory size (*1) is displayed at all times.
- When no memory card is inserted, the message field (*4) displays a message prompting the user to insert a memory card, but does not display the memory card states (*2 and *3).
- If an inserted memory card is invalid (if there is no attribute memory, or if the attribute memory does not contain any device information), the message field (*4) displays an error message, but does not display the memory card states (*2 and *3).

Saving memory data

Data held in CNC memory can be saved to a memory card in MS–DOS format.

Saving memory data

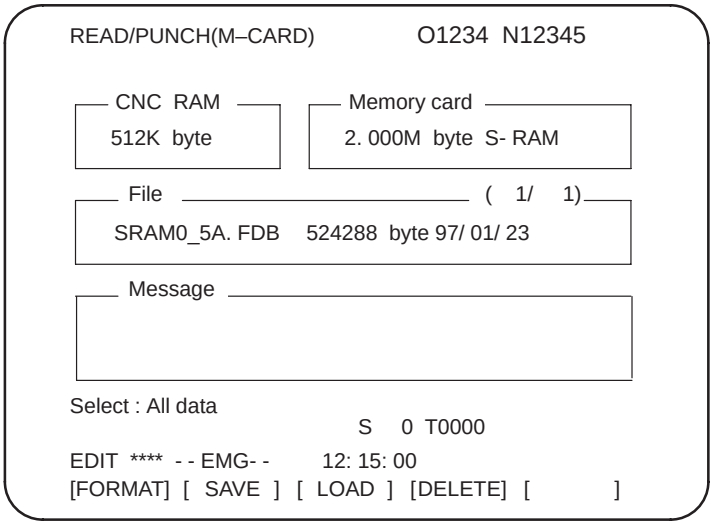
Procedure

1 Press the rightmost soft key ▷ (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

2 Press soft key **[M–CARD]**.

3 Place the CNC in the emergency stop state.

4 When a memory card is inserted, the state of the memory card is displayed as shown below.



( ) ( ) ( ) (CAN) (EXEC)

5 Press soft key **[SAVE]**.

6 A message prompting the user to confirm the operation is displayed. Press soft key **[EXEC]** to execute the save operation.

7 As the data is being saved to the card, the message ”RUNNING” blinks, and the number of bytes saved is displayed in the message field.

8 Once all data has been saved to the card, the message ”COMPLETED” is displayed in the message field, with the message ”PRESS RESET KEY.” displayed on the second line.

9 Press the RESET key. The displayed messages are cleared from the screen, and the display of the memory card state is replaced with that of the saved file.

NOTE
All CNC memory data is saved to a memory card. CNC memory data cannot be saved selectively.

Loading Data into Memory (Restoration)

CNC memory data that has been saved to a memory card can be loaded (restored) back into CNC memory.
CNC memory data can be loaded in either of two ways. In the first method, all saved memory data is loaded. In the second method, only selected data is loaded.

Loading memory data

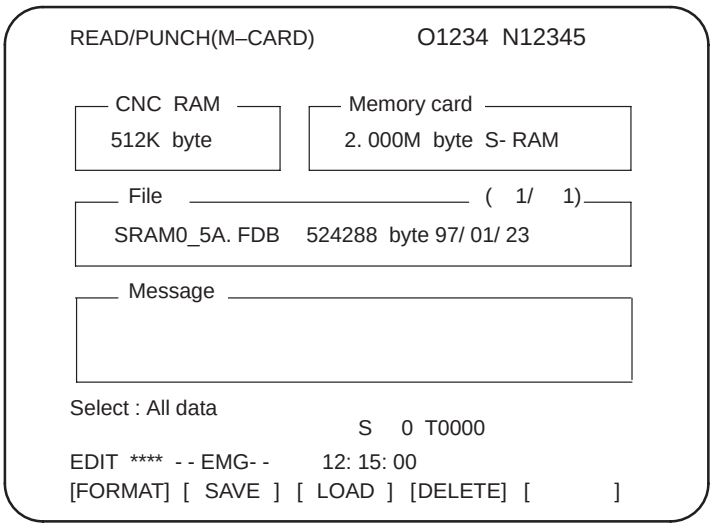
Procedure

1 Press the rightmost soft key [▷] (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

2 Press soft key **[M–CARD]**.

3 Place the CNC in the emergency stop state.

4 When a memory card is inserted, the state of the memory card is displayed as shown below.

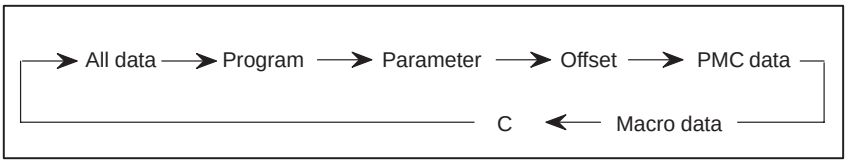


5 Press soft key **[LOAD]**.

6 With cursor keys [↑] and [↓], select the file to be loaded from the memory card.
A system having 1.0MB or 2.5MB of CNC RAM may require the loading of multiple files. All or selective data load can be specified for each file.

[SELECT] [ ] [ ] [CAN] [EXEC]

7 To perform selective data loading, press soft key **[SELECT]**, then select the data to be loaded. Each time the soft key is pressed, the information displayed changes cyclically, as shown below.



8 After checking the file selection, press soft key **[EXEC]**.

9 During loading, the message ”RUNNING” blinks, and the number of bytes loaded is displayed in the message field.

10 Upon the completion of loading, the message ”COMPLETED” is displayed in the message field, with the message ”PRESS RESET KEY.” displayed on the second line.

11 Press the RESET key. The messages are cleared from the screen.

Memory card formatting

Before a file can be saved to a memory card, the memory card must be formatted.

Formatting a memory card

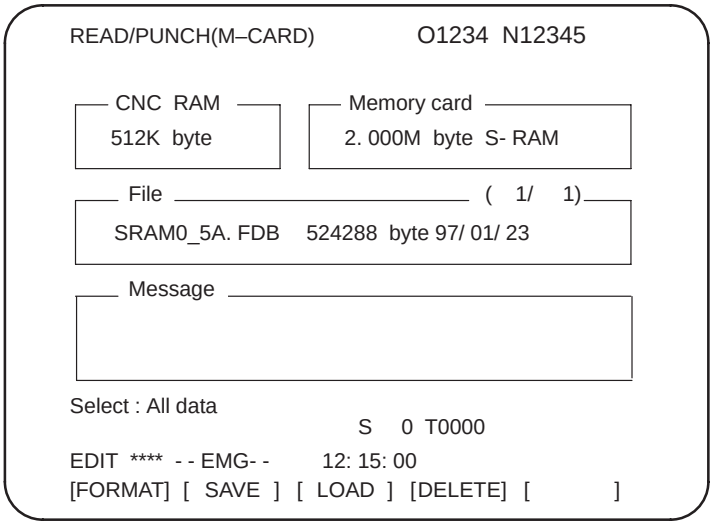
Procedure

1 Press the rightmost soft key [▷] (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

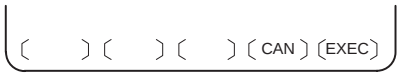
2 Press soft key **[M–CARD]**.

3 Place the CNC in the emergency stop state.

4 When a memory card is inserted, the state of the memory card is displayed as shown below.



5 Press soft key **[FORMAT]**.



6 A message prompting the user to confirm the operation is displayed. Press soft key **[EXEC]** to execute the formatting operation.

7 As formatting is being performed, the message ”FORMATTING” blinks.

8 Upon the completion of formatting, the message ”COMPLETED” is displayed in the message field.

Deleting files

Unnecessary saved files can be deleted from a memory card.

Deleting files

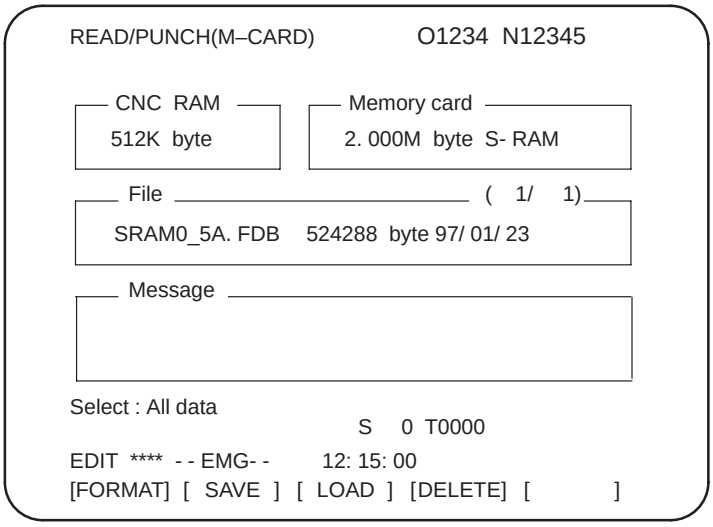
Procedure

1 Press the rightmost soft key ▷ (continuous menu key) on the ALL IO screen, described in Section 3.3.1.

2 Press soft key **[M–CARD]**.

3 Place the CNC in the emergency stop state.

4 When a memory card is inserted, the state of the memory card is displayed as shown below.



5 Press soft key **[DELETE]**.

( ) ( ) ( ) (CAN) (EXEC)

6 With cursor keys ↑ and ↓, select the file to be deleted from the memory card.

7 After checking the file selection, press soft key **[EXEC]**.

8 As detection is being performed, the message ”DELETING” blinks in the message field.

9 Upon the completion of deletion, the message ”COMPLETED” is displayed in the message field

NOTE
An SRAM of 1M bytes or more will contain multiple files. To delete the contents of such an SRAM, delete all the contained files.

File name and messages

- **File name**

The file name used for save operation is determined by the amount of SRAM mounted in the CNC. A file holding saved data is divided into blocks of 512KB.

HEAD1 SRAM file

Amount of SRAM		256KB	0.5 MB
Number of files	1	SRAM256A. FDB	SRAM0_5A. FDB

Messages

Message	Description
INSERT MEMORY CARD.	No memory card is inserted.
UNUSABLE MEMORY CARD	The memory card does not contain device information.
FORMAT MEMORY CARD.	The memory card is not formatted. Format the memory card before use.
THE FILE IS UNUSABLE.	The format or extension of the file to be loaded is invalid. Alternatively, the data stored on the memory card does not match the CNC memory size.
REPLACE MEMORY CARD.	Replace the memory card.
FILE SYSTEM ERROR □□□	An error occurred during file system processing. □□□ represents a file system error code.
SET EMERGENCY STOP STATE.	Save/load operation is enabled in the emergency stop state only.
WRITE–PROTECTED	Save operation: The protect switch of the memory card is set to the disabled position. Load operation: Parameter write is disabled.
VOLTAGE DECREASED.	The battery voltage of the memory card has dropped. (The battery requires replacement.)
DEVICE IS BUSY.	Another user is using the memory card. Alternatively, the device cannot be accessed because automatic operation is in progress.
SRAM → MEMORY CARD?	This message prompts the user to confirm the start of data saving.
MEMORY CARD → SRAM?	This message prompts the user to confirm the start of data loading.
DO YOU WANT TO DELETE FILE(S)?	This message prompts the user to confirm the start of deletion.
DO YOU WANT TO PERFORM FORMAT-TING?	This message prompts the user to confirm the start of formatting.
SAVING	Saving is currently being performed.
LOADING	Loading is currently being performed.
DELETING	File deletion is currently being performed.
FORMATTING	Memory card formatting is currently being performed.
COMPLETED	Save or load processing has been completed.
PRESS RESET KEY.	Press the RESET key.
TURN OFF POWER.	Turn the power off, then back on again.

File system error codes

Code	Meaning
102	The memory card does not have sufficient free space.
105	No memory card is mounted.
106	A memory card is already mounted.
110	The specified directory cannot be found.
111	There are too many files under the root directory to allow a directory to be added.
114	The specified file cannot be found.
115	The specified file is protected.
117	The file has not yet been opened.
118	The file is already open.
119	The file is locked.
122	The specified file name is invalid.
124	The extension of the specified file is invalid.
129	A non–corresponding function was specified.
130	The specification of a device is invalid.
131	The specification of a pathname is invalid.
133	Multiple files are open at the same time.
135	The device is not formatted.
140	The file has the read/write disabled attribute.

3.4 DATA INPUT/OUTPUT USING A MEMORY CARD

By setting the I/O channel (parameter No. 20) to 4, files on a memory card can be referenced, and different types of data such as part programs, parameters, and offset data on a memory card can be input and output in text file format.
The major functions are listed below.

- Displaying a directory of stored files

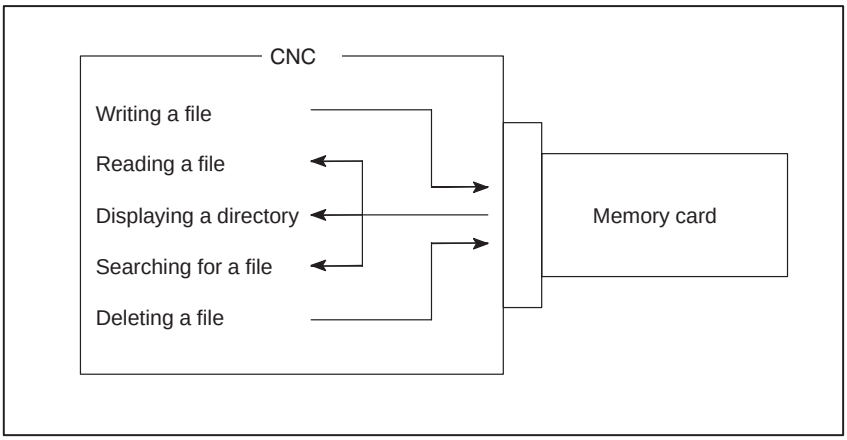
  The files stored on a memory card can be displayed on the directory screen.
- Searching for a file

  A search is made for a file on a memory card and, if found, it is displayed on the directory screen.
- Reading a file

  Text–format files can be read from a memory card.
- Writing a file

  Data such as part programs can be stored to a memory card in text file format.
- Deleting a file

  A file can be selected and deleted from a memory card.



Displaying a directory of stored files

Procedure

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

2 Press function key [PROG] .

3 Press the rightmost soft key [▷] (continuous menu key).

4 Press soft key **[CARD]**. The screen shown below is displayed. Using page keys [↑] and [↓] , the screen can be scrolled.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.   FILE NAME        SIZE          DATE
 0001   O1000          123456        96/07/10
 0002   O1001            8458        96/07/30
 0003   O0002            3250        96/07/30
 0004   O2000           73456        96/07/31
 0005   O2001            3444        96/07/31
 0006   O3001            8483        96/08/02
 0007   O3300             406        96/08/05
 0008   O3400            2420        96/07/31
 0009   O3500            7460        96/07/31

~ [ PROG ][      ][ DIR + ][      ][ (OPRT) ] ~
```

5 Comments relating to each file can be displayed by pressing soft key **[DIR+]**.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.   FILE NAME          COMMENT
 0001   O1000          (COMMENT       )
 0002   O1001          (SUB PROGRAM   )
 0003   O0002          (12345678      )
 0004   O2000          (              )
 0005   O2001          (              )
 0006   O3001          (SKIP–K        )
 0007   O3300          (HI–SPEED      )
 0008   O3400          (              )
 0009   O3500          (TEST PROGRAM)

~ [ PROG ][      ][ DIR + ][      ][ (OPRT) ] ~
```

6 Repeatedly pressing soft key **[DIR+]** toggles the screen between the display of comments and the display of sizes and dates.
Any comment described after the O number in the file is displayed. Up to 18 characters can be displayed on the screen.

Searching for a file

Procedure

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

2 Press function key [PROG] .

3 Press the rightmost soft key [▷] (continuous menu key).

4 Press soft key **[CARD]**. The screen shown below is displayed.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.    FILE NAME        SIZE          DATE
 0001    O1000          123456        96/07/10
 0002    O1001            8458        96/07/30
 0003    O0002            3250        96/07/30
 0004    O2000           73456        96/07/31
 0005    O2001            3444        96/07/31
 0006    O3001            8483        96/08/02
 0007    O3300             406        96/08/05
 0008    O3400            2420        96/07/31
 0009    O3500            7460        96/07/31
~
[ PROG ][      ][ DIR + ][      ][ (OPRT) ]
```

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

```
[F SRH] [F READ] [N READ] [PUNCH] [DELETE]
```

6 Set the number of the desired file number with soft key **[F SRH]**. Then, start the search by pressing soft key **[EXEC]**. If found, the file is displayed at the top of the directory screen.

When a search is made for file number 19

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.    FILE NAME          COMMENT
 0019    O1000          (MAIN PROGRAM)
 0020    O1010          (SUBPROGRAM–1)
 0021    O1020          (COMMENT      )
 0022    O1030          (COMMENT      )
~
```

Reading a file

Procedure

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

2 Press function key PROG.

3 Press the rightmost soft key [▷] (continuous menu key).

4 Press soft key **[CARD]**. Then, the screen shown below is displayed.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.    FILE NAME        SIZE          DATE
 0001    O1000          123456        96/07/10
 0002    O1001            8458        96/07/30
 0003    O0002            3250        96/07/30
 0004    O2000           73456        96/07/31
 0005    O2001            3444        96/07/31
 0006    O3001            8483        96/08/02
 0007    O3300             406        96/08/05
 0008    O3400            2420        96/07/31
 0009    O3500            7460        96/07/31
~
[ PROG ][      ][ DIR  + ][      ][ (OPRT) ]
```

[F SRH] [F READ] [N READ] [PUNCH] [DELETE]

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

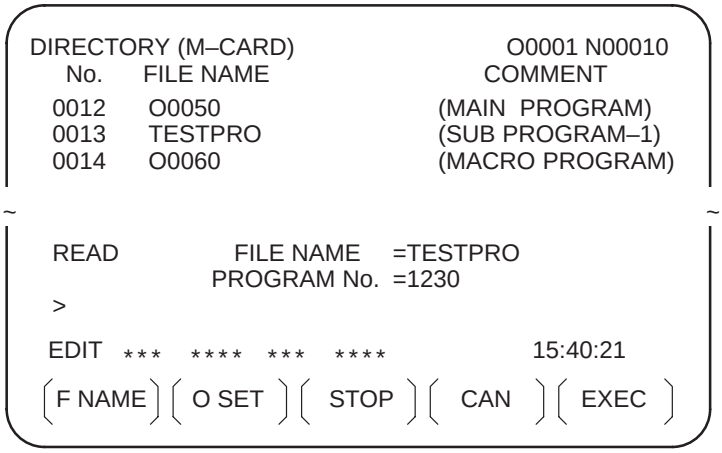
6 To specify a file number, press soft key **[F READ]**. The screen shown below is displayed.

```
DIRECTORY (M–CARD)                    O0001 N00010
  No.    FILE NAME                      COMMENT
 0019    O1000                  (MAIN  PROGRAM)
 0020    O1010                  (SUBPROGRAM–1)
 0021    O1030                  (COMMENT       )
~
 READ
         FILE NAME=20           PROGRAM No.=120
 >
 EDIT  ***  ****  ***  ****              15:40:21
[F NAME][ O SET ][ STOP ][ CAN ][ EXEC ]
```

7 Enter file number 20 from the MDI panel, then set the file number by pressing soft key **[F SET]**. Next, enter program number 120, then set the program number by pressing soft key **[O SET]**. Then, press soft key **[EXEC]**.

- File number 20 is registered as O0120 in the CNC.
- Set a program number to register a read file with a separate O number. If no program number is set, the O number in the file name column is registered.

8 To specify a file with its file name, press soft key **[N READ]** in step 6 above. The screen shown below is displayed.



9 To register file name TESTPRO as O1230, enter file name TESTPRO from the MDI panel, then set the file name with soft key **[F NAME]**. Next, enter program number 1230, then set the program number with soft key [O SET]. Then, press soft key **[EXEC]**.

Writing a file

Procedure

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

2 Press function key [PROG] .

3 Press the rightmost soft key [▷] (continuous menu key).

4 Press soft key **[CARD]**. The screen shown below is displayed.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.   FILE NAME        SIZE          DATE
 0001   O1000           123456        96/07/10
 0002   O1001             8458        96/07/30
 0003   O0002             3250        96/07/30
 0004   O2000            73456        96/07/31
 0005   O2001             3444        96/07/31
 0006   O3001             8483        96/08/02
 0007   O3300              406        96/08/05
 0008   O3400             2420        96/07/31
 0009   O3500             7460        96/07/31
~
[ PROG ][      ][ DIR + ][      ][ (OPRT) ]                ~
```

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

[F SRH] [F READ] [N READ] [PUNCH] [DELETE]

6 Press soft key **[PUNCH]**.

7 Enter a desired O number from the MDI panel, then set the program number with soft key **[O SET]**.
When soft key **[EXEC]** is pressed after the setting shown below has been made, for example, the file is written under program number O1230.

```
~                                                          ~
 PUNCH          FILE NAME  =
                PROGRAM No. =1230
 >
 EDIT  ***  ****  ***  ****                    15:40:21
[F NAME][ O SET ][ STOP ][ CAN ][ EXEC ]
```

8 In the same way as for O number setting, enter a desired file name from the MDI panel, then set the file name with soft key **[F SET]**.
When soft key **[EXEC]** is pressed after the setting shown below has been made, for example, the file is written under program number O1230 and file name ABCD12.

```
~                                                          ~
 PUNCH          FILE NAME  =ABCD12
                PROGRAM No. =1230
 >
 EDIT  ***  ****  ***  ****                    15:40:21
[F NAME][ O SET ][ STOP ][ CAN ][ EXEC ]
```

Deleting a file

Procedure

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

2 Press function key [PROG] .

3 Press the rightmost soft key [▷] (continuous menu key).

4 Press soft key **[CARD]**. The screen shown below is displayed.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.    FILE NAME        SIZE          DATE
 0001    O1000          123456        96/07/10
 0002    O1001            8458        96/07/30
 0003    O0002            3250        96/07/30
 0004    O2000           73456        96/07/31
 0005    O2001            3444        96/07/31
 0006    O3001            8483        96/08/02
 0007    O3300             406        96/08/05
 0008    O3400            2420        96/07/31
 0009    O3500            7460        96/07/31
~                                              ~
[ PROG ][      ][ DIR + ][      ][ (OPRT) ]
```

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

[F SRH] [F READ] [N READ] [PUNCH] [DELETE]

6 Set the number of the desired file with soft key **[DELETE]**, then press soft key **[EXEC]**. The file is deleted, and the directory screen is displayed again.

When file number 21 is deleted

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.    FILE NAME                      COMMENT
 0019    O1000                  (MAIN PROGRAM)
 0020    O1010                  (SUBPROGRAM–1)
 0021    O1020                  (COMMENT      )
 0022    O1030                  (COMMENT      )
~                                              ~
```

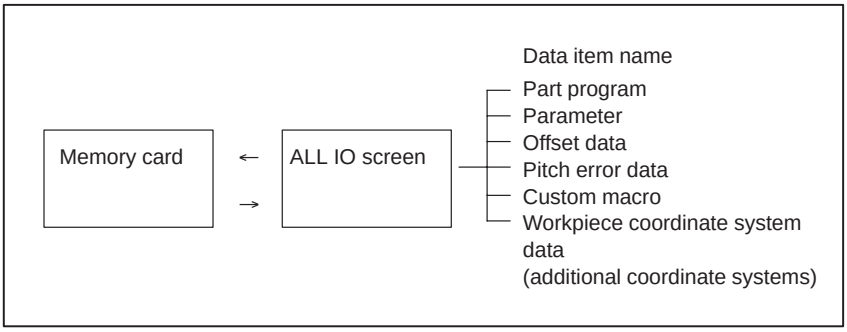
File name O1020 is deleted.

```
DIRECTORY (M–CARD)                    O0034 N00045
  No.    FILE NAME                      COMMENT
 0019    O1000                  (MAIN PROGRAM)
 0020    O1010                  (SUBPROGRAM–1)
 0021    O1020                  (COMMENT      )
 0022    O1030                  (COMMENT      )
~                                              ~
```

File number 21 is assigned to the next file name.

Batch input/output with a memory card

On the ALL IO screen, different types of data including part programs, parameters, offset data, pitch error data, custom macros, and workpiece coordinate system data can be input and output using a memory card; the screen for each type of data need not be displayed for input/output.



Procedure

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

2 Press function key [SYSTEM].

3 Press the rightmost soft key [▷] (continuous menu key) several times.

4 Press soft key **[ALL IO]**. The screen shown below is displayed.

```
READ/PUNCH (PROGRAM)                    O0001 N00001
   No.    FILE NAME          SIZE          DATE
 * 0001   O0222              332010        96–04–06
   0002   O1003              334450        96–05–04
   0003   MACROVAR.DAT       653400        96–05–12
   0004   O0002              341205        96–05–13
     [PROGRAM]
   O0001  O0002  O0003  O0005  O0100  O0020
   O0006  O0004  O0110  O0200  O2200  O0441
   O0330
 >
 EDIT  ***  ****  ***  ****              10:07:37
 [ PROG ][ PARAM ][OFFSET][      ][ (OPRT) ]
```

Upper part : Directory of files on the memory card
Lower part : Directory of registered programs

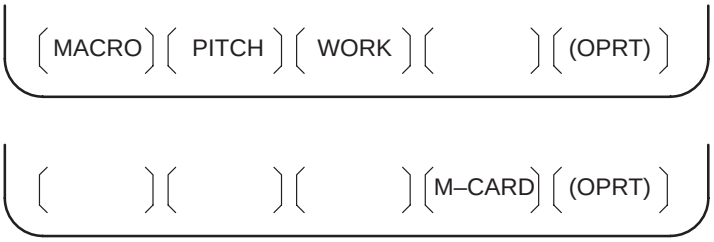
5 With cursor keys [↑] and [↓], the user can choose between upper part scrolling and lower part scrolling. (An asterisk (*) displayed at the left edge indicates the part for which scrolling is possible.)

[↑] : Used for memory card file directory scrolling.

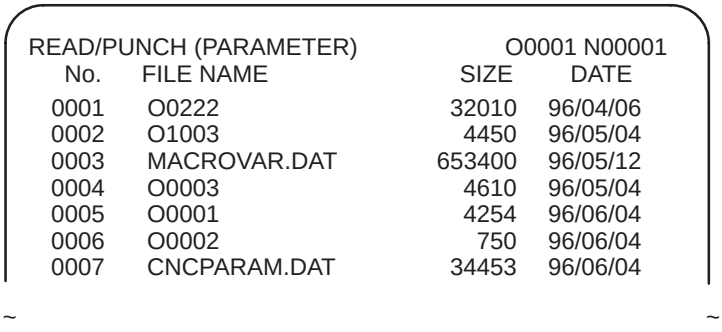
[↓] : Used for program directory scrolling.

6 With page keys [↑] and [↓], scroll through the file directory or program directory.

7 When this screen is displayed, the program data item is selected. The soft keys for other screens are displayed by pressing the rightmost soft key [▷] (continuous menu key). Soft key **[M–CARD]** represents a separate memory card function for saving and restoring system RAM data. (See Sections 3.3.7 and Section NO TAG.)



When a data item other than program is selected, the screen displays only a file directory.
A data item is indicated, in parentheses, on the title line.



8 Display the following soft keys with soft key **[(OPRT)]**.

The operation of each function is the same as on the directory (memory card) screen. Soft key **[O SET]**, used for program number setting, and the ”PROGRAM NUMBER =” indication are not displayed for data items other than program.

[F SRH] : Finds a specified file number.
[F READ] : Reads a specified file number.
[PUNCH] : Writes a file.
[N READ] : Reads a file under a specified file name.
[DELETE] : Deletes a specified file number.

NOTE
With a memory card, RMT mode operation and the subprogram call function (based on the M198 command) cannot be used.

Error codes

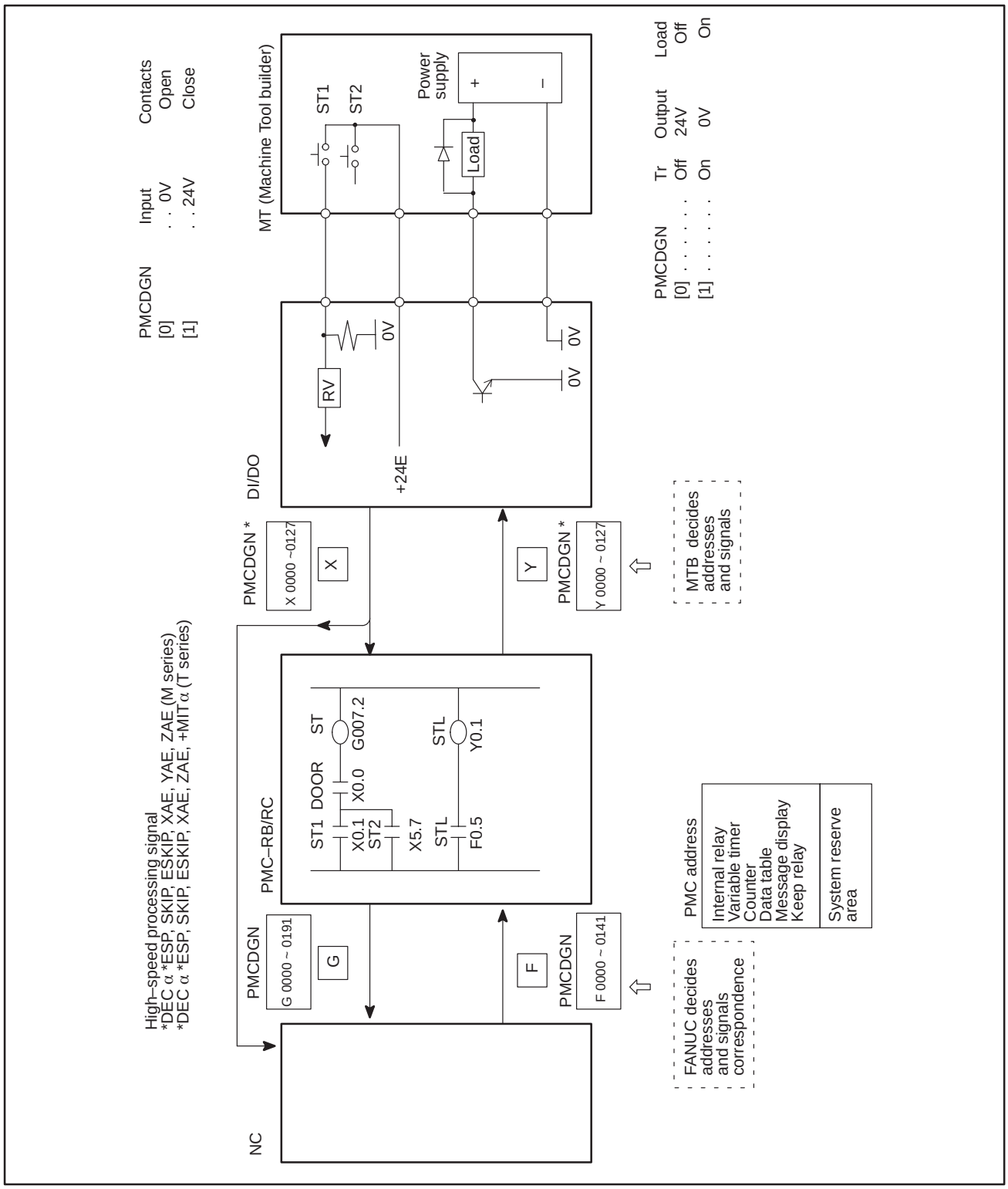
Memory card error codes

Code	Meaning
102	The memory card does not have sufficient free space.
105	No memory card is mounted.
106	A memory card is already mounted.
110	The specified directory cannot be found.
111	There are too many files under the root directory to allow a directory to be added.
114	The specified file cannot be found.
115	The specified file is protected.
117	The file has not yet been opened.
118	The file is already open.
119	The file is locked.
122	The specified file name is invalid.
124	The extension of the specified file is invalid.
129	A non–corresponding function was specified.
130	The specification of a device is invalid.
131	The specification of a pathname is invalid.
133	Multiple files are open at the same time.
135	The device is not formatted.
140	The file has the read/write disabled attribute.

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 screen.
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

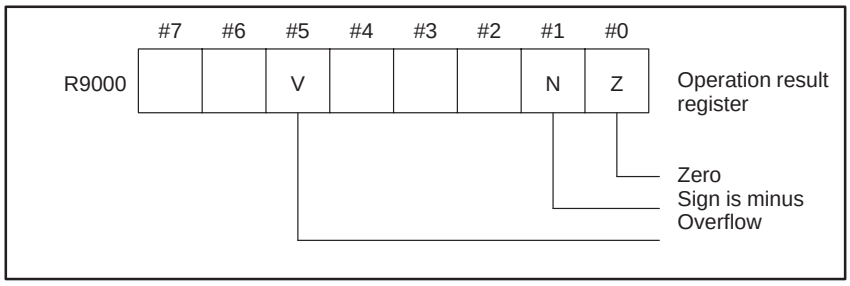
Model		Series 21*i*–MODEL A/Series 210*i*–MODEL A	
		PMC–RA1	PMC–RA5
Programming method language		Ladder	Ladder
Number of ladder level		2	2
Level–1 Cycle Time		8 ms	8 ms
Basic Instruction Execution Time		0.085 (us/step)	0.085 (us/step)
Program capacity			
● Ladder (step)		Approx. 3,000 Approx. 5,000	Approx. 3,000 Approx. 5,000 Approx. 8,000 Approx. 12,000 Approx. 16,000
● Symbol/Comment		1 to 128KB	1 to 128KB
● Message		0.1 to 64KB	0.1 to 64KB
● Language only		–	–
Instuction (Basic) (Functional)		12 kinds 49 kinds	14 kinds 66 kinds
Intemal relay	(R)	1100 byte	1118 byte
Message request	(A)	25 byte	25 byte
Non–volatile			
● Var. Timer	(T)	80 byte	80 byte
● Counter	(C)	80 byte	80 byte
● Keep relay	(K)	20 byte	50 byte
● Data table	(D)	1860 byte	1860 byte
Subprogram	(P)		512 programs
Label	(L)		9999 labels
Fixed timer		Timer No. 100 devices specified	Timer No. 100 devices specified
Input/output			
● I/O link	(I) Max.	1024 points max.	1024 points max.
	(O) Max.	1024 points max.	1024 points max.
Sequence program storage media		Flash ROM	Flash ROM
Ladder		128KB	128KB

4.2.2 Address

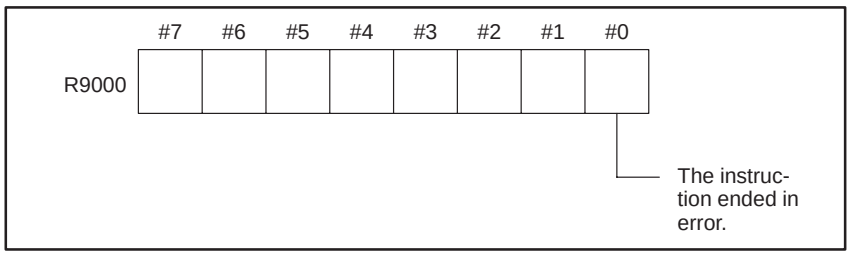
Character	Signal description	Model	
		Series 21*i*–MODEL A /Series 210*i*–MODEL A	
		PMC–RA1	PMC–RA5
X	Input signal from the machine to the PMC (MT to PMC)	X0 to X127	
Y	Output signal from the PMC to the machine (PMC to MT)	Y0 to Y127	
F	Input signal from the NC to the PMC (NC to PMC)	F0 to F255 F1000 to F1255	F0 to F511 F1000 to F1255
G	Output signal from the PMC to the NC (PMC to NC)	G0 to G255 G1000 to G1255	G0 to G511 G1000 to G1255
R	Internal relay	R0 to R999 R9000 to R9099	R0 to R999 R9000 to R9117
A	Message request signal	A0 to A24	A0 to A24
C	Counter	C0 to C79	C0 to C79
K	Keep relay	K0 to K19	K0 to K19
T	Data table	T0 to T79	T0 to T79
D	Variable timer	D0 to D1859	D0 to D1859
L	Label number	–	L1 to L9999
P	Subprogram number	–	P1 to P512

4.2.3 System Reserve Area of Internal Relay

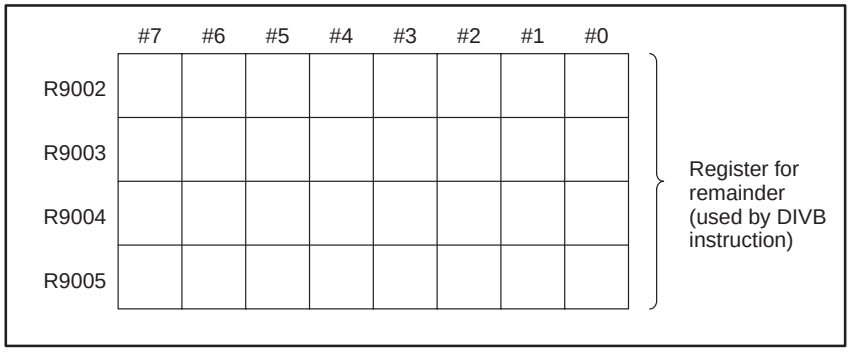
(1) R9000 (Operation output register for the ADD, SUB, MULB, DIVB, and COMPB functional instructions)



(2) R9000 (Error output for the EXIN, WINDR, WINDW, MMCWR, MMCWW, MMC3R, and MMC3W functional instructions)

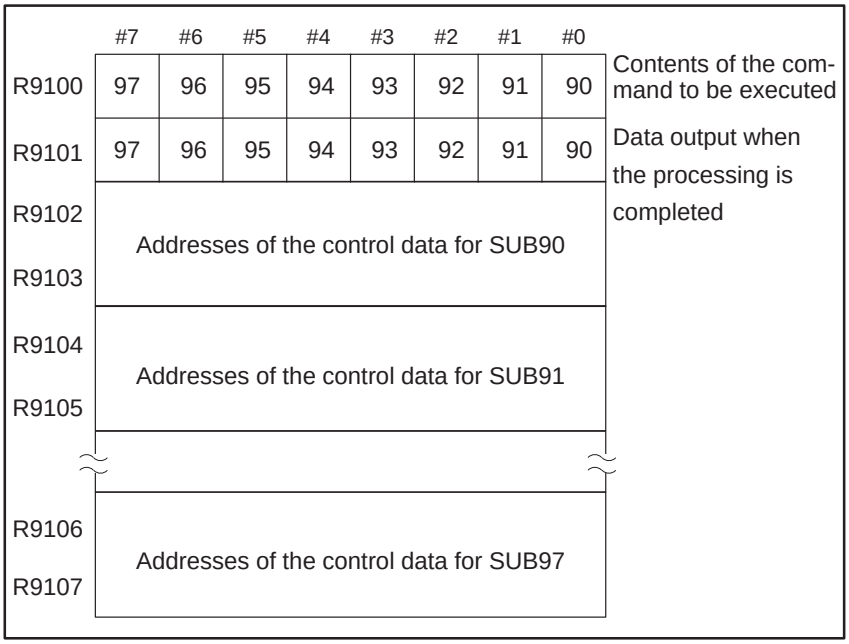


(3) R9002 to R9005 (Operation output registers for the DIVB functional instruction)
The data remaining after the DIVB functional instruction is executed in output.



(4) R9100 to R9117 (Interface area for the FNC9x functional instruction)

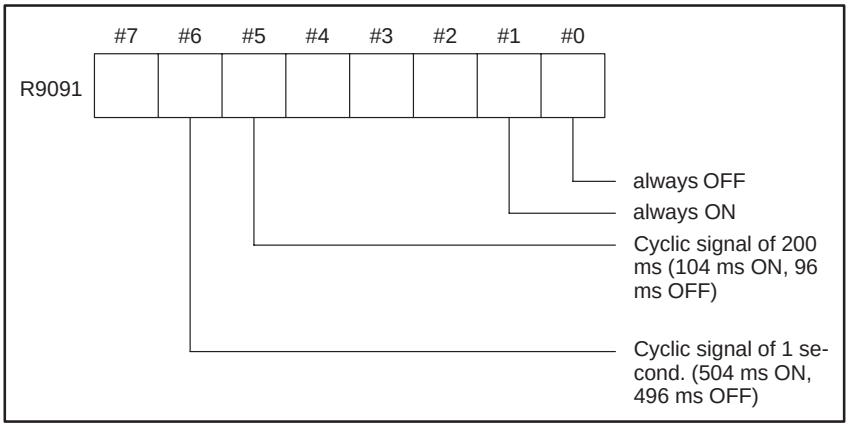
The area is provided as an interface between the FNC9x functional instruction to be executed and a desired function.



(5) R9091 (System timer)

4 signals can be used as system timer.

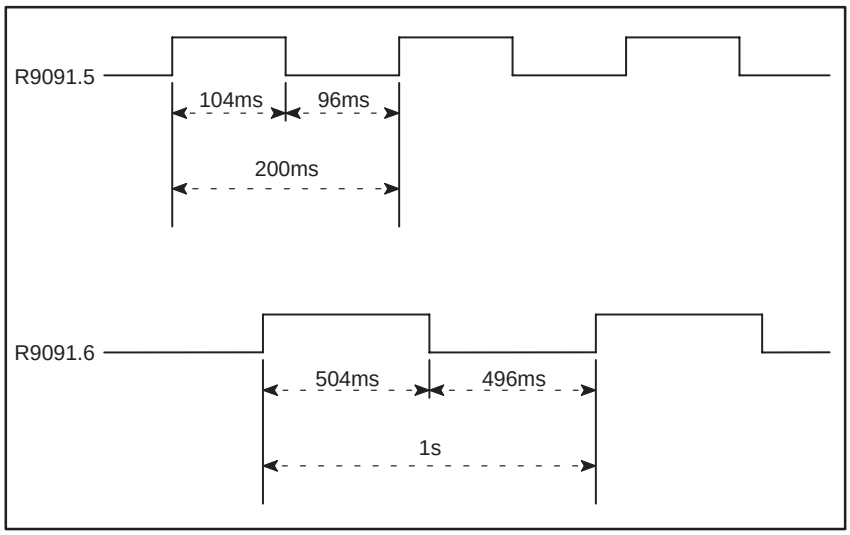
The specifications of every signal are as following.



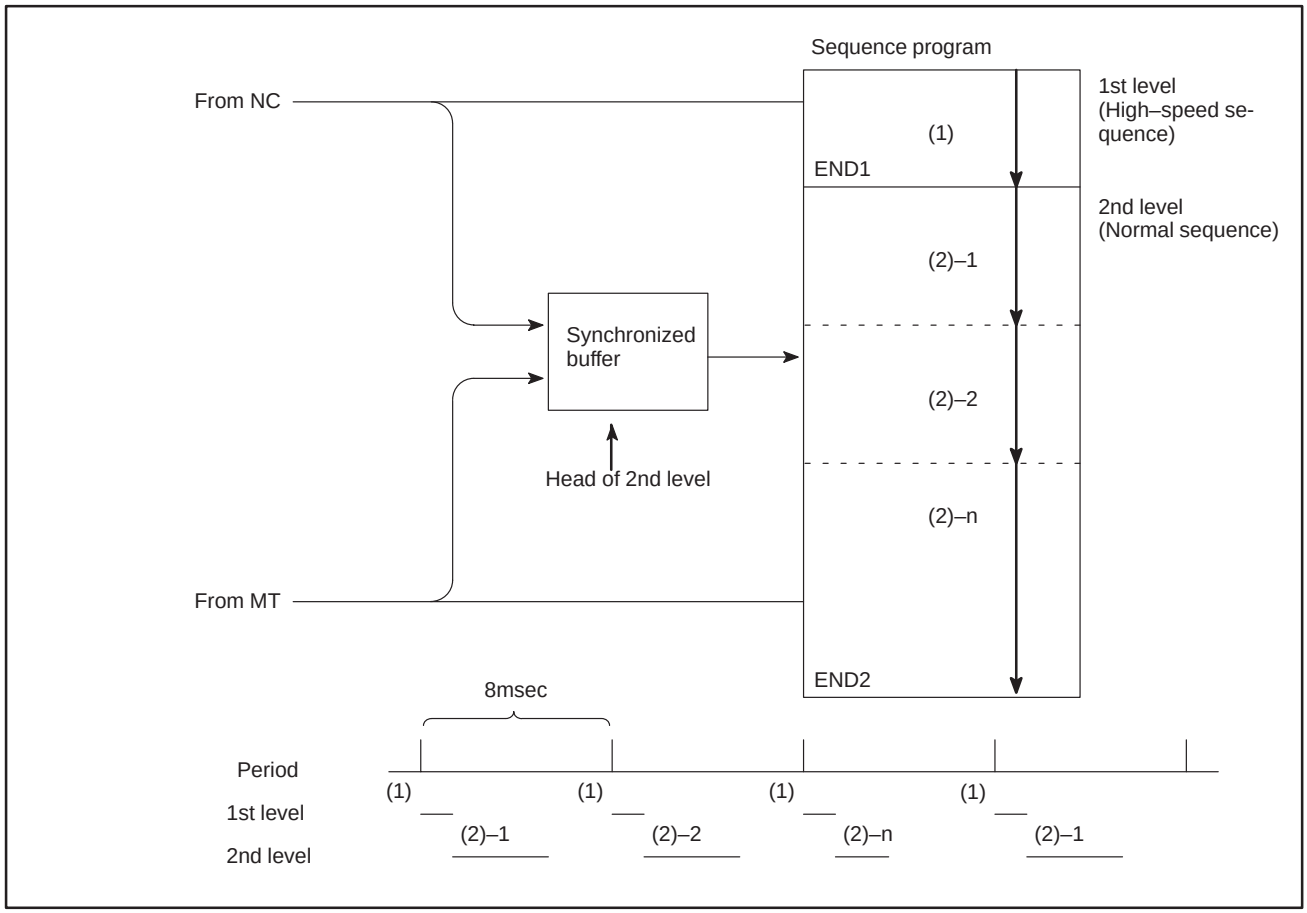
CAUTION

Each signal is initially off. R9091.0 and R9091.1 are set cyclically at the beginning of the first ladder level.

Each signal (ON–OFF signal) has an accuracy of ±8 ms.



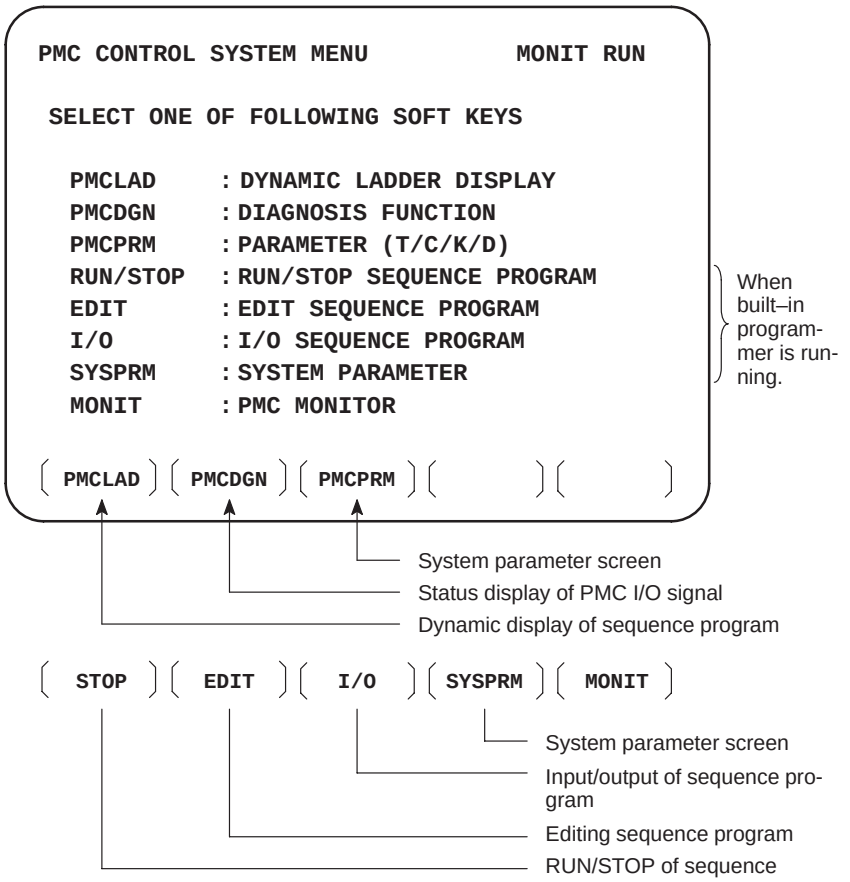
4.2.4 Execution Period of PMC



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:



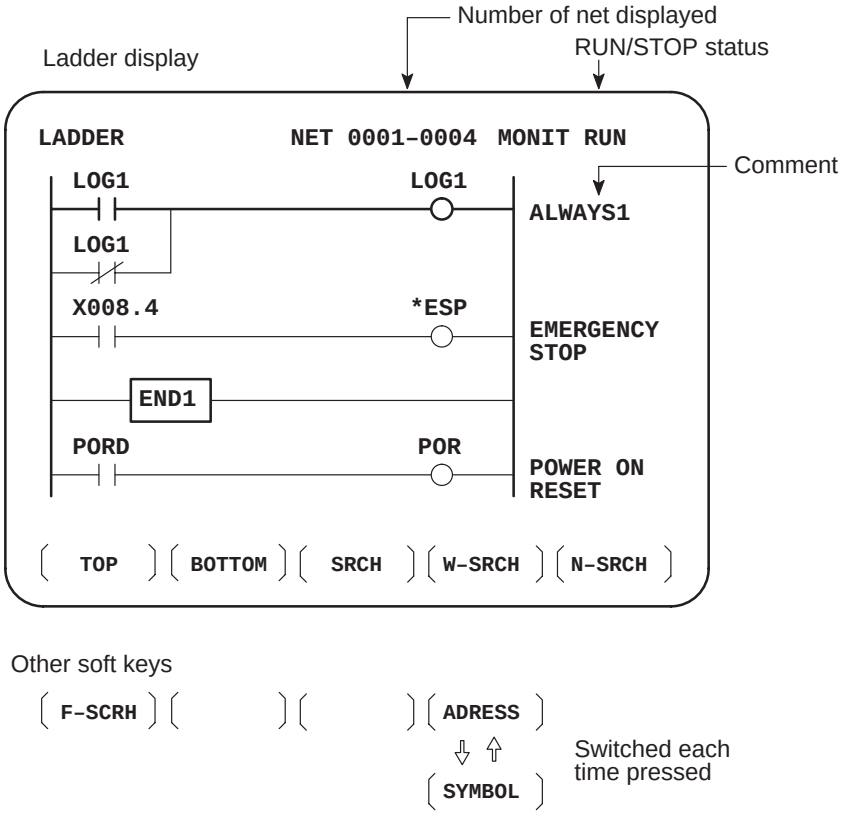
The no. of menus to be displayed changes depending on presence/ absence of built–in programmer.

	PMC–RA1/RA5 (Without memory card for editing)	PMC–RA1/RA5 (With memory card for editing)
RUN/STOP	○	○
EDIT	×	○
I/O	○	○
SYSPRM	×	○

× : Cannot be displayed nor used.

4.3.2 PMCLAD Screen

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



- **Contents displayed**

1. 1Green (Low brightness) displayContacts :open Relay :off
2. White (High brightness) display Contacts : closed Relay : on

- **Search method**

1. Use the cursor keys ↓ ↑ or the page keys PAGE ↓ PAGE ↑ 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.

● Dump display on ladder diagram

Ladder diagram and signal status dump can displayed together.
The dump is displayed over 2 lines at the last line of ladder diagram by pressing the **[DUMP]** soft key.

keys or **[SEARCH]** soft key is used for changing of PMC address.

The [DUMP] soft key has the follwing functions.

(1) [BYTE]: Byte type display (1 BYTE)
"G0000 00 14 00 00 01 00 00 00 00 00 00 00 00 00 00 00"
"G0016 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00"

(2) [WORD] : Word type display (2 BYTE)
"G0000 1400 0000 0001 0000 0000 0000 0000 0000"
"G0016 0000 0000 0000 0000 0000 0000 0000 0000"

(3) [D.WORD]: Long word type display (4 BYTE)
"G0000 00001400 00000001 00000000 00000000"
"G0016 00000000 00000000 00000000 00000000"

● Parameter display on ladder diagram

The value of parameter of a functional instruction is displayed in the functional instruction of a ladder diagram.

The function of the soft key is as follows:

(1) [DPARA] : The value of parameter is displayed in functional instruction.

(2) [NDPARA] : The value of parameter is not displayed in functional instruction.

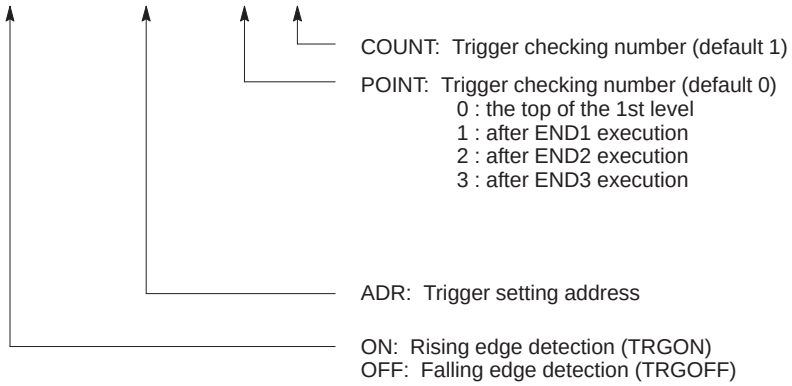
● Stop of ladder diagram display by trigger of signal

The ladder display can be stopped by manual operation or trigger of signal.
The former ladder diagram display renews signal status every moment. But by using this function, all the ladder diagram at the specified moment can be checked.
The stop conditions as a trigger are specified by rising or falling edge detection of the designated signal.

- **Display of setting trigger**

The setting address, condition and counter are displayed at the title line.

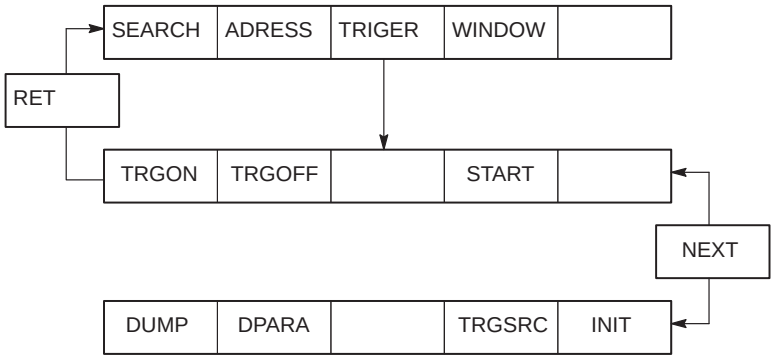
“MODE:ON : X0000. 0 : 0 : 0001 ”



* Setting form adr ;p1 ;p2+[TRGON/TRGOFF]soft key

NOTE
“;”=”EOB” adr (trigger address) ;p1 (trigger point) ;p2 (trigger checking number (1 to 65535))

* Because parameters are stored in the nonvolatile memory, they are not lost even if the power is turned off.
When bit 2 of keep relay K18 is set to 1 after parameters for sampling are specified, the trigger function automatically starts when the power is turned on.
For this operation, depress **[TRIGER]** soft key to bring the following menu.



The function of the **[TRIGER]** soft key is explained below:

(1) [TRGON] : The trigger function is stopped when a specified address signal goes high (is turned ON).

(2) [TRGOFF] : The trigger function is stopped when a specified address signal goes low (is turned OFF).

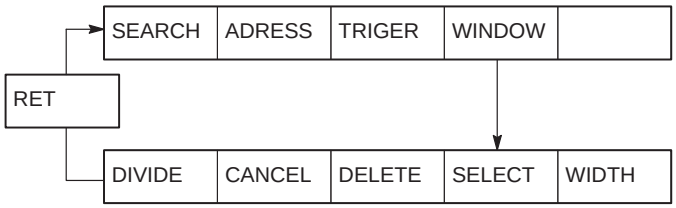
(3) [START] : Pressing this key switches between trigger function execution and trigger function termination. While the trigger function is being executed, the ”TRG” indication blinks.

(4) [TRGSRC]: An instruction at which the trigger function has been stopped by a specified address signal is searched for and indicated by blinking.

(5) [INIT] : The trigger setting is initialized.

- **Divided display of ladder diagram**

This function is used for displaying the divided screen. It can display max. six division.
For this operation, depress **[WINDOW]** soft key to bring the following menu.



The function of the soft key **[WINDOW]** is as follows:

(1) [DIVIDE] : The screen will be divided.
The dividing display of ladder diagram can be displayed for the designated NET number.
(NET number+**[DIVIDE]**)

(2) [CANCEL] : The dividing display of ladder diagram display ends.
(The screen returns to normal display.)

(3) [DELETE] : The screen division subject to operation is ended.

(4) [SELECT] : Change the screen subject to division operation.
The screen in operation is displayed by ”purple” title line, another screen is displayed by “blue” title line.
In monochrome CRT, the screen is displayed by changing brightness.

(5) [WIDTH] : Change the width of division by using **[EXPAND]** or **[SHRINK]** soft key.

(6) [EXPAND] : The divided screen is expanded.

(7) [SHRINK] : The divided screen is shrank.

- **ON–LINE EDIT**

When bit 1 in the keep relay K17 is 1, this function is available and **[ONLEDT]** soft key is displayed.

When the ladder program is executing, a part of the ladder program can be changed.
- Change the type of contact (A contact, B contact)
- Change address of contact and coil.
- Change address parameter of functional instruction.

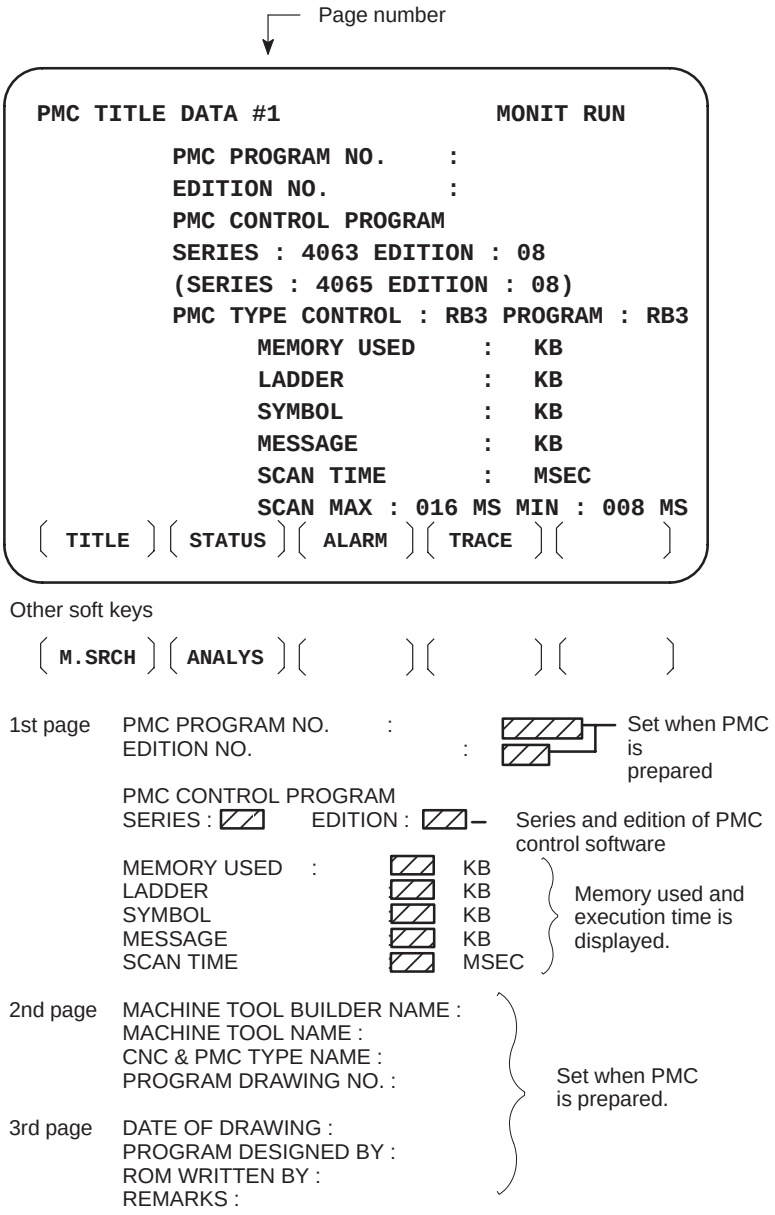
This function don’t change the size.
(Cannot be Addition, deletion and chanegable data size)
When bit 3 in the keep relay K18 is 1, this program is automatically transferred to backup RAM after on–line edit.
When bit 3 in the keep relay K18 is 0, transfer to backup RAM with COPY function of I/O screen. If power is off without this operation, edited data is lost.

4.3.3 PMCDGN Screen

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

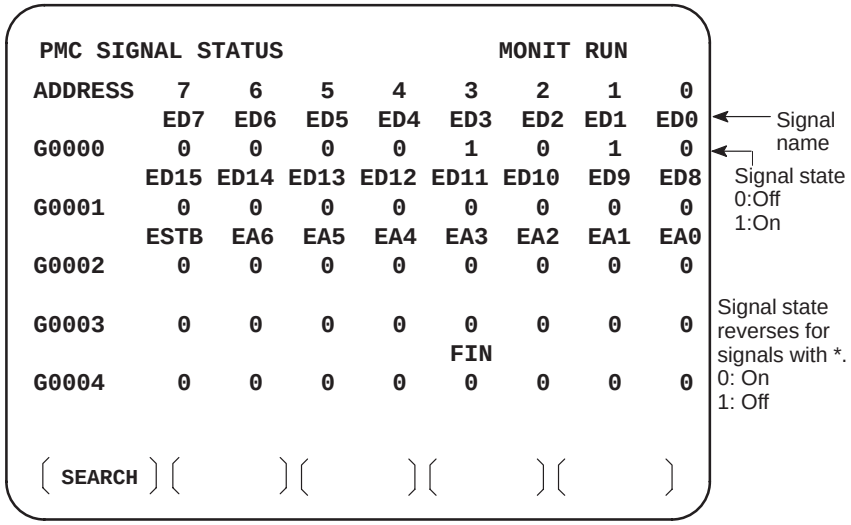
- **TITLE screen**

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.

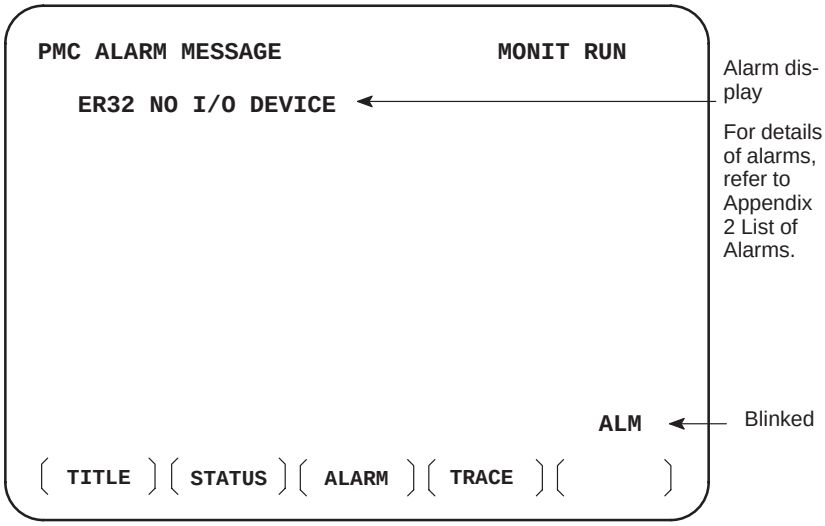


[Search Method]

- 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**

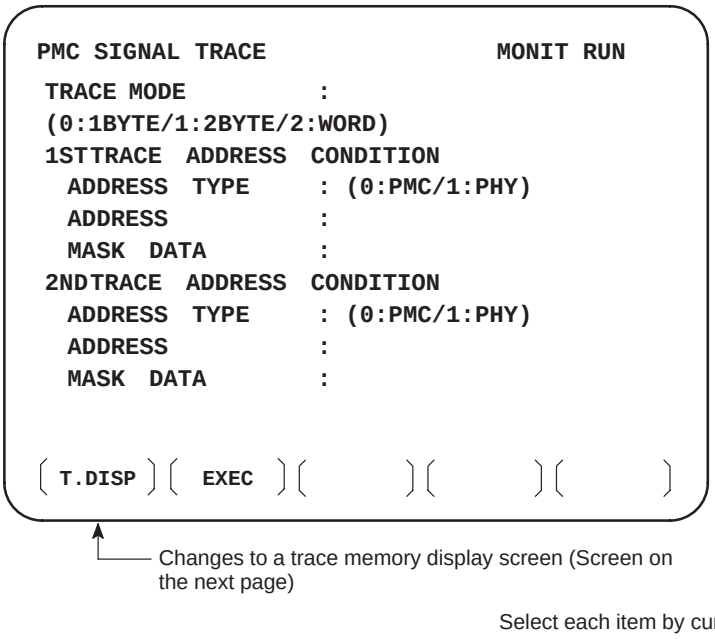
Displays an alarm generated in PMC.



● 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



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.

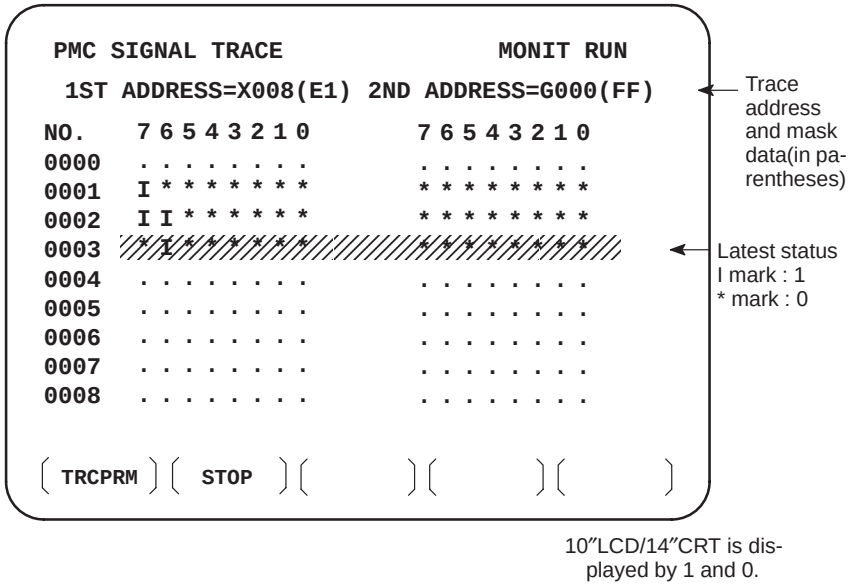
d. MASK DATA: The bits to be traced are specified by a hexadecimal number (2 digits).
For example, to trace the signals at bit 7,6,5 and 0, set E1 (hexadecimal) to MASK DATA.

	#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



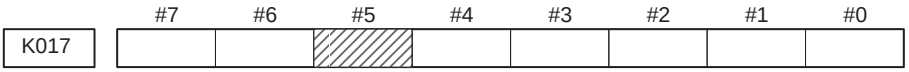
10″LCD/14″CRT is displayed by 1 and 0.

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

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

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

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



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

1 : Tracing starts automatically after power on

4.3.4 Memory Display (M.SRCH)

- **Display of Screen and Operation**

1) Pressing the **[M.SRCH]** soft key changes the screen to that shown in Fig. 3.5. The displayed soft keys also change.
2) Enter a physical address in hexadecimal from which the contents of the memory are to be displayed. Then pressing the **[SEARCH]** key displays 256 byte of stored data starting from the specified address.

   Example) Enter 100000, then pressing the **[SEARCH]** keydisplays the contents of the memory starting from 100000H.

3) An address can be changed using the PAGE ↓ or PAGE ↑ key.
4) Pressing either the **[BYTE]**, **[WORD]**, or **[D.WORD]** soft key displays data of the corresponding type.
   If an address at which the memory is not used is specified, a system error occurs.

- **Function of store memory**

To store data in memory, set bit 4 of keep relay K17 to 1, move the cursor to a position at which the address of the data to be changed in RAM is displayed, and enter data in units of data type in hexadecimal.

Example) Entering 0F41, then pressing the INPUT key stores 0F41 at the address specified by the cursor

```
PMC CONTENTS OF MEMORY                                        MONIT RUN

100000  0000 0000 0000 0000 0000 0000 0000 0000  ................
100010  4142 4344 4546 4748 494A 4B4C 4D4E 4F50  ABCDEFGHIJKLMNOP
100020  2020 2020 2020 2020 2020 2020 2020 2020
100030  5152 5354 5556 5758 595A 2020 2020 2020  QRSTUVWXYZ

100040  0000 0000 0000 0000 0000 0000 0000 0000  ................
100050  0000 0000 0000 0000 0000 0000 0000 0000  ................
100060  0000 0000 0000 0000 0000 0000 0000 0000  ................
100070  0000 0000 0000 0000 0000 0000 0000 0000  ................

100080  4641 4E55 4320 434F 2E2C 5444 0000 0000  FANUC CO.LTD....
100090  0000 0000 0000 0000 0000 0000 0000 0000  ................
1000A0  0000 0000 0000 0000 0000 0000 0000 0000  ................
1000B0  0000 0000 0000 0000 0000 0000 0000 0000  ................

1000C0  0000 0000 0000 0000 0000 0000 0000 0000  ................
1000D0  0000 0000 0000 0000 0000 0000 0000 0000  ................
1000E0  0000 0000 0000 0000 0000 0000 0000 0000  ................
1000F0  0000 0000 0000 0000 0000 0000 0000 0000  ................

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

- **ANALYS screen (Ladder editing card is required)**

Change of signals is displayed as the same display as that on the oscilloscope.

1 Parameter setting screen (1st page)

```
   PMC SIGNAL ANALYSIS(PARAM)   MONIT RUN

SAMPLING TIME      :       10 (1–10 SEC)        (a)

TRIGGER ADDRESS    : G0007.2                    (b)

CONDITION          :        0                   (c)
(0: START 1: TRIGGER–ON 2: TRIGGER–OFF)

TRIGGER MODE       :        0                   (d)
(0: AFTER 1: ABOUT 2: BEFORE 3: ONLY)

 [ SCOPE ][ DELETE ][ INIT  ][ADDRESS][       ]
```

Select each item by cursor key

(a) Set a sampling time.

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

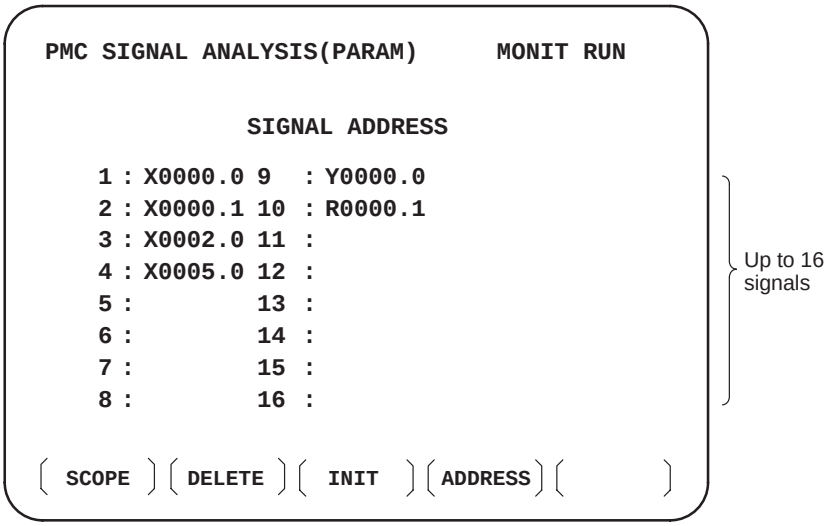
(c) Set a condition under which recording is initiated.

- 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

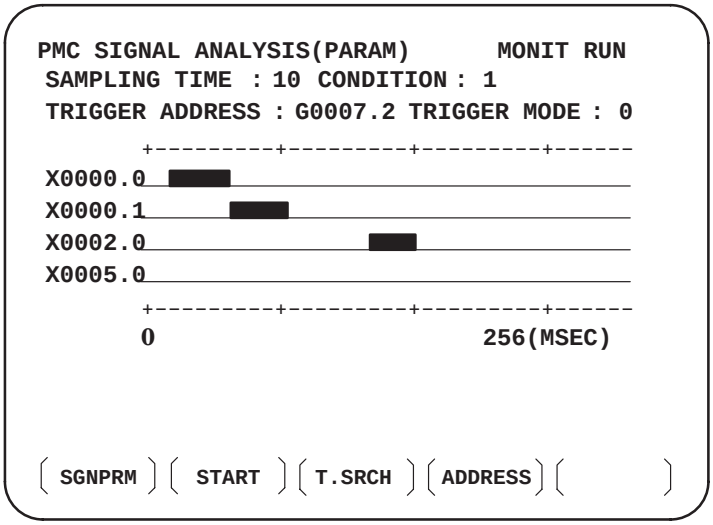
- 0 : Record signal status after the trigger condition is satisfied
- 1 : Record signal status before and after the trigger condition is satisfied.
- 2 : Record signal status before the trigger condition is satisfied.
- 3 : Record signal status when the trigger condition is satisfied. (Display is same 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.
"■" 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

4.3.5 PMCPRM 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

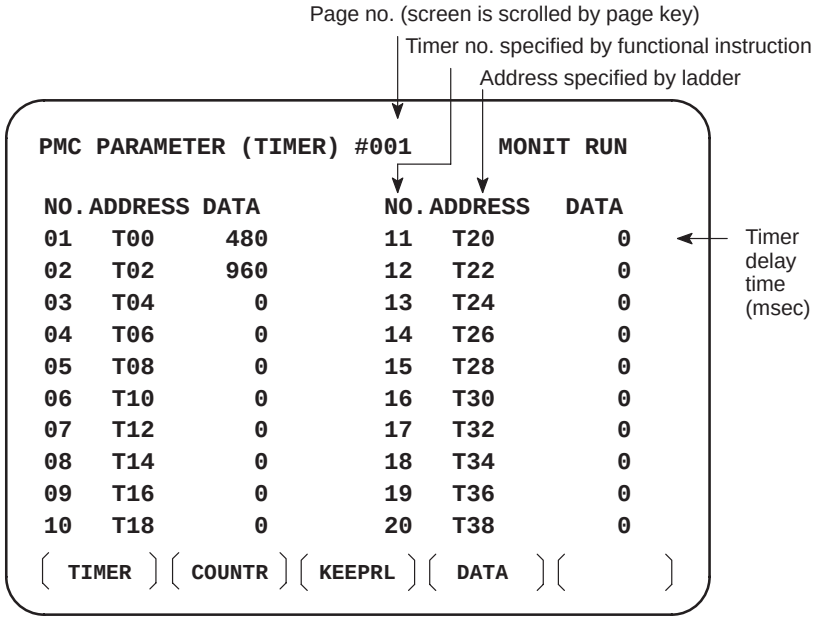
4 Press cursor key and move the cursor to a desired number.

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**

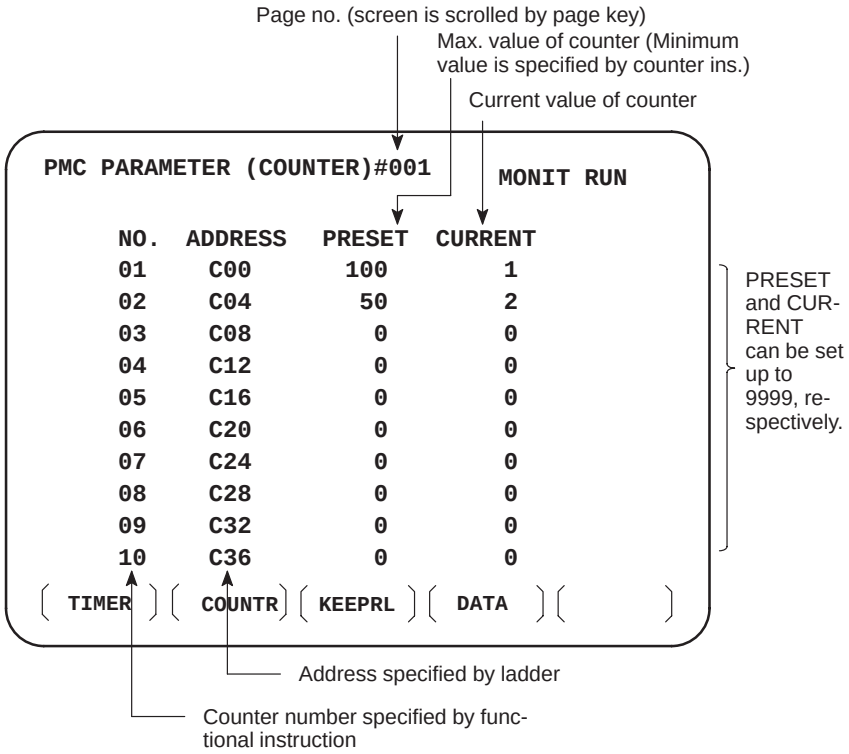
This screen is used for setting timer time of the functional instruction (SUB 3).



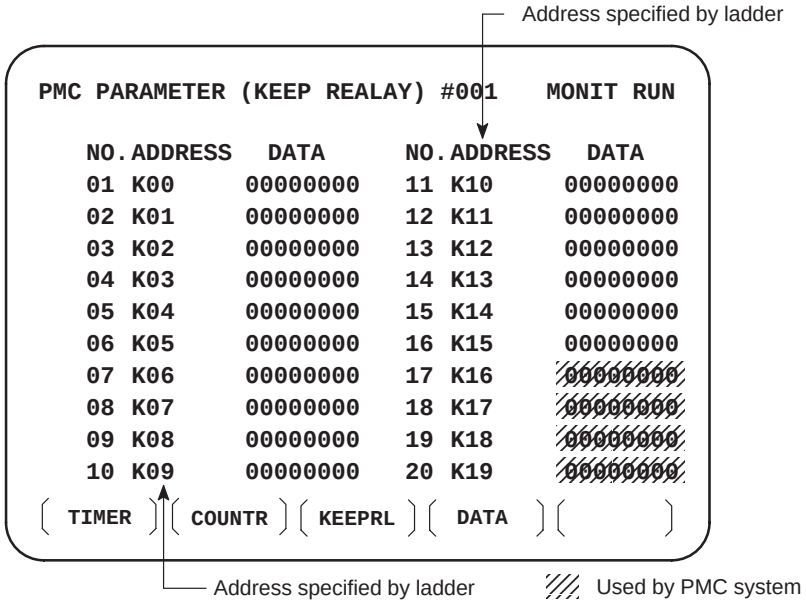
Timer set time : Timer no. 1–8 is max. 1572.8 sec and its accuracy is 48ms.
Timer no. 9 is max. 262.1 sec and its accuracy is 8ms.

- **COUNTER screen**

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



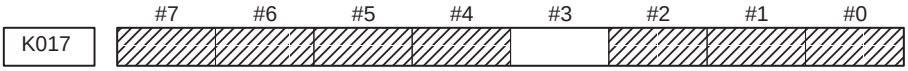
- **KEEP RELAY screen**



1 Nonvolatile memory control

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



#0(LADMASK) 0 : Dynamic display of ladder is executed.

1 : Dynamic display of ladder is not executed.

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

1 : Built–in programmer is used.

#2(AUTORUN) 0 : A sequence program is executed automatically after the power is turned on.

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

#4(MEMINP) 0 : Data input cannot be done in memory contents display function.

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

#5(TRCSTAT) 0 : Signal tracing starts by soft key **[EXEC]** in signal trace function.

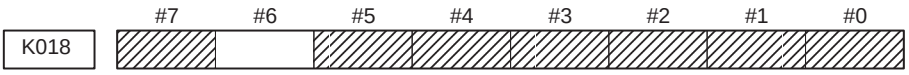
1 : Signal tracing starts automatically by power on in signal trace function.

#6(ANASTAT) 0 : Pressing **[EXEC]** key initiates sampling by signal waveform display function.

1 : Turning power to on initiates sampling by signal waveform display function.

#7(DTBLDSP) 0 : The PMC parameter data table control screen is displayed.

1 : The PMC parameter data table control screen is not displayed.



#0(IGNKEY) 0 : Function keys are enabled when a user program displays the user screen.

1 : Function keys are disabled when a user program displays the user screen.

#1(DBGSTAT) 0: In the C language debug function, the automatic break processing does not start when the power is turned on.

1 : In the C language debug function, the automatic break processing starts when the power is turned on.
*This flag is effective for the PMC C language program.

#2(TRGSTAT) 0 : The trigger stop function does not automatically start when the power is turned on.

1 : The trigger stop function automatically starts when the power is turned on.

#3(TRNSRAM) 0 : A ladder program is not automatically sent to the backup RAM after on–line editing is completed.

1 : A ladder program is automatically sent to the backup RAM after on–line editing is completed.

#4(CALCPRTY) 0 : The built–in programmer function performs RAM parity calculation.

1 : The built–in programmer function does not perform RAM parity calculation.

#5(CHKPRTY) 0 : The parity check is performed for the system ROM and program ROM/RAM.

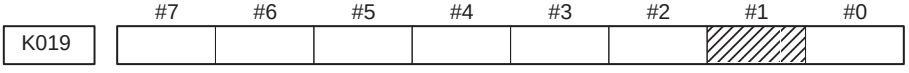
1 : The parity check is not performed for the system ROM and program ROM/RAM.

#7(IGNDINT) 0 : When the screen is switched to the PCMMDI screen, the screen is initialized.

1 : When the screen is switched to the PCMMDI screen, the screen is not initialized.
*It is effective for PMC C language program

*This flag is effective for the PMC C language program.

When this bit is set to 1 of the user screen, the screen cannot be switch to the NC screen using function keys. A program which always sets this bit to 0 or which changes the screen to the NC screen is required.



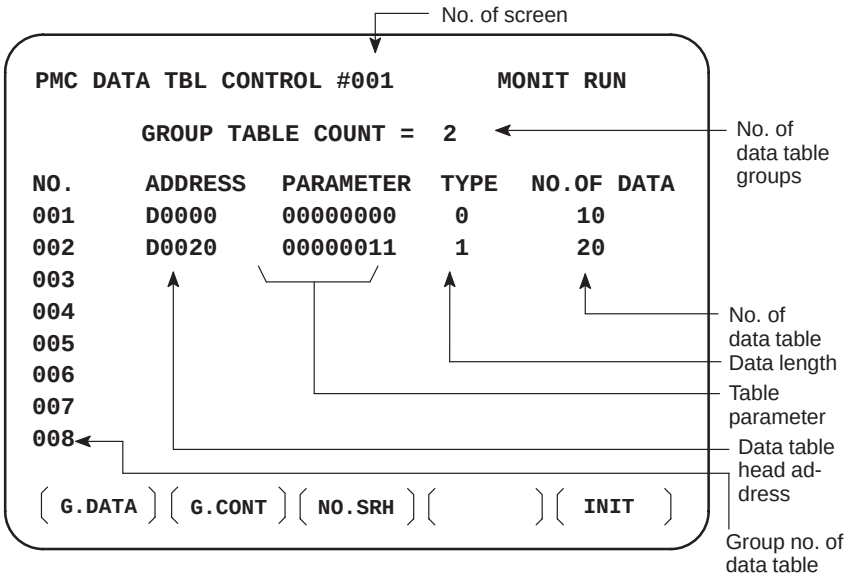
#1(C–REJECT) 0 : A C–language program is activated.

1 : A C–language program is forcibly activated.
*The flag is effective for the PMC C language program.

These bits are status of not used for PMC management software 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)

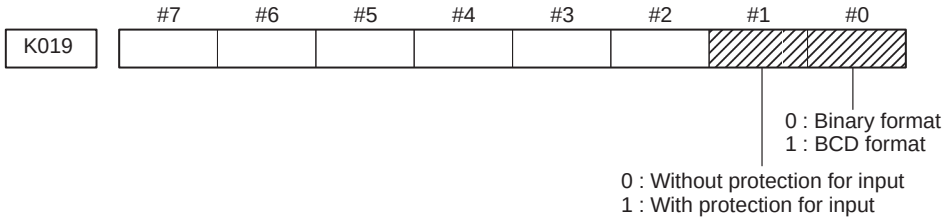
b. NO. OF GROUPS **[G.CONT]**: Set the no. of groups of data table.

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

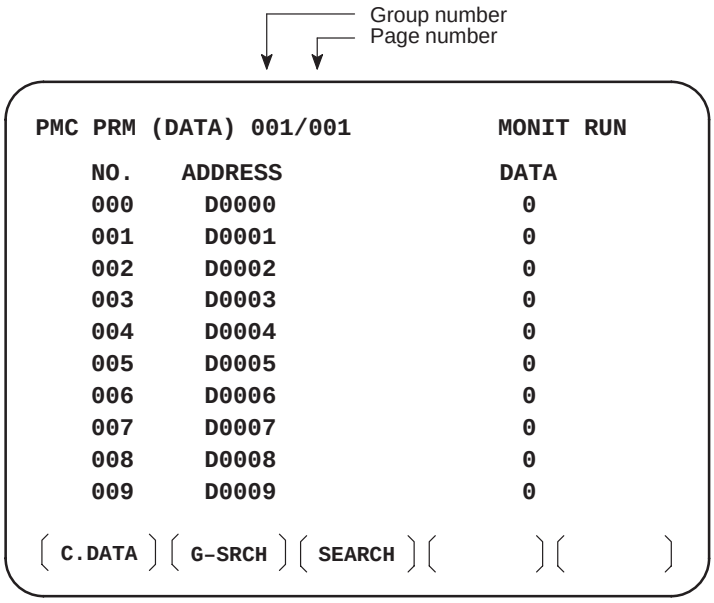


TYPE

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

e. Using the page key PAGE ↓ / PAGE ↑, 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 to 9 (Block delete) MIα (Mirror image) STLK (Start lock:16T/18T) CDZ (Chamfering:16T/18T) SMZ (In–position check:16T/18T) PN1 to 8 (External program no. search) MINP (External program input) DNCI (DNC input mode) HSα1A to D (Handle interrupt axis select) AFL (Auxiliary function neglect) FIN, MFIN2, MFIN3 (Auxiliary function complete) MFIN, SFIN, TFIN, TFIN (High speed M/S/T function complete) GR1, 2 (Gear input 16T/ 18T) *SSTP (Spindle stop) SAR (Spindle speed arrival) SOR (Spindle orientation)	[PMC ⇒ CNC] *FV0 to 7 (Feed rate override) *AFV0 to 7 (2nd feed rate override) OVC (Override cancel) ROV1,ROV2, HROV, *HROV0 to 6 (Rapid traverse override) SOV0 to 7 (Spindle speed override)
		[CNC ⇒ PMC] STL (Cycle start LED) SPL (Feed hold LED) MF, M00 to M31 MF2, M200 to M215 } (Miscellaneous function) MF3, M300 to M315 SF, S00 to S31 (Spindle speed function) TF, T00 to T31 (Tool function) BF, B00 to B31 (2nd miscellaneous func.) DEN (Distribution end) OP (automatic operating) GR1O to GR3O(Gear selection:16M/18M)	

● Manual operation

MODE			INPUT/OUTPUT SIGNAL	FEED RATE, ETC
MANUAL OPERATION	Handle/ incremental		[PMC ⇒ CNC] HSnA to D (Axis selection) n:1 to 3(No. of MPGs) +α, –α (Jog feed)	[PMC ⇒ CNC] MP1, MP2 (Multiplier)
	JOG		[PMC ⇒ CNC] RT (Rapid traverse)	[PMC ⇒ CNC] *JV0 to 15 (Manual feedrate override) +α, –α (Manual feed move command) ROV1, ROV2 HROV *HROV0 to 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)	

● Others

Others	[PMC ⇒ CNC] MD1 to 4 (Mode selection) *ESP (Emergency stop) KEY1 to 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:M series) STLK (Start lock:T series) *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 M series) *±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) TAP (Tapping)

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

#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.

#1 (DGPRM)☆ 0 : Initial setting of digital servo parameter is done.

1 : Initial setting of digital servo parameter is not done.

#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)

(2) Motor number

For α series servo motor

Model name	α 0.5	α 1/3000	α 2/2000	α 2.5/3000	α 3/3000
Drawing number	0113	0371	0372	0374	0123
Format number	13	61	46	84	15

Model name	α 6/2000	α 6/3000	α 12/2000	α 12/3000	α 22/1500
Drawing number	0127	0128	0142	0143	0146
Format number	16	17	18	19	27

Model name	α 22/2000	α 22/3000	α 30/1200	α 30/2000	α 30/3000
Drawing number	0147	0148	0151	0152	0153
Format number	20	21	28	22	23

Model name	α 40/FAN	α 40/2000	α 65	α 100	α 150
Drawing number	0158	0157	0331	0332	0333
Format number	29	30	39	40	41

For α L series servo motor

Model name	α L3/3000	α L6/2000	α L9/3000	α L25/3000	α L50/2000
Drawing number	0561	0562	0564	0571	0572
Format number	56 or 68	57 or 69	58 or 70	59	60

For α C series servo motor

Model name	α C3/2000	α C6/2000	α C12/2000	α C22/1500
Drawing number	0121	0126	0141	0145
Format number	7	8	9	10

For α HV series servo motor

Model name	α 12HV	α 22HV	α 30HV
Drawing number	0176	0177	0178
Format number	3	4	5

For α E and β series servo motor

Model name	α 0.5	β 1/3000 α E1/3000	β 2/3000 α E2/3000	β 3/3000 α E3/3000	β 6/2000 α E6/2000
Drawing number	0113	0101	0102	0105	0106
Format number	13	35	36	33	34

For α M series servo motor

Model name	α M2/3000	α M2.5/3000	α M3/3000	α M6/3000	α M9/3000
Drawing number	0376	0377	0161	0162	0163
Format number	97	98	24	25	26

Model name	α M22/3000	α M30/3000	α M50/3000
Drawing number	0165	0166	0169
Format number	100	101	108

Model name	α M6HV	α M9HV	α M22HV	α M30HV
Drawing number	0182	0183	0185	0186
Format number	104	105	106	107

For linear motor

Model name	1500A	3000B	6000B	9000B
Drawing number	0410	0411	0412	0413
Format number	90	91	92	93

(3) Arbitrary AMR function (for 5–0S to 3–0S)

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

#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

NOTE
Set ”00000000” for serial pulse coder C.

(4) CMR

PRM	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 the power then back on.

(6) Feed gear N/M

PRM	2084	n for flexible feed gear
PRM	2085	m for flexible feed gear

1) For serial pulse coder A or B, and serial α pulse coder.

$$\frac{n}{m} = \frac{\text{Number of feedback pulses per revolution of motor}}{1000000}$$

NOTE
For serial pulse coder B, use a value not exceeding 250,000 as the number of feedback pulses per revolution.

<<Examples of calculation>>

	1/1000 mm	1/10000 mm
One revolution 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

(7) Direction of travel

PRM 2022 Rotational direction of motor

111 : Normal (clockwise) –111 : Reverse (counterclockwise)

(8) Number of velocity pulses and position pulses

1) For serial pulse coder A or B, or serial α pulse coder

	Paramter No.	Increment system : 1/1000mm		Increment system : 1/10000mm	
		Closed loop	Semi–closed loop	Closed loop	Semi–closed loop
High resolution setting	2000	xxxx xxx 0		xxxx xxx 1	
Separate detector	1815	0010 0010	0010 0000	0010 0010	0010 0000
No. of velocity feedback pulses	2023	8192		819	
No. of position feedback pulses	2024	NS	12500	NS/10	1250

NOTE
1 NS is the number of position feedback pulses per one revolution of the motor (multiplied by four)
2 The 5–0S to 3–0S motors have different numbers of poles. Set parameter 2001.
3 Even if the system employs a closed loop, bit 3 of parameter 2002 is 1 and bit 4 is 0.

(9) Reference counter

PRM 1821 Reference counter capacity for each axis (0 to 99999999)

6. Turn off the power then back on.

(10) FSSB display and setting screen

Connecting the CNC control unit to servo amplifiers via a high–speed serial bus (FANUC Serial Servo Bus, or FSSB), which uses only one fiber optics cable, can significantly reduce the amount of cabling in machine tool electrical sections.

Axis settings are calculated automatically according to the interrelationships between axes and amplifiers entered on the FSSB setting screen. Parameter Nos. 1023, 1905, 1910 to 1919, 1936, and 1937 are specified automatically according to the results of the calculation.

- **Display**

The FSSB setting screen displays FSSB–based amplifier and axis information. This information can also be specified by the operator.

1. Press function key [SYSTEM] .
2. To display [FSSB], press continuous menu key [▷] several times.
3. Pressing soft key [FSSB] causes the AMP SET screen (or the previously selected FSSB setting screen) to appear, with the following soft keys displayed.

The FSSB setting screens include: AMP SET, AXIS SET, and AMP MAINTENANCE.

Pressing soft key **[AMP]** causes the AMP SET screen to appear.
Pressing soft key **[AXIS]** causes the AXIS SET screen to appear.
Pressing soft key **[MAINTE]** causes the AMP MAINTENANCE screen to appear.

1) Amplifier setting screen
The amplifier setting screen consists of two sections: the first section displays information about the slave, while the second section displays information about the pulse modules.

```
AMPLIFIER SETTING                O1000 N00001
  NO.  AMP     SERIES  UNIT    CUR.   AXIS NAME
    1  A1-L       α    SVM-HV  40AL    1     X
    2  A1-M       α      SVM   12A     2     Y
    3  A2-L       β      SVM   40A     3     Z
    4  A3-L       α      SVM   20A     4     A




  NO.  EXTRA   TYPE   PCB ID
    6    M1      A    0000 DETECTOR(4AXES)
    8    M2      B    12AB
>_
MDI **** *** ***        13:11:56
[  AMP  ][  AXIS  ][ MAINTE ][     ][(OPRT)]
```

The amplifier setting screen consists of the following items:

- NO. (slave number)

  The numbers of up to ten slaves (up to eight amplifiers and up to two pulse modules) connected via the FSSB are displayed sequentially, with the one nearest to the CNC being number 1.

- AMP (amplifier type)

  The amplifier type display consists of the letter A, which stands for ”amplifier,” a number that indicates the placing of the amplifier, as counted from that nearest to the CNC, and a letter such as L (first axis) or M (second axis) indicating the placing of the axis in the amplifier.

- AXIS NO. (controlled axis number)

  The axis number of each controlled axis specified in parameters (Nos. 1920 to 1929) is displayed. If a number specified in these parameters falls outside the range of between 1 and the maximum number of controlled axes, 0 is displayed.

- NAME (controlled axis name)

  The axis name assigned to a parameter (No. 1020) corresponding to a particular controlled axis number is displayed. If the controlled axis number is 0, – is displayed.

- The following items are displayed as amplifier information:
  - · UNIT (servo amplifier unit type)
  - · SERIES (servo amplifier series)
  - · CURRENT (maximum rating)
- The following items are displayed as pulse module information:
  - · SEPARATE

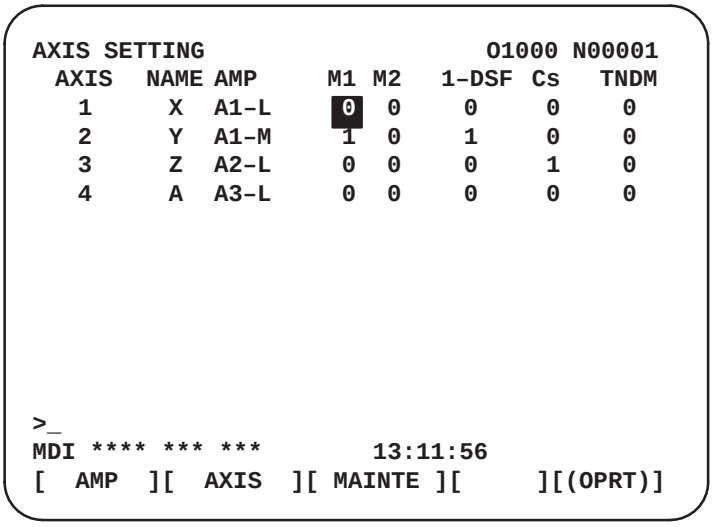
    This display consists of the letter M, which stands for ”pulse module” and a number indicating the placing of the pulse module, as counted from that nearest to the CNC.
  - · TYPE

    This display is a letter indicating the type of the pulse module.
  - · PCB ID

    This display consists of four digits indicating the pulse module ID (hexadecimal). The pulse module ID is followed by DETECTOR (4 AXES) for the eight–axis separate detector module or DETECTOR (4 AXES) for the four–axis separate detector module.

2) Axis setting screen

The axis setting screen displays the information shown below:



This axis setting screen displays the following items:

- AXIS NO. (controlled axis number)

  This item is the placing of the NC controlled axis.
- NAME (controlled axis name)
- AMP (type of the amplifier connected to each axis)
- M1 (connector number for pulse module 1)

  This item is the number of the connector for pulse module 1, specified in parameter No. 1931.
- M2 (connector number for pulse module 2)

  This item is the number of the connector for pulse module 2, specified in parameter No. 1932.

- TWO AXES

  This item is the value specified in bit 0 (parameter 1 DSP) of parameter No. 1904. It is 1 for an axis (such as a learning control axis, high–speed current loop axis, or high–speed interface axis) that exclusively uses a DSP, which is usually shared by two axes.

- Cs: Cs contour controlled axis

  This item is the value specified in parameter No. 1933. It is 1 for the Cs contour controlled axis.

3) Amplifier maintenance screen

   The amplifier maintenance screen displays maintenance information for servo amplifiers. This screen consists of the following two pages, either of which can be selected by pressing the ↑ or ↓ key.

```
AMPLIFIER MAINTENANCE                O1000 N00001
  AXIS   NAME AMP    SERIES    UNIT   AXES   CUR.
    1      X  A1-L      α    SVM-HV    2    40AL
    2      Y  A1-M      α       SVM    2     12A
    3      Z  A2-L      β       SVM    1     40A
    4      A  A3-L      α       SVM    1     20A




MDI **** *** ***        13:11:56
[  AMP  ][  AXIS  ][ MAINTE ][     ][     ]
```

```
AMPLIFIER MAINTENANCE             O1000 N00001
  AXIS    NAME   EDITION    TEST   MAINTE-NO.
    1      X       01A     970123        01
    2      Y       01A     970123        01
    3      Z       01A     970123        01
    4      A       02B     970123        01




MDI **** *** ***        13:11:56
[  AMP  ][  AXIS  ][ MAINTE ][     ][     ]
```

The amplifier maintenance screen displays the following items:

- AXIS NO. (controlled axis number)
- NAME (controlled axis name)
- AMP (type of amplifier connected to each axis)
- SERIES (servo amplifier series of an amplifier connected to each axis)
- UNIT (unit type of a servo amplifier connected to each axis)

- NO. OF AXES (maximum number of axes controlled by an amplifier connected to each axis)
- CURRENT (maximum rating for amplifiers connected to each axis)
- VERSION (unit version number of an amplifier connected to each axis)
- TEST DATE (date of test performed on an amplifier connected to each axis)

  Example) 970123 = January 23, 1997
- MAINTENANCE NO. (engineering change number for an amplifier connected to each axis)

● Setting

On an FSSB setting screen (other than the amplifier maintenance screen), pressing soft key [(OPRT)] displays the following soft keys:

To enter data, place the machine in MDI mode or the emergency stop state, position the cursor to the point where a desired item is to be input, then enter the desired data and press soft key **[INPUT]** (or the INPUT key on the MDI panel).
When soft key **[SET]** is pressed after data has been entered, a warning message is displayed if the entered data contains an error. When the data is satisfactory, the corresponding parameter is set up.
To restore the previous value of a parameter if, for example, an entered value is incorrect, press soft key **[READ]**.
When the power is turned on, values are read from the parameters and displayed on the screen.

CAUTION
1 For the parameters to be specified on the FSSB setting screen, do not attempt to enter values on the parameter screen using the MDI or a G10 command. Use only the FSSB screen to enter values for these parameters.
2 If pressing soft key **[SET]** results in a warning message being displayed, retry data entry, or press soft key **[READ]** to clear the warning message. Note that pressing the reset key does not clear the warning message.

1) Amplifier setting screen

```
AMPLIFIER SETTING                O1000 N00001
  NO.  AMP     SERIES  UNIT   CUR.   AXIS NAME
    1  A1-L      α    SVM-HV  40AL    1     X
    2  A1-M      α      SVM   12A     2     Y
    3  A2-L      β      SVM   40A     3     Z
    4  A3-L      α      SVM   20A     4     A




  NO. EXTRA   TYPE   PCB ID
    6   M1      A    0000 DETECTOR(4AXES)
    8   M2      B    12AB
>_
MDI **** *** ***        13:11:56
[SETTING][       ][ READ ][       ][ INPUT ]
```

The amplifier setting screen displays the following items:

- AXIS NO. (controlled axis number)

  For this item, enter a value of between 1 and the maximum number of controlled axes. If a number that falls outside this range is entered, the warning message **”INVALID FORMAT”** appears. If the entered controlled axis number is duplicate or 0, the warning message **”SPECIFIED DATA IS OUT OF RANGE”** appears when soft key **[SET]** is pressed to assert the entered value. In this case, no value can be entered for the parameter.

2) Axis setting screen

```
AXIS SETTING                             O1000 N00001
  AXIS   NAME AMP     M1 M2   1-DSF  Cs   TNDM
    1      X  A1-L     0  0     0     0     0
    2      Y  A1-M     1  0     1     0     0
    3      Z  A2-L     0  0     0     1     0
    4      A  A3-L     0  0     0     0     0









>_
MDI **** *** ***        13:11:56
[SETTING][       ][ READ ][       ][ INPUT ]
```

On the axis setting screen, the following items can be specified:

- M1 (connector number for pulse module 1)

  For an axis that uses pulse module 1, enter a connector number using a number in the range of between 1 and the maximum number of axes for pulse module 1. When pulse module 1 need not be used, enter 0. If a number that falls outside the valid range is entered, the warning message **”INVALID FORMAT”** is displayed.

- M2 (connector number for pulse module 2)

  For an axis that uses pulse module 2, enter a connector number using a number in the range of between 1 and the maximum number of axes for pulse module 2. When pulse module 2 need not be used, enter 0. If a number that falls outside the valid range is entered, the warning message **”INVALID FORMAT”** is displayed.

- TWO AXES

  Enter 1 for the following axes, each of which exclusively uses a DSP, which is usually shared by two axes. If a number other than 0 or 1 is entered, the warning message **”INVALID FORMAT”** is displayed.

  · Learning control axis

  · High–speed current loop axis

  · High–speed interface axis

- Cs (Cs contour controlled axis)

  Enter 1 for the Cs contour controlled axis. If a number other than 0 or 1 is entered, the warning message **”INVALID FORMAT”** is displayed.

When soft key **[SET]** is pressed on the axis setting screen after data entry, the warning message **”SPECIFIED DATA IS OUT OF RANGE”** is displayed if any of the following conditions is satisfied.

- Both M1 and M2 are nonzero for an axis.
- Any two of TWO AXES, Cs, and TANDEM are nonzero for an axis.
- A duplicate value is specified for M1.
- A duplicate value is specified for M2.
- A duplicate value is specified for Cs.

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 $\text{Set value} = \frac{(\text{PRM } 2021)+256}{256} \times 100$
(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) :

#0 (OFA) : Overflow alarm

#1 (FBA) : Disconnection alarm

#2 (DCA) : Discharge alarm

#3 (HVA) : Excessive voltage alarm

#4 (HCA) : Abnormal current alarm

#5 (OVC) : Overcurrent alarm

#6 (LV) : Insufficient voltage alarm

#7 (OVL) : Overload 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 disconnec-tion (Hardware)
	0	—	—	0	Pulse coder disconnection (software)

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm3		CSA	BLA	PHA	RCA	BZA	CKA	SPH

DGN (202) :

#0 (SPH) : Serial pulse coder or feedback cable is faulty.
Counting the feedback signal is in error.

#1 (CKA) : Serial pulse coder is faulty.
Internal block has stopped.

#2 (BZA) : Battery voltage becomes 0.
Replace batteries and set the reference position.

#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.

#4 (PHA) : Serial pulse coder or feedback cable is abnormal.
Counting the feedback signal is in error.

#5 (BLA) : Battery voltage is in low (warning).

#6 (CSA) : Hardware of serial pulse coder is abnormal.

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm4	DTE	CRC	STB	PRM				

DGN (203) :

#4 (PRM) : Parameter detected by the Digital servo is invalid.

#5 (STB) : Communication error of serial pulse coder.
Transmitted data is in error.

#6 (CRC) : Communication error of serial pulse coder.
Transmitted data is in error.

#7 (DTE) : Communication error of serial pulse coder.
There is no response.

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm5		OFS	MCC	LDM	PMS			

DGN (204) :

#3 (PMS) : No. of feedback pulses are in error because serial pulse coder C or feedback cable is faulty.

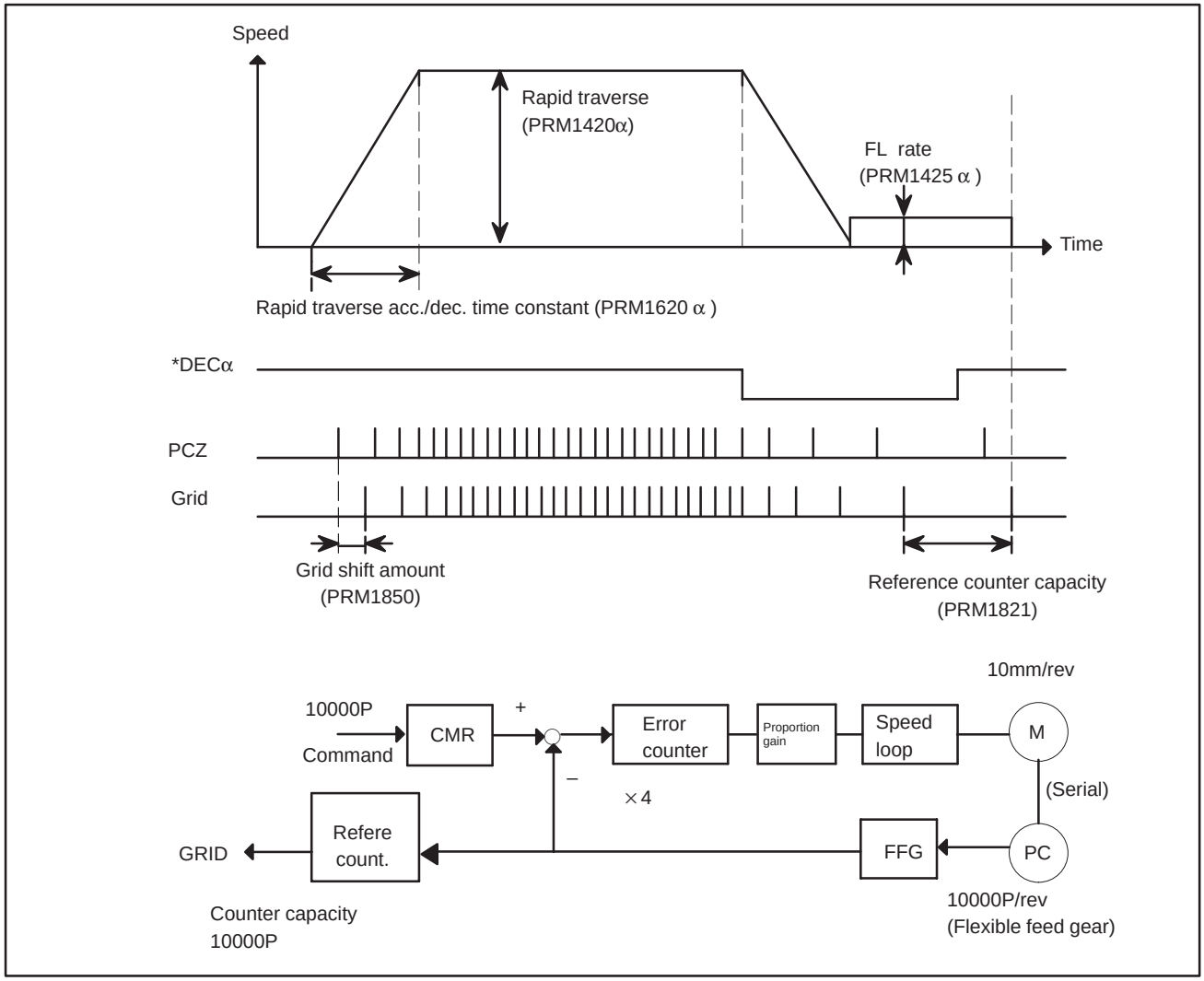
#4 (LDM) : LED of serial pulse coder is abnormal.

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

#6 (OFS) : A/D conversion of current value of digital servo is abnormal.

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	

#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.

#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.

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

1 : Position detector is absolute pulse coder.

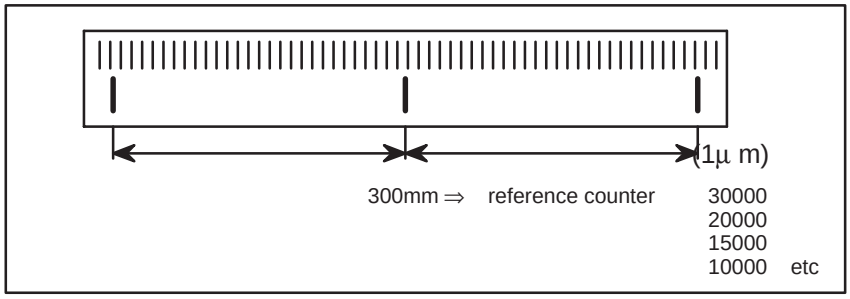
- **Separate Type Pulse Coder or Linear Scale is Used**

PRM	1821	Reference counter capacity per axis [P]

Normally, the number of feedback pulses per motor revolution is set to the reference counter capacity.

When plural reference marks are on a linear scale, a quotient of the distance between the reference marks divided by an interfer may be used as a reference counter capacity:

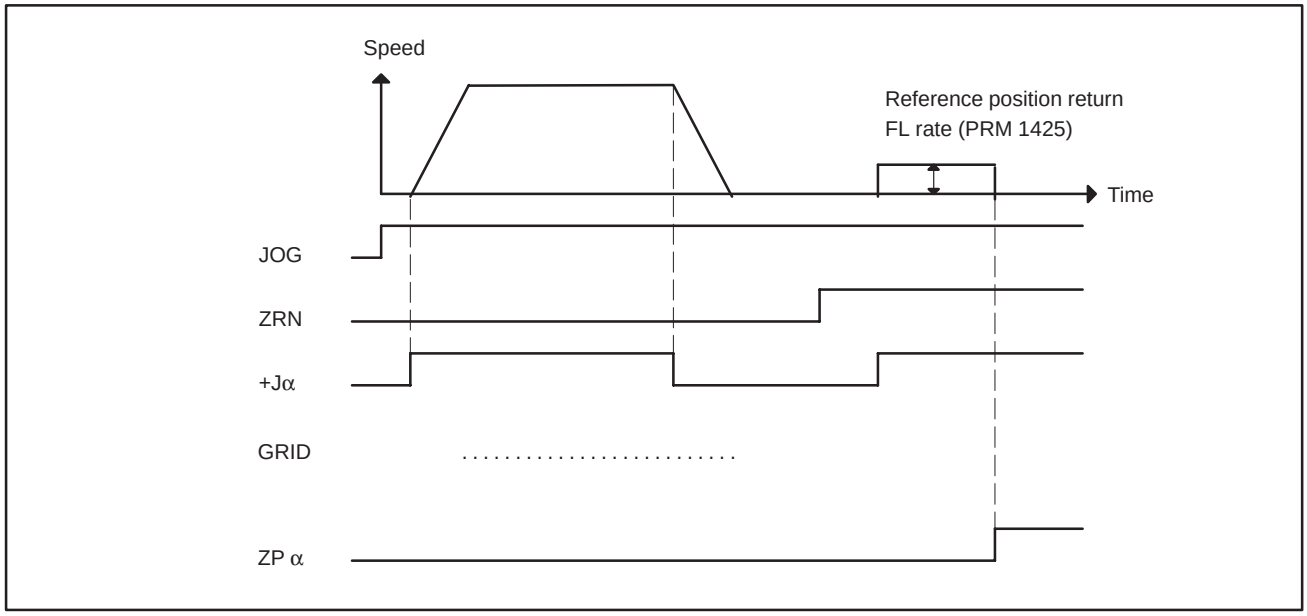
Example)



5.4 DOGLESS REFERENCE POSITION SETTING

When there are no dog nor limit switch for reference position return, this function enables the tool to return the reference position that is set by MTB.
When the absolute position detector is used, the reference position once set remains also during power off. When the absolute detector is replaced or absolute position is lost, perform this setting.

5.4.1 General



5.4.2 Operation

1 Move the tool near the reference position using a manual operation.
2 Select the reference position return mode or switch.
3 Press a button for an axis–and–direction–select–signal + or –, and the machine moves to the next grid, then stops.
(This position is set as the reference position).
After the reference position has been set, select the reference position return mode(ZRN signal is 1) and turn on an axis–and–direction–select signal, then the tool returns to the reference position.

5.4.3 Associated Parameters

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	1002							DLZ	

#1(DLZ) 0 : Dog is used for reference position return

☆ 1 : Dogless reference position setting

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	1006			ZMI					

#5(ZMI) 0 : Reference position return and backlash initial direction is +.

1 : Reference position return and backlash initial direction is –.

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

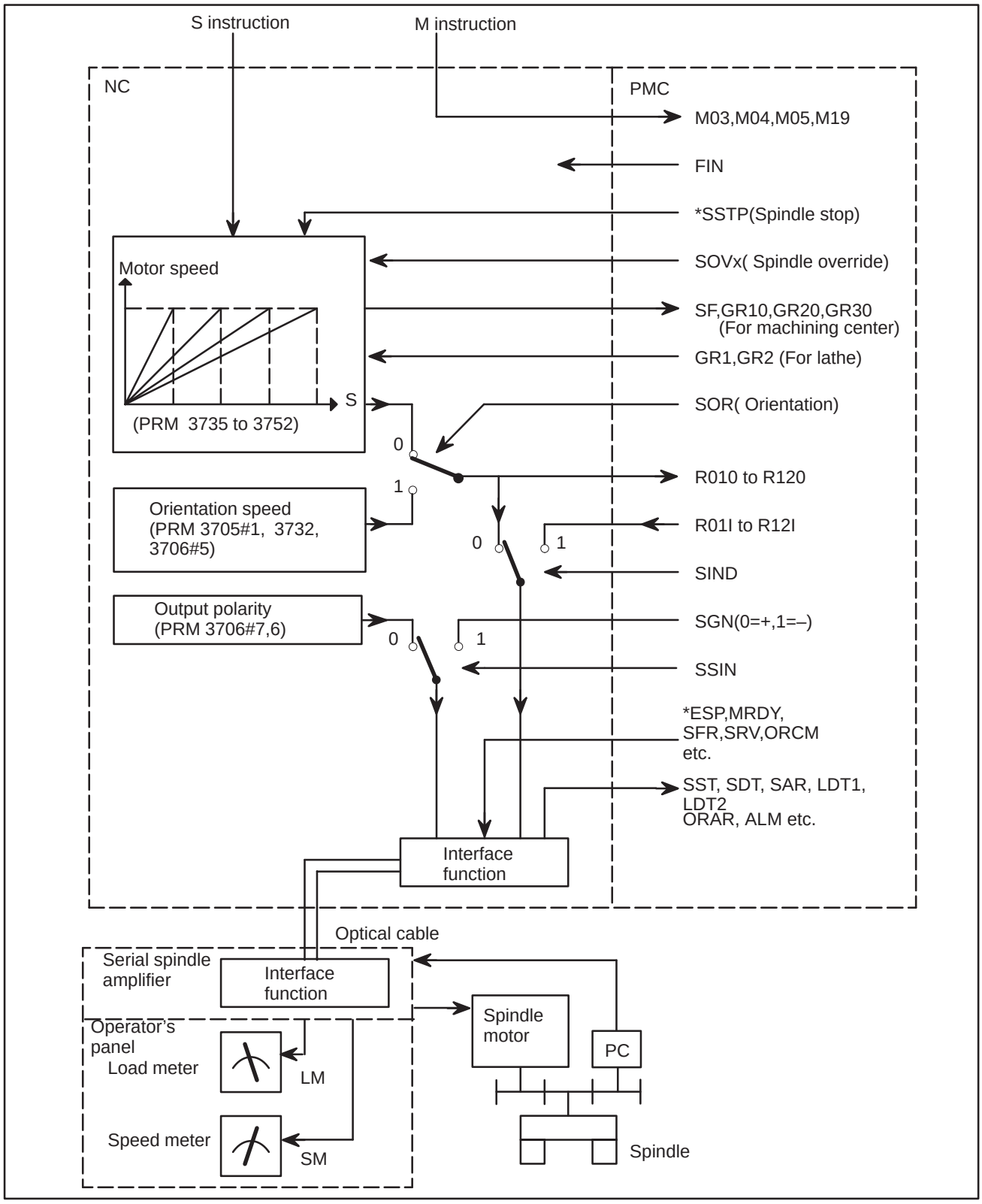
6 AC SPINDLE (SERIAL INTERFACE)

This chapter outlines the serial interface and analog interface spindle amplifiers and explains related parameters.

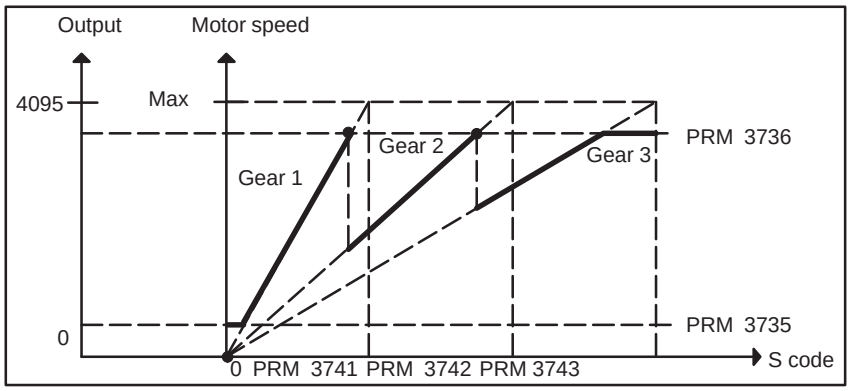
The following drawing number is indicated on the upper part of the spindle unit of the serial interface spindle amplifier:

6.1
AC SPINDLE (SERIAL INTERFACE)

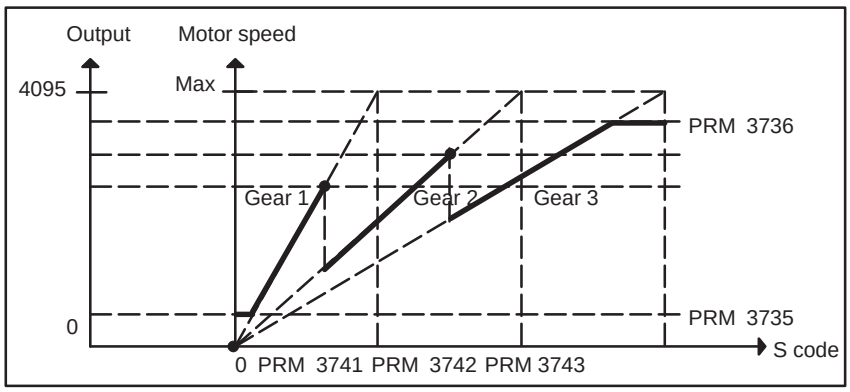
6.1.1
Outline of Spindle Control


S instruction
M instruction
NC
PMC
M03,M04,M05,M19
FIN
*SSTP(Spindle stop)
SOVx(Spindle override)
SF,GR10,GR20,GR30
(For machining center)
GR1,GR2 (For lathe)
SOR(Orientation)
Motor speed
S
(PRM 3735 to 3752)
0
1
R010 to R120
Orientation speed
(PRM 3705#1, 3732,
3706#5)
R01I to R12I
SIND
Output polarity
(PRM 3706#7,6)
SGN(0=+,1=–)
SSIN
*ESP,MRDY,
SFR,SRV,ORCM
etc.
SST, SDT, SAR, LDT1,
LDT2
ORAR, ALM etc.
Interface
function
Optical cable
Serial spindle
amplifier
Interface
function
Spindle
motor
PC
Operator's
panel
Load meter
LM
Speed meter
SM
Spindle

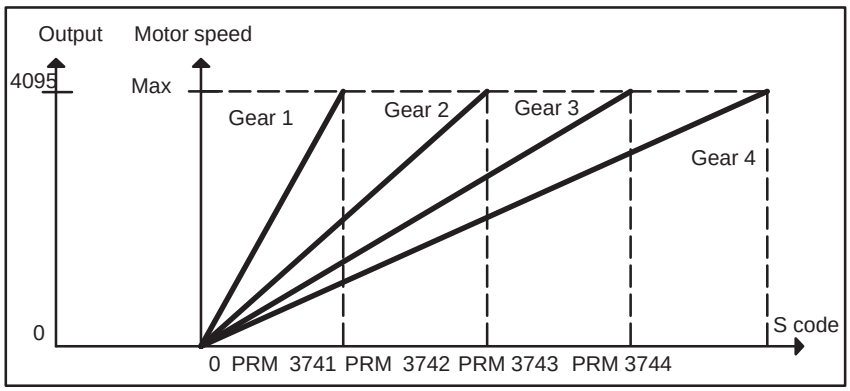
6.1.1.1 Method A of Gear Change for Machining Center



6.1.1.2 Method B of Gear Change for Machining Center(PRM 3705#2=1)



6.1.1.3 For Lathe



6.1.2 Spindle Setting and Tuning Screen

6.1.2.1 Display method

(1) Confirm the parameters

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

Bit1 (SPS) 0 : The spindle tuning screen is not displayed.

☆ 1 : The spindle tuning screen is displayed.

(2) Press the SYSTEM key to select the screen for setting parameters and other data.

(3) Press the continuous menu key ▷ .

(4) Press the soft key **[SP.PRM]**. Then, the spindle setting and tuning screen appears.

(5) The following screens are provided. These screens can be selected using soft keys.

1) **[SP.SET]** : Spindle setting screen
2) **[SP.TUN]** : Spindle tuning screen
3) **[SP.MON]** : Spindle monitor screen

6.1.2.2 Spindle setting screen

```
SPINDLE SETTING
(1)GEAR SELECT     : 1
(2)SPINDLE         : S11

  (PARAMETER)
(3)GEAR RATIO           50
(4)MAX SPINDLE SPEED  3000
(5)MAX MOTOR SPEED    6000
(6)MAX C AXIS SPEED    100
```

- **Gear selection**

The gear select status on the machine side is displayed.

Indication	CTH1	CTH2
1	0	0
2	0	1
3	1	0
4	1	1

- **Spindle**

Select a spindle for which data is to be set.
S11: Main spindle amplifier for the 1st spindle
S12: Subspindle amplifier for the 1st spindle
S21: Main spindle amplifier for the 2nd spindle
S22: Subspindle amplifier for the 2nd spindle

- **Parameters**

	S11:1st Main	S12:1st Sub	S21:2nd Main	S22:2nd Sub
Gear ratio(HIGH)	4056	4216	4056	4216
Gear ratio(MIDIUM HIGH)	4057		4057	
Gear ratio(MIDIUM LOW)	4058	4217	4058	4217
Gear ratio(LOW)	4059		4059	
Max. spindle speed (gear1)	3741		3741	
Max. spindle speed (gear2)	3742		3742	
Max. spindle speed (gear3)	3743		3743	
Max. spindle speed (gear4)	3744		3744	
Max. motor speed	4020	4196	4020	4196
Max. C axis speed	4021	None	4021	None

6.1.2.3 Spindle tuning screen

```
SPINDLE TUNING

OPERATION    : SPEED CONTROL
GEAR SELECT  : 1
SPINDLE      : S11
(PARAMETER)              (MONITOR)
PROP.GAIN      20        MOTOR SPEED   100
INT.GAIN       50        SPINDLE SPEED 150
LOOP GAIN    3000        POS ERR S1    100
MOTOR VOLT     30        POS ERR S2    103
TIME CONST    100        SYN.ERR         3
REF. SHIFT   2046
```

- **Operation mode**

1 : Normal operation
2 : Orientation
3 : Synchronization control
4 : Rigid tapping
5 : Cs contour control
6 : Spindle positioning control

- **Displayed parameters** The displayed parameters vary depending on the operation mode.

Spindle positioning control	Normal operation	Orientation	Synchronization control	Rigid tapping	Cs contour control
Proportional gain Integral gain Loop gain Motor voltage ZRN gain (%) Shift reference position	Proportional gain Integral gain Motor voltage Regenerative power	Proportional gain Integral gain Loop gain Motor voltage ORAR gain (%) Shift spindle stop position Shift reference position	Proportional gain Integral gain Loop gain Motor voltage Acceleration/deceleration constant (%) Shift reference position	Proportional gain Integral gain Loop gain Motor voltage ZRN gain Shift reference position	Proportional gain Integral gain Loop gain Motor voltage ZRN gain (%) Shift reference position

Note) For the parameter numbers corresponding to the displayed parameter items, see Section 6.4.5.

- **Displayed monitoring items** The displayed monitoring items vary depending on the operation mode.

Spindle positioning control	Normal operation	Orientation	Synchronization control	Rigid tapping	Cs contour control
Motor speed Feedrate Position deviation S1	Motor speed Spindle speed	Motor speed Spindle speed Position deviation S1	Motor speed Spindle speed Position deviation S1 Position deviation S2 Synchronous deviation	Motor speed Spindle speed Position deviation S1 Position deviation Z Synchronous deviation	Motor speed Spindle speed Position deviation S1

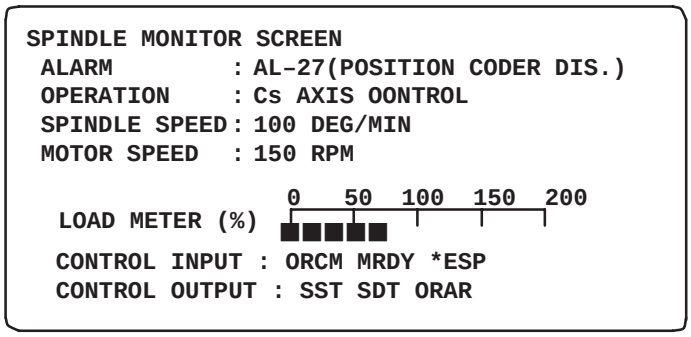
Note 1)

$$\text{Motor speed [rpm]} = \frac{|\text{Spindle data}|}{16383} \times \text{Max. Motor speed.(* 1)}$$

(*1) Parameter 4020: Main spindleParameter 4196: Subspindle

Note 2) The spindle speed in Cs contour control mode is in degrees/min.

6.1.2.4 Spindle monitor screen



- **Spindle alarm**

1: Motor overheated
2: Speed deviation excessive
3: Fuse blow of DC link
4: Fuse blow of AC inputline
5: Fuse blow of DC voltage
7: Excessive speed
9: Heat sink overheat
10: Low voltage of AC input
11: Excess voltage in DC link
12: Excess current in DC link
13: CPU internal data memory error
18: ROM SUM check error
19: U phase current offset excessive
20: V phase current offset excessive
24: Serial data transmission abnormal
25: Serial data transmission stop
26: Cs axis speed detecting signal failure
27: Position coder signal disconnection
28: Cs pos.detect signal disconnection
29: Short time overload
30: Input circuit excess current
31: Speed detecting signal disconnection
32: SLC LSI internal RAM abnormal
33: DC link charging insufficient
34: Parameter abnormal setting
35: Gear ratio data excessive
36: Error counter overflow
37: Speed detecting unit error setting
38: Magnetic sensor signal abnormal
39: Alarm of one revolution signal for Cs axis control is detected
40: Alarm of one revolution signal for Cs axis control is not detected
41: Erroneous detection of the position coder one revolution signal
42: Undetection of the position coder one revolution signal
46: Erroneous detection of the position coder one revolution signal on threading
47: Abnormal position coder signal
48: Erroneous detection of position coder one revolution signal

- **Operation**

Following 6 modes are available:

a. Normal operation
b. Orientation
c. Synchronous operation
d. Rigid tapping
e. Cs contour cotrol
f. Spindle positioning control

- **Load meter**

The load meter displays spindle load in a unit of 10%.

$$1)\ \text{Load meter}[\%] = \frac{\text{Load meter data}}{3276} \times \text{Max.output value of load meter (*)}$$

(*) PRM 4127: Main
PRM 4274: Sub.

- **Control input signal**

Max.10 signals those are ON are displayed from the following signals:

TLML	: Torque limit command (low)	SPSL	: Spindle selection signal
TLMH	: Torque limit command (high)	MCFN	: Power line switching
CTH1	: Gear signal 1	SOCN	: Soft start/stop cancel
CTH2	: Gear signal 2	RSL	: Output switching request
SRV	: Spindle reverse rotation	RCH	: Power line state confirm
SFR	: Spindle forward rotation	INDX	: Orientation stop pos. change
ORCM	: Spindle orientation	ROTA	: Rotation direction of ORCM
MEDY	: Machine ready	NRRO	: Shor–cut of ORCM
ARST	: Alarm reset signal	INTG	: Speed integral control signal
*ESP	: Emergency stop	DEFM	: Referencial mode command

- **Control output signals**

Max. 10 signals those are ON are displayed from the following signals:

ALM	: Alarm signal	TML5	: Torque limitation
SST	: Speed zero signal	ORAR	: Orientation end signal
SDT	: Speed detecting signal	CHP	: Power line switched signal
SAR	: Speed arrival signal	CFIN	: Spindle switch complete
LDT1	: Load detecting signal 1	RCHP	: Output switch signal
LDT2	: Load detecting signal 2	RCFN	: Output switch complete signal

6.1.2.5 Correspondence between operation mode and parameters on spindle tuning screen

- **Normal operation mode**

	S11: 1st Main	S12: 1st Sub	S21: 2nd Main	S22: 2nd Sub
Proportional gain(HIGH)	4040	4206	4040	4206
Proportional gain (LOW)	4041	4207	4041	4207
Integral gain(HIGH)	4048	4212	4048	4212
Integral gain(LOW)	4049		4049	
Motor voltage	4083	4236	4083	4236
Regenerative power	4080	4231	4080	4231

- **Orientation mode**

	S11: 1st Main	S12: 1st Sub	S21: 2nd Main	S22: 2nd Sub
Proportional gain(HIGH)	4042	4208	4042	4208
Proportional gain (LOW)	4043	4209	4043	4209
Integral gain(HIGH)	4050	4213	4050	4213
Integral gain(LOW)	4051		4051	
Loop gain (HIGH)	4060	4218	4060	4218
Loop gain (MID, HIGH)	4061		4061	
Loop gain (MID, LOW)	4062	4219	4062	4219
Loop gain (LOW)	4063		4063	
Motor voltage	4084	4237	4084	4237
Gain change upon completion of orientation	4064	4220	4064	4220
Stop position shift	4077	4228	4077	4228
PC–type orientation stop position	4031	4204	4031	4204

- **Synchronization control mode**

Numerals are parameter numbers :

	S11: 1st Main	S12: 1st Sub	S21: 2nd Main	S22: 2nd Sub
Proportional gain(HIGH)	4044	4210	4044	4210
Proportional gain(LOW)	4045	4211	4045	4211
Integral gain(HIGH)	4052	4214	4052	4214
Integral gain(LOW)	4053		4053	
Position loop gain(HIGH)	4065	4221	4065	4221
Position loop gain(MID,HIGH)	4066		4066	
Position loop gain(MID,LOW)	4067	4222	4067	4222
Position loop gain(LOW)	4068		4068	
Motor voltage	4085	4238	4085	4238
Acc./Dec. time constant	4032		4032	
Shift amount	4034		4034	

- **Rigid tapping mode**

Numerals are parameter numbers :

	S11: 1st Main	S12: 1st Sub	S21: 2nd Main	S22: 2nd Sub
Proportional gain(HIGH)	4044	4210	4044	4210
Proportional gain(LOW)	4045	4211	4045	4211
Integral gain(HIGH)	4052	4214	4052	4214
Integral gain(LOW)	4053		4053	
Position loop gain(HIGH)	4065	4221	4065	4221
Position loop gain(MID,HIGH)	4066		4066	
Position loop gain(MID,LOW)	4067	4222	4067	4222
Position loop gain(LOW)	4068		4068	
Motor voltage	4085	4238	4085	4238
ZRN gain %	4091	4239	4091	4239
Grid shift amount	4073	4223	4073	4223

- **Spindle contouring control mode (Cs axis control)**

Numerals are parameter numbers :

	S11: 1st Main	S12: 1st Sub	S21: 2nd Main	S22: 2nd Sub
Proportional gain(HIGH)	4046		4046	
Proportional gain (LOW)	4047		4047	
Integral gain(HIGH)	4054		4054	
Integral gain(LOW)	4055		4055	
Position loop gain(HIGH)	4069		4069	
Position loop gain(MID,HIGH)	4070		4070	
Position loop gain(MID,LOW)	4071		4071	
Position loop gain(LOW)	4072		4072	
Motor voltage	4086		4086	
ZRN gain %	4092		4092	
Reference position shift	4135		4135	

- **Spindle positioning control mode**

	S11: 1st Main	S12: 1st Sub	S21: 2nd Main	S22: 2nd Sub
Proportional gain(HIGH)	4044	4210	4044	4210
Proportional gain (LOW)	4045	4211	4045	4211
Integral gain(HIGH)	4052	4214	4052	4214
Integral gain(LOW)	4053		4053	
Position loop gain(HIGH)	4065	4221	4065	4221
Position loop gain(MID,HIGH)	4066		4066	
Position loop gain(MID,LOW)	4067	4222	4067	4222
Position loop gain(LOW)	4068		4068	
Motor voltage	4085	4238	4085	4238
ZRN gain %	4091	4239	4091	4239
Reference position shift	4073	4223	4073	4223

6.1.3 Automatic Setting of Standard Parameters

The standard parameters related to each motor model can be set automatically.

- The specifications for controlling a motor depend on the specifications defined by the machine tool builder. The parameters defined by the machine tool builder are set as the standard values (initial values) by this automatic setting function.

  Therefore, when performing automatic operation, always set parameters properly according to the parameter list (parameters 4000 and later).

1. Turn on the power in the emergency stop state.
2. Set bit 7 of parameter 4019 to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
4019	LDSP							

Bit 7 (LDSP) The parameters for the serial interface spindle are:

0 : Not set automatically.

☆ 1 : Set automatically.

3. Set a motor model code.

4133	Motor model code

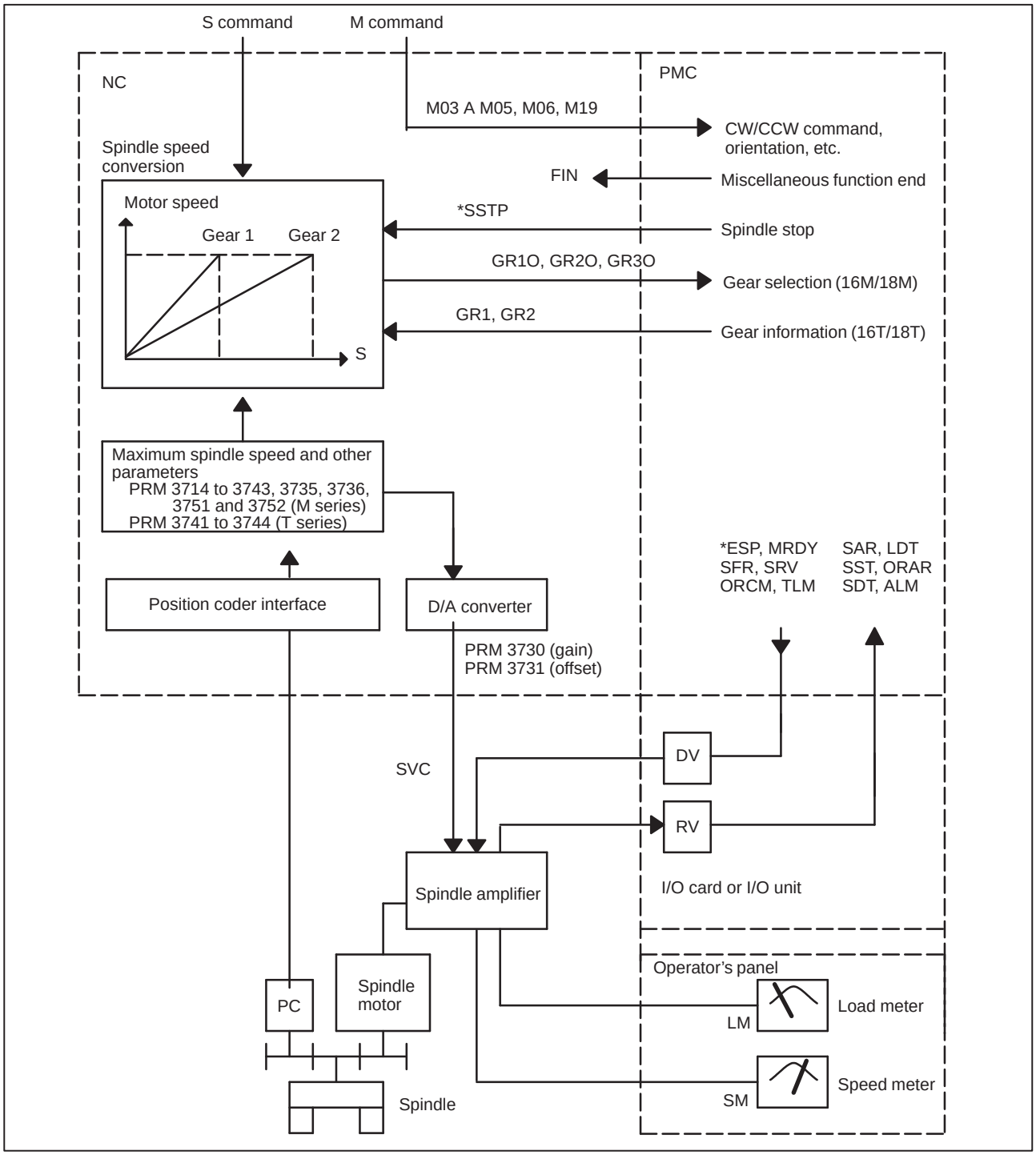
Code	Motor mode	Amplifier
100	α 0.5 (3000/8000min^{-1})	SPM–2.2
101	α 1 (3000/8000min^{-1})	SPM–2.2
102	α 1.5 (1500/8000min^{-1})	SPM–5.5
103	α 2 (1500/8000min^{-1})	SPM–5.5
104	α 2/1500 (3000/1500min^{-1})	SPM–5.5
105	α 3 (1500/8000min^{-1})	SPM–5.5
106	α 6 (1500/8000min^{-1})	SPM–11
107	α 8 (1500/6000min^{-1})	SPM–11
108	α 12 (1500/6000min^{-1})	SPM–15
109	α 15 (1500/6000min^{-1})	SPM–22
110	α 18 (1500/6000min^{-1})	SPM–22
111	α 22 (1500/6000min^{-1})	SPM–26
112	α P8 (750/6000min^{-1})	SPM–11
113	α P12 (750/6000min^{-1})	SPM–11
114	α P15 (750/6000min^{-1})	SPM–15
115	α P18 (750/6000min^{-1})	SPM–15
116	α P22 (750/6000min^{-1})	SPM–22
117	α P30 (575/4500min^{-1})	SPM–22

4. Turn off the power then back on. Then, the parameters are read.

6.2 AC SPINDLE (ANALOG INTERFACE)

6.2.1 Outline of Spindle Control

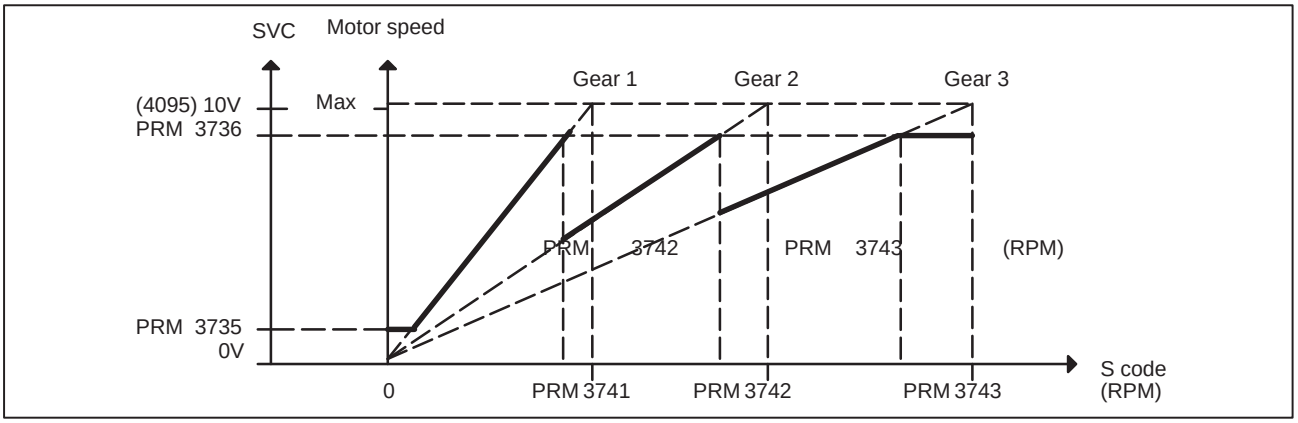
6.2.1.1 Block diagram



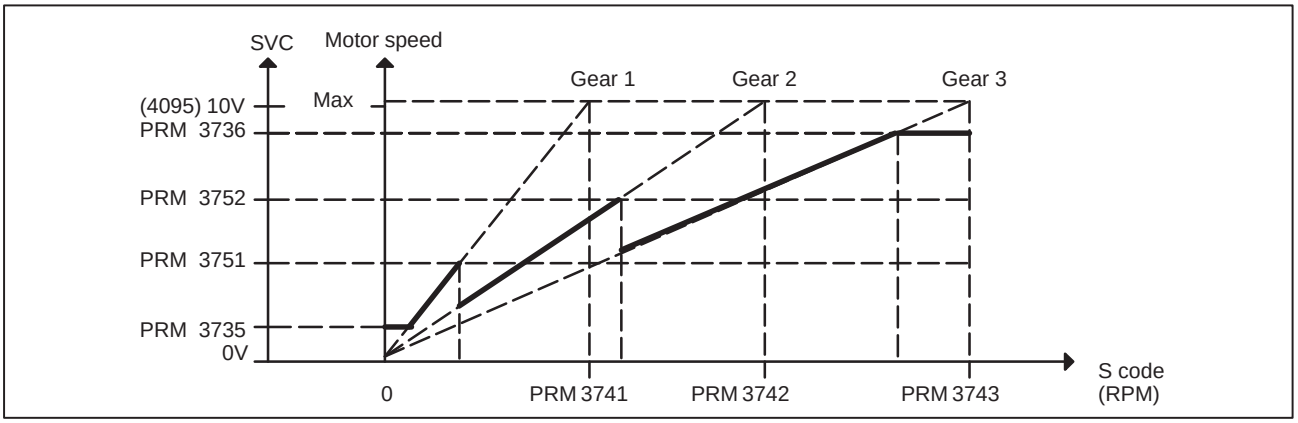
6.2.1.2 Calculation of S analog voltage and related parameters

[M series]

1 Gear change method A (bit 2 of parameter 3705 = 0)

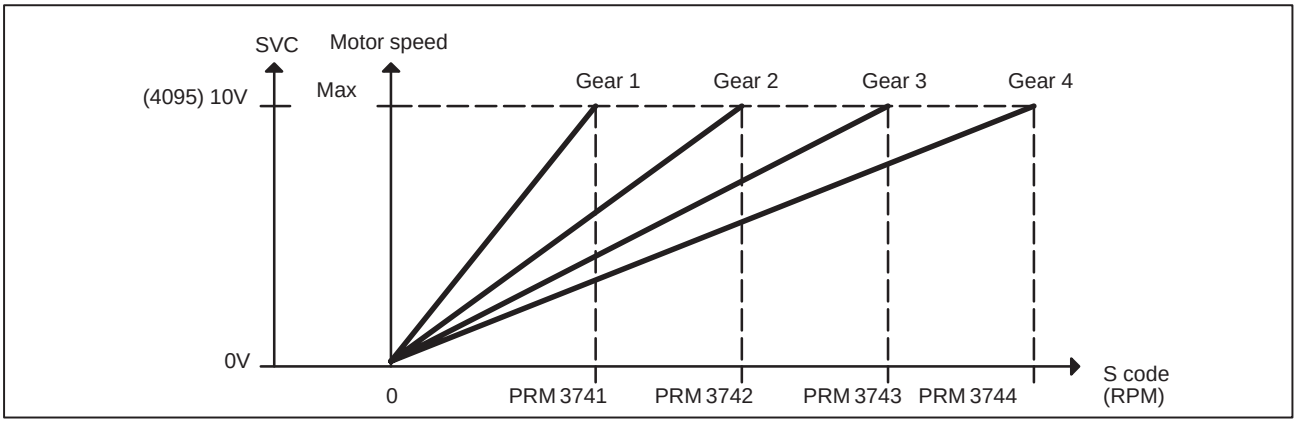


2 Gear change method B (bit 2 of parameter 3705 = 1)



[T series]

Constant surface speed control



	#7	#6	#5	#4	#3	#2	#1	#0
3706	TCW	CWM						

TCW	CWM	Sign of output voltage
0	0	Analog voltage (+) with both M03 and M04
0	1	Analog voltage (–) with both M03 and M04
1	0	(+) with M03, (–) with M04
1	1	(–) with M03, (+) with M04

[M series]

	#7	#6	#5	#4	#3	#2	#1	#0
3705						SGB		

SGB Spindle speed set when gear change is performed is:

0 : Maximum speed for each gear.

1 : Set by respective parameters. (Parameters 542, 543, 585, 586)

3741	Max. spindle speed of gear 1 (1 to 9999) [rpm]
3742	Max. spindle speed of gear 2 (1 to 9999) [rpm]
3743	Max. spindle speed of gear 3 (1 to 9999) [rpm]
3736	Upper limit of the output to the spindle motor
3735	Lower limit of the output to the spindle motor

$$\text{Setting} = \frac{\text{Spindle speed (upper limit/lower limit)}}{\text{Max. spindle speed}} \times 4095$$

[T series]

3741	Max. spindle speed of gear 1 (1 to 9999) [rpm]
3742	Max. spindle speed of gear 2 (1 to 9999) [rpm]
3743	Max. spindle speed of gear 3 (1 to 9999) [rpm]
3744	Max. spindle speed of gear 4 (1 to 9999) [rpm]

6.2.1.3 Tuning S analog voltage (D/A converter)

(1) For M series, change the upper and lower limits as follows:

- When gear change method A is used: Parameter 3736 = 4095, parameter 3735 = 0
- When gear change method B is used: Parameter 3751 = 4095, parameter 3735 = 0

☞ For T series, these changes are not required.

(2) Tuning the D/A converter offset

Specify zero as the spindle speed. Then, by using a digital multimeter, adjust the following parameter so that the voltage at the test pin DA2 on the spindle amplifier printed circuit board is 0 mV.

1 For M series

```
S0; (Specify the command by MDI operation, then press the cycle start button.)
```

2 For T series (in case of G–code system A)

```
G97 S0;   (Specify the command by MDI in the same manner as for M series.)
```

3731	Spindle speed (D/A converter) offset compensation value

(3) Tuning the D/A converter gain

Specify the maximum spindle speed of gear 1. Then, by using a digital multimeter, adjust the following parameter so that the voltage at the test pin DA2 on the spindle amplifier printed circuit board is 10.0 V.

1 For M series

```
Sxxxx ;                (xxxx is the value set in parameter 3741.)
  (Specify the command by MDI operation, then press the cycle start button.)
```

3741	Max. spindle speed of gear 1 (1 to 9999) [rpm]

2 For T series (in case of G–code system A)

```
G97  Sxxxx ;          (xxxx is the value set in parameter 3741.)
  (Specify the command by MDI operation, then press the cycle start button.)
```

3741	Max. spindle speed of gear 1 (1 to 9999) [rpm]

☞ Usually a voltage is output from the D/A converter by only executing an S command. However, the clockwise rotation command (M03) may be required on some machines.

(4) If the output voltage is not correct, perform the following calculation, and change the value of parameter 3730 to adjust the gain of the D/A converter:

$$\text{Setting} = \frac{10\text{V}}{\text{Measured voltage}} \times (\text{Current value of PRM 3730})$$

(5) Execute an S command again and confirm that the output voltage is correct.

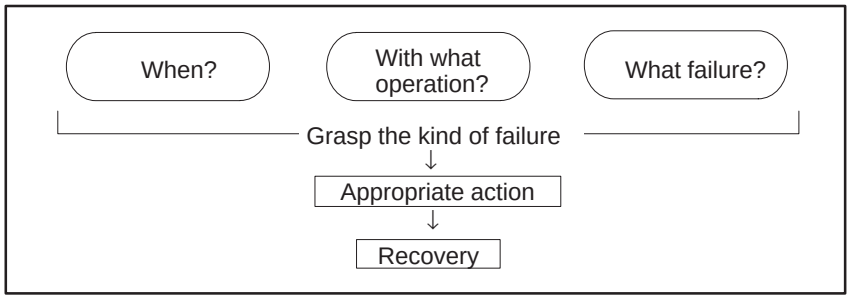
☞Restore the original parameter values.

7 TROUBLESHOOTING

This chapter describes troubleshooting procedure.

7.1 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 :



7.1.1 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 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)
5) Specifications of the spindle amplifier and spindle motor
   (for a failure related to a spindle)

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

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

7.2 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 Section 1.9 CNC 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).

	#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 RRW is 1, reset & rewing signal is input.
When ERS is 1, external reset 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 (Example)
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
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					*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

· T series

	#7	#6	#5	#4	#3	#2	#1	#0
X0004			–MIT2	+MIT2	–MIT1	+MIT1		

±MITn=1 shows interlock signal per axis and direction is input.

* For the T series, ±MITn is valid only for manual operation.

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.

7.3 JOG OPERATION CANNOT BE DONE

Points

(1) Check whether position display is operating.
(2) Check CNC status display.
(3) Check internal status using Diagnostic 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					+J4	+J3	+J2	+J1
G0102					–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	: 1 (Example)
	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

· T series

	#7	#6	#5	#4	#3	#2	#1	#0
X0004			–MIT2	+MIT2	–MIT1	+MIT1		

±MITn=1 shows interlock signal per axis and direction is input.

* For the T series, ±MITn is valid only for manual operation.

c. Jog feedrate override is 0%

Check the signals using PMC's diagnostic function (PMCDGN)

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0
G0011	*JV15	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8

When the override is 0% all bits of the above address becomes 1111 . . . . 1111 or 0000 . . . . . 0000.

*JV15 . . . . . JV0	Override
1111 1111 1111 1111	0.00%
1111 1111 1111 1110	0.01%
:	:
1101 1000 1110 1111	100.00%
:	:
0000 0000 0000 0001	655.34%
0000 0000 0000 0000	0.00%

d. NC is in a reset state

In this case, RESET is also displayed on the status display. Check it using the procedure of 1 above.

(4) Jog feed rate setting (Parameter) is not correct.

1423	Jog feedrate per axis

(5) Manual feed per revolution is selected (T series)

This funciton feeds an axis synchronized with spindle rotation and whether this function is used or not is selected by the following parameter:

	#7	#6	#5	#4	#3	#2	#1	#0
1402				JRV				

#4 (JRV) 0 : Jog feed is of feed per minute

1 : Jog feed is of feed per revolution

(a) When parameter JRV is set to 1, feed rate of the axis is calculated by synchronizing with rotation of the spindle. Therefore, rotate the spindle.

(b) If the axis does not move even when the spindle is rotated, check the detector of the spindle (position coder) and the cable between the position coder and the CNC if it is short–circuited or ungrounded.Refer to 2.4 for connection diagram.

7.4 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 7.2 and 7.3.

2 When only handle operation (MPG) cannot be done

(1) Check CNC status display at lower left corner of the CRT.

(Refer to **1.9 CNC 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

NOTE
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				

↓ ↓

MP2	MP1	Multiplication
0	0	×1
1	0	×10
0	1	×m
1	1	×n

7113	Magnification of handle feed m(1 to 127)
7114	Magnification of handle feed n(1 to 1000)

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

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

0 : same direction

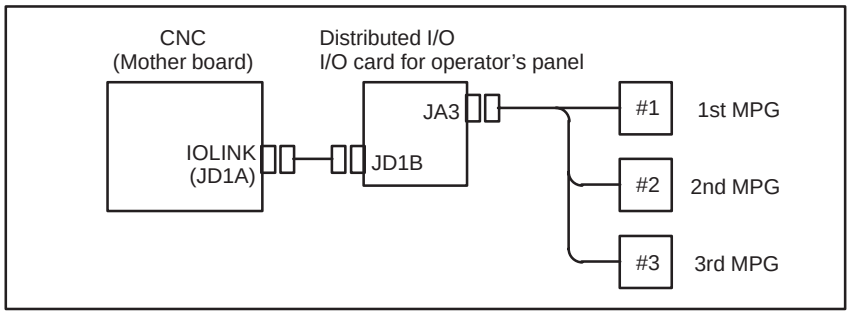
1 : reverse direction

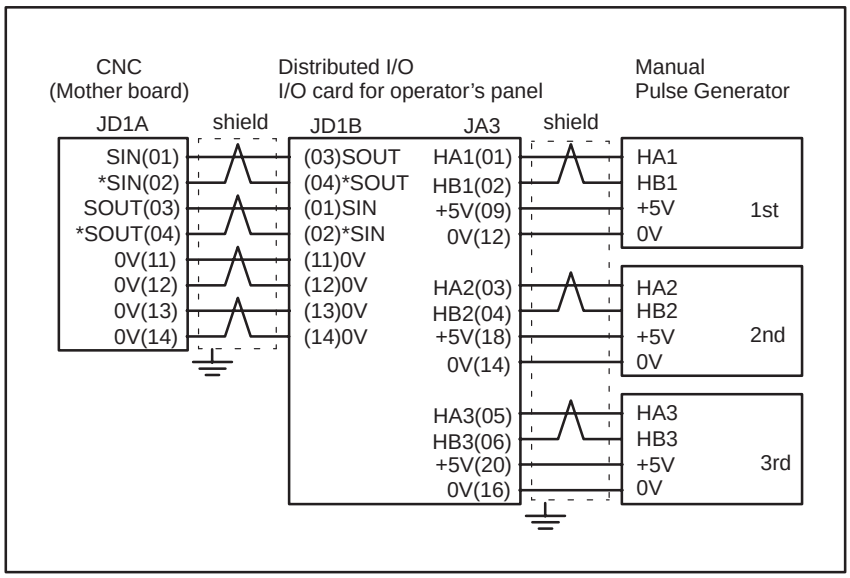
7110	No. of MPGs used (1 to 3)

(4) Checking manual pulse generator

(a) Incorrect of cable

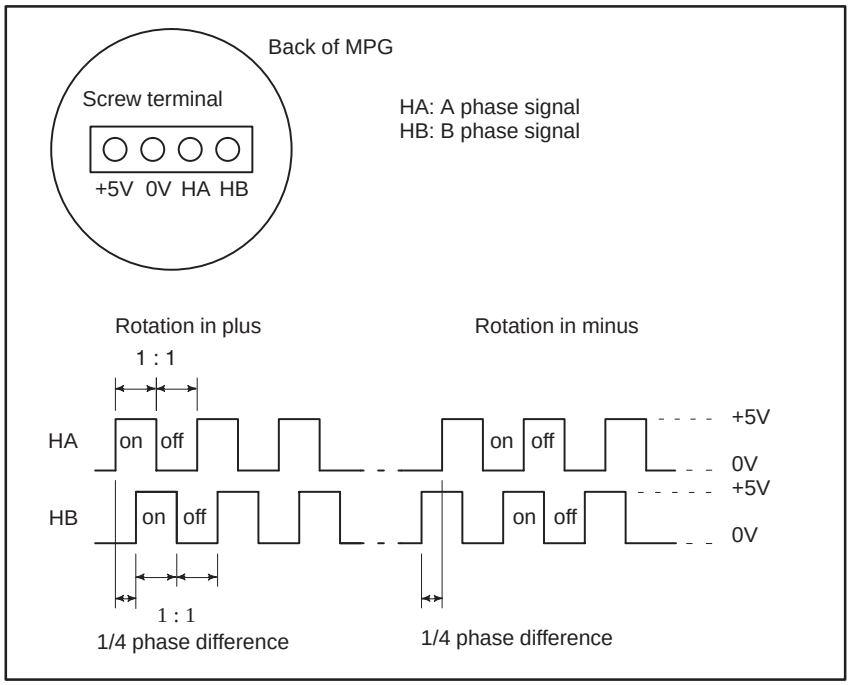
Check disconnection of cable or short circuit.





(b) Manual pulse generator is faulty

When you rotate the MPG, the following signal is output. Measure the signal with synchroscope at screw terminal on back of MPG. If no signal is output, measure +5V voltage.



Check on and off ratio and phase difference of HA and HB.

7.5 AUTOMATIC OPERATION CANNOT BE DONE

Points

(1) Check manual operation is possible.

(2) Check the status of cycle start LED on machine operator's manual.

(3) Check status of CNC.

Causes and Remedies

When manual operation is either impossible, perform countermeasure, based on the previous item "Jog operation cannot be done".
Confirm that a correct mode is selected according to the mode select status of 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	: 1(Example)
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).

<M series>

	#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) : 2nd auxiliary function strobe signal

<T series>

	#7	#6	#5	#4	#3	#2	#1	#0
G0005				BFIN	TFIN	SFIN		MFIN

#0(MFIN) : M function completion signal

#2(SFIN) : S function completion signal

#3(TFIN) : T function completion signal

#4(BFIN) : Second auxiliary function completion 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

#4(BF) : Second auxiliary function strobe signal

<M/T series>

	#7	#6	#5	#4	#3	#2	#1	#0
G0004			MFIN3	MFIN2				

#4(MFIN2) : Second M function completion signal

#5(MFIN3) : Third M function completion signal

	#7	#6	#5	#4	#3	#2	#1	#0
I0008			MF3	MF2				

#4(MF2) : Second M function strobe signal

#5(MF3) : Third M function strobe signal

* The second and third M functions are enabled only when bit 7 (M3B) of parameter No. 3404 is set to 1.

Signal	End state	
Finish signal	0	1
store signal	0	1

b. Travel command is being executed

CNC is reading an axis command (X,Y,Z,...) in a program and giving the command to the axis.

c. A dwell command is being executed

CNC is reading a dwell command (G04) in a program and is executing the dwell command.

d. In–position check (confirming positioning) is being done

Positioning (G00) to a specified position of a specified axis is not completed.
Whether positioning is completed or not is checked as the servo position error amount. Check it CNC's diagnostic function as follows:

DGN no.300 [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 1	254%
0 0 0 0 0 0 0 0	0%

f. Interlock signal or start lock signal is input

<T series only>

Start lock signal is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0007							STLK	

#1 (STLK) With this signal being 1, 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					*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

· M series

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

· T series

	#7	#6	#5	#4	#3	#2	#1	#0
X0004			–MIT2	+MIT2	–MIT1	+MIT1		

± MITn=1 shows interlock signal per axis and direction is input.

* For the T series, ± MITn is valid only for manual operation.

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					MDTCH4	MDTCH3	MDTCH2	MDTCH1

When signal MDTHn is "1" ,the axis detach function is in valid.

The control axis detach function becomes valid by the following signal issued from the PMC or a 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					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. CNC is waiting for spindle speed arrival signal to be input

Actual spindle speed does not arrive at a speed specified in a program. Confirm the signal state using the PMC's diagnostic function (PMCDGN).

	#7	#6	#5	#4	#3	#2	#1	#0
G0029				SAR				

#4(SAR) : When this signal is 0, spindle speed does not arrive at the specified speed.

This function is valid when PARAM 3708#0=1.

h. Manual feedrate override is 0% (dry run)

Normally manual feedrate override function is used for jog feed. But when DRN(dry run) signal turns on during an auomatic operation,override values set with these signals become valid to the following speed set by a parameter.

	#7	#6	#5	#4	#3	#2	#1	#0
G0046	DRN							

#7(DRN) : Dry run signal is input with this signal being 1.

1410	Dry run rate

The rate when the following override value is 100%.

	#7	#6	#5	#4	#3	#2	#1	#0
G0010	*JV7	*JV6	*JV5	*JV4	+JV3	*JV2	*JV1	*JV0
						↓	↓	↓
G0011	*JV15	*JV14	*JV13	*JV12	+JV11	*JV10	*JV9	*JV8

When override value is 0%, all bits of the above address is [1111 . . . . 1111] or [0000 . . . . 0000].

*JV15 . . . . . JV0	Override
1111 1111 1111 1111	0.00%
1111 1111 1111 1110	0.01%
:	:
1101 1000 1110 1111	100.00%
:	:
0000 0000 0000 0001	655.34%
0000 0000 0000 0000	0.00%

i. 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 feedrate set by parameter is incorrect.

1422	Maximum feedrate

Feedrate is clamped at this upper feedrate.

(b) Feedrate is specified by feed per revolution (mm/rev)

1) Position coder does not rotate

Check the connection between spindle and position coder
The following failure is considered:

- T iming belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened

2) Position coder is faulty

(c) Thread cutting does not operate

1) Position coder does not rotate

Check the connection between spindle and position coder
The following failure is considered:

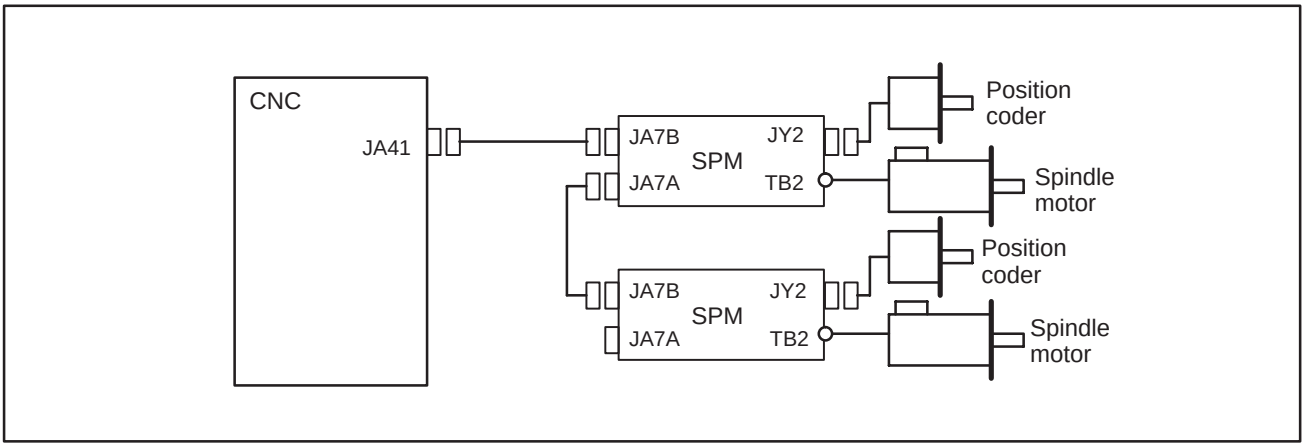
- Timing belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened

2) Position coder is faulty

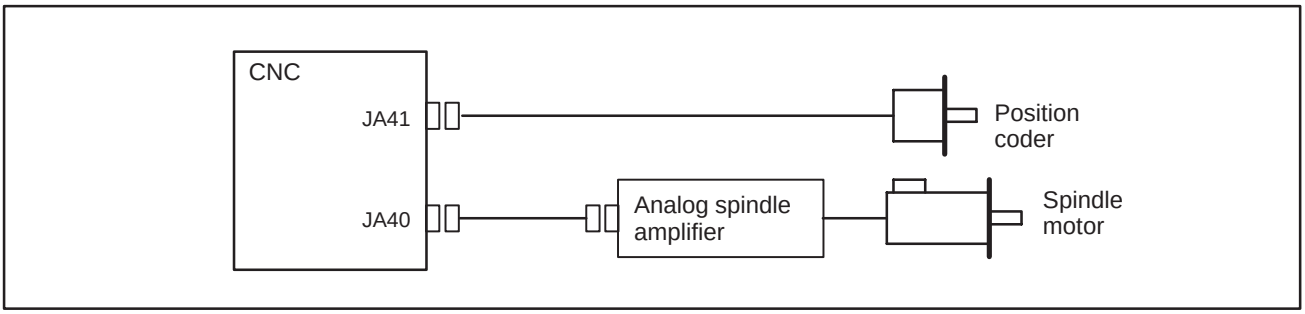
Position coder is connected to the spindle amplifier when serial interface spindle is used or connected to the CNC when analog interface spindle is used.
For details of connection, refer to the following.

<T series>
Whether A/B phase signals from the position coder are read correctly, can be judged also by the spindle speed display on the CRT screen (position screen). (However, it is not displayed when PARAM 3105#2=0).

<α series spindle amplifier>



<Analog interface spindle amplifier>



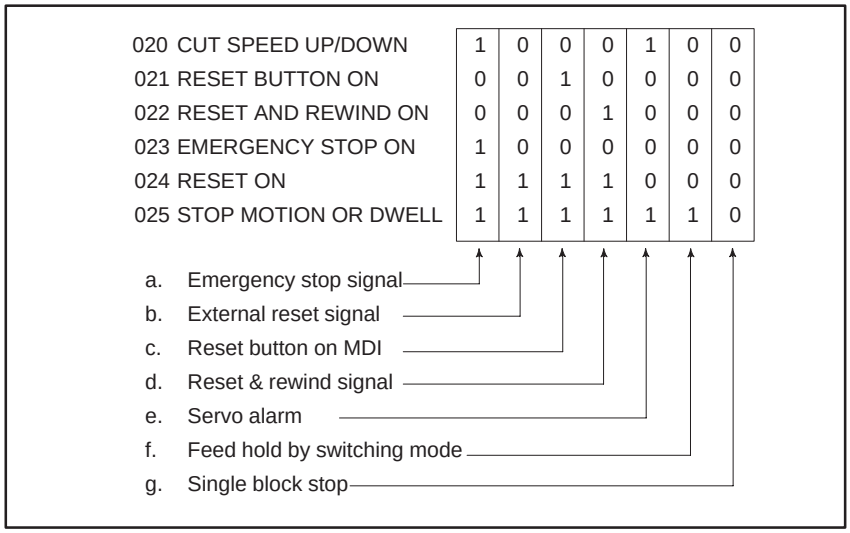
7.6 CYCLE START LED SIGNAL HAS TURNED OFF

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 :

	#7	#6	#5	#4	#3	#2	#1	#0
X1008				*ESP				
	#7	#6	#5	#4	#3	#2	#1	#0
G0008				*ESP				

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

b. External reset signal is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0008	ERS							

#7(ERS) : When the bit is 1, external reset signal is input.

This signal is usually used for a confirmation signal of M02 when an M02 is specified in a program as the end of a program.
Therefore, when M02 is executed, this signal is input.

c. Reset button on the MDI is pressed

An automatic operation is put into a reset status when RESET key on the MDI panel is pressed.

d. Reset & rewind signal is input

	#7	#6	#5	#4	#3	#2	#1	#0
G0008		RRW						

#6(RRW) : When this signal is 1, the reset & rewind signal is input.

This signal is usually used for a confirmation signal of M30 when an M30 is specified in a program as the end of a program.
Therefore, when M30 is executed, this signal is input.

e. Servo alarm has generated

When any servo alarm has generated, cycle operation is put into the reset state and operation stop.

f. Cycle operation is in a feed hold state

The cycle operation becomes feed hold state in the following cases:

1) Modes are switched from an automatic operation mode to a manual operation mode.
2) Feed hold signal is input.

<Mode select signal>

	#7	#6	#5	#4	#3	#2	#1	#0
G0043						MD4	MD2	MD1

Automatic operation	memory edit(EDIT)	0	1	1
	Automatic operation (AUTO)	0	0	1
	Manual data input (MDI)	0	0	0
Manual operation	Jog feed (JOG)	1	0	0
	Handle/step	1	0	1
	TEACH IN 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.

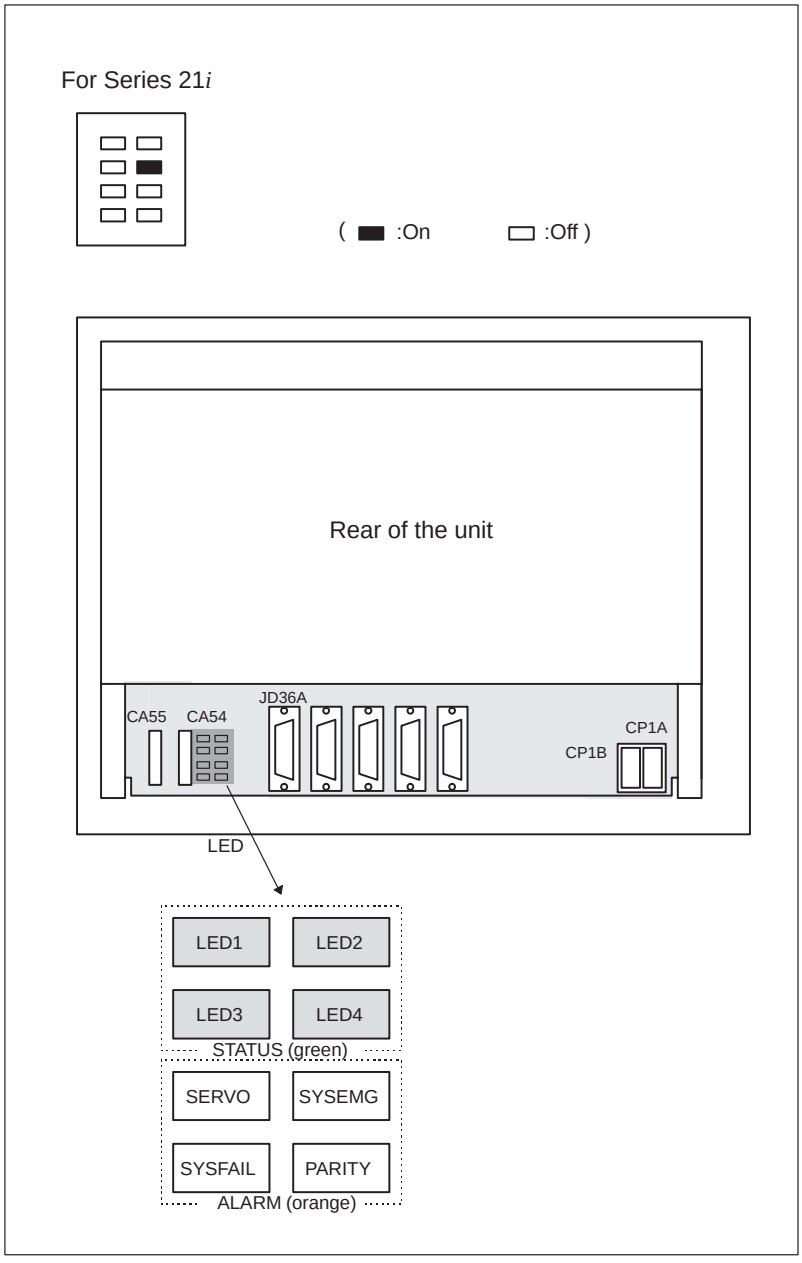
7.7 NO DISPLAY APPEARS AT POWER–UP

Points

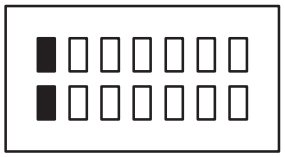
Check whether this problem is caused by (1) a trouble in the display system or (2) a system failure.

Determining the point

Check that the LEDs on the motherboard are in the status shown below.

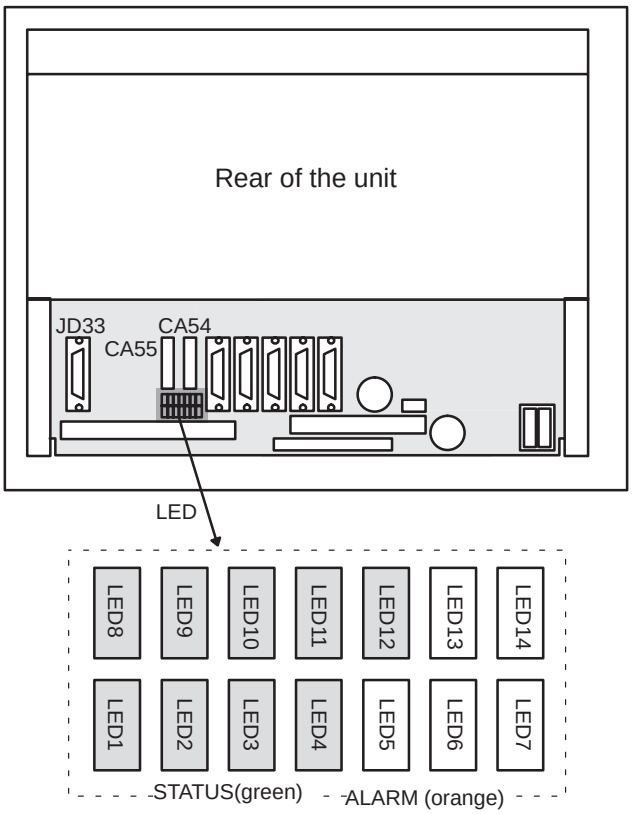


For Series 21*i* with a personal computer function



(: On : Off)

LED positions



If the LED status indicated above is observed, the system operates normally. In this case, there is a trouble in the display system.

If the LEDs are not in the status indicated above, there is a trouble in hardware other than the display system.

Causes and countermeasures

1. When the display system is in trouble

(1) Check the following:

1) Is the power cable of the backlight connected?
2) Is the video signal cable connected? Is there cable breakage or poor contact?

(2) Causes and remedies

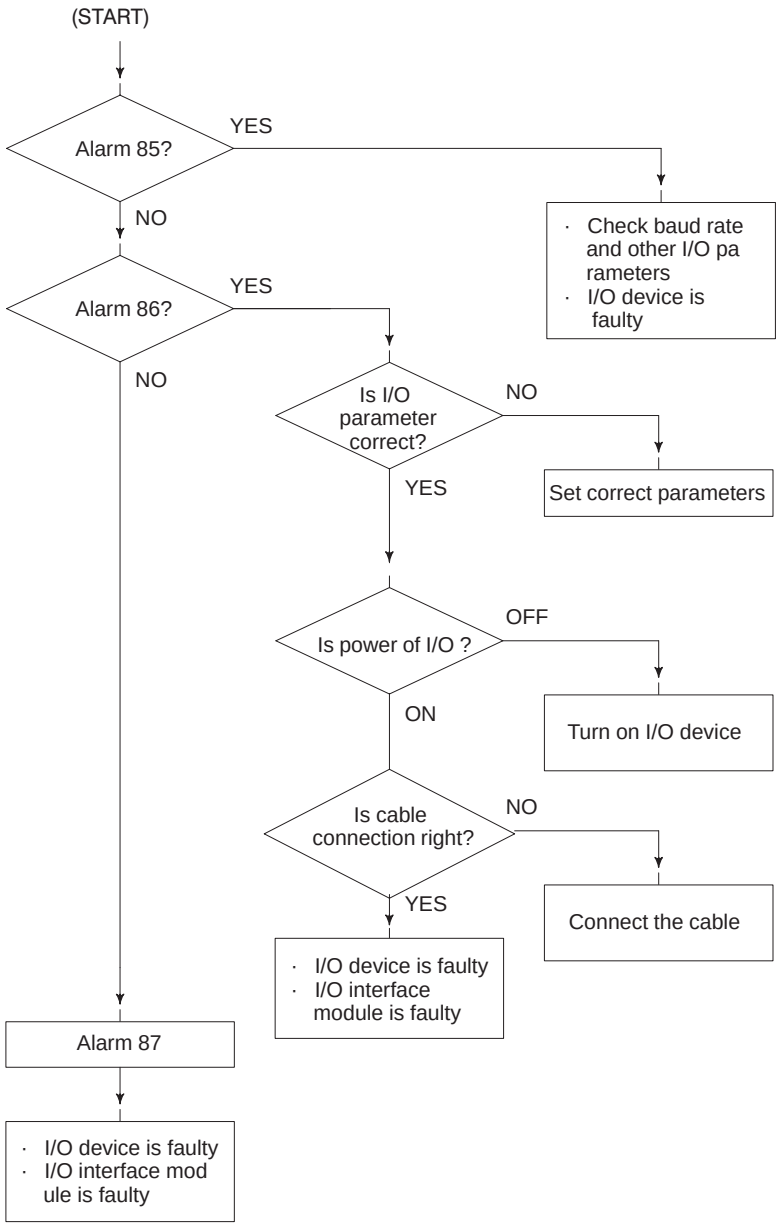
When nothing is displayed

1) The power supply to the display is faulty. (Replace the motherboard or inverter PC board.)
2) The display is faulty.

2. When the system is in trouble

When the LEDs on the motherboard are not in the status indicated in ”Determining the point” given previously, the motherboard or display control card may be faulty.

7.8 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>

Value of parameter 0020 / Function		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			SERIAL COMMUNICATION BOARD	
		JD36A		JD36B	JD28A	JD6A

NOTE
1 Numbers in the table indicate parameters and bit numbers.
Example) 101#7:bit7 of parameter 101.
2 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								

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

#3(ASI) 0 : Data input code is EIA or ISO (automatic recognition)
1 : Data input code is ASCII.

#7(NFD) 0 : Feed is output before and after data in data output (FANUC PPR)
1 : Feed is not output (standard).

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 rete

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	

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

#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.

#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.

#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.

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

#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.

#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.

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

#3(R42) 0 : Interface is of RS–232C.
1 : Interface is of RS–422.

#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.

(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

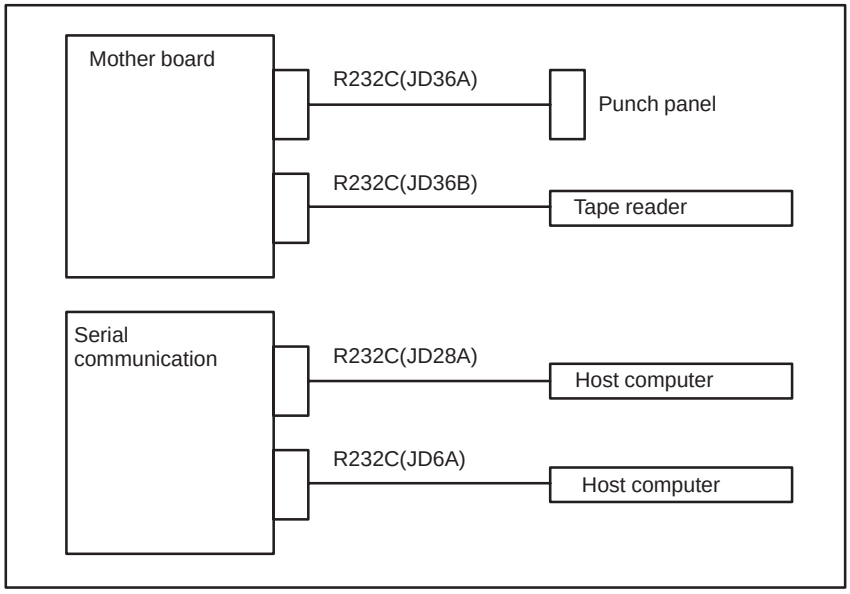
(i) When parameter no.0020 is 0 or 1 or 2 (JD36A,JD36B of Main CPU board) Replace the module since spindle module may be faulty.

(ii) When parameter no. 0020 is 3 (JD28A,JD6A of option 1 board) Because communication control module (5) may be faulty, replace the module.

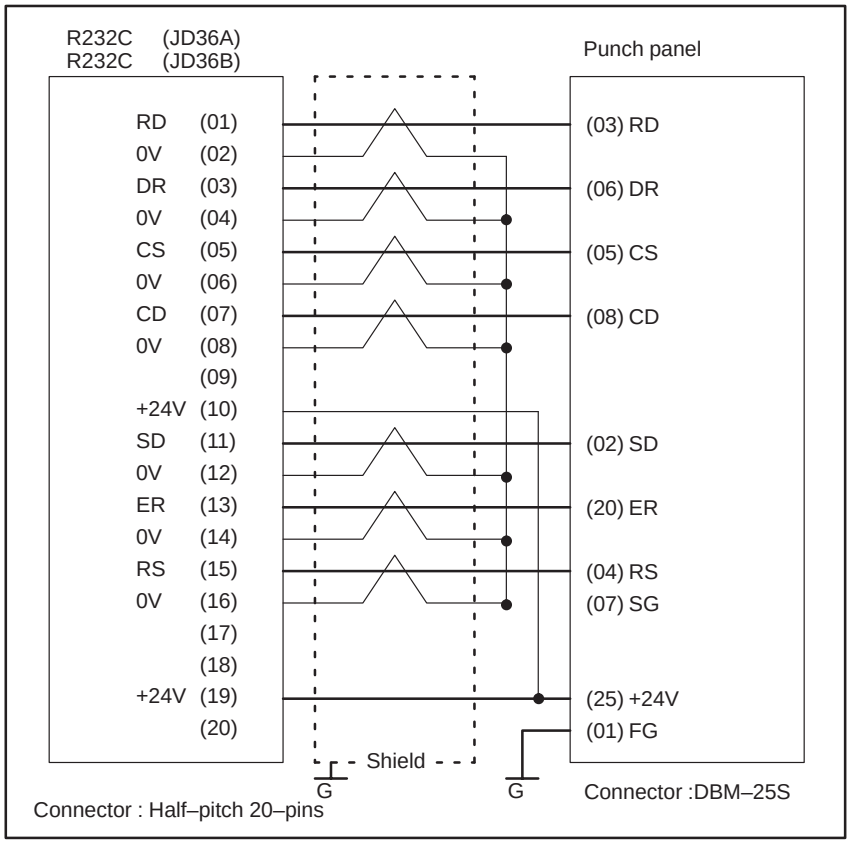
(d) Cable between NC and I/O device is faulty.

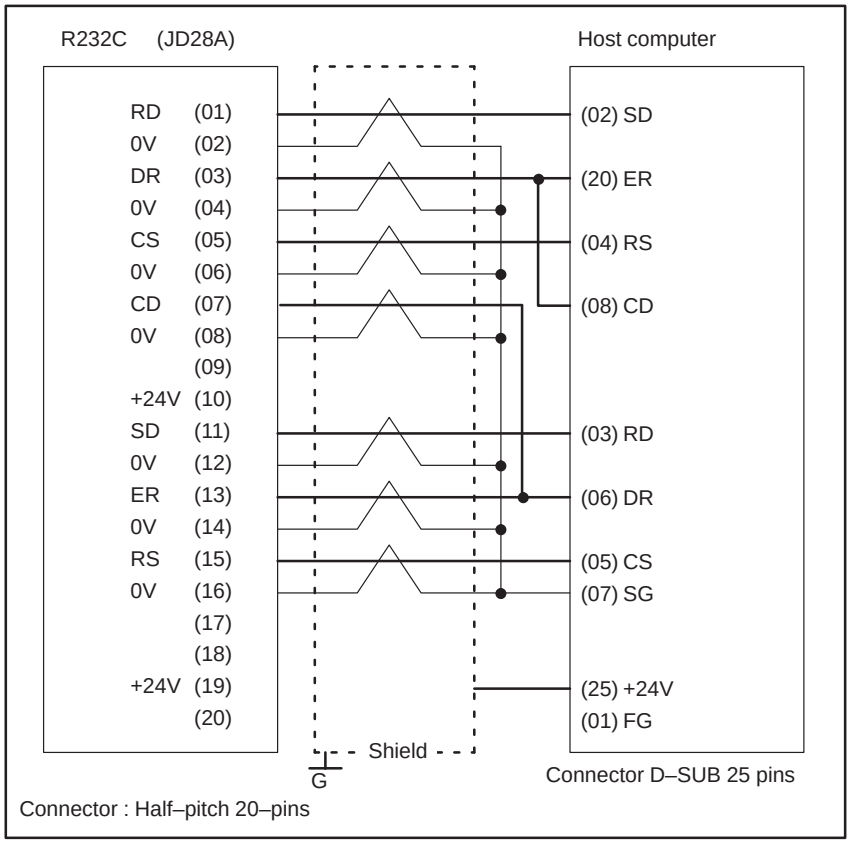
Check the cable for disconnection or wrong connection.

<Connection>

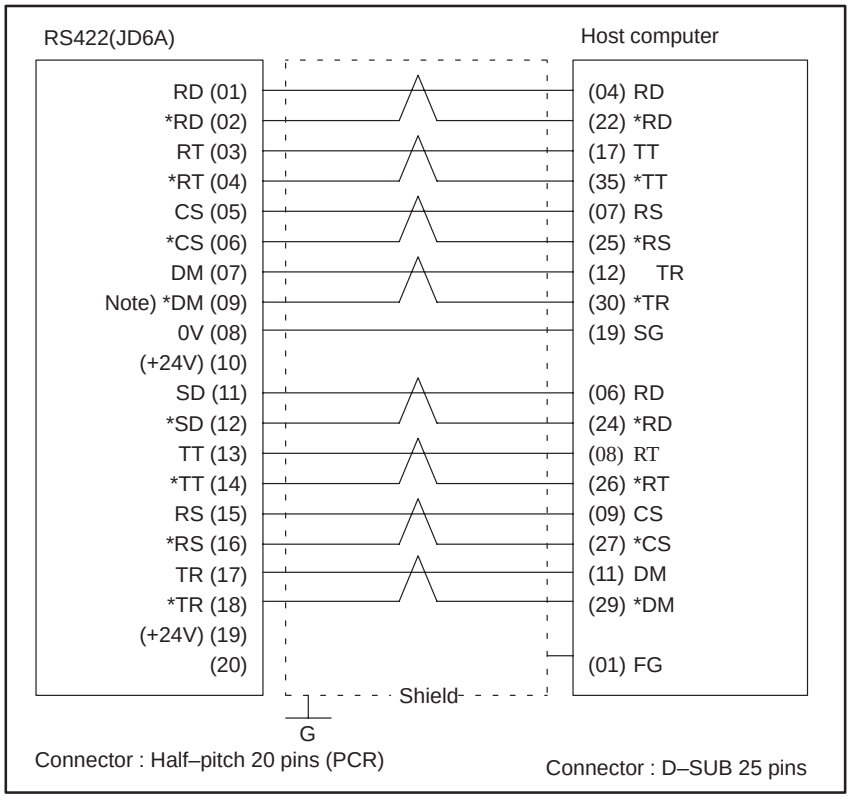


< Cable connection>





CAUTION
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.



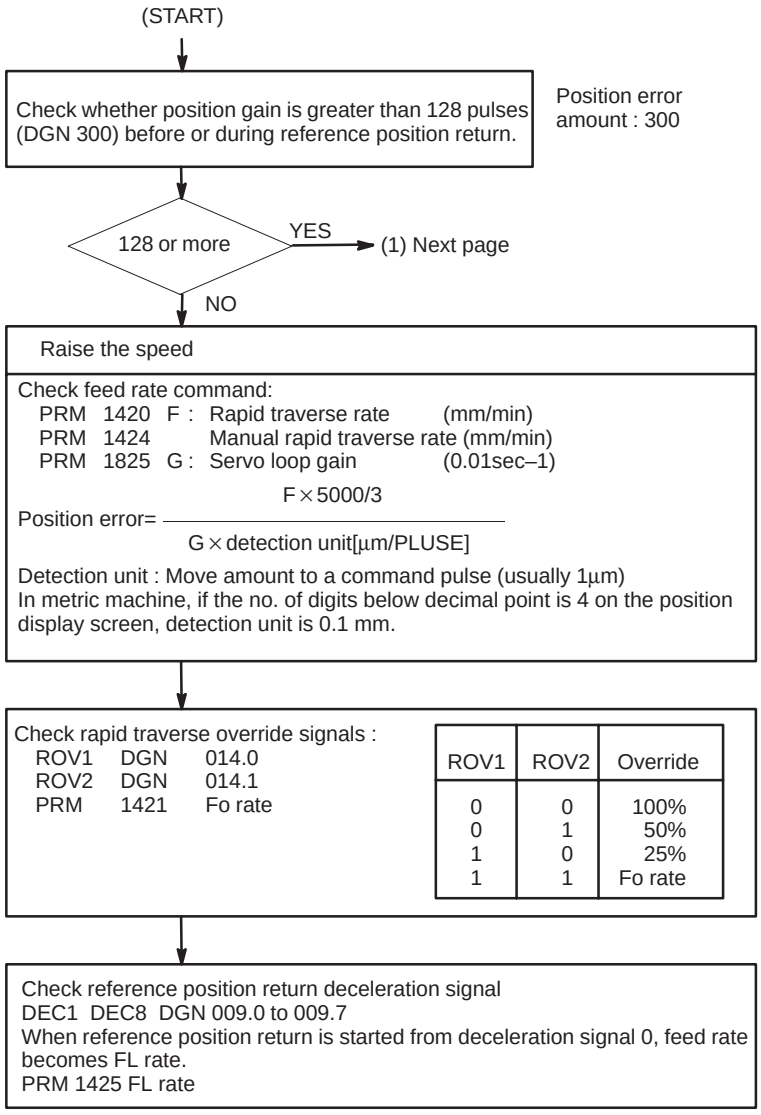
CAUTION
Always use a twisted pair cable.

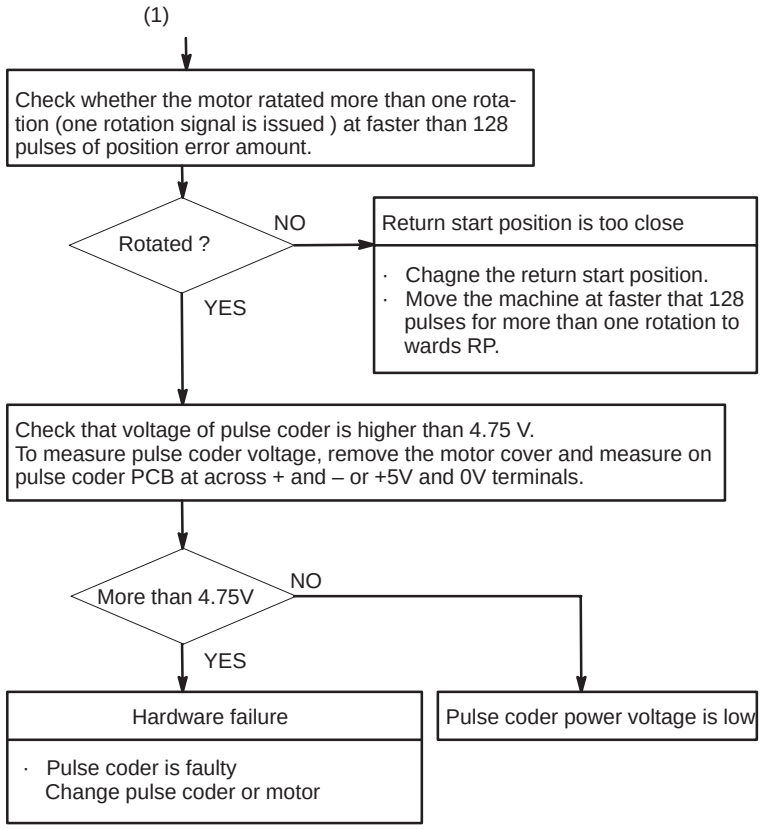
7.9 ALARM 90 (REFERENCE POSITION RETURN IS ABNORMAL)

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





CAUTION

1 After the pulse coder or motor is exchanged, reference position or machine's standard point may be different from former one. Please set it correctly.
2 When the 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.
If bit 0 of parameter No. 2000 is set to 1, a speed corresponding to a positional deviation of 1280 pulses or more is required.
Parameter No. 1836 can be set to 128 or less, as the minimum positional deviation with which reference position return is possible. (If the parameter is set to 0, 128 is assumed as the minimum positional deviation. If bit 0 of parameter No. 2000 is set to 1, a value equal to ten times the set value is used for checking.)

7.10 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				

#4(APZx) Reference position of absolute pulse coder is :

0 : not established
1 : established

#5(APCx) 0 : Position detector is incremental pulse coder.

1 : Position detector is absolute pulse coder.

7.11 ALARM 417 (DIGITAL SERVO SYSTEM IS ABNORMAL)

Digital servo parameters are abnormal.
(Digital servo parameters are set incorrectly.)

- **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 SERVO PARAMETERS” .

This data indicates the cause of servo alarm No. 417, detected by the NC. If the alarm is detected by the servo, the PRM bit (bit 4 of DGN No. 0203) is set to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
0280		AXS		DIR	PLS	PLC		MOT

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

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

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

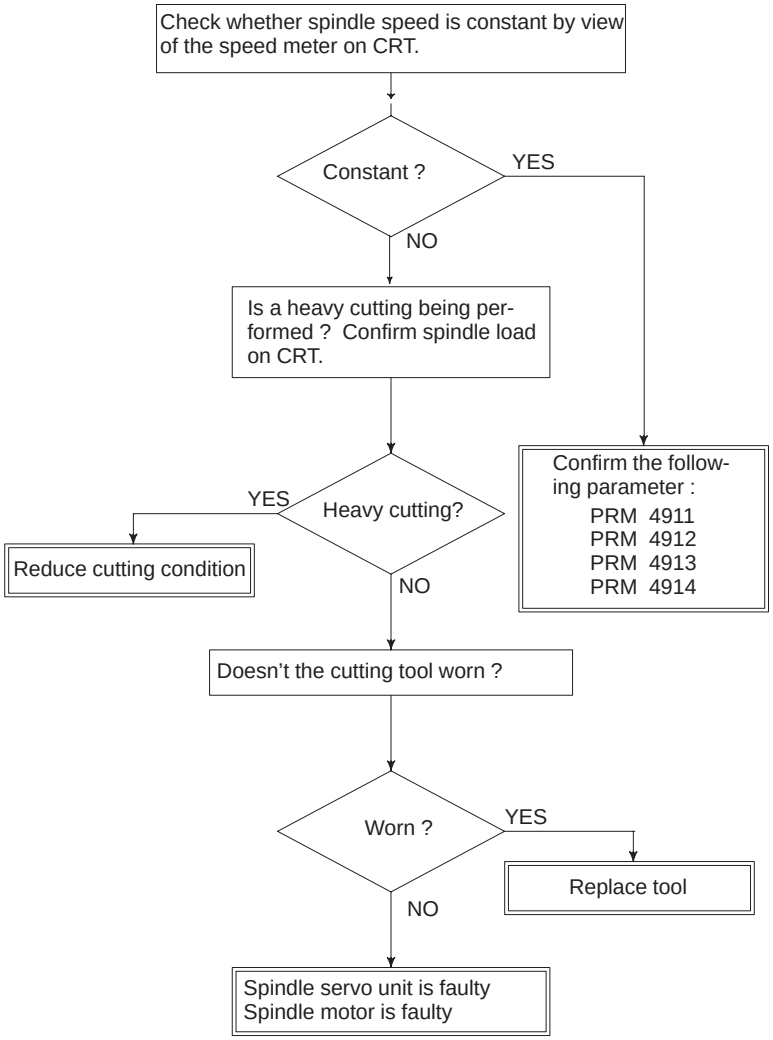
#4(DIR) : The wrong direction of rotation for the motor is specified in parameter No. 2022 (the value is other than 111 or –111).

#6(AXS) : In parameter No. 1023 (servo axis number), a value that falls outside the range of 1 to the number of controlled axes is specified. (For example, 4 is specified instead of 3.) Alternatively, the values specified in the parameter are not consecutive.

7.12 ALARM 704 (SPINDLE SPEED FLUCTUATION DETECTION ALARM)

Spindle speed changes abnormally due to load.

Remedies



Remedies

PRM 4911 : A ratio of spindle speed at which actual spindle speed is regarded as arrived at a command spindle speed.

PRM 4912 : Spindle speed fluctuation ratio up to which the spindle speed fluctuation detection alarm is not issued.

PRM 4913 : Spindle speed fluctuation that is not regarded as the spindle speed fluctuation alarm.

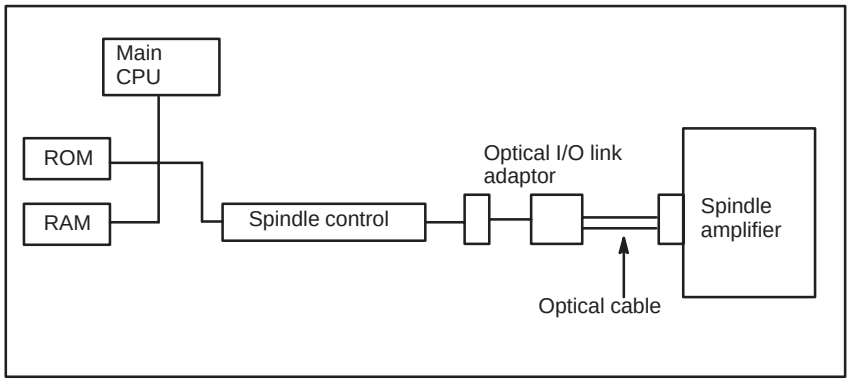
PRM 4914 : Time when a spindle speed changed to when spindle speed fluctuation detection is started.

7.13 ALARM 749 (SERIAL SPINDLE COMMUNICATION ERROR)

Communication error has generated in serial spindle

Causes and Remedies

Improper connection between the mother board and the serial spindle. The following reason is considered.



System control module is faulty. (Bold line in the figure below indicates module mounting position.)
A cable between the mother board and optical I/O link adapter is disconnected or short–circuited.
Optical I/O link adapter is faulty.
Optical cable is disconnected.
Serial spindle amplifier is faulty.

7.14 ALARM 750 (SPINDLE SERIAL LINK CANNOT BE STARTED)

When the spindle amplifier does not become normal state immediately after power is turned on in the serial spindle system, this alarm is informed.

Points

This alarm does not occur once the system becomes ready including the spindle system .
This alarm occurs during power on sequence before the system becomes ready.
After the system becomes ready, serial spindle alarm is issued by alarm 749.

Causes

(1) Optical cable is in poor contact or spindle amplifier power is off.

(2) When display of spindle amplifier shows SU–01 or an alarm other than AL–24 is displayed, power to the NC is turned on.

In this case, this alarm usually occurs when the NC's power is turned off while the serial spindle is operating. Turn off the power of serial spindle once, then turn it on and starts the system.

(3) Combination of hardware is wrong.

(4) When the 2nd spindle is at the state of (1) to (3).

When the 2nd spindle is used, parameter is set as follows :
Bit 4 of parameter no.3701 is 1: No. of serial spindles connected is 2.

Details of Alarms

Confirm the details of troubles on diagnostic 409.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0409					SPE	S2E	S1E	SHE

#0(SHE) 0 : Serial communication module on the CNC side is normal.
1 : Serial communication module was detected to be abnormal on the CNC side.

#1(S1E) 0 : The serial communication module of the CNC side is normal.
1 : The serial communication module of the CNC side is abnormal.

#2(S2E) 0 : At the start of spindle serial control, the spindle is normal.
1 : At the start of spindle serial control, the spindle is abnormal.

#3(SPE) 0 : In spindle serial control, the serial spindle parameters satisfies the starting conditions for spindle amplifier.
1 : In spindle serial control, the serial spindle parameters do not satisfy the starting conditions for spindle amplifier.

Remedies

Reform the following countermeasures based on the above configurations:

(1) #0(SHE)1: The serial communication module is detected to be abnormal. Exchange the following module :

(2) #1(SIE)1: When an abnormality is found in the 1st spindle at the start of serial spindle control, exchange the unit if the following check items are not concerned.

↓

Check the parameters and connections at the 1st spindle to see whether the 1st spindle is mechanically and electrically connected.

↓

If the parameters and connections are correct, the system control module shown below or the spindle amplifier itself is faulty.

(3) #2(S2E)1: At the start of spindle serial control, when an abnormality is found in the 2nd spindle side.

↓

Check the 2nd spindle parameters and connections to see whether the spindle is mechanically and electronically connected to the spindle.

↓

If the above settings and connections are right, the module of (4) or the spindle amplifier itself may be defective.

(4) #3(SPE)1: In spindle serial control, the serial spindle parameters does not satisfy the starting conditions for spindle amplifier.

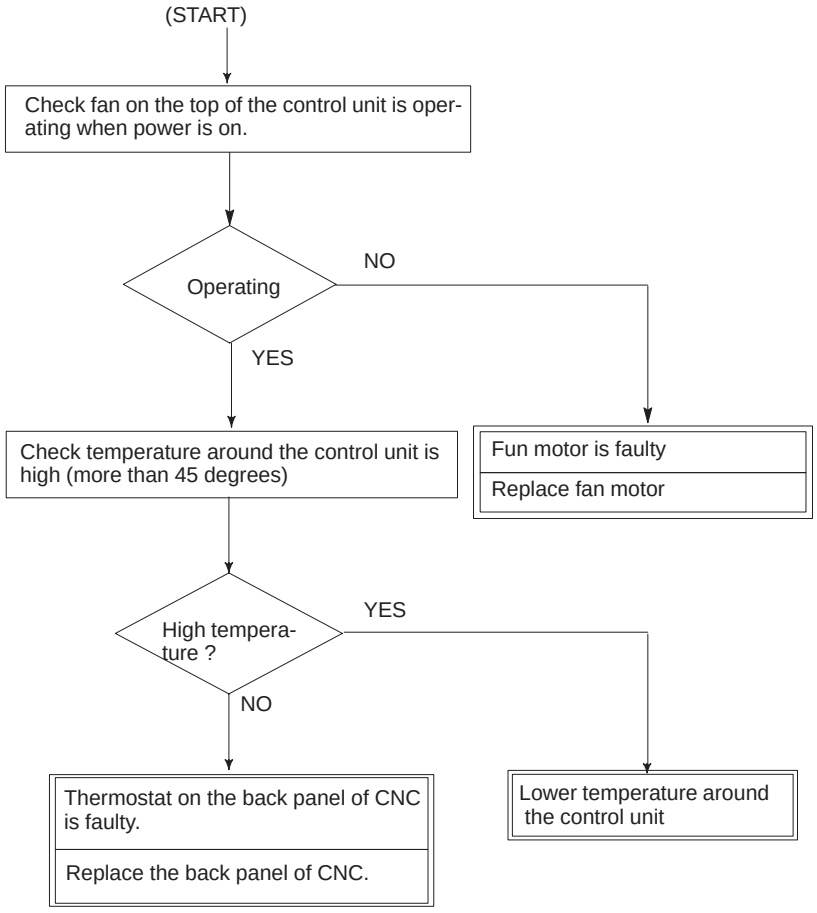
↓

Confirm the settings of parameters 4000s.
Especially checks the parameters those are changed from the standard parameters.

7.15 ALARM 700 (OVERHEAT AT CONTROL SIDE)

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

Remedies

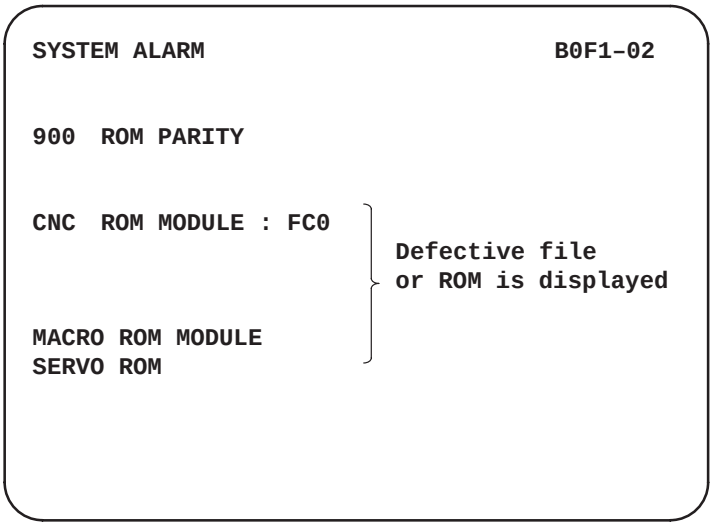


7.16 ALARM 900 (ROM PARITY ERROR)

ROM parity error occurred.

Causes and Remedies

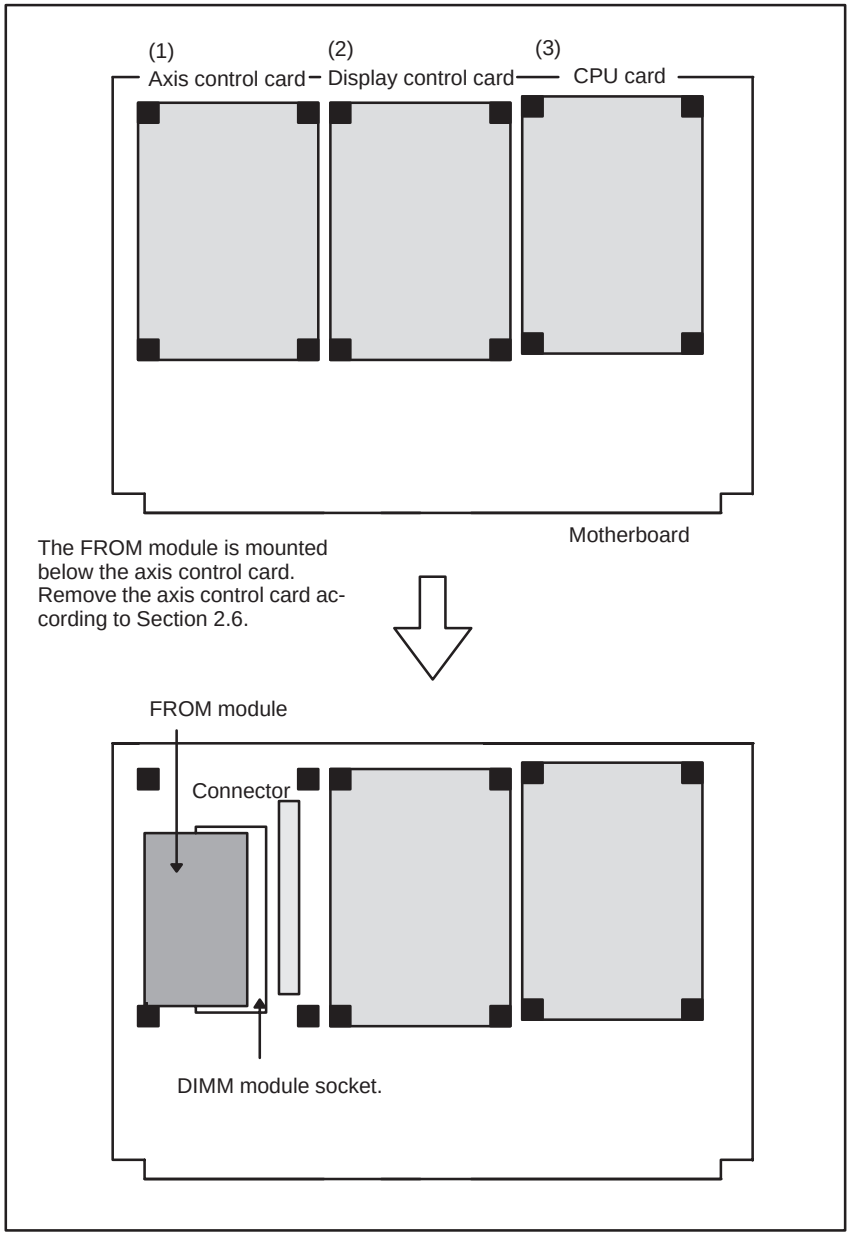
(1) ROM module mounted on the mother board or ROM is defective.



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 the FROM/ROM module**

<Motherboard>



7.17 ALARM 910, 911 (SRAM PARITY ERROR)

A parity error occurred in the RAM module for workpieces.

Causes and countermeasures

- **SRAM module is faulty. Stored data is faulty.**

If the alarm is issued immediately after the power is turned on, turn off the power, then turn it on while holding the RESET and DELETE keys to clear all memory contents.
If the parity alarm still exists even after the memory all clear operation, the SRAM module on the motherboard may be faulty. So, replace the SRAM module.

- Set all data again according to "Data Input/Output".

- **Voltage drop in the memory backup battery**

A battery alarm is issued if the voltage level drops to 2.6 V or lower when the voltage rating is 3.0 V.
When the voltage of the memory backup battery has lowered, "BAT" blinks at the bottom of the screen.
When the battery alarm is turned on, replace the battery with a new lithium battery as soon as possible.

- Replace the battery according to Section 2.9.

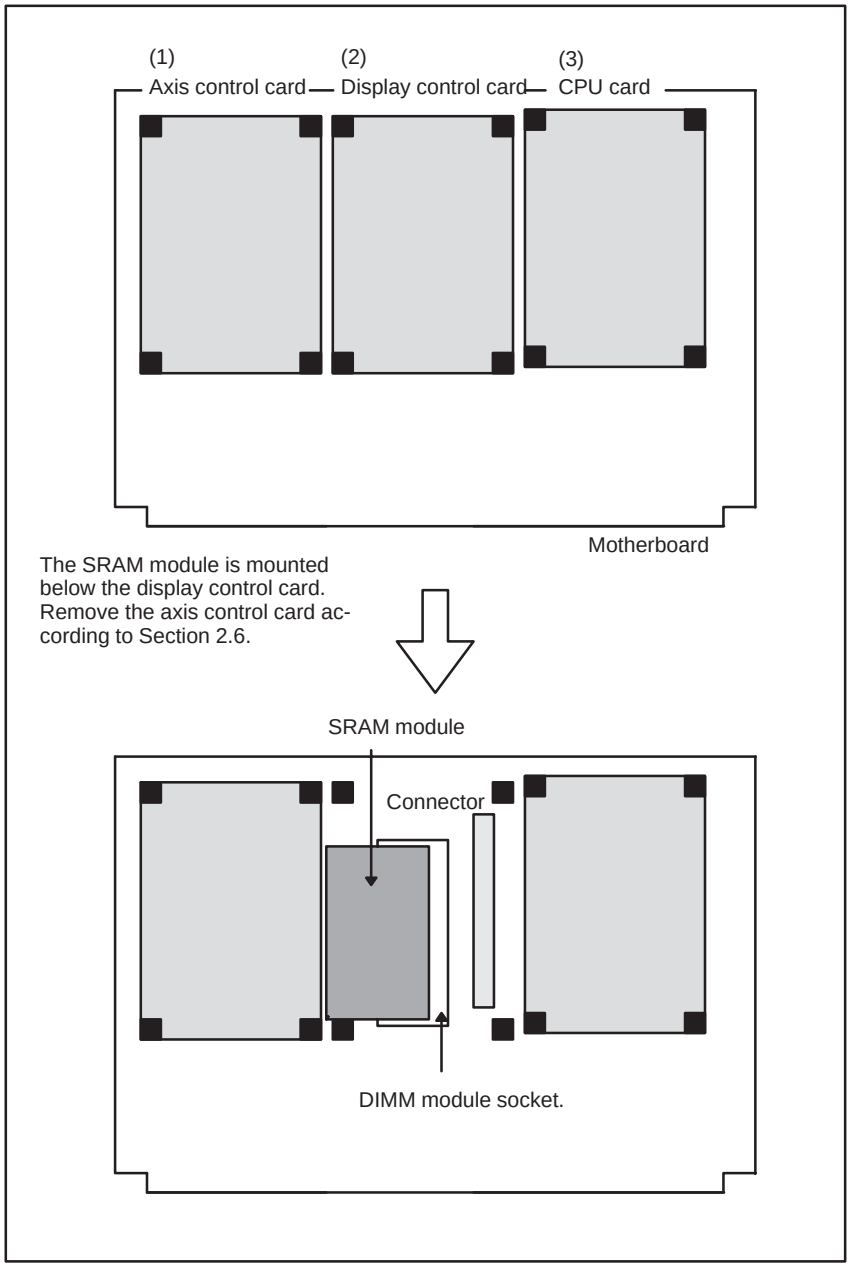
- **The motherboard is faulty.**

If the alarm is released by memory all clear operation, the motherboard may also be faulty.

NOTE
1 If an SRAM parity alarm occurs in a module other than the motherboard, ALM972 NMI OCCURRED IN OTHER MODULE appears.
2 If a parity alarm occurs in a system that has been kept switched off for a long time, it is likely that the battery life has expired or the backup circuit (on the motherboard) is defective.

- **Mounting position of the SRAM module**

<Motherboard>



7.18 ALARM 912 TO 919 (DRAM PARITY ERROR)

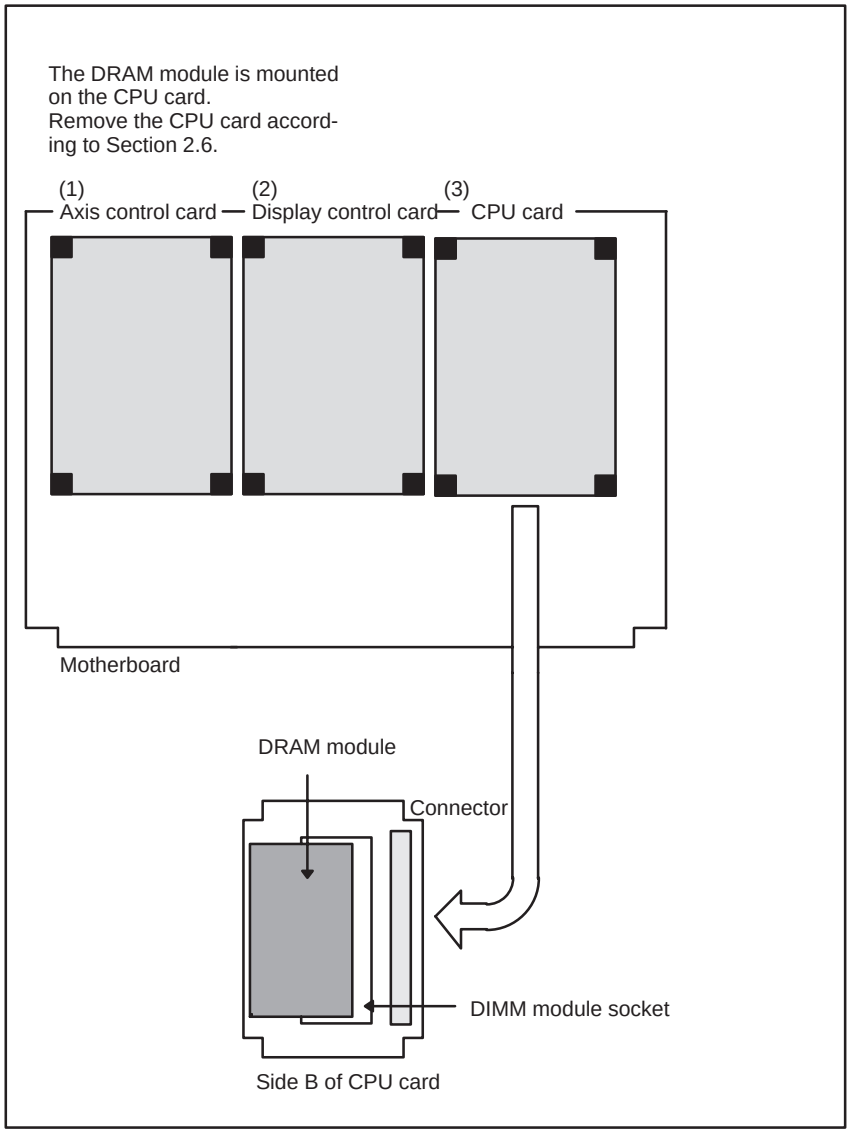
A parity error occurred in the DRAM module.

Cause and countermeasure

The DRAM module on the CPU card may be faulty. Replace the DRAM module.

- **Mounting position of the DRAM module**

<Motherboard>



7.19 ALARM 920 (WATCH DOG OR RAM PARITY)

920: Watch dog alarm or RAM parity in servo control module has occurred in servo control module on the mother board

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.

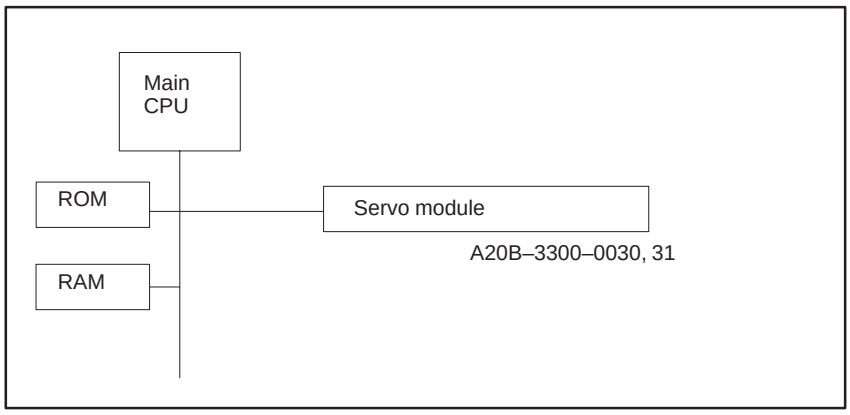
- **RAM parity error**

  Refer to alarm 910 to 919

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 mother board.



- **Mother board is faulty**

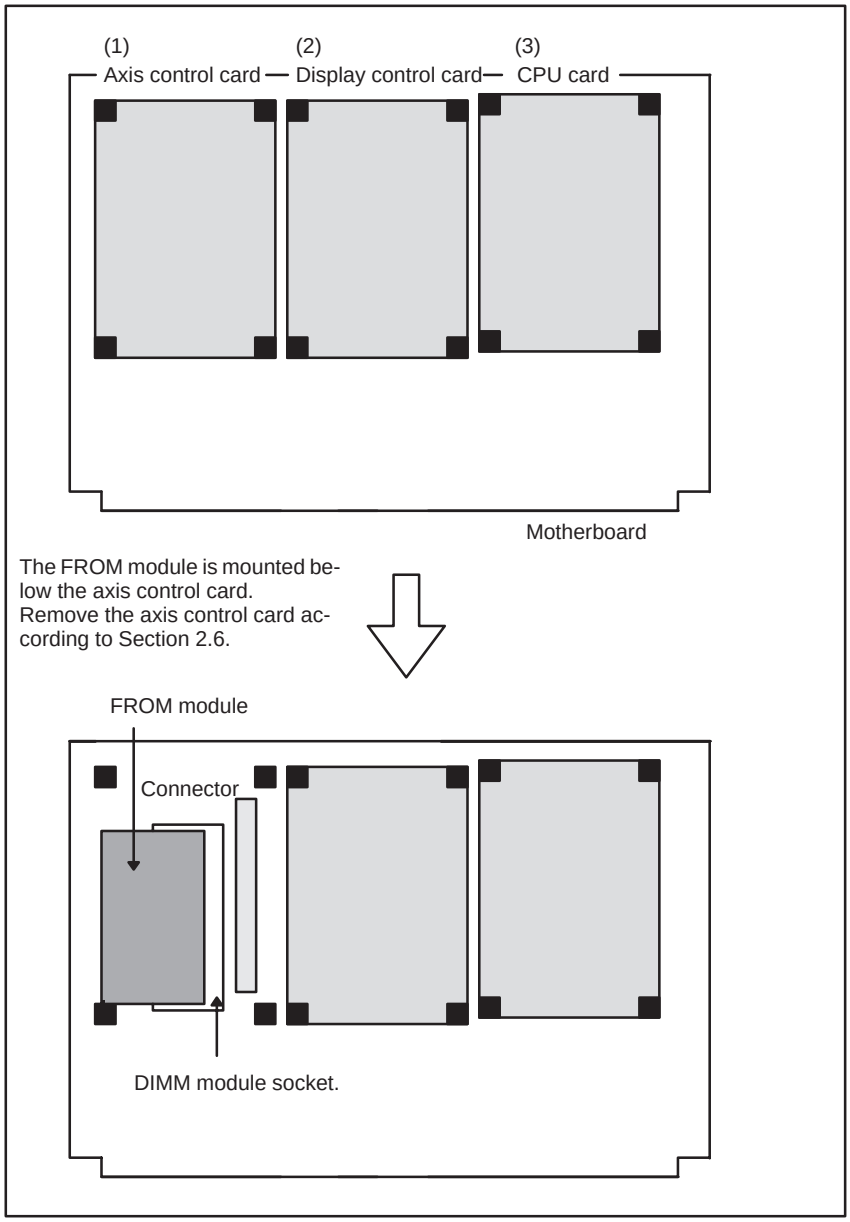
  CPU or peripheral circuits may be faulty. Replace the mother board or CPU card.

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

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

- **Mounting positions of the axis control card, CPU card, and FROM module**

<Motherboard>



7.20 ALARM 924 (SERVO MODULE MOUNTING ERROR)

The digital servo module is not mounted.

CAUTION
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 mother or sub CPU board.
For location of servo module, refer to an installation diagram of alarm 920.

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

7.21 ALARM 930 (CPU ERROR)

930: CPU error (abnormal interrupt) has generated.

Causes and Remedies

- **Mother board or CPU card**

An interrupt which will not occur during usual operation has generated. Peripheral circuit of the CPU may be abnormal. Change the mother CPU board or CPU card. If operation is performed normally by power off and on, noise may be a cause. Refer to Subsec. 2.15.

7.22 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 without C language function**

Fault on mother board

- CPU card is faulty
- DRAM module is faulty
- FROM module is faulty.
- Mother board is faulty.

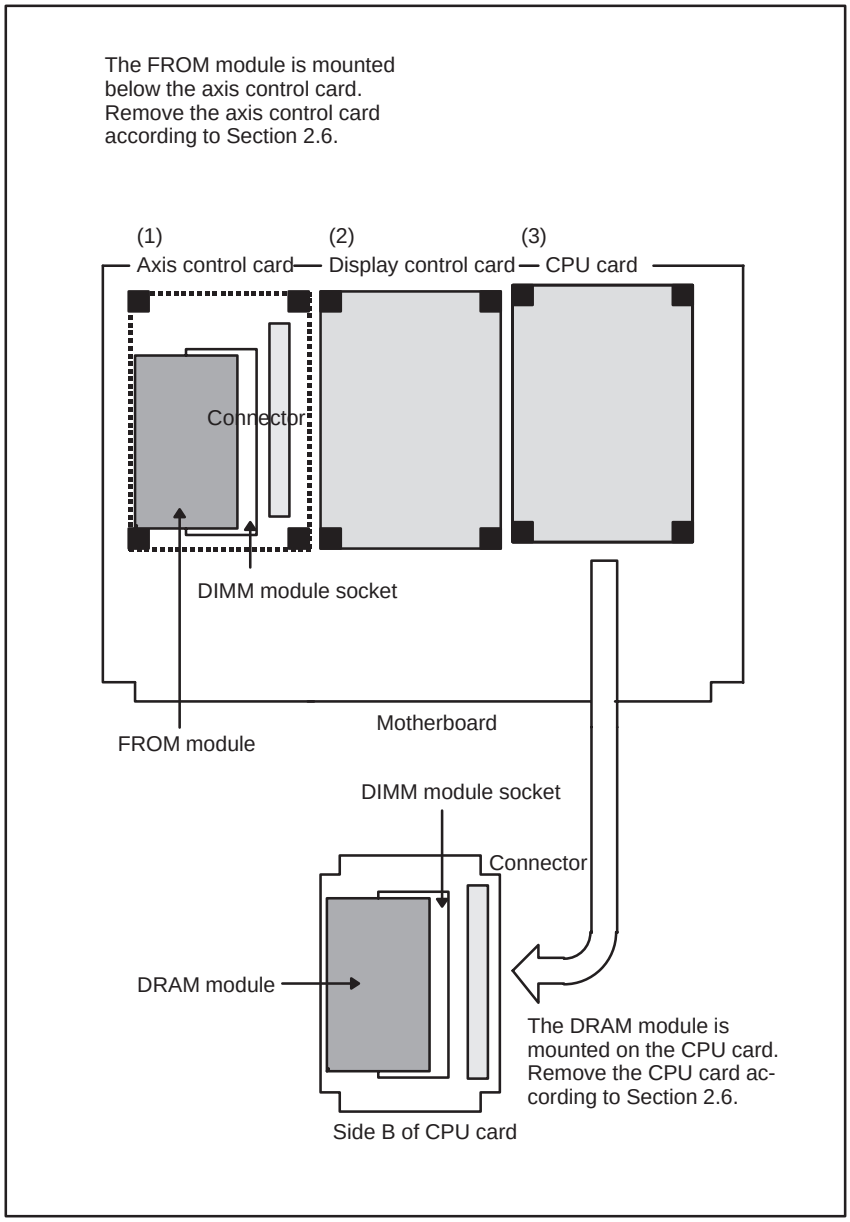
- **For PMC–RC with C language function**

Fault on C language Loard

- CPU card is faulty.
- DRAM module is faulty (C language board)
- C language board is faulty.

- **Mounting positions of the CPU card, DRAM module, and FROM module**

<Motherboard>



7.23 ALARM 951 (PMC WATCH DOG ALARM)

A watch dog alarm has generated in PMC.

Causes and Remedies

Mother board is falty.

7.24 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.
- Serial communication board
- Loader control board

```
SYSTEM ALARM                          DDF1–02

972 NMI OCUURRED IN OTHER MODULE

   SLOT 02
   915 SRAM PARITY : (2N+1)     <SUB
```

Indicates the slot No. where an NMI occurred, and the relevant message.

CAUTION
When you change Loader control board, you must input data (parameters, programs, etc.) on sub side.

7.25 ALARM 973 (NMI ALARM BY UNKNOWN CAUSE)

An unknown NMI has generated.

Causes and Remedies

1) Mother board or CPU card is faulty

CAUTION
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.

· Serial communication board

CAUTION
When you change the Loader control boards board, you must input data (parameters, programs,etc.) on the sub side.

APPENDIX

A ALARM LIST

A.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 " to " 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 " to " input error (Sign " to " was input after an address with which it cannot be used. Or two or more " to " 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 to 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.
014	CAN NOT COMMAND G95 (M series)	A synchronous feed is specified without the option for threading / synchronous feed.
	ILLEGAL LEAD COMMAND (T series)	In variable lead threading, the lead incremental and decremental outputted by address K exceed the maximum command value or a command such that the lead becomes a negative value is given. Modify the program.
015	TOO MANY AXES COMMANDED (M series)	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. Modify the program.
	TOO MANY AXES COMMANDED (T series)	An attempt has been made to move the tool along more than the maximum number of simultaneously controlled axes. Alternatively, no axis movement command or an axis movement command for two or more axes has been specified in the block containing the command for skip using the torque limit signal (G31 P99/98). The command must be accompanied with an axis movement command for a single axis, in the same block.
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.
022	NO CIRCLE RADIUS	The command for circular interpolation lacks arc radius R or coordinate I, J, or K of the distance between the start point to the center of the arc.

Number	Message	Contents
023	ILLEGAL RADIUS COMMAND (T series)	In circular interpolation by radius designation, negative value was commanded for address R. Modify the program.
025	CANNOT COMMAND F0 IN G02/G03 (M series)	F0 (fast feed) was instructed by F1 to digit column feed in circular interpolation. Modify the program.
027	NO AXES COMMANDED IN G43/G44 (M series)	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.
029	ILLEGAL OFFSET VALUE (M series)	The offset values specified by H code is too large. Modify the program.
	ILLEGAL OFFSET VALUE (T series)	The offset values specified by T code is too large. Modify the program.
030	ILLEGAL OFFSET NUMBER (M series)	The offset number specified by D/H code for tool length offset or cutter compensation is too large. Modify the program.
	ILLEGAL OFFSET NUMBER (T series)	The offset number in T function specified for tool offset is tool 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 (M series)	A point of intersection cannot be determined for cutter compensation. Modify the program.
	NO SOLUTION AT CRC (T series)	A point of intersection cannot be determined for tool nose radius compensation. Modify the program.
034	NO CIRC ALLOWED IN ST to UP / EXT BLK (M series)	The start up or cancel was going to be performed in the G02 or G03 mode in cutter compensation C. Modify the program.
	NO CIRC ALLOWED IN ST to UP / EXT BLK (T series)	The start up or cancel was going to be performed in the G02 or G03 mode in tool nose radius compensation. Modify the program.
035	CAN NOT COMMANDED G31 (T series)	Skip cutting (G31) was specified in tool nose radius compensation mode. Modify the program.
036	CAN NOT COMMANDED G31 (M series)	Skip cutting (G31) was specified in cutter compensation mode. Modify the program.
037	CAN NOT CHANGE PLANE IN CRC (M seires)	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.
	CAN NOT CHANGE PLANE IN NRC (T seires)	The offset plane is switched in tool nose radius compensation. Modify the program.
038	INTERFERENCE IN CIRCULAR BLOCK (M seires)	Overcutting will occur in cutter compensation C because the arc start point or end point coincides with the arc center. Modify the program.
	INTERFERENCE IN CIRCULAR BLOCK (T series)	Overcutting will occur in tool nose radius compensation because the arc start point or end point coincides with the arc center. Modify the program.
039	CHF/CNR NOT ALLOWED IN NRC (T series)	Chamfering or corner R was specified with a start to up, a cancel, or switching between G41 and G42 in tool nose radius compensation. The program may cause overcutting to occur in chamfering or corner R. Modify the program.

Number	Message	Contents
040	INTERFERENCE IN G90/G94 BLOCK (T series)	Overcutting will occur in tool nose radius compensation in canned cycle G90 or G94. Modify the program.
041	INTERFERENCE IN CRC (M seires)	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.
	INTERFERENCE IN NRC (T seires)	Overcutting will occur in tool nose radius compensation. Modify the program.
042	G45/G48 NOT ALLOWED IN CRC (M series)	Tool offset (G45 to G48) is commanded in cutter compensation. Modify the program.
044	G27 to G30 NOT ALLOWED IN FIXED CYC (M series)	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 (M series)	Optional chamfering or corner R is commanded in the thread cutting block. Modify the program.
	CHF/CNR NOT ALLOWED IN THRD BLK(T series)	Chamfering or corner R is commanded in the thread cutting block. Modify the program.
051	MISSING MOVE AFTER CHF/CNR (M series)	Improper movement or the move distance was specified in the block next to the optional chamfering or corner R block. Modify the program.
	MISSING MOVE AFTER CHF/CNR (T series)	Improper movement or the move distance was specified in the block next to the chamfering or corner R block. Modify the program.
052	CODE IS NOT G01 AFTER CHF/CNR (M series)	The block next to the chamfering or corner R block is not G01,G02 or G03. Modify the program.
	CODE IS NOT G01 AFTER CHF/CNR (T series)	The block next to the chamfering or corner R block is not G01. Modify the program.
053	TOO MANY ADDRESS COMMANDS (M series)	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.
	TOO MANY ADDRESS COMMANDS (T seires)	In the chamfering and corner R commands, two or more of I, K and R are specified. Otherwise, the character after a comma "," is not C or R in direct drawing dimensions programming. Modify the program.
054	NO TAPER ALLOWED AFTER CHF/CNR (T series)	A block in which chamfering in the specified angle or the corner R was specified includes a taper command. Modify the program.
055	MISSING MOVE VALUE IN CHF/CNR (M series)	In the arbitrary angle chamfering or corner R block, the move distance is less than chamfer or corner R amount.
	MISSING MOVE VALUE IN CHF/CNR (T series)	In chamfering or corner R block, the move distance is less than chamfer or corner R amount.
056	NO END POINT & ANGLE IN CHF/CNR (T series)	Neither the end point nor angle is specified in the command for the block next to that for which only the angle is specified (A). In the chamfering comman, I(K) is commanded for the X(Z) axis.
057	NO SOLUTION OF BLOCK END (T series)	Block end point is not calculated correctly in direct dimension drawing programming.
058	END POINT NOT FOUND (M series)	In a arbitrary angle chamfering or corner R cutting block, a specified axis is not in the selected plane. Correct the program.
	END POINT NOT FOUND (T series)	Block end point is not found in direct dimension drawing programming.

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.
061	ADDRESS P/Q NOT FOUND IN G70 to G73 (T series)	Address P or Q is not specified in G70, G71, G72, or G73 command. Modify the program.
062	ILLEGAL COMMAND IN G71 to G76 (T series)	1. The depth of cut in G71 or G72 is zero or negative value. 2. The repetitive count in G73 is zero or negative value. 3. the negative value is specified to Δi or Δk is zero in G74 or G75. 4. A value other than zero is specified to address U or W though Δi or Δk is zero in G74 or G75. 5. A negative value is specified to Δd, thoughthe relief direction in G74 or G75 is determined. 6. Zero or a negative value is specified to the height of thread or depth of cut of first time in G76. 7. The specified minimum depth of cut in G76 is greater than the height of thread. 8. An unusable angle of tool tip is specified in G76. Modify the program.
063	SEQUENCE NUMBER NOT FOUND (T series)	The sequence number specified by address P in G70, G71, G72, or G73 command cannot be searched. Modify the program.
064	SHAPE PROGRAM NOT MONOTONOUSLY (T series)	A target shape which cannot be made by monotonic machining was specified in a repetitive canned cycle (G71 or G72).
065	ILLEGAL COMMAND IN G71 to G73 (T series)	1. G00 or G01 is not commanded at the block with the sequence number which is specified by address P in G71, G72, or G73 command. 2. Address Z(W) or X(U) was commanded in the block with a sequence number which is specified by address P in G71 or G72, respectively. Modify the program.
066	IMPROPER G to CODE IN G71 to G73 (T series)	An unallowable G code was commanded beween two blocks specified by address P in G71, G72, or G73. Modify the program.
067	CAN NOT ERROR IN MDI MODE (T series)	G70, G71, G72, or G73 command with address P and Q. Modify the program.
069	FORMAT ERROR IN G70 to G73 (T series)	The final move command in the blocks specified by P and Q of G70, G71, G72, and G73 ended with chamfering or corner R. Modify the program.
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.

Number	Message	Contents
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 (M series)	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.
	G37 ARRIVAL SIGNAL NOT ASSERTED (T series)	In the automatic tool compensation function (G36, G37), the measurement position reach signal (XAE or ZAE) is not turned on within an area specified in parameter 6254 (value ε). This is due to a setting or operator error.
081	OFFSET NUMBER NOT FOUND IN G37 (M series)	Tool length automatic measurement (G37) was specified without a H code. (Automatic tool length measurement function) Modify the program.
	OFFSET NUMBER NOT FOUND IN G37 (T series)	Automatic tool compensation (G36, G37) was specified without a T code. (Automatic tool compensation function) Modify the program.
082	H to CODE NOT ALLOWED IN G37 (M series)	H code and automatic tool compensation (G37) were specified in the same block. (Automatic tool length measurement function) Modify the program.
	T to CODE NOT ALLOWED IN G37 (T series)	T code and automatic tool compensation (G36, G37) were specified in the same block. (Automatic tool compensation function) Modify the program.
083	ILLEGAL AXIS COMMAND IN G37 (M series)	In automatic tool length measurement, an invalid axis was specified or the command is incremental. Modify the program.
	ILLEGAL AXIS COMMAND IN G37 (T series)	In automatic tool compensation (G36, G37), 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.
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.

Number	Message	Contents
091	REFERENCE RETURN INCOMPLETE	Manual reference position return cannot be performed when automatic operation is halted.
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.
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. to 10^{47} to to $10^{\text{to } 29}$, 0, $10^{\text{to } 29}$ 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.
114	FORMAT ERROR IN MACRO	There is an error in other formats than <Formula>. Modify the program.
115	ILLEGAL VARIABLE NUMBER	A value not defined as a variable number is designated in the custom macro. Modify the program.
116	WRITE PROTECTED VARIABLE	The left side of substitution statement is a variable whose substitution is inhibited. Modify the program.
118	PARENTHESIS NESTING ERROR	The nesting of bracket exceeds the upper limit (quintuple). Modify the program.

Number	Message	Contents
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 to 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 to 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≦ n ≦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 (M series)	The index table indexing positioning angle was instructed in other than an integral multiple of the value of the minimum angle. Modify the program.
	SPINDLE ORIENTATION PLEASE (T series)	Without any spindle orientation , an attept was made for spindle indexing. Perform spindle orientation.
136	ILLEGAL AXIS COMMAND (M series)	In index table indexing.Another control axis was instructed together with the B axis. Modify the program.
	C/H to CODE & MOVE CMD IN SAME BLK. (T series)	A move command of other axes was specified to the same block as spindle indexing addresses C, H. Modify the program.
137	M to CODE & MOVE CMD IN SAME BLK.	A move command of other axes was specified to the same block as M to code related to spindle indexing. 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 (M series)	G51 (Scaling ON) is commanded in the tool offset mode. Modify the program.
142	ILLEGAL SCALE RATE (M series)	Scaling magnification is commanded in other than 1 to 999999. Correct the scaling magnification setting (G51 P_p ..... or parameter 5411 or 5421).
143	SCALED MOTION DATA OVERFLOW (M series)	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 (M series)	The coordinate rotation plane and arc or cutter compensation C plane must be the same. Modify the program.

Number	Message	Contents
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 to 4.4 and modify the program.
148	ILLEGAL SETTING DATA (M series)	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 (M series)	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 to 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 (M series)	When the group is not commanded, H99 or D99 was commanded. Correct the program.
155	ILLEGAL T to CODE IN M06 (M series)	In the machining program, M06 and T code in the same block do not correspond to the group in use. Correct the program.
	ILLEGAL T to CODE IN M06 (T series)	Group No.ΔΔ which is specified with TΔΔ 88 of the machining program do not included in the tool 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 to axis name radius of cylinder.”
176	IMPROPER G to CODE IN G107 (T series)	Any of the following G codes which cannot be specified in the cylindrical interpolation mode was specified. 1) G codes for positioning: G28, G76, G81 to G89, including the codes specifying the rapid traverse cycle 2) G codes for setting a coordinate system: G50, G52 3) G code for selecting coordinate system: G53 G54 to 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.

Number	Message	Contents
180	COMMUNICATION ERROR (REMOTE BUF)	Remote buffer connection alarm has generated. Confirm the number of cables, parameters and I/O device.
190	ILLEGAL AXIS SELECT (M series)	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 to MODE	A contour control mode, spindle positioning (Cs to 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.)
197	C to AXIS COMMANDED IN SPINDLE MODE	The program specified a movement along the Cs to 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) (M series)	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. 1) The execution of an M198 or M99 command was attempted during scheduled operation. Alternatively, the execution of an M198 command was attempted during DNC operation. Correct the program. 2) The execution of an M99 command was attempted by an interrupt macro during pocket machining in a multiple repetitive canned cycle.
211	G31 (HIGH) NOT ALLOWED IN G99	G31 is commanded in the per revolution command when the high to speed skip option is provided. Modify the program.
212	ILLEGAL PLANE SELECT (M series)	The arbitrary angle chamfering or a corner R is commanded or the plane including an additional axis. Correct the program.
	ILLEGAL PLANE SELECT (T series)	The direct drawing dimensions programming is commanded for the plane other than the Z to X plane. Correct the program.

Number	Message	Contents
213	ILLEGAL COMMAND IN SYNCHRO to 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 to MODE	Coordinate system is set or tool compensation of the shift type is executed in the synchronous control. Correct the program.
217	DUPLICATE G51.2 (COMMANDS) (T series)	G51.2/G251 is further commanded in the G51.2/G251 mode. Modify the program.
218	NOT FOUND P/Q COMMAND IN G251 (T series)	P or Q is not commanded in the G251 block, or the command value is out of the range. Modify the program.
219	COMMAND G250/G251 INDEPENDENTLY (T series)	G251 and G250 are not independent blocks.
220	ILLEGAL COMMAND IN SYNCHR to MODE (T series)	In the synchronous operation, movement is commanded by the NC program or PMC axis control interface for the synchronous axis.
221	ILLEGAL COMMAND IN SYNCHR to MODE (T series)	Polygon machining synchronous operation and axis control or balance cutting are executed at a time. Modify the program.
224	RETURN TO REFERENCE POINT (M series)	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.
	TURN TO REFERENCE POINT (T series)	Reference position return is necessary before cycle start.
231	ILLEGAL FORMAT IN G10 OR L50	Any of the following errors occurred in the specified format at the programmable to 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 to type parameter. 5 An axis number was specified in the parameter which is not an axis type. Correct the program. 6 An attempt was made to reset bit 4 of parameter 3202 (NE9) or change parameter 3210 (PSSWD) when they are protected by a password. Correct the program.
233	DEVICE BUSY	When an attempt was made to use a unit such as that connected via the RS to 232 to 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.
244	P/S ALARM (T series)	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 to CODE NOT ALOWEE IN THIS BLOCK (T series)	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.

Number	Message	Contents
253	G05 IS NOT AVAILABLE (M series)	Alarm details Binary input operation using high to speed remote buffer (G05) or high to speed cycle machining (G05) has been specified in advance control mode (G08P1). Execute G08P0; to cancel advance control mode, before executing these G05 commands.
5010	END OF RECORD	The end of record (%) was specified. I/O is incorrect. modify the program.
5014	TRACE DATA NOT FOUND (M series)	Transfer cannot be performed because no trace data exists.
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) (T series)	The end command (G110) was specified before the registratioin start command (G101, G102, or G103) was specified for the B to axis.
5031	ILLEGAL COMMAND (G100, G102, G103) (T series)	While a registration start command (G101, G102, or G103) was being executed, another registration start command was specified for the B to axis.
5032	NEW PRG REGISTERED IN B to AXS MOVE (T series)	While the machine was moving about the B to axis, at attempt was made to register another move command.
5033	NO PROG SPACE IN MEMORY B to AXS (T series)	Commands for movement about the B to axis were not registered because of insufficient program memory.
5034	PLURAL COMMAND IN G110 (T series)	Multiple movements were specified with the G110 code for the B to axis.
5035	NO FEEDRATE COMMANDED B to AXS (T series)	A feedrate was not specified for cutting feed about the B to axis.
5036	ADDRESS R NOT DEFINED IN G81 to G86 (T series)	Point R was not specified for the canned cycle for the B to axis.
5037	ADDRESS Q NOT DEFINED IN G83 (T series)	Depth of cut Q was not specified for the G83 code (peck drilling cycle). Alternatively, 0 was specified in Q for the B to axis.
5038	TOO MANY START M to CODE COMMAND (T series)	More than six M codes for starting movement about the B to axis were specified.
5039	START UNREGISTERED B to AXS PROG (T series)	An attempt was made to execute a program for the B to axis which had not been registered.
5040	CAN NOT COMMANDED B to AXS MOVE (T series)	The machine could not move about the B to axis because parameter No.8250 was incorrectly specified, or because the PMC axis system could not be used.
5041	CAN NOT COMMANDED G110 BLOCK (T series)	Blocks containing the G110 codes were successively specified in tool to tip radius compensation for the B to axis.
5044	G68 FORMAT ERROR (M series)	A G68 command block contains a format error. This alarm is issued in the following cases: 1. I, J, or K is missing from a G68 command block (missing coordinate rotation option). 2. I, J, and K are 0 in a G68 command block. 3. R is missing from a G68 command block.
5074	ADDRESS DUPLICATION ERROR	The same address has been specified two or more times in a single block. Alternatively, two or more G codes in the same group have been specified in a single block.
5134	FSSB : OPEN READY TIME OUT	Initialization did not place FSSB in the open ready state.
5135	FSSB : ERROR MODE	FSSB has entered error mode.
5136	FSSB : NUMBER OF AMPS IS SMALL	In comparison with the number of controlled axes, the number of amplifiers recognized by FSSB is not enough.
5137	FSSB : CONFIGURATION ERROR	FSSB detected a configuration error.

Number	Message	Contents
5138	FSSB : AXIS SETTING NOT COMPLETE	In automatic setting mode, axis setting has not been made yet. Perform axis setting on the FSSB setting screen.
5197	FSSB : OPEN TIME OUT	The CNC permitted FSSB to open, but FSSB was not opened.
5198	FSSB : ID DATA NOT READ	Temporary assignment failed, so amplifier initial ID information could not be read.

(2) Background edit alarm

Number	Message	Contents
???	BP/S alarm	BP/S alarm occurs in the same number as the P/S alarm that occurs in ordinary program edit. (070, 071, 072, 073, 074 085,086,087 etc.)
140	BP/S alarm	It was attempted to select or delete in the background a program being selected in the foreground. **(NOTE)** Use background editing correctly.

NOTE
Alarm in background edit is displayed in the key input line of the background edit screen instead of the ordinary alarm screen and is resettable by any of the MDI key operation.

(3) Absolute pulse coder (APC) alarm

Number	Message	Contents
300	nth to axis origin return	Manual reference position return is required for the nth to axis (n=1 to 4).
301	APC alarm: nth to axis communication	nth to axis (n=1 to 4) APC communication error. Failure in data transmission Possible causes include a faulty APC, cable, or servo interface module.
302	APC alarm: nth to axis over time	nth to axis (n=1 to 4) APC overtime error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
303	APC alarm: nth to axis framing	nth to axis (n=1 to 4) APC framing error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
304	APC alarm: nth to axis parity	nth to axis (n=1 to 4) APC parity error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
305	APC alarm: nth to axis pulse error	nth to axis (n=1 to 4) APC pulse error alarm. APC alarm.APC or cable may be faulty.
306	APC alarm: nth to axis battery voltage 0	nth to axis (n=1 to 4) 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 to axis battery low 1	nth to axis (n=1 to 4) axis APC battery voltage reaches a level where the battery must be renewed. APC alarm. Replace the battery.
308	APC alarm: nth to axis battery low 2	nth to axis (n=1 to 4) APC battery voltage has reached a level where the battery must be renewed (including when power is OFF). APC alarm .Replace battery.
309	APC ALARM: n AXIS ZRN IMPOSSIBL	Return to the origin has been attempted without first rotating the motor one or more times. Before returning to the origin, rotate the motor one or more times then turn off the power.

(4) Serial pulse coder (SPC) alarms

No.	Message	Description
360	n AXIS : ABNORMAL CHECKSUM (INT)	A checksum error occurred in the built to in pulse coder.
361	n AXIS : ABNORMAL PHASE DATA (INT)	A phase data error occurred in the built to in pulse coder.
362	n AXIS : ABNORMAL REV.DATA (INT)	A rotation speed count error occurred in the built to in pulse coder.
363	n AXIS : ABNORMAL CLOCK (INT)	A clock error occurred in the built to in pulse coder.
364	n AXIS : SOFT PHASE ALARM (INT)	The digital servo software detected invalid data in the built to in pulse coder.
365	n AXIS : BROKEN LED (INT)	An LED error occurred in the built to in pulse coder.
366	n AXIS : PULSE MISS (INT)	A pulse error occurred in the built to in pulse coder.
367	n AXIS : COUNT MISS (INT)	A count error occurred in the built to in pulse coder.
368	n AXIS : SERIAL DATA ERROR (INT)	Communication data from the built to in pulse coder cannot be received.
369	n AXIS : DATA TRANS. ERROR (INT)	A CRC or stop bit error occurred in the communication data being received from the built to in pulse coder.
380	n AXIS : BROKEN LED (EXT)	The separate detector is erroneous.
381	n AXIS : ABNORMAL PHASE (EXT LIN)	A phase data error occurred in the separate linear scale.
382	n AXIS : COUNT MISS (EXT)	A pulse error occurred in the separate detector.
383	n AXIS : PULSE MISS (EXT)	A count error occurred in the separate detector.
384	n AXIS : SOFT PHASE ALARM (EXT)	The digital servo software detected invalid data in the separate detector.
385	n AXIS : SERIAL DATA ERROR (EXT)	Communication data from the separate detector cannot be received.
386	n AXIS : DATA TRANS. ERROR (EXT)	A CRC or stop bit error occurred in the communication data being received from the separate detector.

- **The details of serial pulse coder alarm**

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

#0 (SPH) : Soft phase data trouble alarm has occurred.
#1 (CKA) : Clock alarm has occurred.
#2 (BZA) : Battery zero alarm has occurred.
#3 (PCA) : Speed count trouble alarm has occurred.
#4 (PHA) : Phase data trouble alarm has occurred.
#5 (BLA) : Battery low alarm has occurred.
#6 (CSA) : Check sum alarm has occurred.

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

#4 (PRM) : Parameter error alarm has occurred. In this case, a servo parameter error alarm (No. 417) is also output.

#5 (STB) : Stop bit error has occurred.

#6 (CRC) : CRC error has occurred.

#7 (DTE) : Data error has occurred.

(5) Servo alarms

Number	Message	Contents
401	SERVO ALARM: n to TH AXIS VRDY OFF	The n to th axis (axis 1 to 4) servo amplifier READY signal (DRDY) went off. Refer to procedure of trouble shooting.
404	SERVO ALARM: n to TH AXIS VRDY ON	Even though the n to th axis (axis 1 to 4) 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.
409	SERVO ALARM: n AXIS TORQUE ALM	Abnormal servo motor load has been detected. Alternatively, abnormal spindle motor load has been detected in Cs mode.
410	SERVO ALARM: n to TH AXIS to EXCESS ERROR	The position deviation value when the n to th axis (axis 1 to 4) stops is larger than the set value. Refer to procedure of trouble shooting.
411	SERVO ALARM: n to TH AXIS to EXCESS ERROR	The position deviation value when the n to th axis (axis 1 to 4) moves is larger than the set value. Refer to procedure of trouble shooting.
413	SERVO ALARM: n to th AXIS to LSI OVERFLOW	The contents of the error register for the n to th axis (axis 1 to 4) exceeded $\pm 2^{31}$ power. This error usually occurs as the result of an improperly set parameters.
415	SERVO ALARM: n to TH AXIS to EXCESS SHIFT	A speed higher than 511875 units/s was attempted to be set in the n to th axis (axis 1 to 4). This error occurs as the result of improperly set CMR.

Number	Message	Contents
417	SERVO ALARM: n to TH AXIS to PARAMETER INCORRECT	This alarm occurs when the n to th axis (axis 1 to 4) 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 to 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 to continuous value (Parameter 1023 (servo axis number) contains a value out of the range from 1 to the number of axes, or an isolated value (for example, 4 not prceded by 3).was set in parameter No. 1023 (servo axisnumber).
420	SERVO ALARM: n AXIS SYNC TORQUE (M series)	During simple synchronous control, the difference between the torque commands for the master and slave axes exceeded the value set in parameter No. 2031.
421	SERVO ALARM: n AXIS EXCESS ER (D)	The difference between the errors in the semi to closed loop and closed loop has become excessive during dual position feedback. Check the values of the dual position conversion coefficients in parameters No. 2078 and 2079.
422	SERVO ALARM: n AXIS	In torque control of PMC axis control, a specified allowable speed has been exceeded.
423	SERVO ALARM: n AXIS	In torque control of PMC axis control, the parameter to set allowable cumulative travel distance has been exceeded.
430	n AXIS : SV. MOTOR OVERHEAT	A servo motor overheat occurred.
431	n AXIS : CNV. OVERLOAD	1) PSM: Overheat occurred. 2) β series SVU: Overheat occurred.
432	n AXIS : CNV. LOWVOLT CON./ POWFAULT	1) PSM: Phase missing occurred in the input voltage. 2) PSMR: The control power supply voltage has dropped. 3) α series SVU: The control power supply voltage has dropped.
433	n AXIS : CNV. LOW VOLT DC LINK	1) PSM: The DC link voltage has dropped. 2) PSMR: The DC link voltage has dropped. 3) α series SVU: The DC link voltage has dropped. 4) β series SVU: The DC link voltage has dropped.
434	n AXIS : INV. LOW VOLT CONTROL	SVM: The control power supply voltage has dropped.
435	n AXIS : INV. LOW VOLT DC LINK	SVM: The DC link voltage has dropped.
436	n AXIS : SOFTTHERMAL (OVC)	The digital servo software detected the soft thermal state (OVC).
437	n AXIS : CNV. OVERCURRENT POWER	PSM: Overcurrent flowed into the input circuit.
438	n AXIS : INV. ABNORMAL CURRENT	1) SVM: The motor current is too high. 2) α series SVU: The motor current is too high. 3) β series SVU: The motor current is too high.

Number	Message	Contents
439	n AXIS : CNV. OVERVOLT POWER	1) PSM: The DC link voltage is too high. 2) PSMR: The DC link voltage is too high. 3) α series SVU: The C link voltage is too high. 4) β series SVU: The link voltage is too high.
440	n AXIS : CNV. EX DECELERATION POW.	1) PSMR: The regenerative discharge amount is too large. 2) α series SVU: The regenerative discharge amount is too large. Alternatively, the regenerative discharge circuit is abnormal.
441	n AXIS : ABNORMAL CURRENT OFFSET	The digital servo software detected an abnormality in the motor current detection circuit.
442	n AXIS : CNV. CHARGE FAULT/INV. DB	1) PSM: The spare discharge circuit of the DC link is abnormal. 2) PSMR: The spare discharge circuit of the DC link is abnormal. 3) α series SVU: The dynamic brake circuit is abnormal.
443	n AXIS : CNV. COOLING FAN FAILURE	1) PSM: The internal stirring fan failed. 2) PSMR: The internal stirring fan failed. 3) β series SVU: The internal stirring fan failed.
444	n AXIS : INV. COOLING FAN FAILURE	SVM: The internal stirring fan failed.
445	n AXIS : SOFT DISCONNECT ALARM	The digital servo software detected a broken wire in the pulse coder.
446	n AXIS : HARD DISCONNECT ALARM	A broken wire in the built to in pulse coder was detected by hardware.
447	n AXIS : HARD DISCONNECT (EXT)	A broken wire in the separate detector was detected by hardware.
448	n AXIS : UNMATCHED FEEDBACK ALARM	The sign of feedback data from the built to in pulse coder differs from that of feedback data from the separate detector.
449	n AXIS : INV. IPM ALARM	1) SVM: IPM (intelligent power module) detected an alarm. 2) α series SVU: IPM (intelligent power module) detected an alarm.
460	n AXIS : FSSB DISCONNECT	FSSB communication was disconnected suddenly. The possible causes are as follows: 1) The FSSB communication cable was disconnected or broken. 2) The power to the amplifier was turned off suddenly. 3) A low to voltage alarm was issued by the amplifier.
461	n AXIS : ILLEGAL AMP INTERFACE	The axes of the 2 to axis amplifier were assigned to the fast type interface.
462	n AXIS : SEND CNC DATA FAILED	Because of an FSSB communication error, a slave could not receive correct data.
463	n AXIS : SEND SLAVE DATA FAILED	Because of an FSSB communication error, the servo system could not receive correct data.
464	n AXIS : WRITE ID DATA FAILED	An attempt was made to write maintenance information on the amplifier maintenance screen, but it failed.
465	n AXIS : READ ID DATA FAILED	At power to up, amplifier initial ID information could not be read.
466	n AXIS : MOTOR/AMP COMBINATION	The maximum current rating for the amplifier does not match that for the motor.
467	n AXIS : ILLEGAL SETTING OF AXIS	The servo function for the following has not been enabled when an axis occupying a single DSP (corresponding to two ordinary axes) is specified on the axis setting screen. 1. Learning control (bit 5 of parameter No. 2008 = 1) 2. High to speed current loop (bit 0 of parameter No. 2004 = 1) 3. High to speed interface axis (bit 4 of parameter No. 2005 = 1)

- **Details of servo alarm**

The details of servo alarm 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

#0 (OFA) : An overflow alarm is being generated inside of digital servo.
#1 (FBA) : A disconnection alarm is being generated.
#2 (DCA) : A regenerative discharge circuit alarm is being generated in servo amp.
#3 (HVA) : An overvoltage alarm is being generated in servo amp.
#4 (HCA) : An abnormal current alarm is being generated in servo amp.
#5 (OVC) : A overcurrent alarm is being generated inside of digital servo.
#6 (LV) : A low voltage alarm is being generated in servo amp.
#7 (OVL) : An overload alarm is being generated.

	#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 to in pulse coder disconnection (hardware)
1	1	Separately installed pulse coder disconnection (hardware)
0	0	Pulse coder is not connected due to software.

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

#3 (PMS) : A feedback pulse error has occured because the feedback cable is defective.
#4 (LDA) : The LED indicates that serial pulse coder C is defective
#5 (MCC) : A magnetic contactor contact in the servo amplifier has welded.
#6 (OFS) : A current conversion error has occured in the digital servo.

(6) Over travel alarms

Number	Message	Contents
500	OVER TRAVEL : +n	Exceeded the n to th axis + side stored stroke limit I. (Parameter No.1320 or 1326 **NOTE)**
501	OVER TRAVEL : to n	Exceeded the n to th axis to side stored stroke limit I. (Parameter No.1321 or 1327 **NOTE)**
502	OVER TRAVEL : +n	Exceeded the n to th axis + side stored stroke limit II. (Parameter No.1322)

Number	Message	Contents
503	OVER TRAVEL : to n	Exceeded the n to th axis to side stored stroke limit II. (Parameter No.1323)
504	OVER TRAVEL : +n	Exceeded the n to th axis + side stored stroke limit III. (Parameter No.1324)
505	OVER TRAVEL : to n	Exceeded the n to th axis to side stored stroke limit III. (Parameter No.1325)
506	OVER TRAVEL : +n	Exceeded the n to th axis + side hardware OT.
507	OVER TRAVEL : to n	Exceeded the n to th axis to side hardware OT.

NOTE
Parameters 1326 and 1327 are effective when EXLM(stroke limit switch signal) is on.

(7) Overheat alarms

Number	Message	Contents
700	OVERHEAT: CONTROL UNIT	Control unit overheat Check that the fan motor operates normally, and clean the air filter.
701	OVERHEAT: FAN MOTOR	The fan motor on the top of the cabinet for the contorl unit is overheated. Check the operation of the fan motor and replace the motor if necessary.
704	OVERHEAT: SPINDLE	Spindle overheat in the spindle fluctuation detection (1) If the cutting load is heavy, relieve the cutting condition. (2) Check whether the cutting tool is share. (3) Another possible cause is a faulty spindle amp.

(8) Rigid tapping alarms

Number	Message	Contents
740	RIGID TAP ALARM: EXCESS ERROR	The positional deviation of the stopped spindle has exceeded the set value during rigid tapping.
741	RIGID TAP ALARM: EXCESS ERROR	The positional deviation of the moving spindle has exceeded the set value during rigid tapping.
742	RIGID TAP ALARM: LSI OVERFLOW	An LSI overflow has occurred for the spindle during rigid tapping.

(9) Serial spindle alarms

Number	Message	Contents
749	S to SPINDLE LSI ERROR	It is serial communication error while system is executing after power supply on. Following reasons can be considered. 1) Optical cable connection is fault or cable is not connected or cable is cut. 2) MAIN CPU board is fault. 3) Spindle amp. printed board is fault. If this alarm occurs when CNC power supply is turned on or when this alarm can not be cleared even if CNC is reset, turn off the power supply also turn off the power supply in spindle side.
750	SPINDLE SERIAL LINK START FAULT	This alarm is generated when the spindle control unit is not ready for starting correctly when the power is turned on in the system with the serial spindle. The four reasons can be considered as follows: 1) An improperly connected optic cable, or the spindle control unit's power is OFF. 2) When the NC power was turned on under alarm conditions other than SU to 01 or AL to 24 which are shown on the LED display of the spindle control unit. In this case, turn the spindle amplifier power off once and perform startup again. 3) Other reasons (improper combination of hardware) This alarm does not occur after the system including the spindle control unit is activated. 4) The second spindle (when SP2, bit 4 of parameter No. 3701, is 1) is in one of the above conditions 1) to 3). See diagnostic display No. 409 for details.
751	FIRST SPINDLE ALARM DETECTION (AL to XX)	This alarm indicates in the NC that an alarm is generated in the spindle unit of the system with the serial spindle. The alarm is displayed in form AL to XX (XX is a number). Refer to **B.3** or **B.4 Alarms displayed on spindle servo unit** .The alarm number XX is the number indicated on the spindle amplifier. The CNC holds this number and displays on the screen.
752	FIRST SPINDLE MODE CHANGE FAULT	This alarm is generated if the system does not properly terminate a mode change. The modes include the Cs contouring, spindle positioning, rigid tapping, and spindle control modes. The alarm is activated if the spindle control unit does not respond correctly to the mode change command issued by the NC.
754	SPINDLE to 1 ABNORMAL TORQUE ALM	Abnormal first spindle motor load has been detected.
761	SECOND SPINDLE ALARM DETECTION (AL to XX)	Refer to alarm No. 751. (For 2nd axis)
762	SECOND SPINDLE MODE CHANGE FAULT	Refer to alarm No. 752.(For 2nd axis)
764	SPINDLE to 2 ABNORMAL TORQUE ALM	Same as alarm No. 754 (for the second spindle)

- **The details of spindle alarm No.750**

The details of spindle alarm No. 750 are displayed in the diagnosis display (No. 409) as shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
409					SPE	S2E	S1E	SHE

#0 (SHE) 0 : The serial communications module in the CNC is normal.

1 : The serial communications module in the CNC was detected to have a fault.

#1 (S1E) 0 : The first spindle is normal during the spindle serial control startup.

1 : The first spindle was detected to have a fault during the spindle axis serial control startup.

#2 (S2E) 0 : The second spindle is normal during the spindle serial control startup.

1 : The second spindle was detected to have a fault during the spindle serial control startup.

#3 (SPE) 0 : In the spindle serial control, the serial spindle parameters fulfill the spindle unit startup conditions.

1 : In the spindle serial control, the serial spindle parameters do not fulfill the spindle unit startup conditions.

(10) System alarms

(These alarms cannot be reset with reset key.)

Number	Message	Description
900	ROM PARITY	A parity error occurred in the CNC, macro, or servo ROM. Correct the contents of the flash ROM having the displayed number.
910	SRAM PARITY : (BYTE 0)	A RAM parity error occurred in the part program storage RAM. Clear the RAM, or replace the SRAM module or motherboard. Subsequently, re to set the parameters and all other data.
911	SRAM PARITY : (BYTE 1)	
912	DRAM PARITY : (BYTE 0)	A RAM parity error occurred in the DRAM module. Replace the DRAM module.
913	DRAM PARITY : (BYTE 1)	
914	DRAM PARITY : (BYTE 2)	
915	DRAM PARITY : (BYTE 3)	
916	DRAM PARITY : (BYTE 4)	
917	DRAM PARITY : (BYTE 5)	
918	DRAM PARITY : (BYTE 6)	
919	DRAM PARITY : (BYTE 7)	
920	SERVO ALARM (1 to 4 AXIS)	Servo alarm (first to fourth axis). A watchdog alarm condition occurred, or a RAM parity error occurred in the axis control card. Replace the axis control card.
926	FSSB ALARM	FSSB alarm. Replace the axis control card.
930	CPU INTERRUPT	CPU error (abnormal interrupt). The motherboard or CPU card may be faulty.
950	PMC SYSTEM ALARM	An error occurred in the PMC. The PMC control circuit on the motherboard may be faulty.
951	PMC WATCH DOG ALARM	An error occurred in the PMC. (Watchdog alarm) The motherboard may be faulty.
972	NMI OCCURRED IN OTHER MODULE	An NMI occurred on a board other than the motherboard. The option board may be faulty.
973	NON MASK INTERRUPT	An NMI occurred as a result of an unknown cause.
974	F to BUS ERROR	A bus error occurred on the FANUC bus. The motherboard or option board may be faulty.
975	BUS ERROR	A bus error occurred on the motherboard. The motherboard may be faulty.
976	L to BUS ERROR	A bus error occurred on the local bus. The motherboard may be faulty.

A.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 to 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.
ER07 NO OPTION (LADDER STEP)	There is no step number option of LADDER.
ER10 OPTION AREA NOTHING (series name)	The management software for the PMC to RB has not been transferred. (solution) The software installation is not consistent with the order. Contact FANUC.
ER11 OPTION AREA NOTHING (series name)	The management software for the PMC C board has not been transferred. (solution) The software installation is not consistent with the order. Contact FANUC.
ER12 OPTION AREA ERROR (series name)	The series of the management software for the PMC to RB differs between BASIC and OPTION. (solution) Contact FANUC.
ER13 OPTION AREA ERROR (series name)	The series of the management software for the PMC C board differs between BASIC and OPTION. (solution) Contact FANUC.
ER14 OPTION AREA VERSIION ERROR (series name)	The edition of the management software for the PMC to RB differs between BASIC and OPTION. (solution) Contact FANUC.
ER15 OPTION AREA VERSIION ERROR (series name)	The edition of the management software for the PMC C board differs between BASIC and OPTION. (solution) Contact FANUC.
ER 16 RAM CHECK ERROR (PROGRAM RAM)	The debugging RAM cannot be read/written normally. (solution) Please exchange the debugging RAM.

Message	Contents and solution
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.
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.
ER24 LADDER, LANGUAGE AREA OVERLAP	The C program area overlaps the ladder program area. (solution) Adjust the address range assigned to C programs.
ER25 SOFTWARE VERSION ERROR (PMCAOPT)	The PMC to RB management software editions are inconsistent. (solution) Contact FANUC.
ER26 SOFTWARE VERSION ERROR (PMCAOPT)	The PMC to RB management software cannot be initialized. (solution) Contact FANUC.
ER32 NO I/O DEVICE	Any DI/DO unit of I/O Unit or the connection unit etc. is not connected. When built to in I/O card is connected, this message is not displayed. (solution) When built to in I/O card is used: Please confirm whether the built to 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

Message	Contents and solution
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 to MODEL A Connection and Maintenance Manual” (B–61813E) “FANUC I/O Unit to MODEL B Connection 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 to MODEL A Connection and Maintenance Manual” (B–61813E) “FANUC I/O Unit to MODEL B Connection 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 ER26 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 to 0 is illegal. (solution) Please correct the address setting data.
WN03 ABORT NC to 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 to RAx/RBxx=1 to 3) (solution) Please confirm the slot position installed. Please confirm the installed module.
WN05 PMC TYPE NO CONVERSION	A ladder program for the PMC to RA3/RA5 was transferred to the PMC to RB5. (solution) Correct the ladder type.
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.

(2) System alarm messages (PMC to RB)

	Message	Contents and solution
1	PC004 CPU ERR xxxxxxxx:yyyyyyyy PC006 CPU ERR xxxxxxxx:yyyyyyyy PC009 CPU ERR xxxxxxxx:yyyyyyyy PC010 CPU ERR xxxxxxxx:yyyyyyyy	A CPU error occurred in the PMC. xxxxxxxx and yyyyyyyy indicate internal error code. If this error occurs, the motherboard may be faulty. Replace the motherboard, then check whether the error recurs. If the error still occurs even after the replacement of the motherboard, report the conditions under which the error occurred (system configuration, operation, time and frequency of error occurrences, etc.) to FANUC.
2	PC030 RAM PARITY aa:bb	A RAM parity error occurred in the PMC. aa and bb indicate internal error code. If this error occurs, the motherboard may be faulty. Solution) Replace the motherboard, then check whether the error recurs. If the error still occurs even after the replacement of the motherboard, report the conditions under which the error occurred (system configuration, operation, time and frequency of error occurrences, etc.) and the indicated internal error code to FANUC.
3	PC050 NMI SLC aa:bb	A communication error occurred in the I/O Link. aa and bb indicate internal error code. If this error occurs, the possible causes are as follows: (1) Although the base expansion is assigned when the I/O Unit A is used, the base is not connected. (2) A cable is not connected securely. (3) Cabling is faulty. (4) I/O equipment (I/O unit, Power Mate, etc.) is faulty. (5) The motherboard is faulty. Solution) (1) Check whether the I/O assignment data and the actual I/O equipment connection match. (2) Check whether the cables are connected correctly. (3) According to ”FANUC I/O Unit to MODEL A Connection and Maintenance Manual” (B to 61813E) or ”FANUC I/O Unit to MODEL B Connection manual” (B to 62163E), check for an error in the cable specifications. (4) Replace the I/O unit interface module, cable, or motherboard. Then, check whether the error still occurs.
4	PC060 FBUS xxxxxxxx:yyyyyyyy PC061 FL to R xxxxxxxx:yyyyyyyy PC062 FL to W aa: xxxxxxxx:yyyyyyyy	A bus error occurred in the PMC. aa, xxxxxxxx, and yyyyyyyy indicate internal error code. If this error occurs, the hardware may be faulty. Solution) Report the conditions under which the error occurred (system configuration, operation, time and frequency of error occurrences, tc.), the indicated internal error code, and the LED status on each board to FANUC.

	Message	Contents and solution
5	PC070 SUB65 CALL (STACK)	A stack error occurred during execution of ladder function instruction CALL/CALLU. Solution) Check the correspondence between the CALL/CALLU instruction and SPE instruction. If the error cannot be located, report the conditions under which the error occurred and the ladder program to FANUC.
6	PC080 SYS EMG xxxxxxxx:yyyyyyyy PC081 FL EMG xxxxxxxx:yyyyyyyy	A system alarm was caused by another software. Solution) Report the conditions under which the error occurred (system configuration, operation, time and frequency of error occurrences, etc.), the indicated internal error code, and the LED status on each board to FANUC.
7	PC097 PARITY ERR (LADDER) PC098 PARITY ERR (DRAM)	A parity error occurred in the PMC system. If this error occurred, the motherboard may be faulty. Solution) Replace the motherboard, then check whether the error recurs. If the error still occurs even after the replacement of the motherboard, report the conditions under which the error occurred (system configuration, operation, time and frequency of error occurrences, etc.) to FANUC.

(3) Alarm messages (For EDIT 1)

Message	Contents and solution
ADDRESS BIT NOTHING	The address of the relay/coil is not set.
FUNCTION NOT FOUND	There is no functional instruction of the input number.
COM FUNCTION MISSING	The funcitonal instruction COM (SUB29) is not correctly dealt with. Correspondence of COM and COME (SUB29) is incorrect. Or, the number of coil controlled by COM is specified by the model which the number cannot be specified.
EDIT BUFFER OVER	There in no empty area of the buffer for the editing. (solution) Please reduce NET under editing.
END FUNCTION MISSING	Functional instruction END1,END2,END3 and END do not exist. Or, there are error net in END1,END2,END3,END. Or, order of END1,END2,END3, and END is not correct.
ERROR NET FOUND	There is an error net.
ILLEGAL FUNCTION NO.	The wrong number of the functional instruction is searched.
FUNCTION LINE ILLEGAL	The functional instruction is not correctly connected.
HORIZONTAL LINE ILLEGAL	The horizontal line of the net is not connected.
ILLEGAL NET CLEARED	Because the power had been turn off while editing LADDER, some net under editing was cleared.
ILLEGAL OPERATION	Operation is not correct. The value is not specified and only INPUT key was pushed. The address data is not correctly inputted. Because the space to display the instruction on screen is not enough, the functional instruction cannot be made.
SYMBOL UNDEFINED	The symbol which was inputted is not defined.

Message	Contents and solution
INPUT INVALID	There is an incorrect input data. Non to numerical value was inputted with COPY, INSLIN,C to UP,C to 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 to 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.
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.

(4) 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= to 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.

A.3 SPINDLE ALARMS (SERIAL SPINDLE)

NOTE
Er to xx is not displayed on the screen.

Message	Contents	Countermeasure
Er to 01	*Although ESP (there are 2 types : connection signal and PMC→CNC) and MRDY (machine ready signal) are not input, SFR/SRV is input. However, regarding MRDY, pay attention to the setting of use/not use spindle parameter MRDY.	*Confirm the sequence of ESP and MRDY.
Er to 02	If spindle motor is not integrated with spindle in system with high to resolution magnetic pulse coder, speed detector of spindle motor is set to 128 p/rev. Attempt to excite motor fails if value other than 128 p/rev is set.	Set the spindle motor speed detector parameter to 128 p/rev.
Er to 03	Parameter for high to resolution magnetic pulse coder is not set, but Cs contouring control command is entered. In this case, motor is not excited.	Check parameter setting for high to resolution magnetic pulse coder.
Er to 04	Although parameter setting for using position coder was not performed, commands for servo mode and synchronous control are input. In this case, the motor will not be excited.	Confirm the parameter setting of the position coder.
Er to 05	Although option parameter for orientation is not set, the orientation command (ORCM) is input.	Confirm the parameter setting of orientation.
Er to 06	Although option parameter for output switchover is not set, LOW winding is selected.	Confirm the parameter setting for output switching and power line status signal.
Er to 07	Although Cs contouring control command was entered, SFR/SRV is not entered.	Confirm the sequence.
Er to 08	Although servo mode control command was input, SFR/SRV is not input.	Confirm the sequence.
Er to 09	Although synchronous control command was input, SFR/SRV is not input.	Confirm the sequence.
Er to 10	Cs control command was entered, but another mode (servo mode, synchronous control, orientation) is specified.	Never set another mode when Cs contouring control command is being processed. Before changing to another mode, clear Cs contouring contorl command.
Er to 11	Servo mode command was entered, but another mode (Cs contouring control, synchronous control, orientation)is specified.	Do not command other modes during servo mode command. When moving to other modes, perform after releasing the servo mode command.
Er to 12	Synchronous control command was entered, but another mode (Cs contouringt control, servo mode, orientation) is specified.	Do not command other modes during synchronous control command. When moving to other modes, perform after releasing the synchronous control command.
Er to 13	Orientation command was entered, but another mode (Cs contouring control, servo mode, synchronous control) is specified.	Do not command other modes during orientation command. When moving to other modes, perform after releasing the orientation command.
Er to 14	SFR/SRV are simultaneously commanded.	Command one or the other.
Er to 15	Cs contouring control command is entered when differential speed control function is enabled by parameter setting (No.6500#5=1).	Check parameter setting and control input signal.

Message	Contents	Countermeasure
Er to 16	Differential mode command (DEFMDA) is entered when differential speed function is disabled by parameter setting (No.6500#5=1).	Check parameter setting and control input signal.
Er to 17	Parameter setting (No.6511#0,1,2) for speed detector is incorrect. (Specified speed detector is not present.)	Check parameter setting.
Er to 18	Spindle orientation command of position coder type is entered when use of position coder signal is disabled by parameter setting(No.6501#2=0).	Check parameter setting and control input signal.
Er to 19	Although the command for orienting the magnetic sensor system was entered, another mode was issued.	Do not issue another mode while the orientation command is executed. Before issuing another mode, cancel the orientation command.
Er to 20	Both the slave mode and the high to resolution magnetic pulse coder were enabled.	These two settings are incompatible. Check the parameter settings.
Er to 21	The slave mode command (SLV=1) was entered under position control (servo mode, orientation,etc.).	Enter the slave mode command in the normal operation mode.
Er to 22	The position control command (servo mode, orientation,etc.) was entered in the slave operation mode (SLV=1).	Enter the position control command in the normal operation mode.
Er to 23	A slave mode command was entered when the slave mode is disabled.	Enable the slave mode.
Er to 24	To perform continuous indexing in the mode for orienting the position coder system, incremental operation(INCMD=1) was first performed, then the absolute position command (INCMD=0) was entered.	Check the control input signal (INCMD). To execute the absolute position command continuously, be sure to perform orientation with the absolute position command first.
Contact signal of *ESP	Between ESP1 and ESP2 of spindle control printed circuit board	Contact is open : emergency stop Contact is closed : general operation

Alarms (Serial spindle)

No.	Message	Alarm No.	Meaning	Description	Remedy
		“A” display	Program ROM abnormality (not installed)	Detects that control program is not started (due to program ROM not installed, etc.)	Install normal program ROM
7n01	SPN_n_ : MOTOR OVERHEAT	AL to 01	Motor overheat	Detects motor speed exceeding specified speed excessively.	Check load status. Cool motor then reset alarm.
7n02	SPN_n_ : EX SPEED ERROR	AL to 02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load status. Reset alarm.
7n03	SPN_n_ : FUSE ON DC LINK BLOWN	AL to 03	DC link section fuse blown	Detects that fuse F4 in DC link section is blown (models 30S and 40S).	Check power transistors, and so forth. Replace fuse.
7n04	SPN_n_ : INPUT FUSE/ POWER FAULT	AL to 04	Input fuse blown. Input power open phase.	Detects blown fuse (F1 to F3), open phase or momentary failure of power (models 30S and 40S).	Replace fuse. Check open phase and power supply regenerative circuit operation.
7n05	SPN_n_ : POWER SUPPLY FUSE BLOWN	AL to 05	Control power supply fuse blown	Detects that control power supply fuse AF2 or AF3 is blown (models 30S and 40S).	Check for control power supply short circuit . Replace fuse.

No.	Message	Alarm No.	Meaning	Description	Remedy
7n07	SPN_n_ : OVERSPEED	AL to 07	Excessive speed	Detects that motor rotation has exceeded 115% of its rated speed.	Reset alarm.
7n08	SPN_n_ : HIGH VOLT INPUT POWER	AL to 08	High input voltage	Detects that switch is flipped to 200 VAC when input voltage is 230 VAC or higher (models 30S and 40S).	Flip switch to 230 VAC.
7n09	SPN_n_ : OVERHEAT MAIN CIRCUIT	AL to 09	Excessive load on main circuit section	Detects abnormal temperature rise of power transistor radiator.	Cool radiator then reset alarm.
7n10	SPN_n_ : LOW VOLT INPUT POWER	AL to 10	Low input voltage	Detects drop in input power supply voltage.	Remove cause, then reset alarm.
7n11	SPN_n_ : OVERVOLT POW CIRCUIT	AL to 11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Remove cause, then reset alarm.
7n12	SPN_n_ : OVERCURRENT POW CIRCUIT	AL to 12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power cirtcuit	Remove cause, then reset alarm.
7n13	SPN_n_ : DATA MEMORY FAULT CPU	AL to 13	CPU internal data memory abnormality	Detects abnormality in CPU internal data memory. This check is made only when power is turned on.	Remove cause, then reset alarm.
7n15	SPN_n_ : SP SWITCH CONTROL ALARM	AL to 15	Spindle switch/output switch alarm	Detects incorrect switch sequence in spindle switch/output switch operation.	Check sequence.
7n16	SPN_n_ : RAM FAULT	AL to 16	RAM abnormality	Detects abnormality in RAM for external data. This check is made only when power is turned on.	Remove cause, then reset alarm.
7n18	SPN_n_ : SUMCHECK ERROR PGM DATA	AL to 18	Program ROM sum check error	Detects program ROM data error.This check is made only when power is turned on.	Remove cause, then reset alarm.
7n19	SPN_n_ : EX OFFSET CURRENT U	AL to 19	Excessive U phase current detection circuit offset	Detects excessive U phase current detection ciucuit offset. This check is made only when power is turned on.	Remove cause, then reset alarm.
7n20	SPN_n_ : EX OFFSET CURRENT V	AL to 20	Excessive V phase current detection circuit offset	Detects excessive V phase current detection circuit offset. This check is made only when power is turned on.	Remove cause, then reset alarm.
7n24	SPN_n_ : SERIAL TRANSFER ERROR	AL to 24	Serial transfer data error	Detects serial transfer data error (such as NC power supply turned off, etc.)	Remove cause, then reset alarm.
7n25	SPN_n_ : SERIAL TRANSFER STOP	AL to 25	Serial data transfer stopped	Detects that serial data transfer has stopped.	Remove cause, then reset alarm.

No.	Message	Alarm No.	Meaning	Description	Remedy
7n26	SPN_n_ : DISCONNECT C to VELO DETECT	AL to 26	Disconnection of speed detection signal for Cs contouring control	Detects abnormality in position coder signal(such as unconnected cable and parameter setting error).	Remove cause, then reset alarm.
7n27	SPN_n_ : DISCONNECT POS to CODER	AL to 27	Position coder signal disconnection	Detects abnormality in position coder signal (such as unconnected cable and adjustment error).	Remove cause, then reset alarm.
7n28	SPN_n_ : DISCONNECT C to POS DETECT	AL to 28	Disconnection of position detection signal for Cs contouring control	Detects abnormality in position detection signal for Cs contouring control (such as unconnected cable and adjustment error).	Remove cause, then reset alarm.
7n29	SPN_n_ : SHORTTIME OVERLOAD	AL to 29	Short to time overload	Detects that overload has been continuously applied for some period of time (such as restraining motor shaft in positioning).	Remove cause, then reset alarm.
7n30	SPN_n_ : OVERCURRENT POW CIRCUIT	AL to 30	Input circuit overcurrent	Detects overcurrent flowing in input circuit.	Remove cause, then reset alarm.
7n31	SPN_n_ : MOTOR LOCK OR V to SIG LOS	AL to 31	Speed detection signal disconnection motor restraint alarm or motor is clamped.	Detects that motor cannot rotate at specified speed or it is detected that the motor is clamped. (but rotates at very slow speed or has stopped). (This includes checking of speed detection signal cable.)	Remove cause, then reset alarm.
7n32	SPN_n_ : RAM FAULT SERIAL LSI	AL to 32	Abnormality in RAM inside the LSI used for serial data transfer. This check is made only when power is turned on.	Detects abnormality in RAM inside the LSI used for serial data transfer. This check is made only when power is turned on.	Remove cause, then reset alarm.
7n33	SPN_n_ : SHORTAGE POWER CHARGE	AL to 33	Insufficient DC link section charging	Detects insufficient charging of direct current power supply voltage in power circuit section when magnetic contactor in amplifier is turned on (such as open phase and defectifve charging resistor).	Remove cause, then reset alarm.
7n34	SPN_n_ : PARAMETER SETTING ERROR	AL to 34	Parameter data setting beyond allowable range of values	Detects parameter data set beyond allowable range of values.	Set correct data.

No.	Message	Alarm No.	Meaning	Description	Remedy
7n35	SPN_n_ : EX SETTING GEAR RATIO	AL to 35	Excessive gear ratio data setting	Detects gear ratio data set beyond allowable range of values.	Set correct data.
7n36	SPN_n_ : OVERFLOW ERROR COUNTER	AL to 36	Error counter overflow	Detects error counter overflow.	Correct cause, then reset alarm.
7n37	SPN_n_ : SPEED DETECT PAR. ERROR	AL to 37	Speed detector parameter setting error	Detects incorrect setting of parameter for number of speed detection pulses.	Set correct data.
7n39	SPN_n_ : 1 to ROT Cs SIGNAL ERROR	AL to 39	Alarm for indicating failure in detecting 1 to rotation signal for Cs contouring control	Detects 1 to rotaion signal detection failure in Cs contouring contorl.	Make 1 to rotaion signal adjustment. Check cable shield status.
7n40	SPN_n_ : NO 1 to ROT Cs SIGNAL DETECT	AL to 40	Alarm for indicating 1 to rotation signal for Cs contouring control not detected	Detects that 1 to rotation signal has not occurred in Cs contouring control.	Make 1 to rotaion signal adjustment.
7n41	SPN_n_ : 1 to ROT POS to CODER ERROR	AL to 41	Alarm for indicating failure in detecting position coder 1 to rotaion signal.	Detects failure in detecting position coder 1 to rotation signal.	Make signal adjustment for signal conversion circuit. Check cable shield status.
7n42	SPN_n_ : NO 1 to ROT. POS to CODER DETECT	AL to 42	Alarm for indicating position coder 1 to rotation signal not detected	Detects that position coder 1 to rotation signal has not issued.	Make 1 to rotation signal adjustment for signal conversion circuit.
7n43	SPN_n_ : DISCON. PC FOR DIF. SP. MOD.	AL to 43	Alarm for indicating disconnection of position coder signal for differential speed mode	Detects that main spindle position coder signal used for differential speed mode is not connected yet (or is disconnected).	Check that main spindle position coder signal is connected to connector CN12.
7n44	SPN_n_ : CONTROL CIRCUIT(AD) ERROR	AL to 44			
7n46	SPN_n_ : SCREW 1 to ROT POS to COD. ALARM	AL to 46	Alarm for indicating failure in detecting position coder 1 to rotation signal in thread cutting operation.	Detects failure in detecting position coder 1 to rotation signasl in thread cutting operation.	Make 1 to rotation signal adjustment for signal conversion circuit. Check cable shield status.

No.	Message	Alarm No.	Meaning	Description	Remedy
7n47	SPN_n_ : POS to CODER SIGNAL ABNORMAL	AL to 47	Position coder signal abnormality	Detects incorrect position coder signal count operation.	Make signal adjustment for signal conversion circuit. Check cable shield status.
7n49	SPN_n_ : HIGH CONV. DIF. SPEED	AL to 49	The converted differential speed is too high.	Detects that speed of other spindle converted to speed of local spindle has exceeded allowable limit in differential mode.	Calculate differential speed by multiplying speed of other spindle by gear ratio. Check if calculated value is not greater than maximum speed of motor.
7n50	SPN_n_ : SPNDL CONTROL OVERSPEED	AL to 50	Excessive speed command calculation value in spindle synchronization control	Detects that speed command calculation value exceeded allowable range in spindle synchronization control.	Calculate motor speed by multiplying specified spindle speed by gear ratio. Check if calculated value is not greater than maximum speed of motor.
7n51	SPN_n_ : LOW VOLT DC LINK	AL to 51	Undervoltage at DC link section	Detects that DC power supply voltage of power circuit has dropped (due to momentary power failure or loose contact of magnetic contactor).	Remove cause, then reset alarm.
7n52	SPN_n_ : ITP SIGNAL ABNORMAL I	AL to 52	ITP signal abnormality I	Detects abnormality in synchronization signal (ITP signal) used in software.	Replace servo amp. PCB.
7n53	SPN_n_ : ITP SIGNAL ABNORMAL II	AL to 53	ITP signal abnormality II	Detects abnormality in synchronization signal (ITP signal) used in hardware.	Replace servo amp. PCB.
7n56	SPN_n_ : INNER COOLING FAN STOP	AL to 56	The cooling fan in the unit stopped.	The cooling fan in the control circuit section stopped.	Check the turning state of the cooling fan. Replace the cooling fan.
7n57	SPN_n_ : EX DECELERATION POWER	AL to 57	Deceleration power is too high.	Abnormal current flowed through the regenerative resistor.	Check the selection of the regenerative resistor. Alternatively, check whether the cooling fan motor is rotating.
7n58	SPN_n_ : OVERLOAD IN PSM	AL to 58	Overload on the PSM main circuit	The temperature of the radiator of the main circuit has increased abnormally. (Cooling fan failure, dirt in the cooling fan, overload operation, etc.)	Eliminate the cause, then reset the alarm.
7n59	SPN_n_ : COOLING FAN STOP IN PSM	AL to 59	The PSM cooling fan stopped.	The cooling fan of the control circuit section stopped.	Check the turning state of the cooling fan. Replace the cooling fan.

B LIST OF MAINTENANCE PARTS

B.1
MAINTENANCE PARTS

Name		Ordering code	Remarks
Fuse	For the power supply to Series 16*i*/18*i* control section	A60L–0001–0290#LM50	Rated at 5 A
	For the power supply to Series 160*i*/180*i* control section	A60L–0001–0046#7.5	Rated at 7.5 A
	For the power supply to the operator's panel I/O card	A60L–0001–0290#LM10	Rated at 5 A
	For the power supply to the operator's panel I/O module	A60L–0001–0172#DM10	Rated at 1 A
Battery	For memory backup in the control section	A98L–0031–0012	
Fan motor	For the control section with no expansion slot	A90L–0001–0441	
	For the control section with expansion slots	A90L–0001–0423#105	
Backlight	For 7.2" LCD (manufactured by Hitachi)	A61L–0001–0142#BL	
	For 7.2" LCD (manufactured by Sharp)	A61L–0001–0142#BLS	
	For 8.4" LCD	A61L–0001–0162#BL	
	For 9.5" LCD	A61L–0001–0154#BL	
	For 10.4" LCD	A61L–0001–0163#BL	
Touch pad protection sheet		A990–0165–0001	
Pen for the touch pad		A990–0164–0001	

C BOOT SYSTEM

C.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 ROM
- Reads a file from a memory card, in FAT format, into flash ROM.

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

(3) Deleting a file from flash ROM

(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 ROM 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.

CAUTION
This control unit supports the use of a memory card as an input/output device. When a flash card is used, however, data can be written to a FANUC–recommended card only. Data can be read in the same way as with an ordinary SRAM card, provided the data has been saved in FAT format. Note that, when a flash card is used, the card capacity is reduced by 128KB.
See the order list for details of the supported memory card types.

C.1.1 Starting the Boot System

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

1 In system maintenance, for example, to replace a file in ROM
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 ROM to DRAM. If, for some reason, a file required to start the CNC (NC basic) is not in flash ROM or has been destroyed, the boot system is automatically started.

C.1.2 System Files and User Files

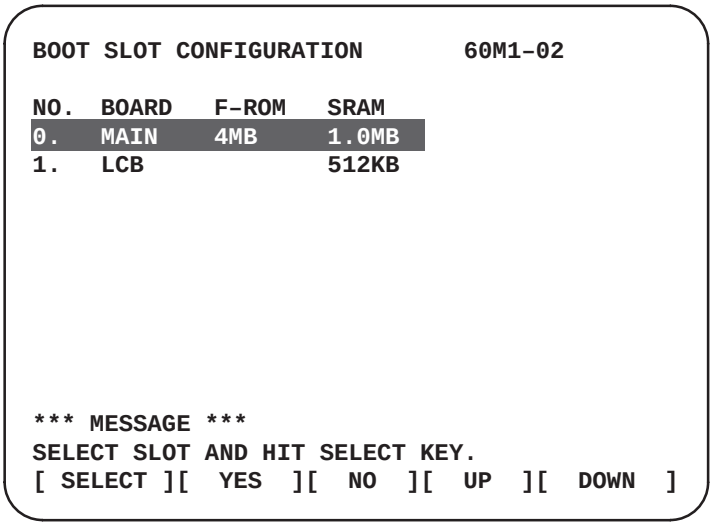
The boot system organizes files in flash ROM into two main groups : system files and user files. These two file types have the following characteristics :

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

C.1.3 Boot Slot Configuration Screen

When LCB (loader control board) is mounted on the CNC, we have to access to SRAM that mounted on additional board. So, the boot system displays BOOT SLOT CONFIGURATION screen that to select a access board.

- **Screen configuration**



(1): Screen title.

(2): Flash memory size and SRAM size of each board.

(3): Message

- **Operation**

Press the **[UP]** or **[DOWN]** soft key to move the cursor, and select board to press the **[SELECT]** soft key.

C.2 SCREEN CONFIGURATION AND OPERATING PROCEDURE

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

● MAIN MENU screen

```
(1)  SYSTEM MONITOR MAIN MENU          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)  10.END

     *** MESSAGE ***
(10) 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 ROM.

(3) : Function for checing the edition of a file in ROM.

(4) : Function for deleting a file from flash ROM.

(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.

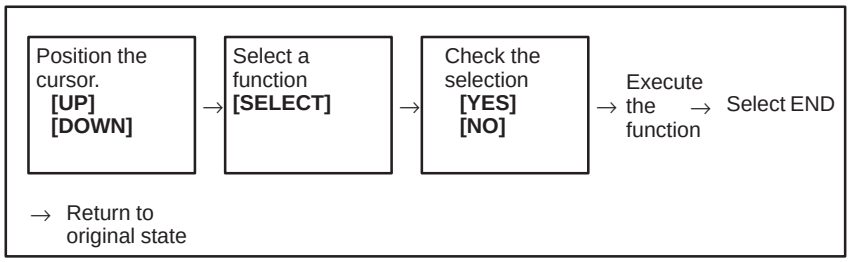
(9) : Function for terminating the boot system and starting the CNC.

(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

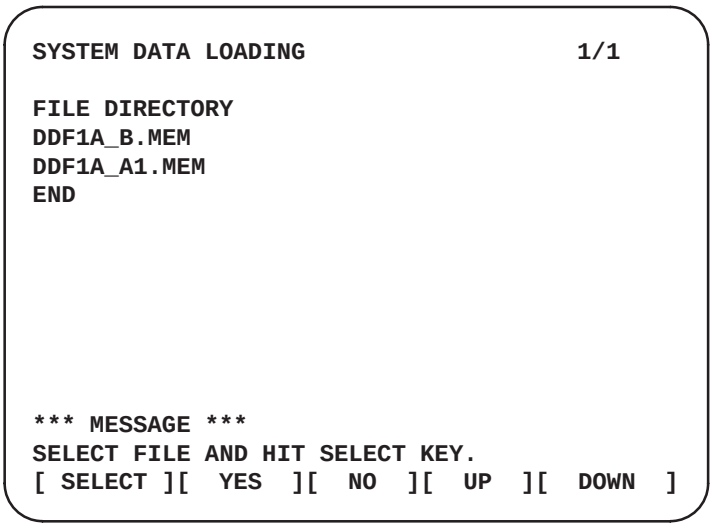


C.2.1 System Data Loading Screen

- **Description**

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

- **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 ROM. Then, press the **[SELECT]** soft key.

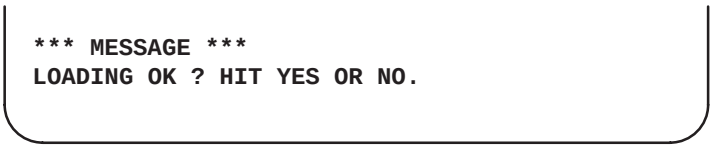
A single page can list up to eight file names. If the memory card contains nine or more files, the remaining files are displayed on another page.

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 ROM

2 File name in flash ROM

The boot system identifies a file in flash ROM by the first four characters of the ID in the header. If flash ROM has a file of the same type as a file to be read from the memory card, the file in flash ROM is deleted before the file on the memory card is read. The following table lists the IDs in the header and the contents. Note that these IDs are subject to change without prior 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

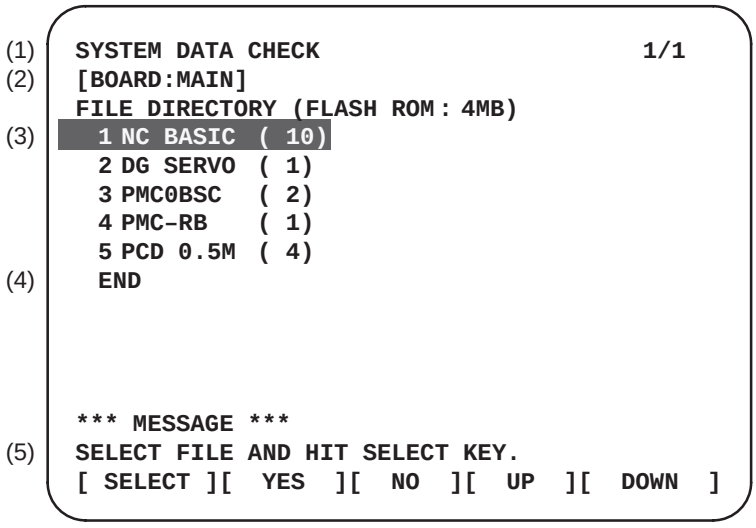
□ : A numeric character, *: An alphabetic character

C.2.2 System Data Check Screen

- **Description**

This screen is used to list files in flash ROM, 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 ROM The number of management units constituting each file appears in parentheses to the right of the file name.

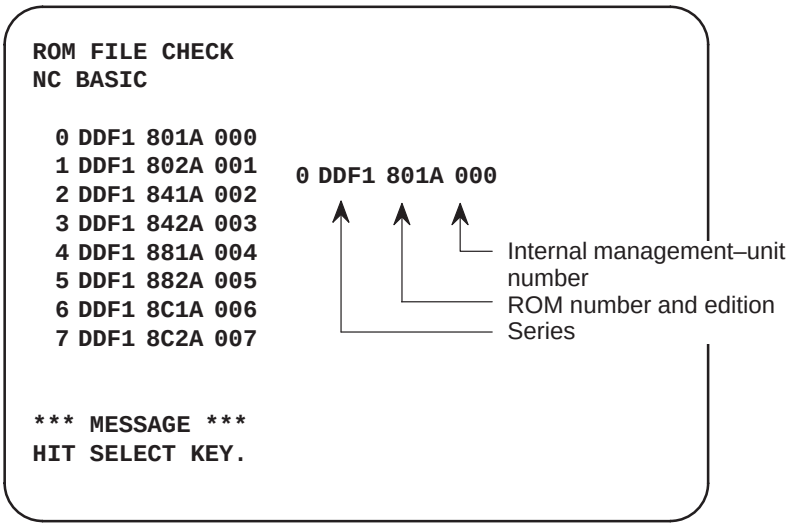
(4): Returning to the previous menu

(5): Message

- **Operating procedure**

1 Select the file whose details are required. For example, select “1 NC BASIC (10).”

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

The 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.

C.2.3 System Data Delete Screen

- **Description**

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

- **Screen configuration**

```
(1) SYSTEM DATA CHECK                          1/1
(2) [BOARD:MAIN]
    FILE DIRECTORY (FLASH ROM : 4MB)
(3)   1 NC BASIC  ( 10)
      2 DG SERVO  ( 1)
      3 PMC0BSC   ( 2)
      4 PMC-RA    ( 1)
      5 PCD 0.5M  ( 4)
(4)   END




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

(1): Screen title
(2): Names of accessing board
(3): Names of files in flash ROM 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**

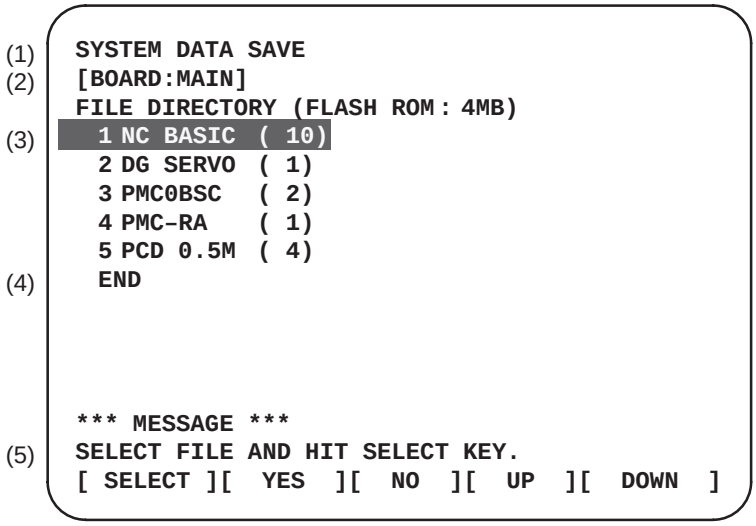
1 System files and user files on SYSTEM DATA DELETE screen
The system files are protected from accidental deletion. User files, however, are not protected. Protected system files can be overwritten from the SYSTEM DATA LOADING screen.

C.2.4 SYSTEM DATA SAVE Screen

- **Description**

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

- **Screen configuration**



(1): 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 ROM to a memory card have the following names :

Flash ROM		File name in Memory card
PMC–RA	→	PMC_RB. XXX
PMC 0.5M	→	PCD_0.5M.XXX
PMC 1.0M	→	PCD_10M.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 ROM is saved to a memory card that does not yet contain a file whose name begins with “PMC–RA”, 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.

C.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 in SRAM 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)  SRAM DATA BACKUP
(2)  [BOARD:MAIN]
(3)    1. SRAM BACKUP (CNC → MEMORY CARD)
       2. RESTORE SRAM (MEMORY CARD → CNC)
(4)    END

(5)    SRAM SIZE  :  256K (BASIC)
(6)    FILE NAME  :  SRAM256A. FDB




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

(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. The backup file name may be displayed according to the SRAM capacity.

2 Press **[YES]** to start backup.

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

3 If a backup file is already on the memory card, you will be prompted to confirm whether to permit overwriting.

4 The name of the file being written to the memory card is displayed in the FILE NAME: field.

```
SRAM SIZE  : 0.5MB (BASIC)
FILE NAME  : SRAM0_5A.FDB  → MEMORY CARD
                                  ↖ Name of the file being saved

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

5 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
256KB	SRAM256A.FDB
0.5MB	SRAM0_5A.FDB

The backup file for SRAM on the LCB board will have the following extension:

Board	MAIN	LCB
Extension	FDB	LCB

CAUTION

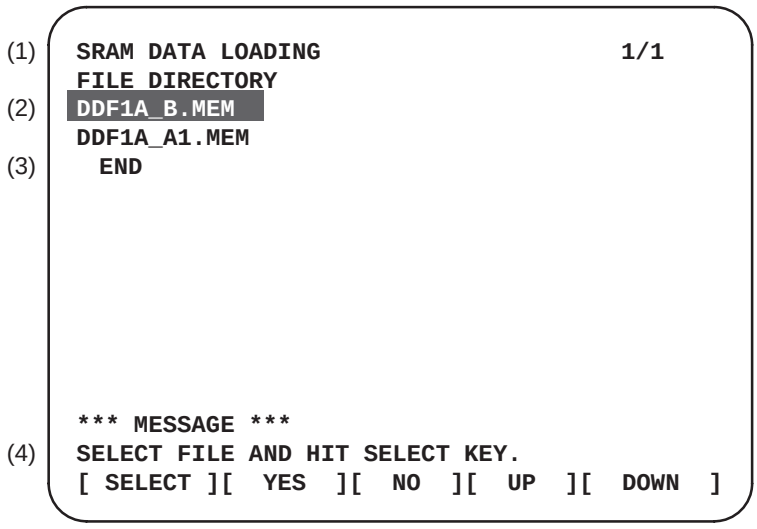
If data such as parameters was restored from a memory card to SRAM in a system using an absolute pulse coder, set bit 4 (APZ) of parameter No. 1815 to 0, and set the reference point again.

C.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 a file has been deleted normally, display the following message. Press the **[SELECT]** key.

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

C.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.
```

C.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. Press the **[NO]** soft key, and you will be brought back to the main menu.

```
*** MESSAGE ***
ARE YOU SURE ? HIT YES OR NO.

[ SELECT ][  YES  ][  NO  ][  UP  ][  DOWN  ]
```

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 :

```
SYSTEM MONITOR MAIN MENU          60M1-01

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


10.END

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

C.3 ERROR MESSAGES AND REQUIRED ACTIONS

The following table lists and explains error messages in alphabetical order.

	Message	Description and required action
B	BOOT ROM PARITY. PLEASE POWER OFF.	The contents of flash memory containing boot software was destroyed. Replace the CPU card.
C	CHANGE MEMORY CARD. AND HIT YES OR NO.	The memory card becomes full in the middle of SRAM backup operation. Replace the card with a memory card containing enough free space.
D	DELETE ERROR. HIT SELECT KEY.	An attempt to delete a file from flash ROM was unsuccessful. Retry the deletion. If the second attempt also fails, the flash ROM may have been damaged or destroyed. Replace the flash ROM module.
	DEVICE ERROR (CNC x)	An attempt to write data to flash ROM was unsuccessful. Retry the write operation. If the second attempt also fails, the flash ROM may have been damaged or destroyed. Repalce the flash ROM 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 ROM to store the selected file. Delete any unnecessary files from flash ROM.
	FLASH ROM MODULE NOT EXIST. HIT SELECT.	The flash ROM module is not mounted on that CNC system. Put the flash ROM module on the board.
I	ILLEGAL FORMAT FILE	The selected file cannot be read into flash memory. The selected file or the header information for flash ROM may have been damaged or destroyed.
	ILLEGAL FROM MODULE. HIT SELECT KEY.	The flash ROM module ID is illegal. Check the drawing No. of the flash ROM module.
	ILLEGAL SRAM MODULE. HIT SELECT KEY.	The SRAM module ID is illegal. Check the drawing No. of the SRAM module.
L	LOADING ERROR. HIT SELECT KEY.	An error occurred while loading data into flash ROM. Do not touch the memory card while loading data.

	Message	Description and required action
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 IS NOT AVAILABLE. HIT SEL.	The use of this memory card is not supported. Use only FANUC–recommended memory cards, as described in the order list.
	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 PROTECTED.HIT SELECT KEY.	Although writing to the memory card was selected, the write inhibit switch is set. Disable the write inhibit switch. 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.
	MEMORY CARD TYPE IS NOT AVAILABLE.	Write has been attempted to an incompatible flash memory card. Use only the flash ROM cards recommended by FANUC. Recommended flash ROM cards are listed in the ordering list.
	MEMORY CARD RESET ERROR. HIT SELECT KEY.	Access to a memory card failed. The memory card's battery may have gone dead, the memory card may have been damaged electrically, or the memory card may not be inserted in the slot securely.
	MEMORY CARD WRITE ERROR. HIT SELECT KEY.	Access to the memory card has failed. Check whether the memory card is defective. 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.
N	NMI OCCURRED. PLEASE POWER OFF.	A hardware or software error occurred. Determine the procedure which causes the error, and report it to FANUC together with the series and edition of the boot software.
P	PLEASE FORMAT FLASH TYPE CARD.HIT SEL.	It is not possible to delete only specific files from a flash ROM card, due to the characteristics of the memory used. To delete a file it is necessary to delete all files on the card, by using the FORMAT function.
R	ROM PARITY ERROR: NC BASIC. HIT SELECT.	The NC BASIC is parity error. Check whether NC BASIC is in flash ROM, using SYSTEM DATA CHECK.
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. 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.
	SRAM PARITY OCCURRED. PLEASE POWER OFF.	A parity error was detected during backup operation of SRAM (Caution).

CAUTION

Action to be taken when an SRAM parity error is detected during backup of SRAM in the boot system

The SRAM area of each CNC shipped from the factory is cleared and is free of parity errors. However, shock applied to the CNC during transportation may cause a parity error in the SRAM area. A parity error may also occur in the SRAM area when the CNC was kept switched off for one year or longer, and the battery has been exhausted. If a parity error occurs in the SRAM area, the data held in the SRAM area is not guaranteed. However, the CNC does not always use the entire SRAM area. A parity error is not detected by hardware unless the part containing the error is read. Therefore, if a parity error occurs in an area not accessed by the CNC, the CNC may operate normally. The SRAM backup function of the boot system reads the entire SRAM area. So, a parity error may occur in the middle of backup operation even when the CNC has operated normally. In this case, the SRAM data of the CNC is not guaranteed, and the data cannot be backed up using the SRAM backup function of the boot system. Nevertheless, the CNC may operate normally. So, it is recommended that necessary data be backed up using the Floppy Cassette or Handy File, data all clear operation be performed, then the backed up data be restored in the CNC. Once all clear operation is performed, the parity error can be removed. Then, the SRAM backup function of the boot system can be used.

Index

[A]

[B]

[C]

[D]

[E]

[O]

[P]

[R]

[S]

[T]

[W]

Revision Record

FANUC Series 21*i*/210*i*–MODEL A MAINTENANCE MANUAL (B–63085EN)

Edition	Date	Contents	Edition	Date	Contents
01	May, ’97				