SEIKI - SEICOS

∑10/16/18/21

INSTRUCTION MANUAL

MAINTENANCE

41 Edition 1.01   11-2000

Hitachi Seiki Deutschland
Werkzeugmaschinen GmbH

CONTENTS

MAINTENANCE

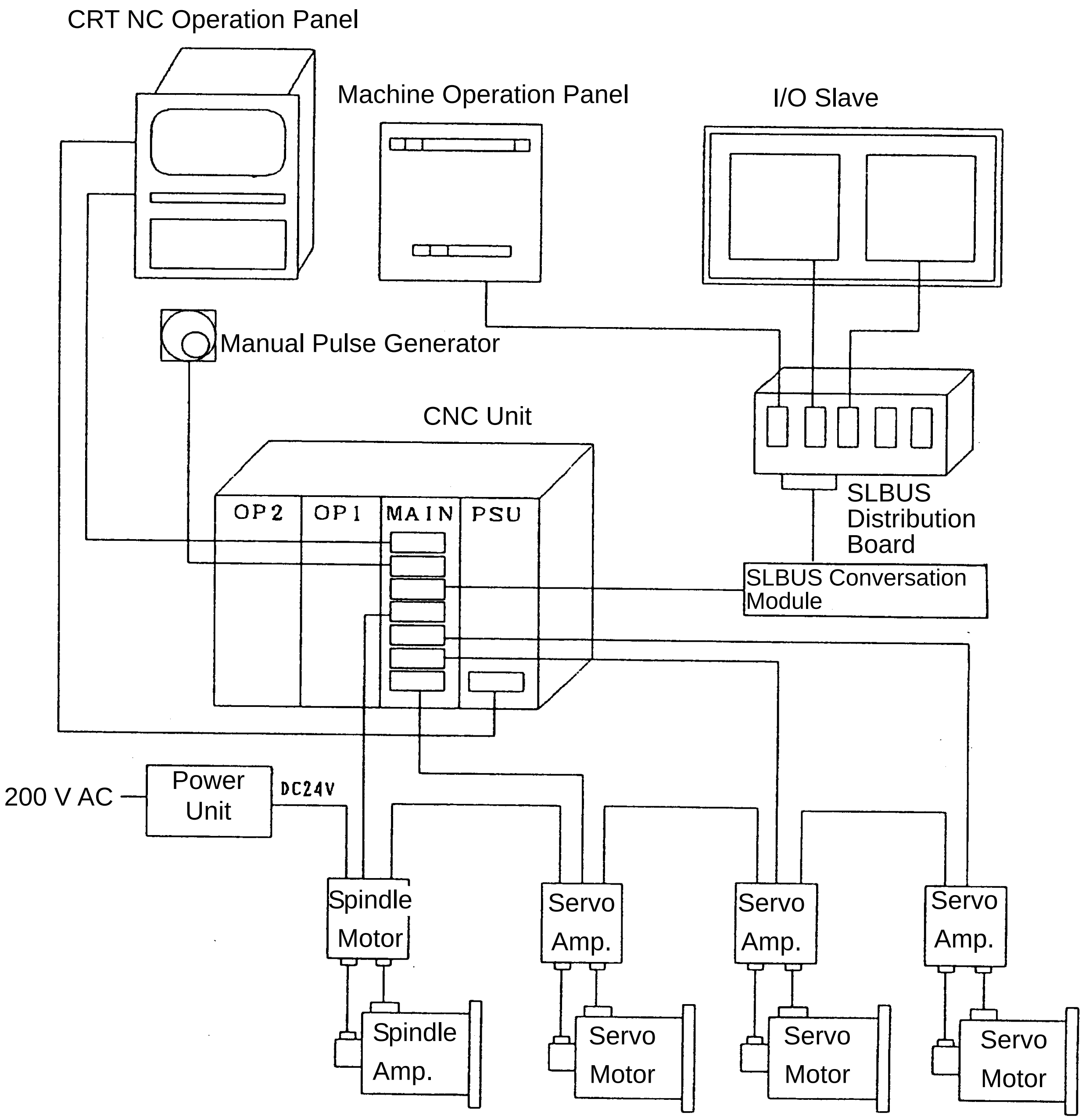
I-I SEICOS Σ 10 UNIT

1. OVERVIEW

The SEICOS Σ 10 CNC unit is a compact high-reliability unit provided with up-to-date device technologies. In the M-system, it enables high-speed, high-accuracy machining by using 64-bit RISC.

1.1 System Configuration

The following figure shows a system example using the SEICOS Σ 10 CNC unit.



1.2 Component Units List

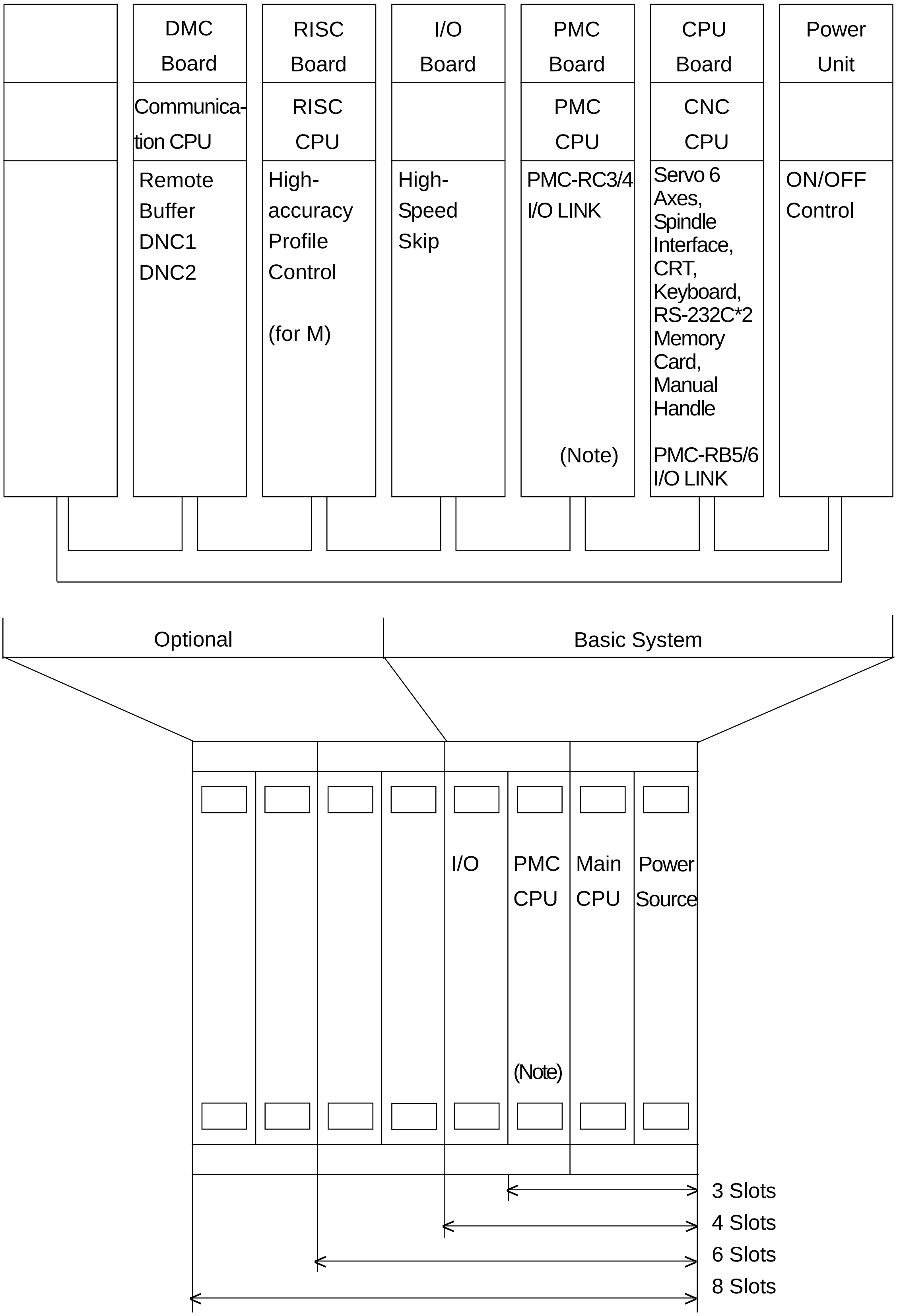
The following table lists the component units of the controller. A mounting position of each unit is fixed as shown in the mounting drawing. All the component units are plug-in type and can be easily replaced.

(1) Unit list

Name	Symbol	Function/Usage
Power unit	PSU	ON/OFF control
CPU board	MAIN	Main CPU
PMC board	PMC	Sequence control
I/O board	I/O	High-speed skip
RISC board	RISC	High-accuracy profile control (for M)
DNC board	DNC	DNC operation

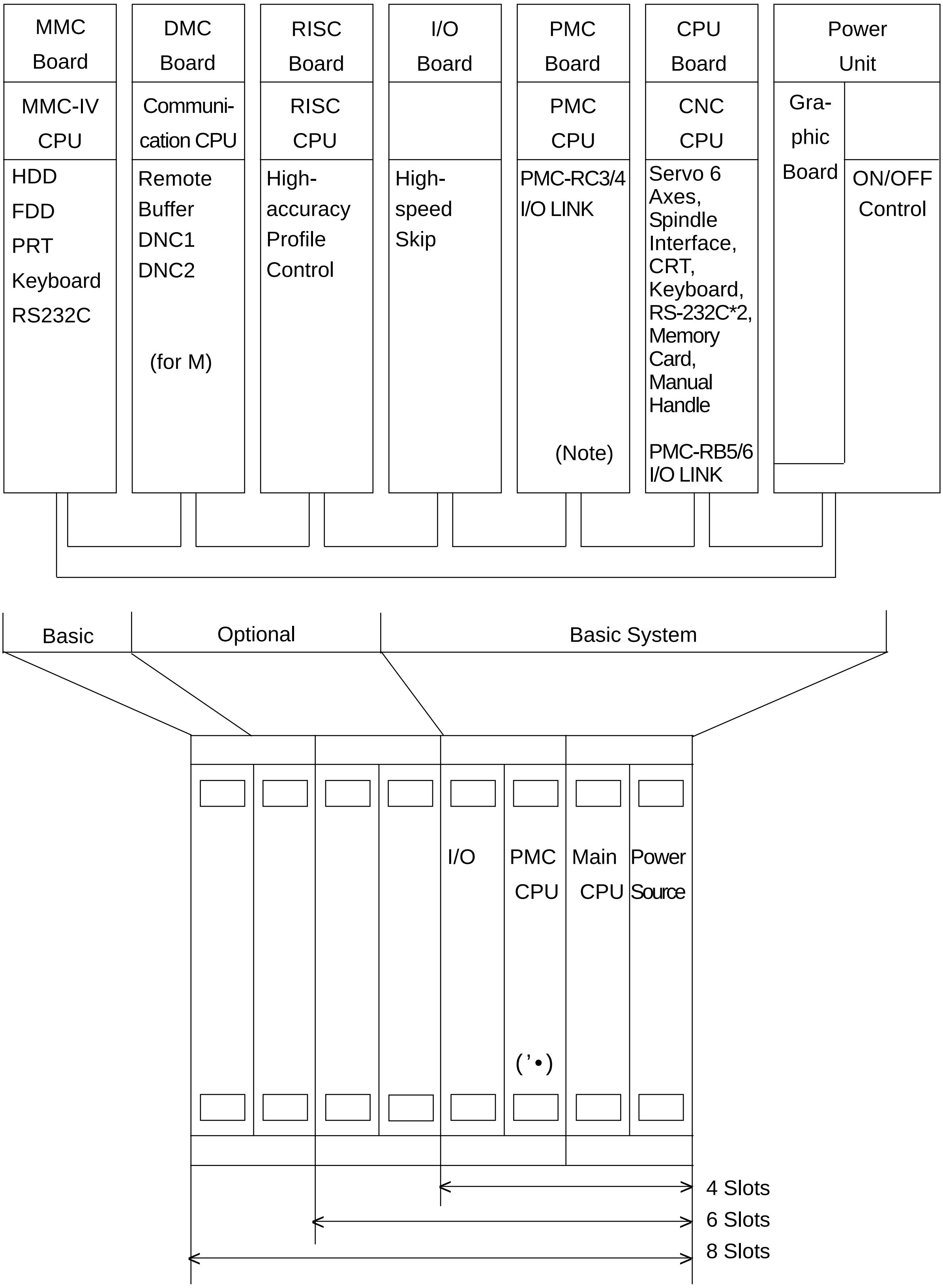
(Note) *The PMC board may be called an “option-3 board,” and DNC board an “option-1 board,” respectively.*

(2) SEICOS Σ 10 unit configuration



(Note) *The PMC board is required when using the "PMC-RC3 or PMC-RC4," but not required when using the "PMC-RB5 or PMC-RB6." [The PMC function is incorporated in the main CPU board.]*

(3) SEICOS Σ 10 Multi unit configuration



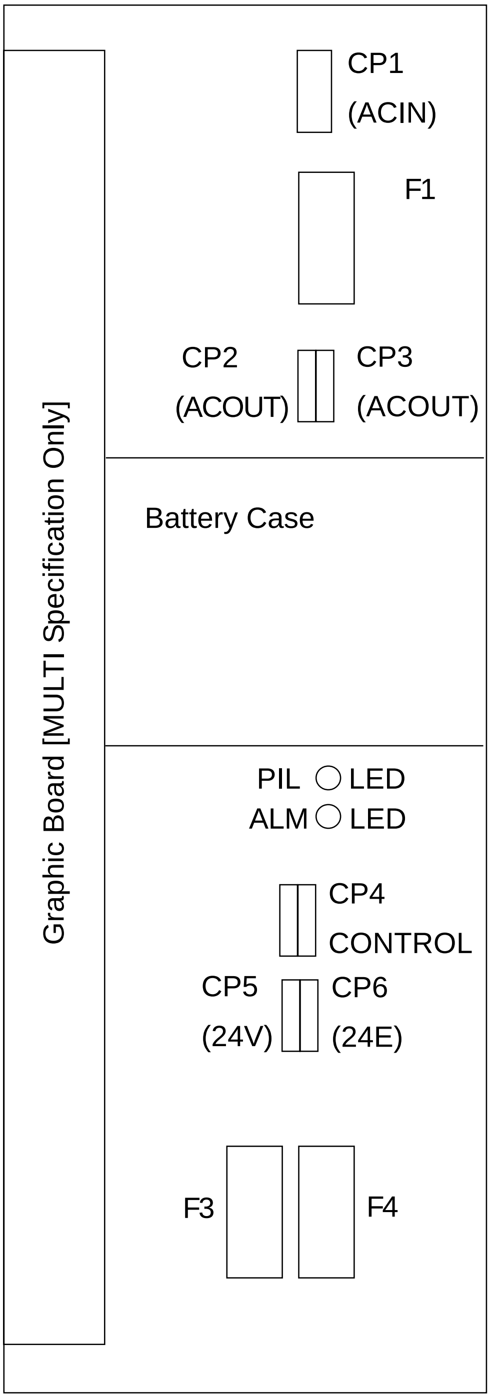
(Note) *The PMC board is required when using the "PMC-RC3 or PMC-RC4," but not required when using the "PMC-RB5 or PMC-RB6." [The PMC function is incorporated in the main CPU board.]*

2. FUNCTIONS AND HANDLING OF CONTROL UNITS

2.1 Power Unit (PSU)

This unit supplies DC power to each control unit.

Name	Type
Power Unit AI	A16B-1212-0901
Power Unit BI	A16B-1212-0871



2.1.1 LED Indications

Signal	Color	Description
PIL	Green	Illuminated when an input supply voltage is supplied to the CP1.
ALM	Red	Illuminated when a DC output voltage has an overcurrent/ overvoltage or drops.

2.1.2 FUSE

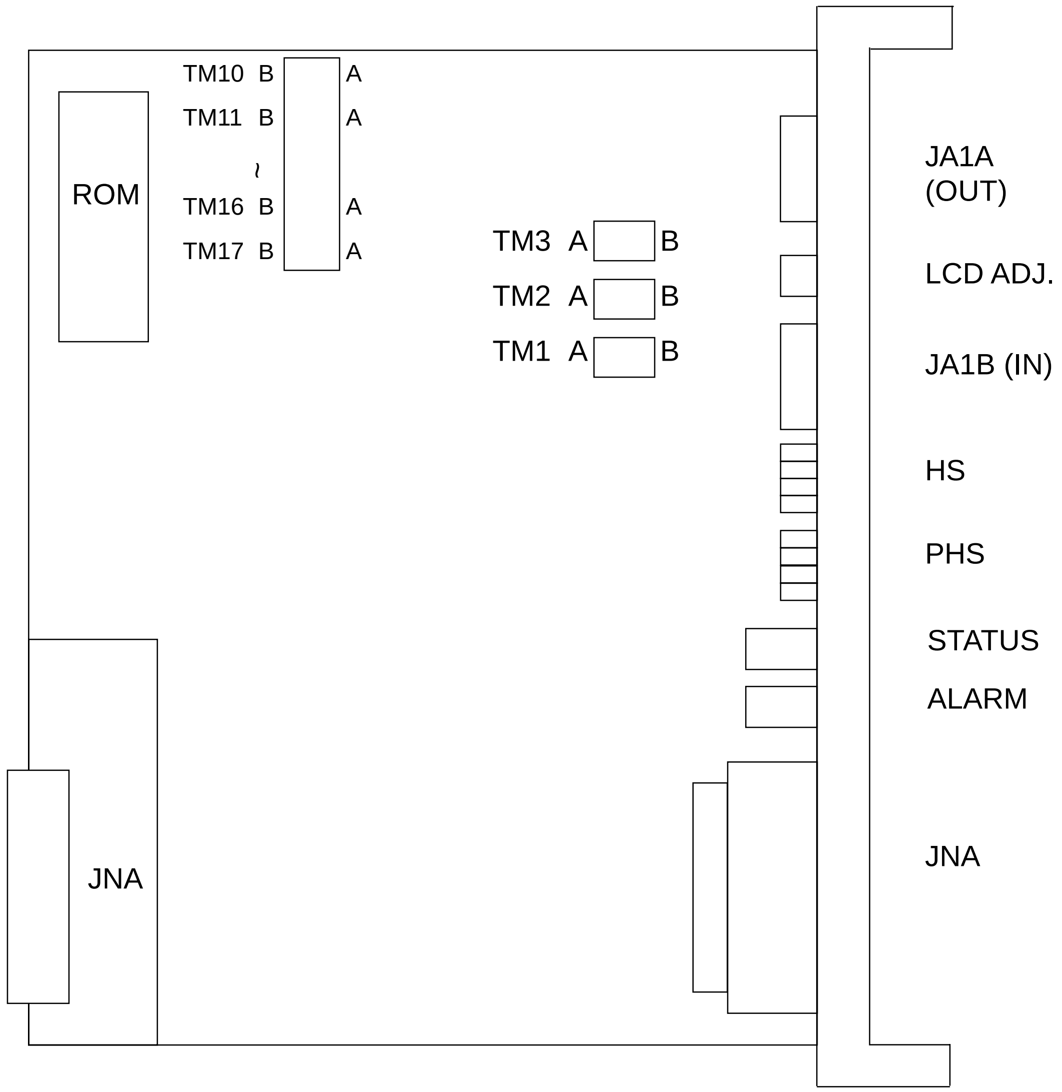
(1) Type

Power Unit	Order No.	Symbol	Ratings	Individual No.
AI	A02B-0200-K100	F1	7.5A	A60L-0001-0245#GP75
		F3	3.2A	A60L-0001-0075#3.2
		F4	5.0A	A60L-0001-0046#5.0
BI	A02B-0200-K101	F1	7.5A	A60L-0001-0245#GP75
		F3	5.0A	A60L-0001-0075#5.0
		F4	5.0A	A60L-0001-0046#5.0

(2) Application

Symbol	Application
F1	AC200V input
F3	Indicator
F4	Others

2.1.3 SETTING OF GRAPHIC BOARD (A20B-8001-0480)



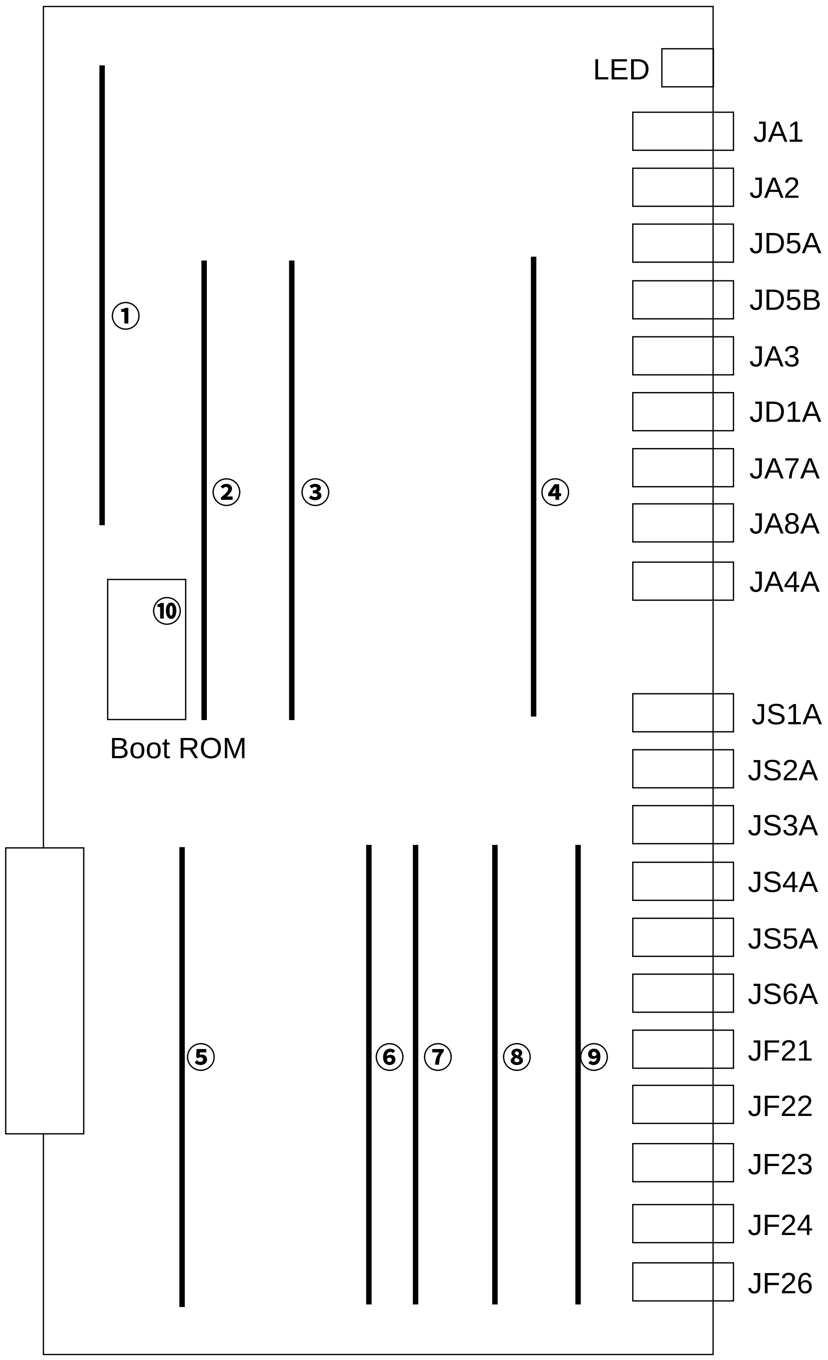
TM1~TM3	LCD/CRT switchingA:CRT	B: LCD (B:Standard setting)
TM10	ROM switching	A: Standard setting
LCD ADJ.	Adjustment in VIDEO output level	
HS AB	Adjustment in NC page HSYNC phase	A: Standard setting
012	Adjustment in NC page horizontal position	1: Standard setting
PHS01234	Fine adjustment in NC page HSYNC phase	0: Standard setting

- Perform adjustment with “HS AB” and “PHS 01234” when dots slippage causing flicker takes place on switching between an MMC page and an NC page. First, change “PHS 01234” and set it so that no flicker takes place. When adjustment cannot be made even through this, change “HS AB”.
- Use “HS 012” to adjust by one dot when an MMC and an NC page are not equal in their horizontal position.
- Adjust luminance blur with “LCD ADJ.” on the main board for the NC page. For the MMC page, make adjustment with “LCD ADJUST” of the MMC-IV board.

2.2 CPU Board (MAIN)

This is a CNC main CPU board.

Name	Type
S-Σ 10M Main CPU Board	A16B-3200-0190
S-Σ 10L Main CPU Board	A16B-3200-0210



2.2.1 List of Modules

No.	Name	Function	Specification	Type
①	DRAM module	CNC system RAM	8MB	A20B-2902-0461
②	SRAM module	Extension SRAM	256KB	A20B-2902-0350
			768KB	A20B-2902-0351
			2.25MB	A20B-2902-0352
③	FROM module	CNC system, PMC Ladder	8MB	A20B-2902-0501
			12MB	A20B-2902-0500
④	Spindle module	Spindle control	Serial+Analog	A20B-2901-0980
			Serial	A20B-2901-0981
			Analog	A20B-2901-0982
⑤	PMC module	PMC control	With SLC	A20B-2902-0480
⑥	HSSBC module	CRTC text display control	Standard (HSSB)	A20B-2902-0490
	CRTC module		Multi (VGA)	A20B-2902-0275
⑦	Servo module	Servo control 5th and 6th axes		A20B-2902-0070 A20B-2902-0061
⑧	Servo module	Servo control 3rd and 4th axes		
⑨	Servo module	Servo control 1st and 2nd axes		

2.2.2 LED Indications

The STATUS LED is green and the ALARM LED is red.

(1) LED indication change at power-on □: Turned off ■: Turned on

LED Indication	Description
BTATUS □□□□	The Power is not turned on.
BTATUS ■■■■	The CPU is not starting after turning on the power.
BTATUS ■□■■	Each processor in the system is waiting for ID.
BTATUS □□■■	ID setting for each processor in the system is completed.
BTATUS ■■□■	Completion of FANUC BUS initialization
BTATUS □■□■	Completion of PMC initialization (1)
BTATUS ■□□■	Completion of setting of hardware configuration information for each printed circuit board in the system
BTATUS ■■■□	Completion of initial run of the PMC ladder (PMC-RB)
BTATUS □■■□	Digital servo initialization wait
BTATUS ■□□□	Initial setting is completed and the system is running normally

(2) LED indications for errors

□ : Turned off ■ : Turned on ✕ : Irrelevant

LED Indication	Description
STATUS □■□□ ALARM ■■□	The main CPU board has a RAM parity error or the option-2 board has a servo alarm or RAM parity.
STATUS □■□□ ALARM □■■	A servo alarm (watchdog timer alarm) occurred.
STATUS □■□□ ALARM □■□	Other system alarm occurred.
STATUS ■■■■ ALARM ✕■✕	The system is stopping before the CPU is started.

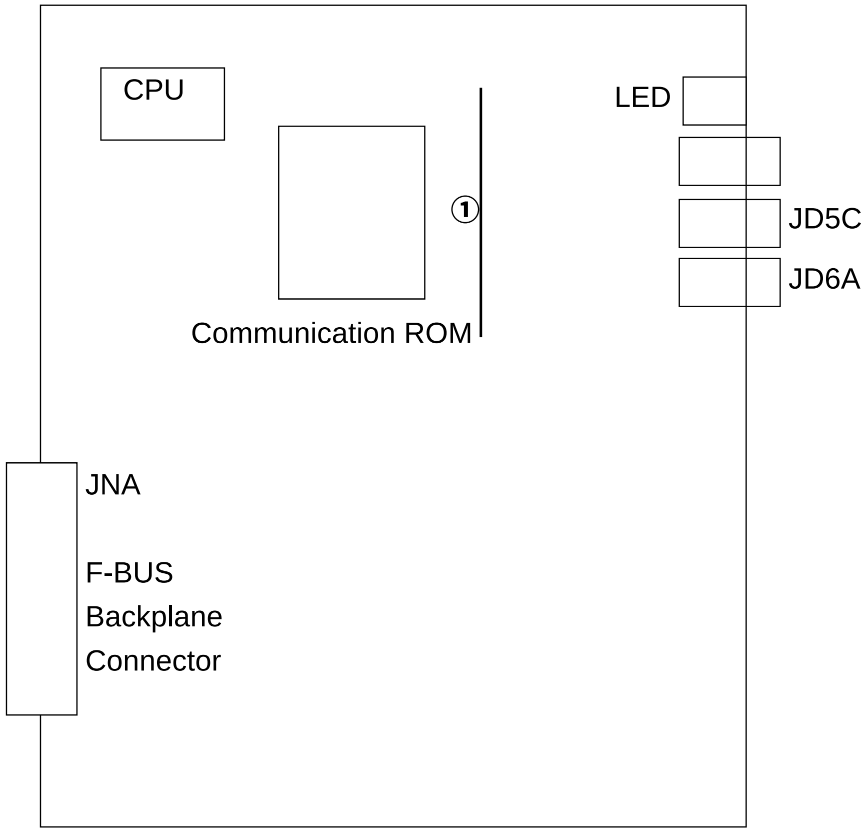
2.2.3 Connectors

Symbol	Name	Description
JA1	CRT	CRT video signal
JA2	MDI	MDI keyboard
JD5A	R232-1	RS-232C serial port
JD5B	R232-2	RS-232C serial port
JA3	MPG	Manual pulse generator
JD1A	IOLINK	FANUC I/O link
JA7A	SPDL-1	Serial spindle
JA8A	A-OUT1	Analog output
JA4A	APCBAT	APC battery
JS1A	SERV01	1st axis servo amplifier
JS2A	SERV02	2nd axis servo amplifier
JS3A	SERV03	3rd axis servo amplifier
JS4A	SERV04	4th axis servo amplifier
JS5A	SERV05	5th axis servo amplifier
JS6A	SERV06	6th axis servo amplifier
JF21	SCALE1	1st axis scale
JF22	SCALE2	2nd axis scale
JF23	SCALE3	3rd axis scale
JF24	SCALE4	4th axis scale
JA26	SV-CHK	Servo check

2.3 Option-1 Board (DNC)

This is a DNC operation board.

Name	Specification	Type
Option-1 Board	Remote Buffer	A16B-2200-0913



2.3.1 List of Modules

No.	Name	Function	Specification	Type
①	Communication control module	Communication control		A20B-2901-0361

2.3.2 LED Indications

Indicates the status of the communicating function

STATUS □□□□ (green)

ALARM □□□ (red)

Indication of Communicating Function

□ : Turned off ■ : Turned on × : Irrelevant ☆ : Blinking

LED Indication	Description
STATUS ■■■■ ALARM ■□□	The CPU is not running after turning on the power.
STATUS ××□■ ALARM □□□	The remote buffer has been initialized and the system is running normally.
STATUS ××☆☆ ALARM □□□	There is an error in communication control of the option-1 board.

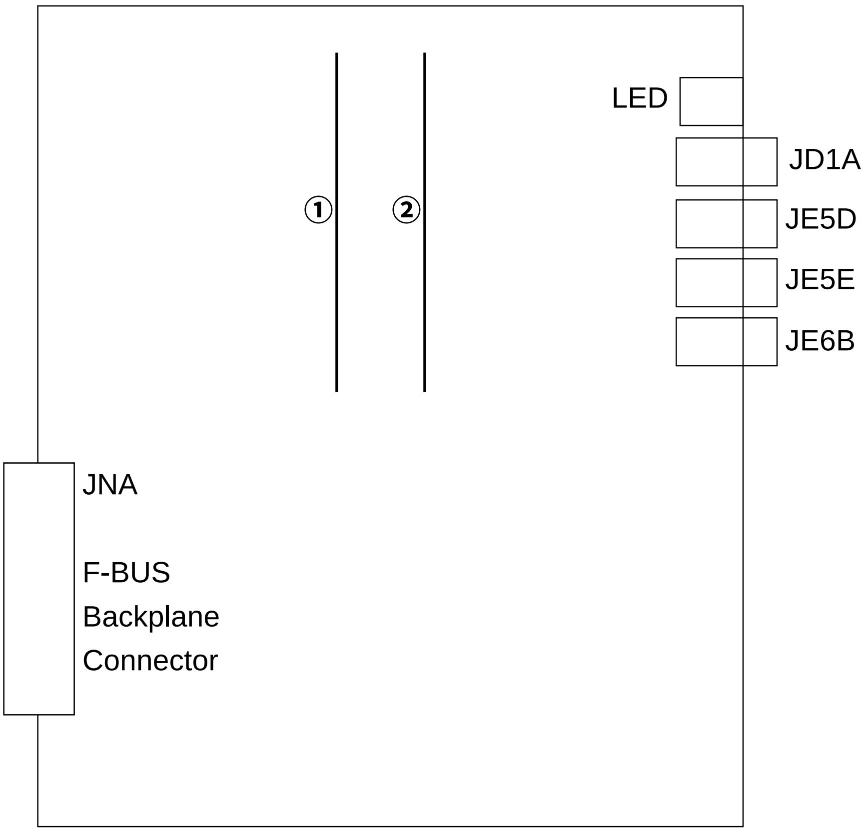
2.3.3 Connectors

Symbol	Name	Description
JD5C	R232-3	RS-232C serial port
JD6A	R422-1	RS422 serial port

2.4 Option-3 Board (PMC)

This is a sequence control board.

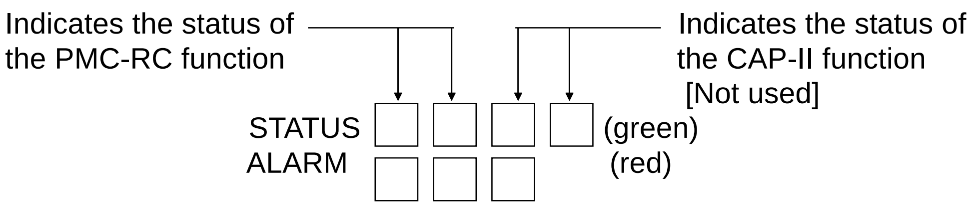
Name	Specification	Type
Option-3 board	PMC-RC	A16B-3200-0054



2.4.1 List of Modules

No.	Name	Function	Specification	Type
①	DRAM module for PMC	DRAM for PMC		
②	PMC control module	PMC control	PMP2	A20B-2901-0960 A20B-2901-0961

2.4.2 LED Indications



(1) LED indications for the PMC-RC function

(a) LED indication change at power-on

□ : Turned off ■ : Turned on × : Irrelevant

LED Indication	Description
STATUS ■■××	The CPU is not starting after turning on the power.
STATUS □□××	Waiting for ID setting for each processor in the system
STATUS ■■××	Waiting for completion of initialization of each processor in the system
STATUS □□××	Initialization of the PMC-RC function is completed and the system is running normally.

(b) LED indications for errors

□ : Turned off ■ : Turned on × : Irrelevant ★☆ : Blinking

LED Indication	Description
STATUS ☆☆×× ALARM □□□	Other printed circuit board has NMI. (LEDs blinking simultaneously) Check other printed circuit board for LED indication. Parity error for the ladder memory or work memory.
STATUS □☆×× ALARM ■□□	Initialize the ladder memory or replace the work RAM module. A bus error (illegal memory access) occurred.
STATUS ☆□×× ALARM □□□	Replace the option-3 board.

LED Indication	Description
STATUS ■☆✕✕ ALARM □□□	An I/O link has a communication error, etc. Check a link device or cable.
STATUS ☆■✕✕ ALARM ■□□	The PMC control module has a parity error, etc. in it. Replace the PMC control module.
STATUS ★☆✕✕ ALARM □□□	Checksum error for the system program memory. The DRAM module for PMC may be defective.

2.4.3 Connectors

Symbol	Name	Description	
JD1A	IOLINK	FANUC I/O LINK	
JD5D	RS232-4	RS232C	May not be installed
JD5E	RS232-5	Unused	
JD6B	R422-2	Unused	

2.5 64-bit RISC Board (RISC) ...... for M

This is a board designed for high-accuracy profile control.

Name	Type
64bit RISC board	A16B-3200-0150

2.5.1 LED Indications

The STATUS LED is green and ALARM LED is red.

(1) LED indication change at power-on　　□ : Turned off ■ : Turned on

LED Indication	Description
STATUS □□□□	The power is not turned on.
STATUS ■■■■	The RISC CPU is not starting after turning on the power.
STATUS □□□■	The DRAM and SRAM are being tested. (When an error is detected during a test, this in-test LED indication is held)
STATUS □□■□	The ROM is being tested. (When an error is detected during a test, this in-test LED indication is held)
STATUS ■□□□	Waiting for a request from the main CPU request (1)
STATUS ■□□■	Waiting for a request from the main CPU request (2)
STATUS ■□■□	Waiting for a request from the main CPU request (3)
STATUS ■■□□	Waiting for a request from the main CPU request (4)

(2) LED indication while running □ : Turned off ■ : Turned on

LED Indication	Description
STATUS □□□★	Waiting for the RISC mode
STATUS □★□★	Waiting for an input of NC statement
STATUS □★★□	Running a command in the RISC mode
STATUS ★□□□	Resetting
STATUS ★□★★	Override 0 at acceleration/deceleration time before inter-polation (Waiting for an override change)

(3) LED indication for errors □ : Turned off ■ : Turned on

LED Indication	Description
STATUS □□□■	An error was detected in testing the DRAM or SRAM on the RISC board.
STATUS □□■□	An error was detected in testing the ROM module.
STATUS □□■■	A synchronizing signal from the main CPU cannot be detected.
STATUS □■□□	An error was detected in accessing the F-BUS.
STATUS ■■■□	System error

(4) ALARM LED indications □ : Turned off ■ : Turned on

LED Indication	Description
STATUS ■□□	The RISC CPU is not starting.
STATUS □■□	SRAM parity
STATUS □□■	DRAM parity

2.6 MMC-IV BOARD (MMC-IV) ...... Applies only to Multi-Interactive Spec.

This DOS-V personal computer is used in multi-interactive processing. This is a board designed for high-accuracy profile control.

Name	MODEL
MMC-IV BOARD	A02B-0207-C022 (Conventional type)
	A16B-2203-0180 (New type)

Note) *The conventional and new types of MMC-IV Board are differentiated by use of a memory card socket.*
- *Conventional type: With a memory card socket*
- *New type: Without a memory card socket*

2.6.1 SETTING ADJUSTMENT

Since Machine is delivered as having been adjusted prior to shipment, no change is necessary under normal circumustances.

2.6.2 LED DISPLAY

STATUS LED in green color and ALARM LED in red color.

(1) Normal state □ : Turned off ■ : Turned on ✕ : Irrelevant

LED Indication	Description
STATUS □□□□	Power OFF state
STATUS ■✕✕✕	MMC-IV reset cancelled
STATUS ✕✕✕■	HDD access lamp

(2) Abnormal state ■ : Turned on ✕ : Irrelevant

LED Indication	Description
STATUS ■✕✕	NMI has occurred in MMC-IV CPU.
STATUS ✕■✕	Ambient temperature of HDD is either equal to or below 5°C or equal to or above 55°C.
STATUS ✕✕■	Parity alarm has occurred in DRAM on the back plane.

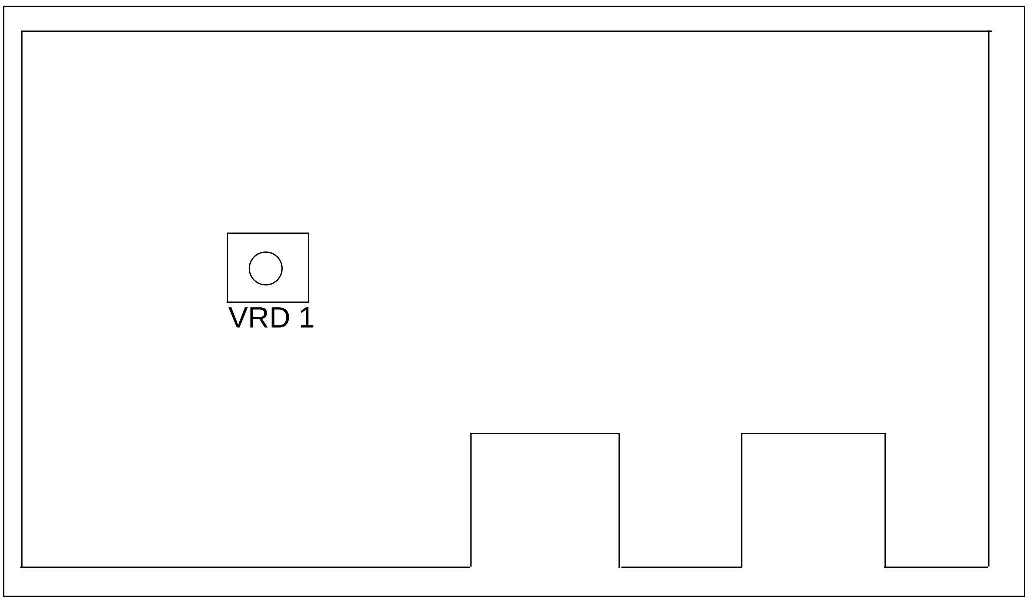
2.7 LIQUID CRYSTAL DISPLAY (LCD)

This is a board designed for high-accuracy profile control.

Name	SPEC.	MODEL
9.5" Monochromatic LCD	Without Multi	A02B-0222-C110
10.4" Color LCD	Without Multi	A02B-0222-0150
10.4" Color LCD	With Multi	A02B-0200-0153

2.7.1 ADJUSTMENT REQUIRED

(1) For A02B-0222-C110 ...... Without Multi Spec./9.5" Monochromatic LCD



DISPLAY, REAR VIEW

• VRD1 (Contrast Adjustment)

Through adjustment of VRD1, contrast can be adjusted.

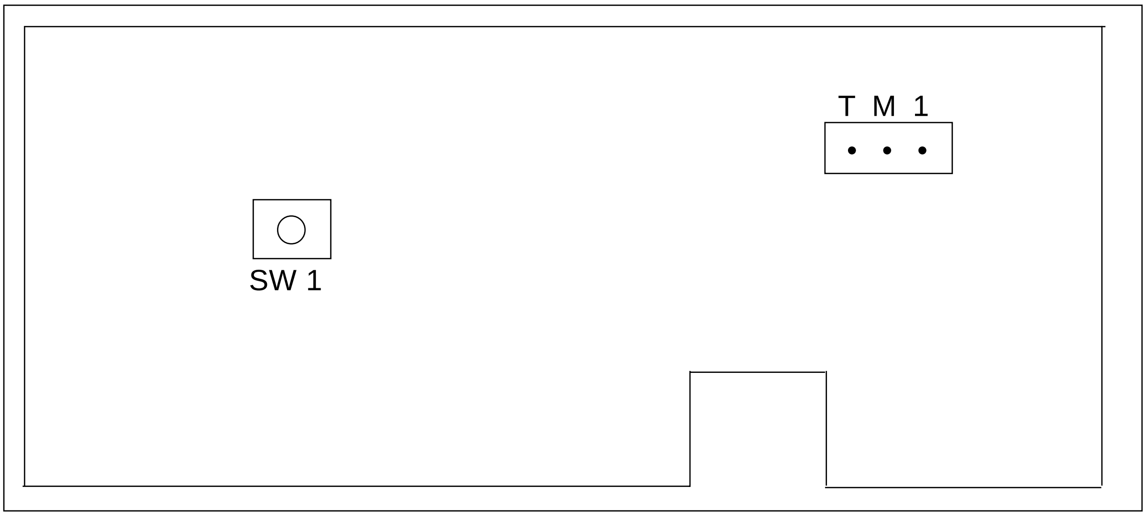
> ***Note***
>
> *Do not change any setting, volume, etc. other than those mentioned above. A change, if made in any setting other than the above, results in incorrect screen display.*

(2) For A02B-0222-C150 ...... Without Multi Spec./10.4" Color LCD

This display does not include the set pin, volume, etc. for screen adjustment.

> ***Note***
>
> *Do not change any setting, volume, etc. other than those mentioned above. A change, if made in any setting other than the above, results in incorrect screen display.*

(3) For A02B-0200-C153 ...... With Multi Spec./10.4" Color LCD



DISPLAY, REAR VIEW

• TM1 (Flicker Adjustment)

On occurrence of flicker on the screen, change setting of the set pin TM1 into the other. Normally, flicker can be eliminated in one of these two ways.

• SW1 (Setting of Horizontal Position)

① Use this to shift a display screen horizontally by one dot.

② Use this to set position where all displays are available. There is only one place for toral display. As it is normally set prior to shipment, no change is necessary.

> ***Note***
>
> *Do not change any setting, volume, etc. other than those mentioned above. A change, if made in any setting other than the above, results in incorrect screen display.*

2.8 DATA SERVER BOARD

Name	MODEL
DATA SERVER BOARD	A16B-2202-0630

2.8.1 LED DISPLAY

STATUS LED in green color and ALARM LED in red color.

(1) LED Indications on Supply of Power □ : Turned off ■ : Turned on

No	LED display 1 2 3 4	DATA SERVER STATE	
1	STATUS □□□□	Power OFF state	
2	STATUS ■■■■	Initial state immediately after supply of power.	
3	STATUS □■■■	Hardware in checking	Main memory test
4	STATUS ■□■■		Ethernet RAM test
5	STATUS □□■■		Common RAM test
6	STATUS ■■□■		Initialization of system area
7	STATUS □■□■		FANUC BUS interrupt test 1
8	STATUS ■□□■		FANUC BUS interrupt test 2
9	STATUS □□□■		FANUC BUS interrupt test 3
10	STATUS ■■■□		FANUC BUS interrupt test 4
11	STATUS □■■□		Initialization of interrupt controller
12	STATUS ■□■□	Starting of data serve software	Initialization BIOS
13	STATUS □□■□		Program loading
14	STATUS ■□□□	Completion of starting of the data server board	

When the data server board starts properly, LED display is stopped in “No.14” state.

(2) LED Indications on Occurrence of Error (STATUS)

□ : Turned off ■ : Turned on ✕ : Irrelevant

"STATUS" LED repeats "LONG" and "SHORT" patterns. The "LONG" pattern is displayed for a longer time length, while the "SHORT" one for a shorter time length.

No	LED DISPLAY (STATUS)		DATA SERVER STATE
	LONG 1 2 3 4	SHORT 1 2 3 4	
1	□□□■	□□■□	Main memory failure. Check the data server board.
2	□□□■	■□■□	Ethernet RAM failure. Check the data server board.
3	□□□■	□■■□	Common RAM failure. Check the data server board.
4	■□□■	✕✕✕✕	An invalid interrupt has been given to CPU.
5	□■□■	✕✕✕✕	An invalid interrupt has been given to CPU.
6	■■□■	✕✕✕✕	An invalid interrupt has been given to CPU.
7	□■■■	■□□□	A system error has occurred in the data server board.
8	□□■■	■□□□	A bus error has occurred in FUNUC BUS. Check the data server board.
9	□□■■	□■□□	A parity error has occurred in the main memory.
10	□□■■	■■□□	A parity error has occurred in the Ethernet RAM.
11	□□■■	□□■□	A parity error has occurred in the Common RAM.
12	□□■■	■□■□	"Refresh" to the main memory has ceased for a time longer than the set length.

(3) LED Display on Occurrence of Error (ALARM)

■ : Turned on ✕ : Irrelevant

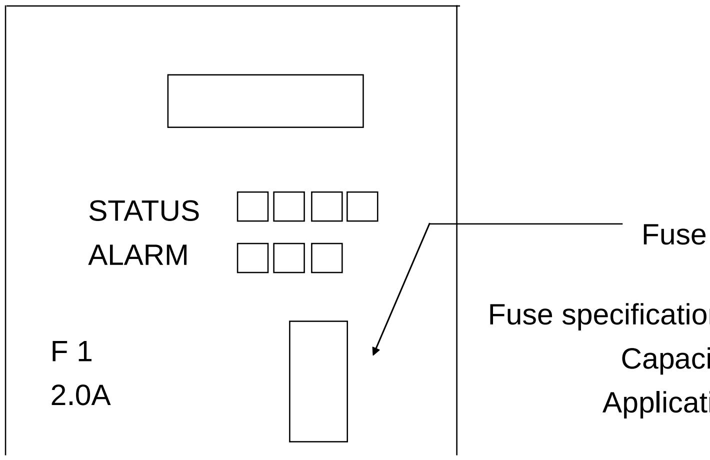
No	LED DISPLAY 1 2 3	DATA SERVER STATE
1	ALARM ■✕✕	Either a parity error has occurred in any of the main memory, Ethernet RAM, and Common RAM, or "refresh" to the main memory has ceased for a time longer than the set length. Referring to "STATUS" LED NO's 9 to 12, identify the failure and replace the part.
2	ALARM ✕■✕	Fuse is gone. Replace a fuse.
3	ALARM ✕✕■	CPU is in Halt or SHUTDOWN state. Check the board.

2.8.2 REPLACEMENT OF FUSE

(1) Check the fuse on the front panel of the data server board for any disconnection. On occurrence of disconnection, a white marker appears in a small window of the fuse.

(2) Remove the cause which has disconnected the fuse.

(3) Pulling out the disconnected fuse, insert a new one of the same specification.



Fuse specification: A08B-0048-K101
Capacity:2.0A
Application: For Ethernet supply power

2.9 LIST OF UNITS AND PRINT BOARDS

2.9.1 CONTROL UNIT RACK

NAME	SPECIFICATIONS		TYPE
S-Σ 10L CONTROL UNIT RACK	MMC-IV not provided	6 slots	A02B-0200-C003
		8 slots	A02B-0200-C004
	MMC-IV provided	6 slots	A02B-0200-C011
		8 slots	A02B-0200-C012
S-Σ 10L CONTROL UNIT RACK	MMC-IV not provided	4 slots	A02B-0129-C002
		6 slots	A02B-0129-C003
	MMC-IV provided	4-slots	A02B-0129-C010
		6 slots	A02B-0129-C011

2.9.2 POWER UNIT

NAME	TYPE
POWER UNIT AI	A16B-1212-0901
POWER UNIT BI	A16B-1212-0871

2.9.3 CONTROL UNIT P.C.B.

NAME	SPECIFICATIONS	TYPE
MAIN CPU BOARD	S-Σ 10M	A16B-3200-0190
	S-Σ 10L	A16B-3200-0210
OPTION 1 BOARD	REMOTE BUFFER	A16B-2200-0913
OPTION 3 BOARD	PMC-RC	A16B-3200-0054
HIGH-SPEED SKIP SIGNAL INPUT BOARD		A16B-2200-0954
CONTROL UNIT GRAPHIC BOARD		A20B-8001-0480
64-BIT RISC BOARD		A16B-3200-0150
DATA SERVER BOARD		A16B-2202-0630
MC-IV BOARD	MULTI-INTERACTIVE	A02B-0207-C022 (Conventional type)
		A16B-2203-0180 (New type)

3. TROUBLESHOOTING

When a trouble happened, check "when it happened," "what you were operating," "what it was like," and "how often it happens."

3.1 Tracking through the ALARM Screen

When an alarm happened during operation, an alarm message appears on the top area of the screen.

For some alarms, the details are displayed on the diagnostic screen. Confirm, then, the description on the diagnostic screen in the following operation:

[Display Operation of Diagnostic Screen]

While NC "General Screen" is displayed, operate as:

◁ (OPER./MAINTE) → F4 SYSTEM → 3 0 (F MENU) INPUT → 2 (F_SYSTEM) INPUT → F7 DGNOS

to display the diagnostic screen. Input, then, a number to be referred to and push F6 NO.SRH . Data for the diagnostic number are displayed. (The page key is useable to make a change.)

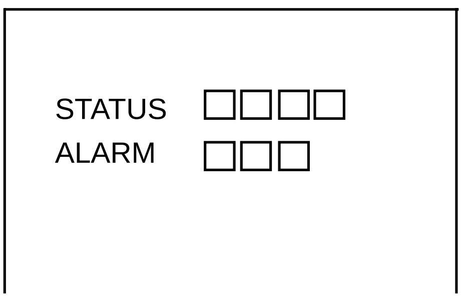
(Note 1) *When the diagnostic function does not appear in F7 following "F SYSTEM" being selected in the above operation, push (RETURN) a few times.*

(Note 2) *Use ALTER , not ▷ (RETURN), for return operation from the diagnostic screen.*

3.2 Tracking through the Controller's Monitor LEDs

Each unit in the controller has monitor LEDs so that you can check for the status of each unit. For details, see 2. FUNCTIONS AND HANDLING OF CONTROL UNITS.

Each Unit



4. POWER-ON ADJUSTMENT

4.1 Power-on Procedure

① Enter (set) the PMC ladder and others.

② Enter (set) the NC parameters.

③ Turn off the power and turn it on again.

(Note) *When system software has not been entered into the NC internal memory, transfer it into the NC internal memory according to the instructions in [APPENDIX] BOOT SYSTEM, and then, go through the above-mentioned steps.*

4.2 System Table

This CNC unit sets allocations of the data areas such as machining program, tool offset amount through the "system table."

To display the System Table screen, operate in the following order in the Overall screen:

[◁] [OPER./MAINTE] → [F4/SYSTEM] → [2] [5] (SYSTEM TABLE) → [INPUT]

SYSTEM TABLE

BASIC RAM SIZE [38E40] EXT. RAM SIZE [0]

No.	TABLE	SIZE	OFFSET	No.	TABLE	SIZE	OFFSET
01	SYSTEM	10000	0	11		0	0
02	TOOL	5000	0	12		0	0
03	SPARE	3900	0	13		0	0
04	MONI	6F00	0	14		0	0
05	PRGRM	13000	0	15	DUMMY	6600	32800
06		0	0	16		0	0
07		0	0	17		0	0
08		0	0	18		0	0
09		0	0	19		0	0
10		0	0	20		0	0

When initially starting up the system, press [F5/SYSTEM CLR] to initialize the system. When this is done, the basic RAM capacity and extended RAM capacity are automaticlly set. Pressing [F3/TABLE] brings the cursor into the table. In accordance with the names versus capacities table provided on the next page, set the table names and capacities, using [Cursor] and [Alphanumeral] plus the [INPUT] key.

(Note 1) *The numbers 01 through 15 are the tables for the basic RAM, and 16 through 20 are those for the extended RAM. When the extended RAM capacity is 0 (zero), do not set for the numbers 16 through 20.*

(Note 2) *Set the capacity in an increment of 100, suffixing a numeral with "H" (indicates hexadecimal)*

(Note 3) *If the capacity is entered, the offset for the next table will be automatically set. Different from the S-III, however, the last table capacity is not adjusted. Set a dummy table before the last table capacity so that it will be of specified capacity.*

(Note 4) *The table number 01 has a fixed table name, "SYSTEM," and capacity, "1000H." For the other tables, you can set any table names in any places.*

(Note 5) *A standard set value varies from one model to another. When actually setting it, follow the materials for each model.*

(Note 6) *When the system table is changed, be sure to turn off and on the power to make sure that "790 System Table Error" does not occur, and then, start* *operating the system.*

<table>
<tr><th rowspan="2">Function</th><th rowspan="2">Table</th><th rowspan="2">Spec.</th><th colspan="2">Capacities</th><th rowspan="2">Remarks</th></tr>
<tr><th>Σ 10M</th><th>Σ 10L</th></tr>
<tr><td>System Data</td><td>SYSTEM</td><td></td><td colspan="2">10000H</td><td>Table No. 01 Fixed</td></tr>
<tr><td rowspan="7">Tool offset</td><td rowspan="7">TOOL</td><td>32 pairs</td><td>600H</td><td>C00H</td><td rowspan="7">The 100 pairs in the Spec. column represents;
M-system: 100 pairs
L-system: 99 pairs</td></tr>
<tr><td>64 pairs</td><td>C00H</td><td>1400H</td></tr>
<tr><td>100 pairs</td><td>1400H</td><td>2800H</td></tr>
<tr><td>200 pairs</td><td>2800H</td><td>5000H</td></tr>
<tr><td>400 pairs</td><td>5000H</td><td rowspan="3"></td></tr>
<tr><td>500 pairs</td><td>5E00H</td></tr>
<tr><td>1,000 pairs</td><td>BC00H</td></tr>
<tr><td rowspan="7">Tool life management</td><td rowspan="7">SPARE</td><td>32 pairs</td><td>B00H</td><td rowspan="4">400H</td><td rowspan="7">The Spec. column represents the number of tool offset pairs.</td></tr>
<tr><td>64 pairs</td><td>F00H</td></tr>
<tr><td>100 pairs</td><td>1300H</td></tr>
<tr><td>200 pairs</td><td>2000H</td></tr>
<tr><td>400 pairs</td><td rowspan="3">3900H</td><td rowspan="3"></td></tr>
<tr><td>500 pairs</td></tr>
<tr><td>1,000 pairs</td></tr>
<tr><td rowspan="7">Cutting monitoring</td><td rowspan="7">MONI</td><td>32 pairs</td><td>2800H</td><td rowspan="4">2000H</td><td rowspan="7">The spec. column represents the number of tool offset pairs.</td></tr>
<tr><td>64 pairs</td><td>2E00H</td></tr>
<tr><td>100 pairs</td><td>3500H</td></tr>
<tr><td>200 pairs</td><td>4800H</td></tr>
<tr><td>400 pairs</td><td rowspan="3">6F00H</td><td rowspan="3"></td></tr>
<tr><td>500 pairs</td></tr>
<tr><td>1,000 pairs</td></tr>
<tr><td rowspan="11">Machining program</td><td rowspan="11">PRGRM</td><td>80m</td><td colspan="2">A000H</td><td rowspan="11">The maximum number of registerable programs is irrelevant.</td></tr>
<tr><td>160m</td><td colspan="2">13000H</td></tr>
<tr><td>320m</td><td colspan="2">24000H</td></tr>
<tr><td>500m</td><td colspan="2">37000H</td></tr>
<tr><td>640m</td><td>4A000H</td><td></td></tr>
<tr><td>1,000m</td><td colspan="2">6F000H</td></tr>
<tr><td>1,280m</td><td>8B000H</td><td rowspan="5"></td></tr>
<tr><td>2,000m</td><td>D5000H</td></tr>
<tr><td>2,560m</td><td>10E000H</td></tr>
<tr><td>4,000m</td><td>1A1000H</td></tr>
<tr><td>5,120m</td><td>200000H</td></tr>
<tr><td>High-precision contour control</td><td>HPCC</td><td></td><td>10000H</td><td></td><td>M-system only</td></tr>
<tr><td rowspan="4">Automatic program (Multi-interactive)</td><td rowspan="4">TLFILE</td><td rowspan="4"></td><td>3800H</td><td></td><td></td></tr>
<tr><td rowspan="3"></td><td>3500H</td><td>NR/TG turning only</td></tr>
<tr><td>5100H</td><td>NR/TG turning + rotation</td></tr>
<tr><td>6600H</td><td>CA</td></tr>
</table>

4.3 SLBUS Table

In order to allocate the addresses for the input signals (X contact) and output signal (Y contact) on the part of the machine, itis necessary to set ths SLBUS table.

To display the SLBUS TABLE screen, operate as follows in the OVERALL screen.

[◁] (OPRE/MAINTE) → [F4/SYSTEM] → [2][4](SLBUS) → [INPUT]

SLBUS TABLE

No.	Loc#	Type	Slave	Division	Lead Ch.	Chanels	High Speed		Bytes		Address	
					Buffer	Size	IN	OUT	IN	OUT	IN	OUT
01	00	0			00	00	00	00	00	00	F0	F0
02	00	0			01	01	02	00	00	10	00	00
03	00	0			00	00	00	00	00	00	00	00
04	00	0			00	00	00	00	00	00	00	00
05	00	0			00	00	00	00	00	00	00	00
06	00	0			00	00	00	00	00	00	00	00
07	00	0			00	00	00	00	00	00	00	00
08	00	0			00	00	00	00	00	00	00	00
09	00	0			00	00	00	00	00	00	00	00
10	00	0			00	00	00	00	00	00	00	00
11	00	0			00	00	00	00	00	00	00	00
12	00	0			00	00	00	00	00	00	00	00
13	00	0			00	00	00	00	00	00	00	00
14	00	0			00	00	00	00	00	00	00	00
15	00	0			00	00	00	00	00	00	00	00
16	00	0			00	00	00	00	00	00	00	00

To alter the set value, press [F9/ALTER]. The message, "DO YOU WANT TO ALTER ? (Y/N)," is messaged. Press [Y]. Aframe cursor appears in the table, allowing you to alter the set value. Make setting according to the machine specifications.

When you start up the system for the first time, press [F8/CLEAR ALL] to initialize the data, and then, set each item.

After alteration is completed, press [F9/REFER] to end the setting mode.

5. DAILY MAINTENANCE AND INSPECTION

5.1 Replacing the Battery

> [WARNING]
>
> Turn on the power for the machine (CNC), press the EMERGENCY STOP switch, and then, replace the battery. Since this work is carried out with the cabinet left open in the power-on state, only personnel who has been trained on maintenance and safety should do it.
>
> When opening the cabinet to replace the battery, do not touch a high-voltage circuit. If the cover is not in place and you touch there, you will get an electric shock.

5.1.1 CNC Memory Backup Battery

The CNC is provided with batteries for retaining memory to store programs, offset volumes, parameters, etc. When battery voltage has lowered, “794 BATTERY ALARM” warning is displayed. On appearance of the warning, change batteries as soon as possible. Try not to turn off the CNC unit as much as possible until the battery is replaces.

(1) CNC memory backup battery replacement procedure

① Turn on the power for the machine (CNC). (Note)

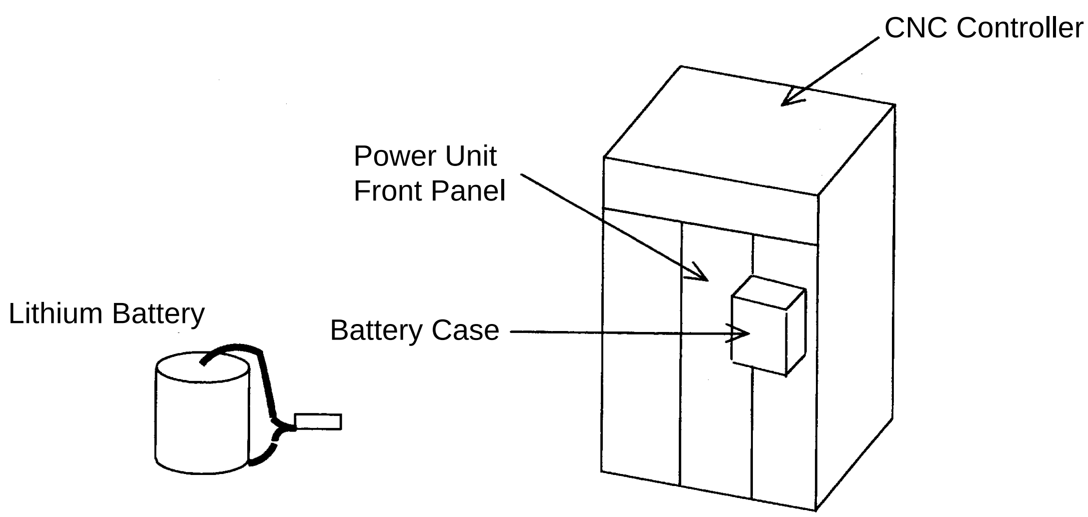
② Remove a battery case located on the front panel of the power unit. Hold down the top of the case and pull it to your side to remove it.

③ Disconnect a connector attached to the battery.

④ Replace the battery and put back the connector.

⑤ Reattach the battery case.

⑥ Turn off the power for the machine (CNC).



A02B-0200-K102 (For Power Sources AI and BI)

A02B-0200-K106 (For Power Sources C)

> ***[Note]***
>
> *Whether the CNC is turned on or off, the battery can be replaced. When replacing it with the CNC turned off, however, complete replacement within 30 minutes. If the battery has been removed for 30 minutes or more with the power turned off, the contents of the CNC memory may be lost. When the contents of the memory are lost this way, a RAM PARITY system alarm may occur to disable the CNC, even if it is turned on.*

5.1.2 Replacing the Absolute Encoder Battery

When the machine has an absolute encoder such as absolute pulse coder or absolute linear scale, an absolute encoder battery has been installed in addition to a memory backup battery.

When an APC alarm no. F307 or no. F308 occurs, replace the battery as soon as possible. Unless it is replaced, an absolute position will be lost and you will have to manually operate reference point return again.

(1) Absolute encoder battery replacement procedure (α series servo amplifier module)

① Turn on the power for the machine (CNC).

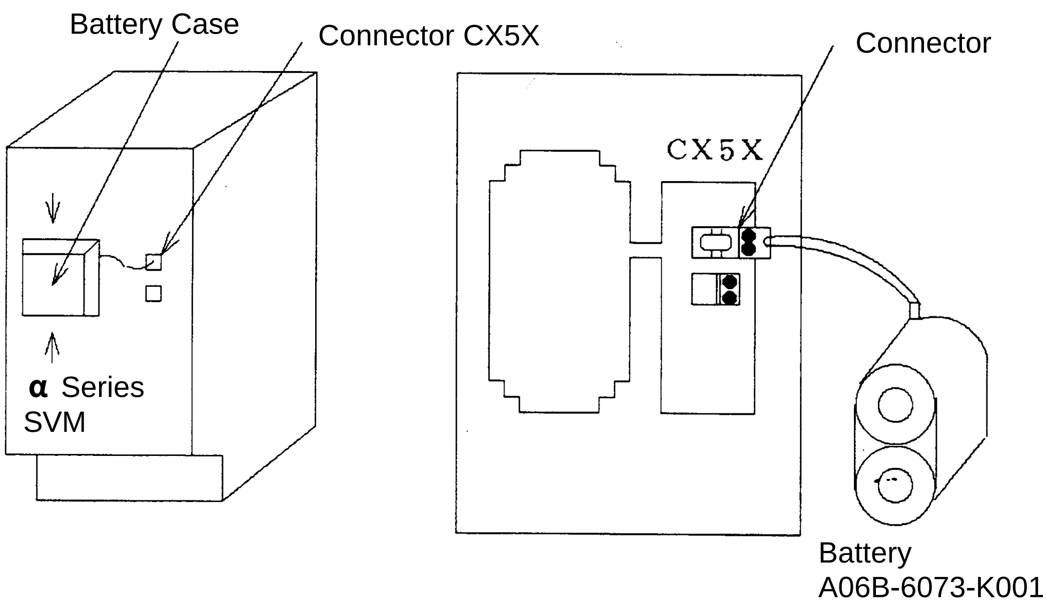
② Remove a battery case located on the front of a α series servo amplifier module (SVM). Hold the top and bottom of the case and pull it to your side.

③ Disconnect a connector attached to the battery.

④ Replace the battery and put back the connector.

⑤ Reattach the battery case.

⑥ Turn off the power for the machine (CNC).



(2) Absolute encoder battery replacement procedure (Separate pulse coder)

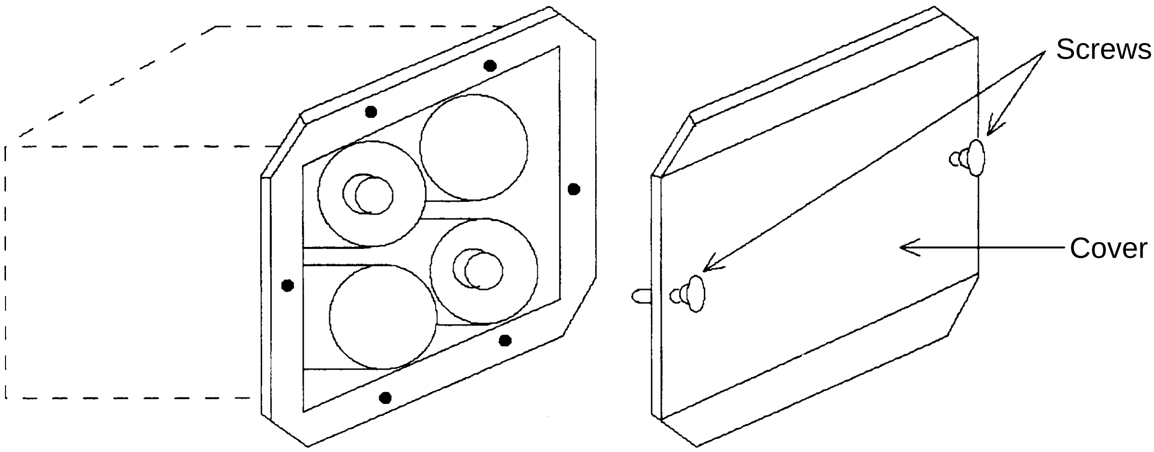
① Turn on the power for the machine (CNC).

② Unscrew the battery case and remove the cover.

③ Replace the dry cells in the case. Set two each of dry cells in different directions.

④ After replacing the dry cells, put back the cover.

⑤ Turn off the power for the machine (CNC).



> ***[Note]***
>
> *Replace the battery with the CNC turned on. If the battery is replaced with the power turned off, a memorized absolute position will be lost.*

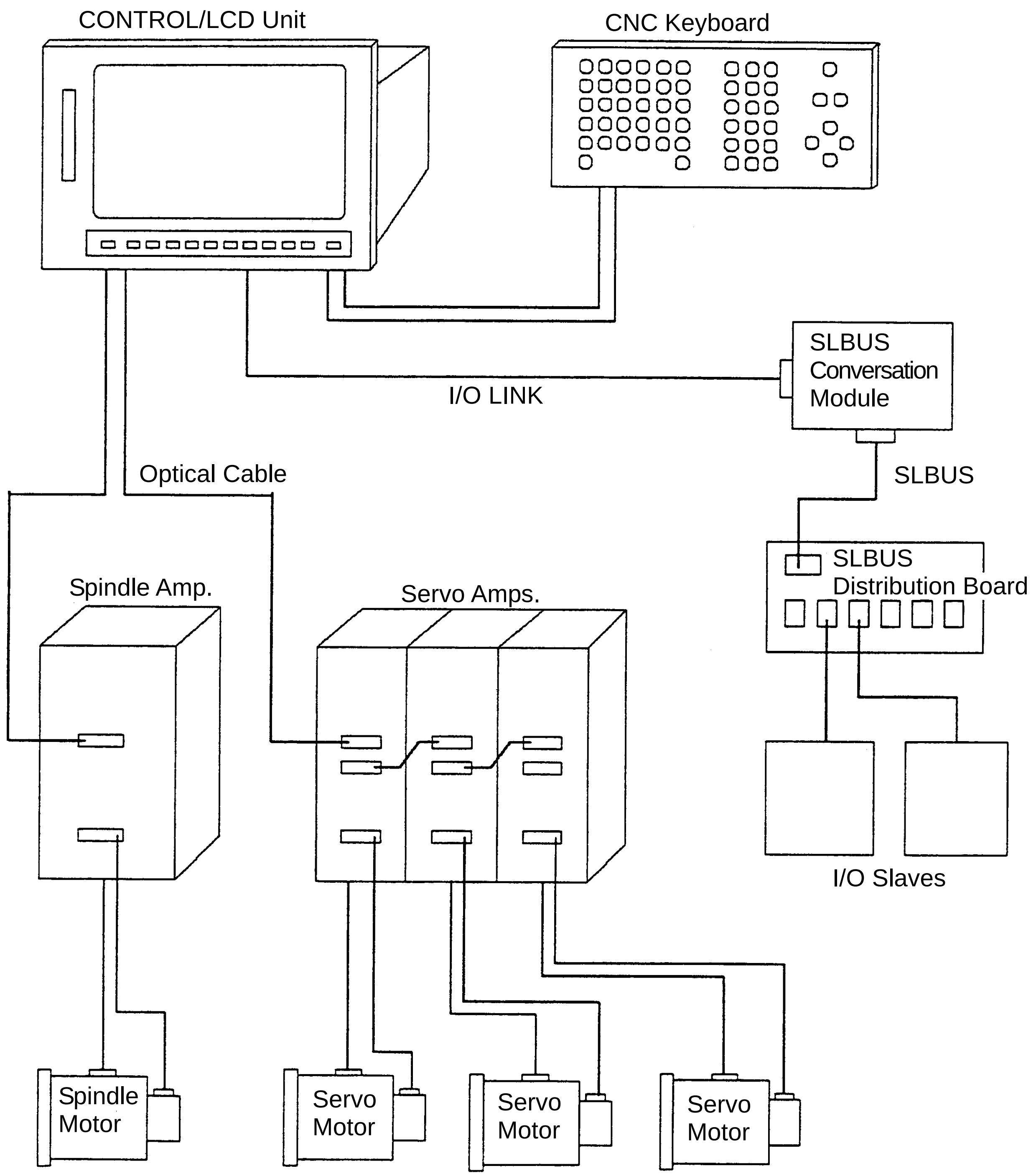
I-II SEICOS Σ 16/18/21 UNIT

1. OVERVIEW

The SEICOSΣ 16/18/21 CNC system is a more compact high-reliability unit provided with up-to-date device technology and integrates a display unit and an NC unit.

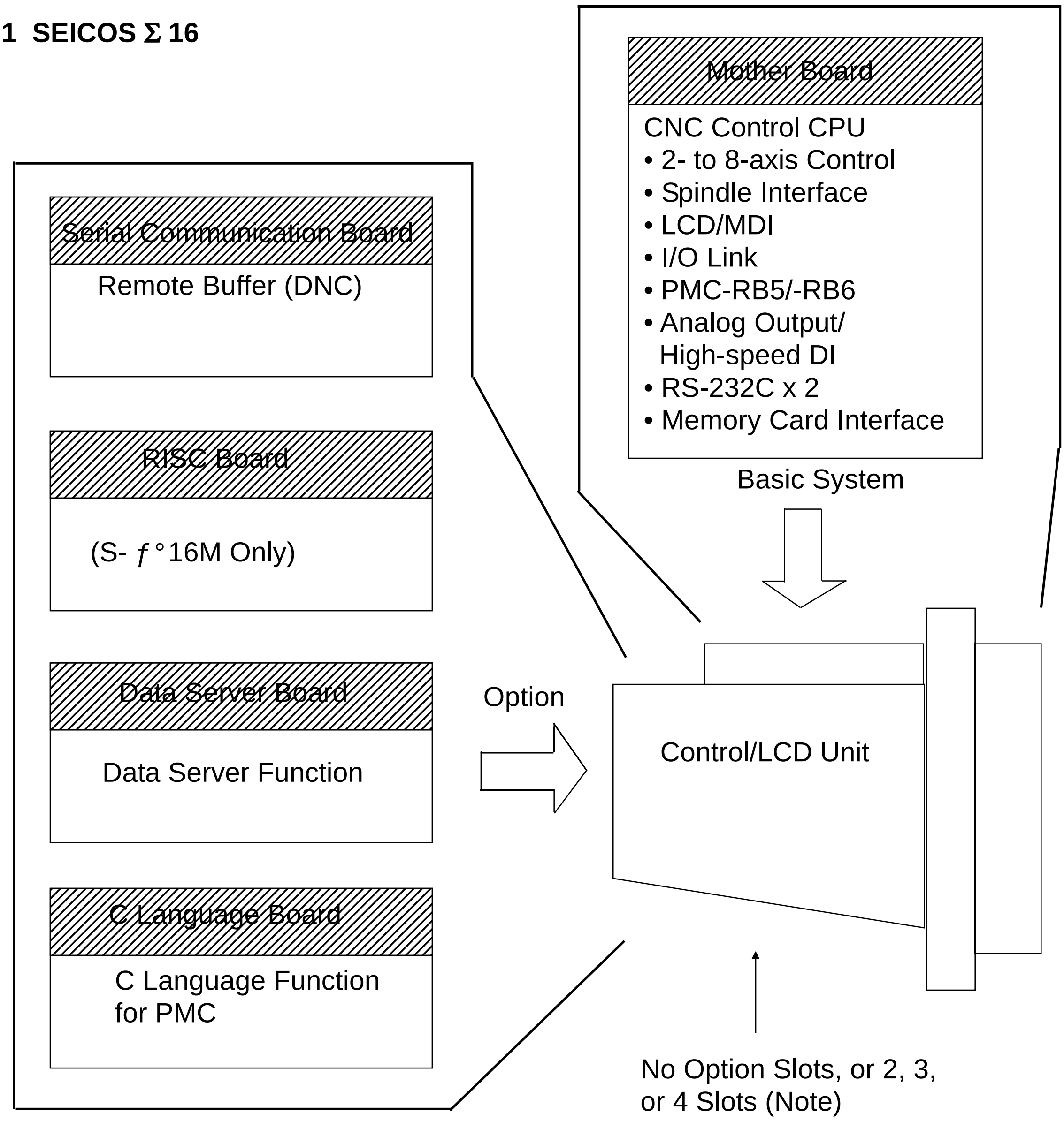
1.1 System Configuration

The following figure shows a system example using the SEICOS Σ 16/18/21 CNC unit.



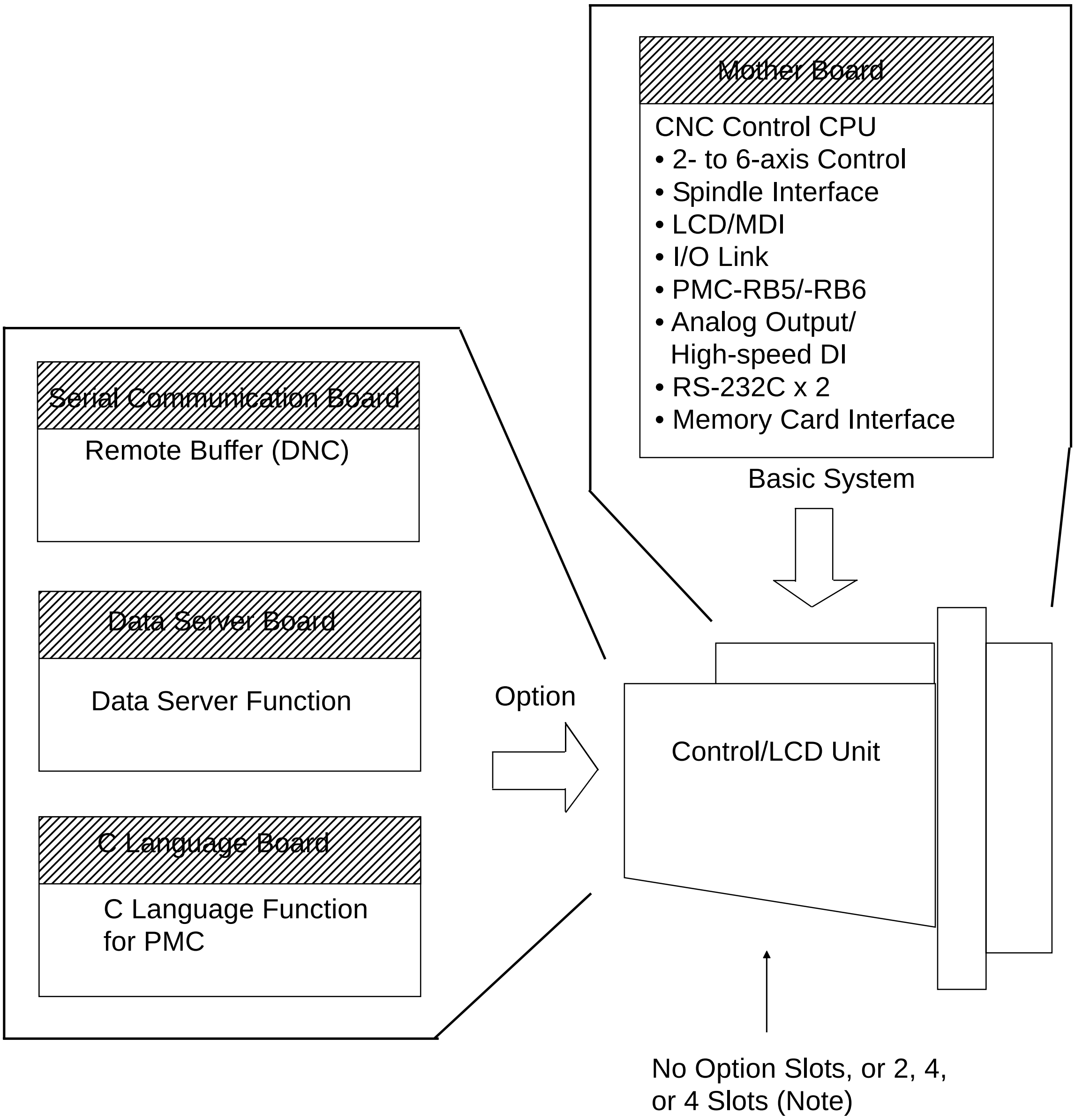
1.2 Hardware Overview

1.2.1 SEICOS Σ 16



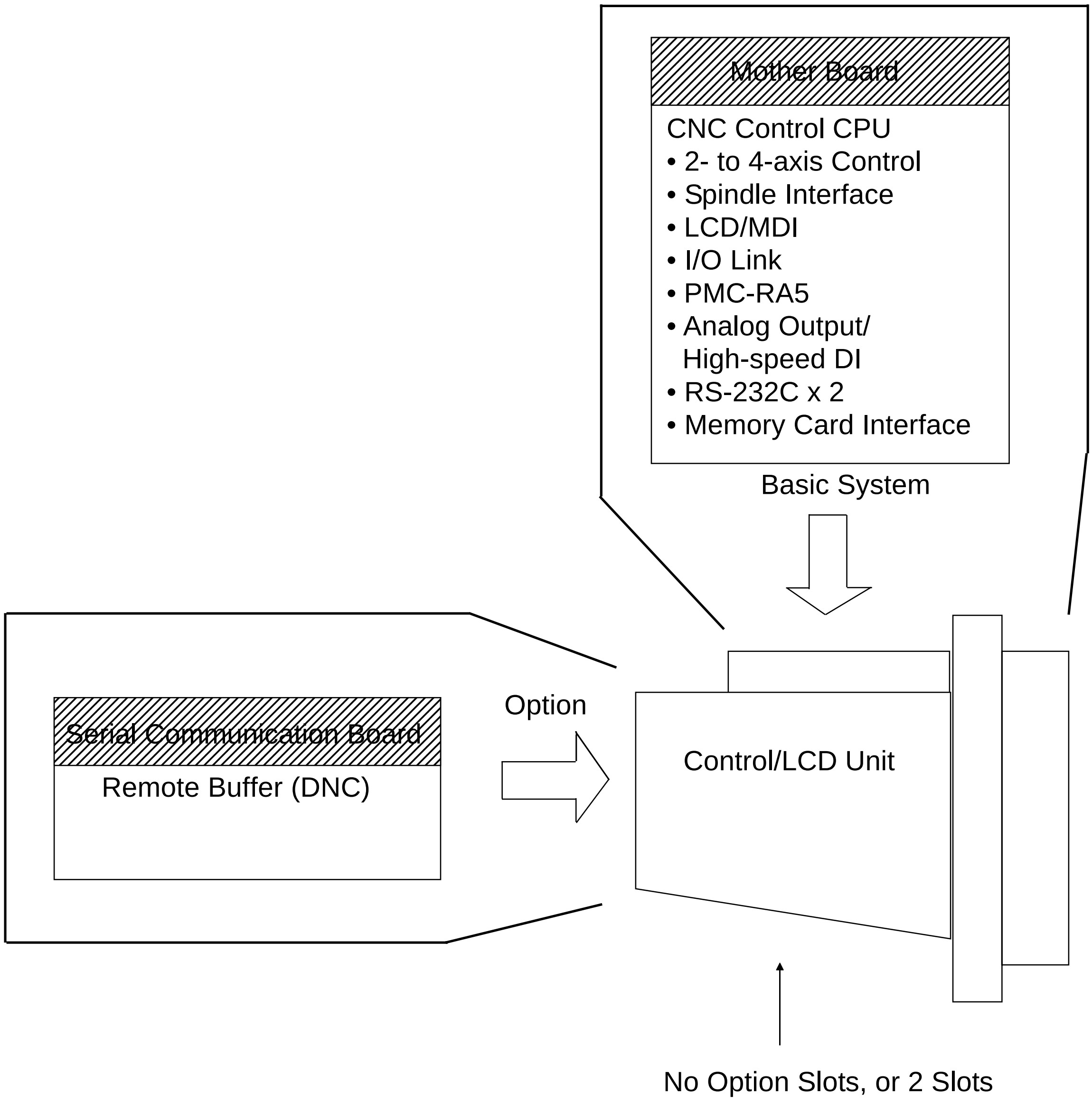
(Note) *If there are 3 or 4 slots provided, only the RISC board can be installed in the 2nd slot (center) of the 3 slots and in the 4th slot (farthest from the LCD) of the 4 slots, respectively.*

1.2.2 SEICOS Σ 18



(Note) *If there are 4 slots provided, the 4th slot (farthest from the LCD) is not available.*

1.2.3 SEICOS Σ 21



2. PCB CONNECTORS AND CARD CONFIGURATION

2.1 Mother Boards

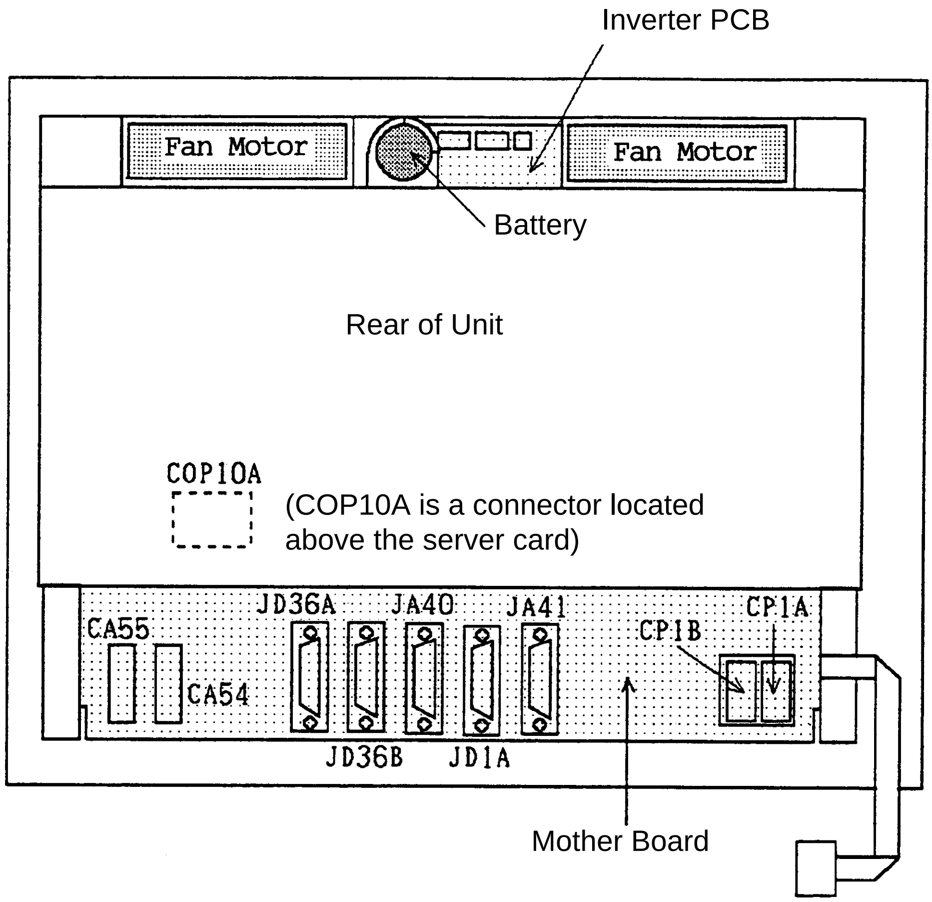
2.1.1 Specification

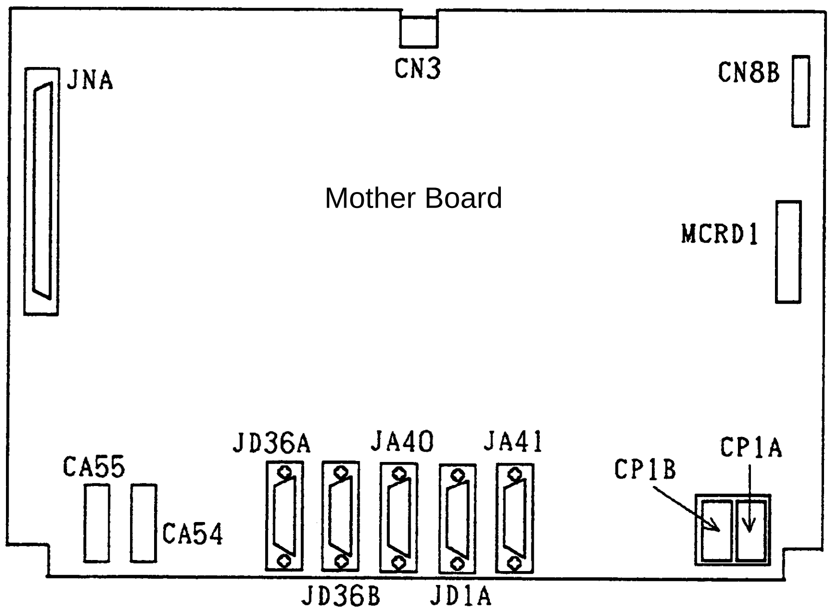
Name	Specification
S- Σ 16 Mother Boards	A20B-8100-0130
S- Σ 18 Mother Boards	A20B-8100-0135
S- Σ 21 Mother Boards (PMC-RA5)	A20B-8100-0136

2.1.2 Connector Applications

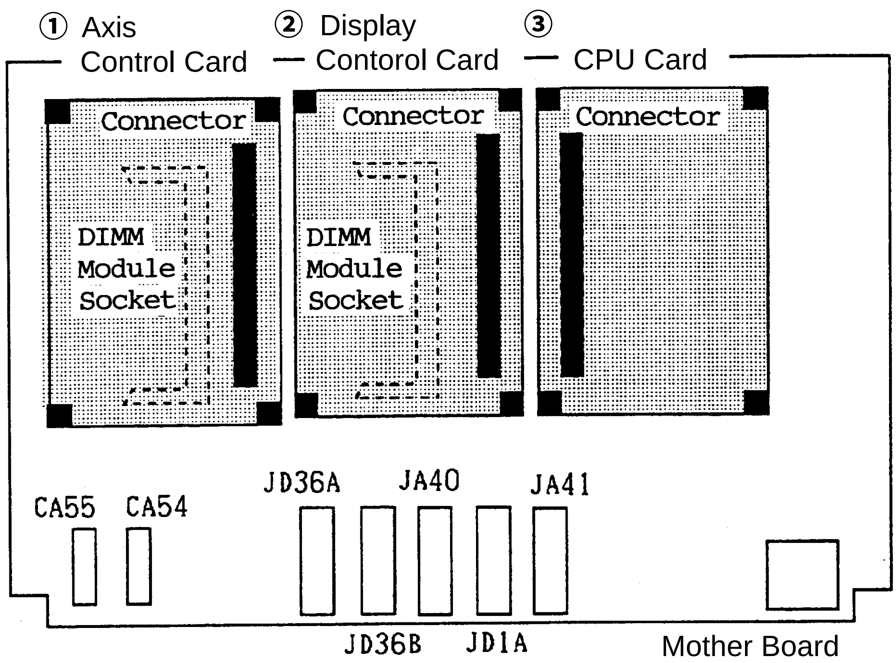
Connector No.	Application
COP10A	Servo motor (FSSB)
CA55	MDI (CNC keyboard)
CA54	Servo check
JD36A	RS-232C serial port 1
JD36B	RS-232C serial port 2
JA40	Analog output/high-speed DI
JD1A	I/O link
JA41	Serial spindle/position coder
CP1B	24 V DC-OUT
CP1A	24 V DC-IN
JNA	F-BUS interface
CN8B	Video signal interface
MCRD1	PCMCIA (memory card) interface

2.1.3 Connector Mounting Positions





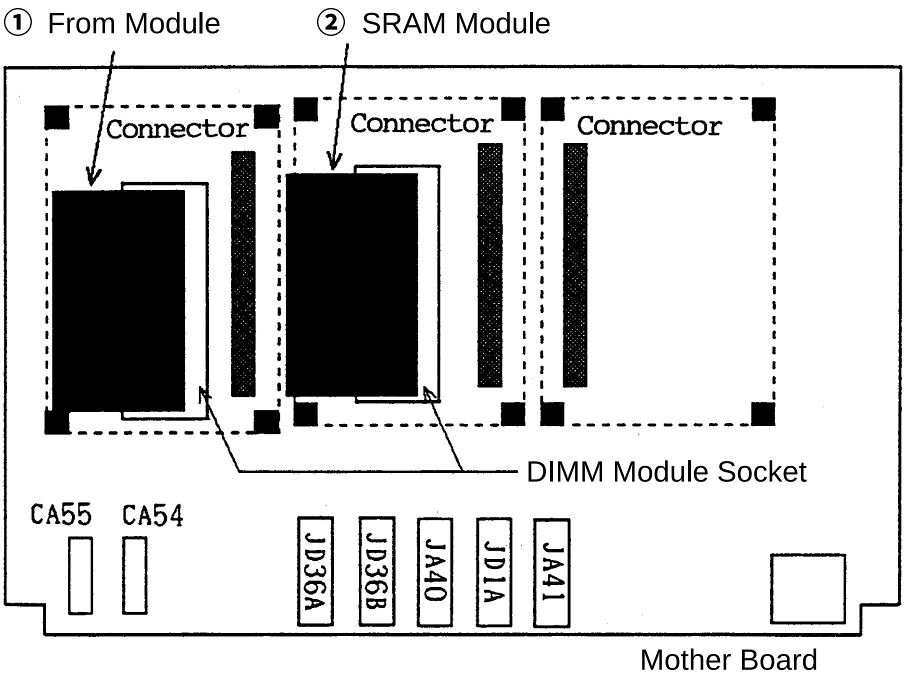
2.1.4 Card Mounting Positions



No	Name	Specification	Function	Remark
①	Axis control card	A17B-3300-0100	Axis control	8 axes (Allowed only for Σ 16)
		A17B-3300-0101		6 axes (Allowed only for Σ 16/18)
		A20B-3300-0030		4 axes
		A20B-3300-0031		2 axes
②	Display control card	A20B-3300-0020	Text display/ graphic display	10.4-inch color
		A20B-3300-0023		9.5-inch monochrome
③	CPU card	A20B-3300-0050	CNC control	Pentium (Σ 16/18)
		A20B-3300-0070		486DX2 (Σ 21)

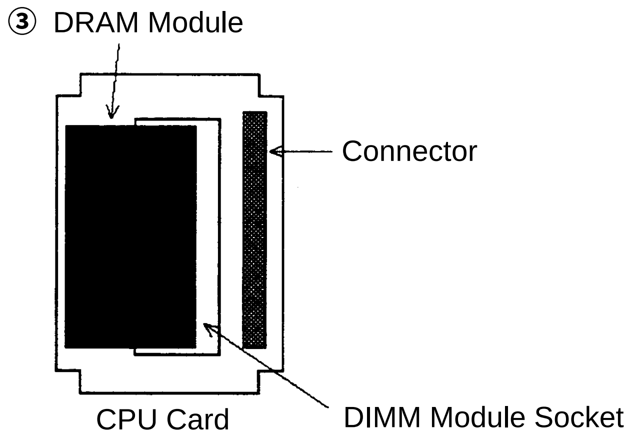
2.1.5 DIMM Module Mounting Positions

(1) FROM/SRAM module



No	Name	Specification	Function	Remark
①	FROM module	A20B-3900-0010	CNC system, Servo system, PMC ladder	16 M (Allowed only for Σ 16/18)
		A20B-3900-0011		12 M (Allowed only for Σ 16/18)
		A20B-3900-0012		8 M
②	SRAM module	A20B-3900-0020	System SRAM graphic display	3 M (Allowed only for Σ 16/18)
		A20B-3900-0060		2 M (Allowed only for Σ 16/18)
		A20B-3900-0061		1 M (Allowed only for Σ 16/18)
		A20B-3900-0052		512 K

(2) DRAM module



Side B

No	Name	Specification	Function	Remark
①	DRAM module	A20B-3900-0040	CNC System RAM	12 M (Allowed only for Σ 16/18)
		A20B-3900-0041		8 M

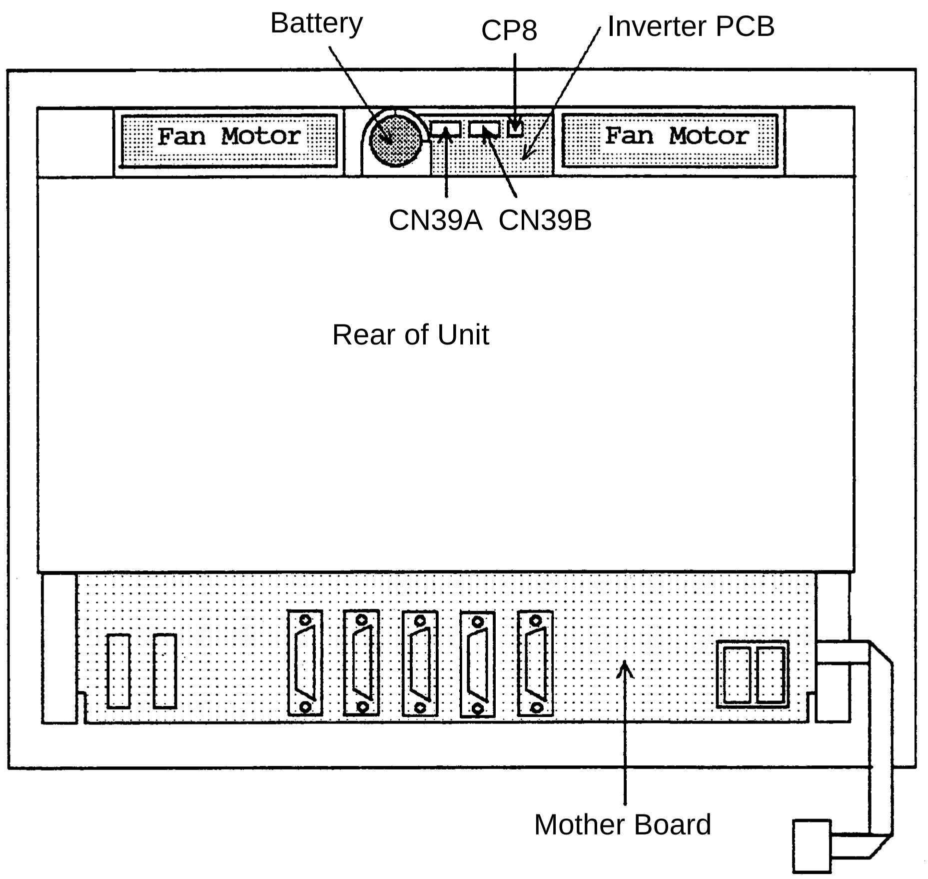
2.2 Inverter PCBs

2.2.1 Specifications

Name		Specification
Inverters	10.4" color (For 0 or 2 slots)	A20B-2002-0500
	10.4" color (For 4 slots)	A20B-8100-0200
	9.5" monochrome (For 0 or 2 slots)	A20B-2002-0480
	9.5" monochrome (For 4 slots)	A20B-2002-0550

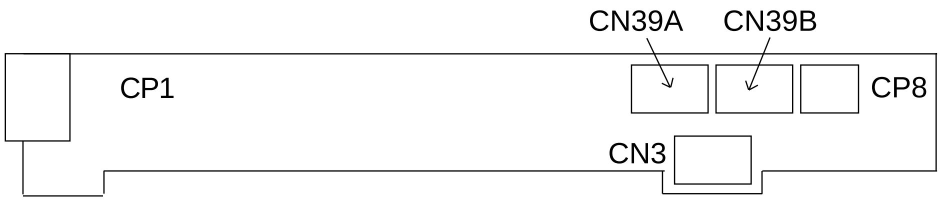
2.2.2 Connector Mounting Positions

(1) Overall

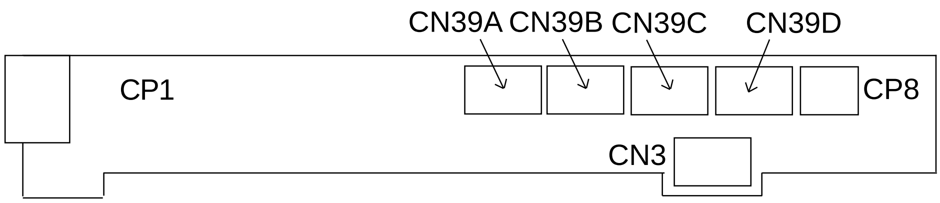


(2) PCB alone

① With no slots or 2 slots



② With 4 slots



Connector No.	Application
CN39A	Fan power
CN39B	
CN39C	
CN39D	
CP8	Battery
CP1	LCD backlight power
CN3	Inverter PCB power

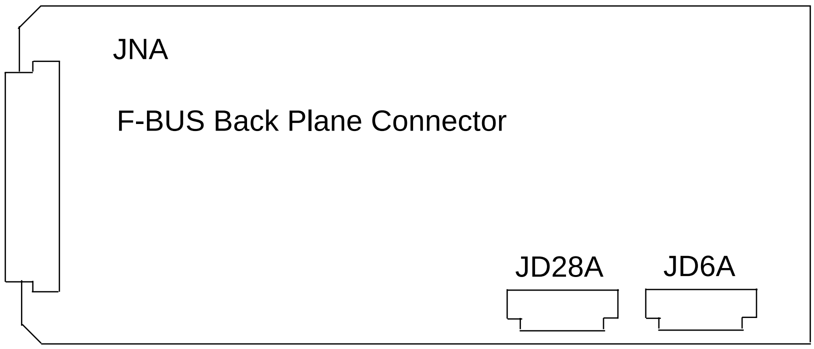
2.3 Serial Communication Board (Remote Buffer)/C Language Board

2.3.1 Specifications

Name	Specification	Remark
Serial communication board A (Remote buffer)	A20B-8100-0152	
C language board	A20B-8100-0151	Allowed only for Σ 16/18

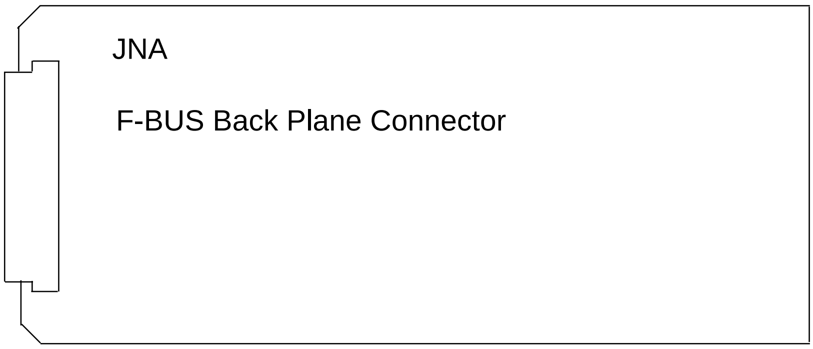
2.3.2 Connector Mounting Positions

(1) Serial communication board A (Remote buffer)



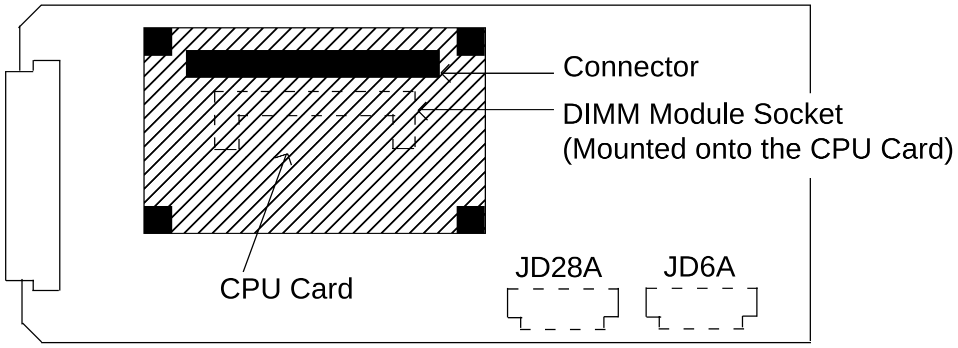
Connector No.	Application
JD28A	RS-232C serial port
JD6A	RS-422 serial port

(2) C language board



(Note) *The C language board has no connectors to link to the outside.*

2.3.3 Card Mounting Position



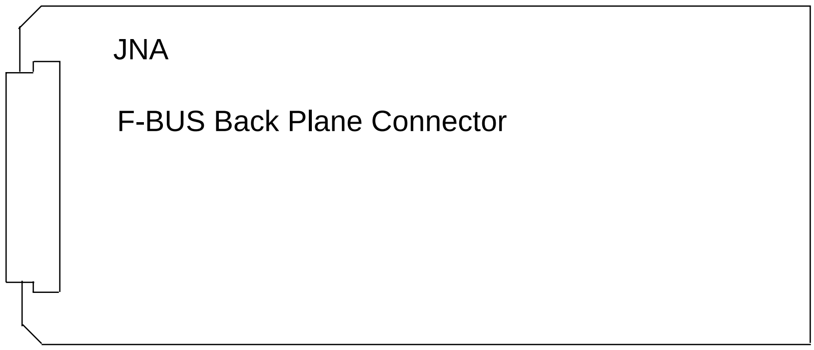
Name	Specification	Function	Remark
CPU Card	A20B-3300-0070	Serial communication function, PMC C language function	486DX2

2.4 RISC Board

2.4.1 Specifications

Name	Specification	Remark
RISC board	A20B-8100-0170	Allowed only for Σ 16M allowed

2.4.2 Connector Mounting Positions



(Note) *The RISC board has no connectors to link to the outside.*

2.4.3 Card Mounting Position

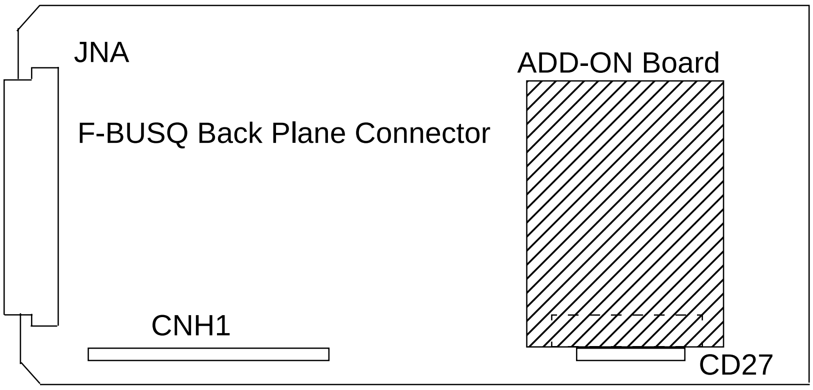
(Note) *No cards are mounted onto the RISC board.*

2.5 Data Server Board

2.5.1 Specifications

Name	Specification	Remark
Data server board	A20B-8100-0160	Allowed only for Σ 16/18

2.5.2 Connector Mounting Positions



* CD27 is mounted above the ADD-ON board.

Connector No.	Application
CNH1	IDE hard disk interface
CD27	AUI interface

2.5.3 Card Mounting Position

(Note) *No cards are mounted onto the data server board.*

2.6 List of Units and PCBs

2.6.1 Basic Units

Model	Unit Name		Drawing No.	Remark
Σ16	Basic unit A4, 10.4" color	No slots	A02B-0236-C511	Soft keys (10 + 2)
	Basic unit A5, 10.4" color	2 slots	A02B-0236-C512	Soft keys (10 + 2)
	Basic unit A6, 10.4" color	4 slots	A02B-0236-C513	Soft keys (10 + 2)
	Basic unit A32, 10.4" color	3 slots	A02B-0236-C518	Soft keys (10 + 2)
	Basic unit A13, 9.5" monochrome	No slots	A02B-0236-C541	Soft keys (10 + 2)
	Basic unit A14, 9.5" monochrome	2 slots	A02B-0236-C542	Soft keys (10 + 2)
	Basic unit A15, 9.5" monochrome	4 slots	A02B-0236-C543	Soft keys (10 + 2)
	Basic unit A35, 9.5" monochrome	3 slots	A02B-0236-C548	Soft keys (10 + 2)
Σ18	Basic unit A4, 10.4" color	No slots	A02B-0238-C511	Soft keys (10 + 2)
	Basic unit A5, 10.4" color	2 slots	A02B-0238-C512	Soft keys (10 + 2)
	Basic unit A6, 10.4" color	4 slots	A02B-0238-C513	Soft keys (10 + 2)
	Basic unit A32, 10.4" color	3 slots	A02B-0238-C518	Soft keys (10 + 2)
	Basic unit A13, 9.5" monochrome	No slots	A02B-0238-C541	Soft keys (10 + 2)
	Basic unit A14, 9.5" monochrome	2 slots	A02B-0238-C542	Soft keys (10 + 2)
	Basic unit A15, 9.5" monochrome	4 slots	A02B-0238-C543	Soft keys (10 + 2)
	Basic unit A35, 9.5" monochrome	3 slots	A02B-0238-C548	Soft keys (10 + 2)
Σ21	Basic unit A13, 10.4" color	No slots	A02B-0247-C515	Soft keys (10 + 2) RA5
	Basic unit A14, 10.4" color	2 slots	A02B-0247-C516	Soft keys (10 + 2) RA5
	Basic unit A17, 9.5" monochrome	No slots	A02B-0247-C545	Soft keys (10 + 2) RA5
	Basic unit A18, 9.5" monochrome	2 slots	A02B-0247-C546	Soft keys (10 + 2) RA5

2.6.2 Controller PCBs

Type	Name		Drawing No.	ID	Remark
Master PCB	Mother board	Σ 16	A20B-8100-0130	1xD5	
		Σ 18	A20B-8100-0135	1xC5	
		Σ 21	A20B-8100-0136	1xD7	PMC-RA5
Card PCBs	CPU card (For mother board)	Σ 16/18	A20B-3300-0050	01	Pentium
		Σ 21	A20B-3300-0070	09	486DX2
	CPU card (For communication/C language board)		A20B-3300-0070	09	486DX2
	Display control card	A	A20B-3300-0020	0E	10.4" color
		C	A20B-3300-0023	06	9.5" monochrome
	Axis control card	Σ 16	A17B-3300-0100	x3	8 axes
		Σ 18	A17B-3300-0101	x2	6 axes
		Σ 21	A20B-3300-0030	x1	4 axes
			A20B-3300-0031	x0	2 axes
DIMM module	DRAM module	Σ 16/18	A20B-3900-0040	87	12 M
		Σ 21	A20B-3900-0041	86	8 M
	SRAM module	Σ 16/18	A20B-3900-0020	05	3 m
			A20B-3900-0060	04	2 M
			A20B-3900-0061	03	1 M
		Σ 21	A20B-3900-0052	02	512 K
	FROM module	Σ16/18	A20B-3900-0010	47	16 M
			A20B-3900-0011	45	12 M
		Σ 21	A20B-3900-0012	43	8 M
Option PCBs	C language board	Σ 16/18	A20B-8100-0151	OxCD	
	Serial communication board A		A20B-8100-0152	2xCD	Remote buffer
	RISC board	Σ 16M	A20B-8100-0170	0xCF	
	Data server board	Σ 16/18	A20B-8100-0160	1xA3	
Back Panel	Back panel	Σ16/18	A20B-2100-0230	-	4 slots
			A20B-2100-	-	3 slots
		Σ 21	A20B-2100-0220	-	2 slots
Others	Inverters	For no or 2 slots	A20B-2002-0500	-	10.4" color
			A20B-2002-0480	-	9.5" monochrome
		For 4 slots	A20B-8100-0200	-	10.4" color
			A20B-2002-0550	-	9.5" monochrome

(Note) *x: PCB version number*

3. TROUBLESHOOTING

When a trouble occurred, check “what you were operating when it occurred,” “what it is like,” and “how often it happens.”

3.1 Tracking through the ALARM Screen

When an alarm occurs during operation, an alarm message is displayed at the top of the screen. Depending on the alarm, its details are displayed in the Diagnosis screen. If this is the case, operate as follows to confirm what is displayed in the Diagnosis screen.

[Diagnosis Screen Display Operation]

With the NC Overall screen displayed, operate as follows to display the Diagnosis screen.

[◁] (OPER./MAINTE) → [F4/SYSTEM] → [3] [0] (F MENU) [INPUT] →
[2] (F_SYSTEM) [INPUT] → [F7 DGNOS]

Enter the diagnosis number you want to refer to and press

[F6/NO. SRH]. The data for that diagnosis number is displayed.

(It is also possible to change with the page key.)

(Note 1) *When [F SYSTEM] is selected in the above-mentioned operation sequence, but [DIAGNOSE] is not displayed at F7, press [▷] (RETURN) several times.*

(Note 2) *To return from the Diagnosis screen, press [ALTER], not [▷] (RETURN).*

4. POWER-ON ADJUSTMENT

4.1 Power-on Procedure

① Enter (set) the PMC ladder and others.

② Enter (set) the CNC parameters.

③ Turn off the power and turn it on again.

(Note) *When system software has not been entered into the CNC internal memory, transfer it into the CNC internal memory according to the instructions in [APPENDIX] BOOT SYSTEM, and then, go through the above-mentioned steps.*

4.2 System Table

This CNC unit sets allocations of the data areas such as machining programs, tool offset amounts, and so on through the "system table."

To display the System Table screen, operate in the following order in the Overall screen.

[◁] (OPER./MEINTE) → [F4/SYSTEM] → [2] [5] (SYSTEM TABLE) → [INPUT]

SYSTEM TABLE

BASIC RAM SIZE [38E40]   EXT. RAM SIZE [0]

No.	TABLE	SIZE	OFFSET	No.	TABLE	SIZE	OFFSET
01	SYSTEM	10000	0	11		0	0
02	TOOL	5000	0	12		0	0
03	SPARE	3900	0	13		0	0
04	MONI	6F00	0	14		0	0
05	PRGRM	13000	0	15	DUMMY	6600	32800
06		0	0	16		0	0
07		0	0	17		0	0
08		0	0	18		0	0
09		0	0	19		0	0
10		0	0	20		0	0

When initially starting up the system, press [F5/SYSTEM CLR] to initialize the system. When this is done, the basic RAM capacity and extended RAM capacity are automatically set.

Pressing [F3/TABLE] brings the cursor into the table. According to Table Names versus Capacities provided on the next page, set the table names and capacities, using the cursor and alphanumerals plus the [INPUT] key.

(Note 1) *The numbers 01 through 15 are the tables for the basic RAM, 16 through 20 are those for the extended RAM. When the extended RAM capacity is 0 (zero), do not set to the numbers 16 through 20.*

(Note 2) *Set the capacity in an increment of 100, suffixing a number with "H" (indicates hexadecimal).*

(Note 3) *If the capacity is entered, the offset for the next table will be automatically set. Unlike the S-III, the last table capacity is not adjusted. Set a dummy table before the last table capacity so that it will be the prescribed capacity.*

(Note 4) *The table number has a fixed table name of "SYSTEM" and capacity of "10000H." For the other tables, you can set any table names in any places.*

(Note 5) *A standard set value varies from one model to anther. When actually setting it, follow the materials for each model.*

(Note 6) *When the system table is changed, be sure to turn off and on the power to make sure that "790 System Table Error" does not occur, and then, operate the system.*

<<Table Names versus Capacities>>

Function	Table	Spec.	Capacities			Remark
			Σ 16/18M	Σ 18L	Σ 21L	
System Data	SYSTEM		10000H			Table number fixed at 01
Tool offset	TOOL	32 pairs	600H	C00H		The 100 pairs in the Spec. column represents; M-system: 100 pairs, L-system: 99 pairs
		64 pairs	C00H	1400H		
		100 pairs	1400H	2800H		
		200 pairs	2800H	5000H		
		400 pairs	5000H			
		500 pairs	5E00H			
		1,000 pairs	BC00H			
Tool life management	SPARE	32 pairs	B00H	400H		The Spec. column represents the number of tool offset pairs.
		64 pairs	F00H			
		100 pairs	1300H			
		200 pairs	2000H			
		400 pairs	3900H			
		500 pairs				
		1,000 pairs				
Cutting monitoring	MONI	32 pairs	2800H	2000H		The Spec. column represents the number of tool offset pairs. (Not allowed for the Σ 21L)
		64 pairs	2E00H			
		100 pairs	3500H			
		200 pairs	4800H			
		400 pairs	6F00H			
		500 pairs				
		1,000 pairs				
Machining program	PRGRM	80 m	A000H			The maximum number of registerable programs is irrelevant.
		160 m	13000H			
		320 m	24000H			
		500 m	37000H			
		640 m	4A000H			
		1,000 m	6F000H			
		1,280 m	8B000H			
		2,000 m	D5000H			
		2,560 m	10E000H			
		4,000 m	1A1000H			
		5,120 m	200000H			
High-precision contour control	HPCC		10000H			Allowed only for the Σ 16M

4.3 SLBUS Table

In order to allocate the addresses for the input signals (X contact) and output signal (Y contact) on the part of the machine, itis necessary to set ths SLBUS table.

To display the SLBUS TABLE screen, operate as follows in the OVERALL screen.

[◁] (OPRE/MAINTE) → [F4/SYSTEM] → [2][4](SLBUS) → [INPUT]

SLBUS TABLE

No.	Loc#	Type	Slave	Division	Lead Ch.	Chanels	High Speed		Bytes		Address	
					Buffer	Size	IN	OUT	IN	OUT	IN	OUT
01	00	0			00	00	00	00	00	00	F0	F0
02	00	0			01	01	02	00	00	10	00	00
03	00	0			00	00	00	00	00	00	00	00
04	00	0			00	00	00	00	00	00	00	00
05	00	0			00	00	00	00	00	00	00	00
06	00	0			00	00	00	00	00	00	00	00
07	00	0			00	00	00	00	00	00	00	00
08	00	0			00	00	00	00	00	00	00	00
09	00	0			00	00	00	00	00	00	00	00
10	00	0			00	00	00	00	00	00	00	00
11	00	0			00	00	00	00	00	00	00	00
12	00	0			00	00	00	00	00	00	00	00
13	00	0			00	00	00	00	00	00	00	00
14	00	0			00	00	00	00	00	00	00	00
15	00	0			00	00	00	00	00	00	00	00
16	00	0			00	00	00	00	00	00	00	00

To alter the set value, press [F9/ALTER]. The message, “DO YOU WANT TO ALTER ? (Y/N),” is messaged. Press [Y]. Aframe cursor appears in the table, allowing you to alter the set value. Make setting according to the machine specifications.

When you start up the system for the first time, press [F8/CLEAR ALL] to initialize the data, and then, set each item.

After alteration is completed, press [F9/REFER] to end the setting mode.

5. DAILY MAINTENANCE AND INSPECTION

The S- Σ 16/18/21 has the CNC unit on the back of the CNC display. (Display integrated CNC unit)

5.1 Replacing the Batteries

5.1.1 CNC Memory Backup Batteries

The CNC unit has batteries to hold the memory where the programs, offset amounts, parameters, and so on are stored. If a battery voltage drops, a warning, “794 BATTERY ALARM,” is displayed on the screen. If this is displayed, replace the batteries as soon as possible. Try not to turn off the CNC unit as much as possible until the battery is replaced.

(1) CNC memory backup battery replacement procedure

Prepare lithium batteries (A02B-0200-K102) in advance.

> [WARNING]
>
> Unless the batteries are correctly replaced, there may be an explosion. Use only the specified batteries (A02B-0200-K102).

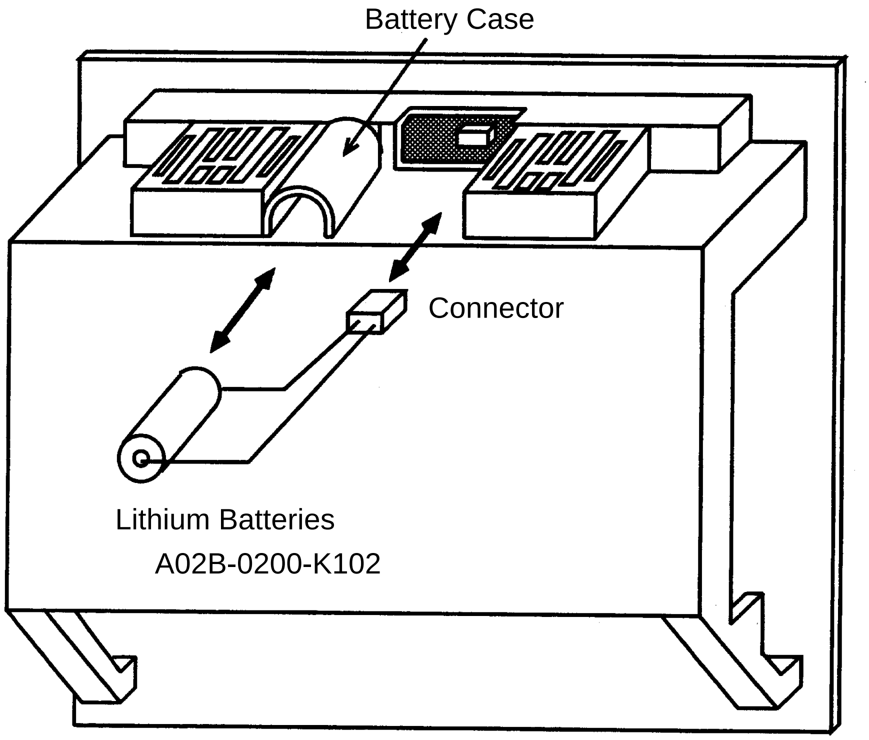
① Turn on the power for the machine (CNC) for about 30 seconds, and then, turn it off.

② Remove the batteries from the upper section of the CNC unit. Disconnect a connector and remove the batteries from a battery case.

③ Replace the batteries and reconnect the connector.

(Note) *The battery case is located;*

- At the upper middle of the unit as shown in the figure below, if the option slots are provided.
- At the upper right end of the unit, if the option slots are not provided.



[CAUTION]

The above-mentioned steps ① through ③ should be carried out within 30 minutes. Note that if the unit is left without the batteries for a long time, the memory contents will be lost.

If the batteries may not be replaced within 30 minutes, save the contents of the SRAM memory collectively in the memory card. This way, the memory contents can be easily recovered, if they are lost by any chance.

For an operating method, see "APPENDIX: BOOT SYSTEM."

5.1.2 Replacing the Absolute Encoder Batteries

[WARNING]

Turn on the power for the machine (CNC), press the EMERGENCY STOP button, and replace the batteries. As this work is carried out with the power turned on and the cabinet opened, only the qualified personnel trained for maintenance and safety is allowed for this work. When opening the cabinet to replace the batteries, do not touch a high-voltage circuit. If the cover is not in place and you touch inside, you will get an electric shock.

When the machine is provided with an absolute encoder such as an absolute pulse coder or absolute linear scale, absolute encoder batteries have been also installed in addition to the memory backup batteries.

When an APC alarm F307 or F308 occurs, replace the battery as soon as possible. Unless it is replaced, an absolute position will be lost and you will have to manually perform reference point return again.

(1) Absolute encoder battery replacement procedure (α series servo amplifier module)

① Turn on the power for the machine (CNC).

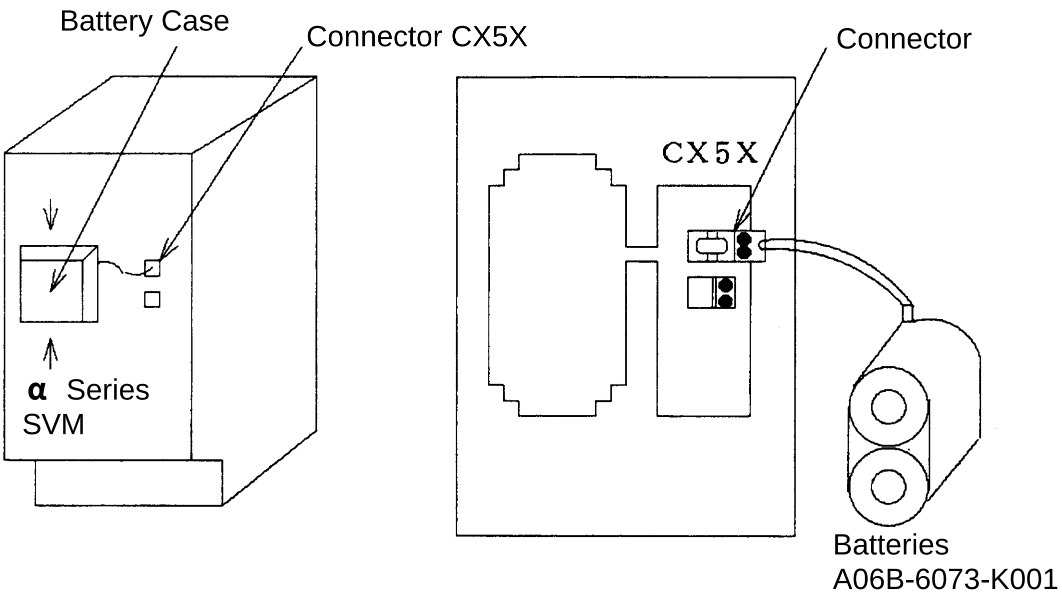
② Detach the front battery case of the CCC series servo amplifier module (SVM). Hold the top and bottom of the case and pull it to this side.

③ Detach a connector from the batteries.

④ Replace the batteries and reconnect the connector.

⑤ Reattach the battery case.

⑥ Turn off the power for the machine (CNC).



(2) Absolute encoder battery replacement procedure (Standalone pulse coder)

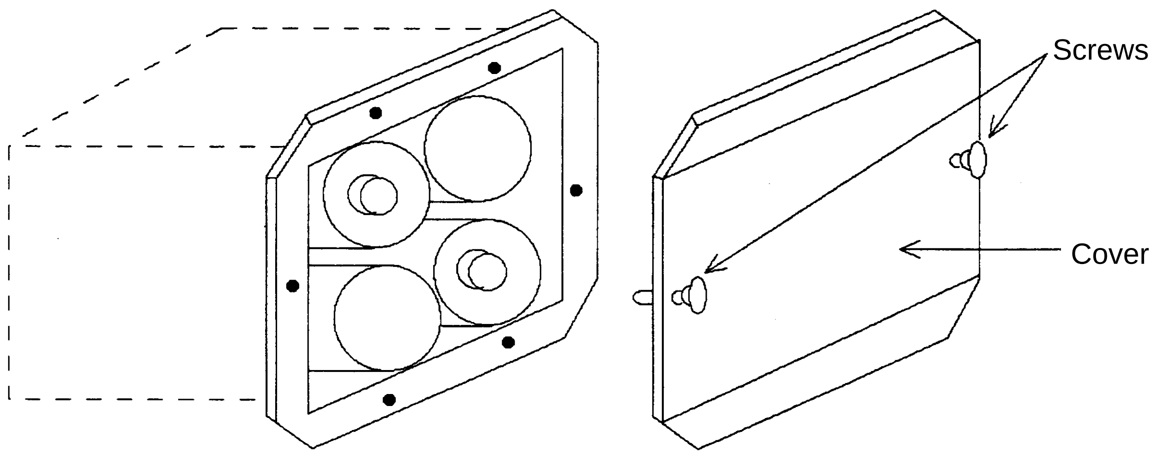
① Turn on the power for the machine (CNC).

② Loosen the screws of the battery case and detach the cover.

③ Replace the batteries in the case. Put two each of them in the reverse direction.

④ After replacement is completed, put back the cover.

⑤ Turn off the power for the machine (CNC).



[CAUTION]

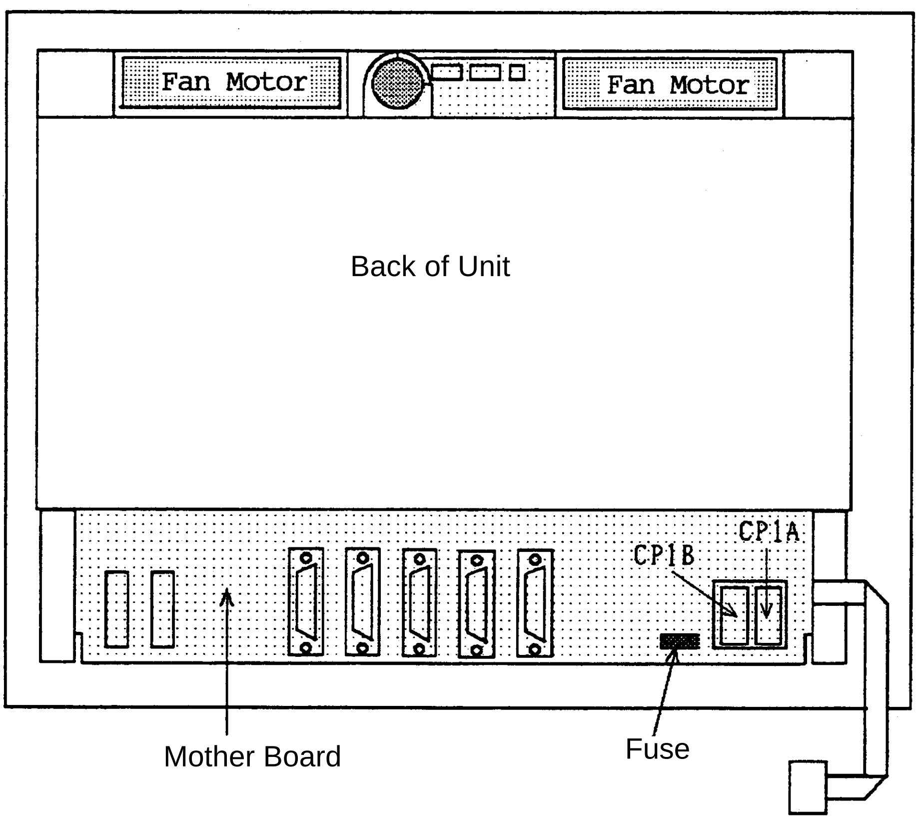
Replace the batteries with the CNC power turned on. Note that if they are replaced with the power turned off, an absolute position in the memory will be lost.

5.2 Replacing the Fuse for the Control Unit

[WARNING]

Prior to replacing the fuse, eliminate a cause for its blowing. Therefore, only the qualified personnel fully trained for maintenance and safety is allowed for this work. When you open the cabinet to replace the fuse, be careful not to touch a high-voltage circuit. If the cover is not in place and you touch inside, you will get an electric shock.

5.2.1 Fuse Mounting Position



5.2.2 Arrangement Specifications of Fuse

Basic Unit	Arrangement Spec.	Rating	Individual Spec.
Σ 16/18/21	A02B-0236-K100	5A	A60L-0001-0290#LM50

5.3 Replacing the Fan Motor

> [WARNING]
>
> When you open the cabinet to replace the fuse, be careful not to touch a high-voltage circuit. If the cover is not in place and you touch inside, you will get an electric shock.

5.3.1 Arrangement Specifications of Fan

	Arrangement Spec.	Required Q'ty
For the unit with no option slots	A90L-0001-0441	2 pieces
For the unit with 2 option slots	A90L-0001-0423#105	2 pieces
For the unit with 4 option slots	A90L-0001-0423#105	4 pieces

5.3.2 Replacing the Fan Motor

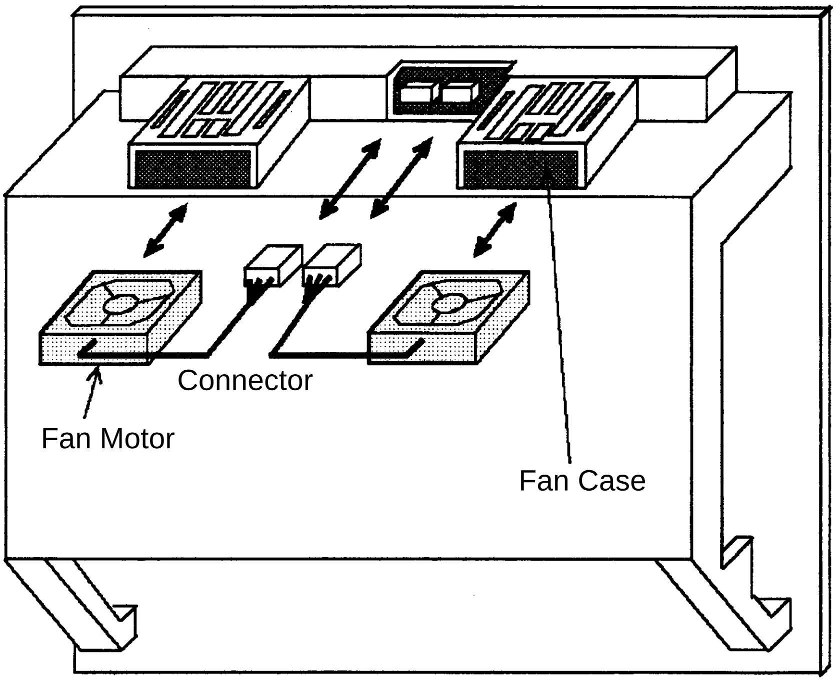
(1) When the unit is provided with no or two option slots

① When replacing the fan motor, be sure to turn off the power for the machine (CNC).

② Disconnect a connector from the fan motor you want to replace. The connector is latched. Holding down the latch at the lower part of the connector with a regular screwdriver, etc., pull it out.

③ Unlatch the fan motor and take it out.

④ Insert a new fan motor into a fan case and reconnect the connefctor.



(Note) *Pay attention to the fan motor's direction so that the air flows from the bottom to the top. (A label should face upward)*

(2) When the unit is provided with four option slots

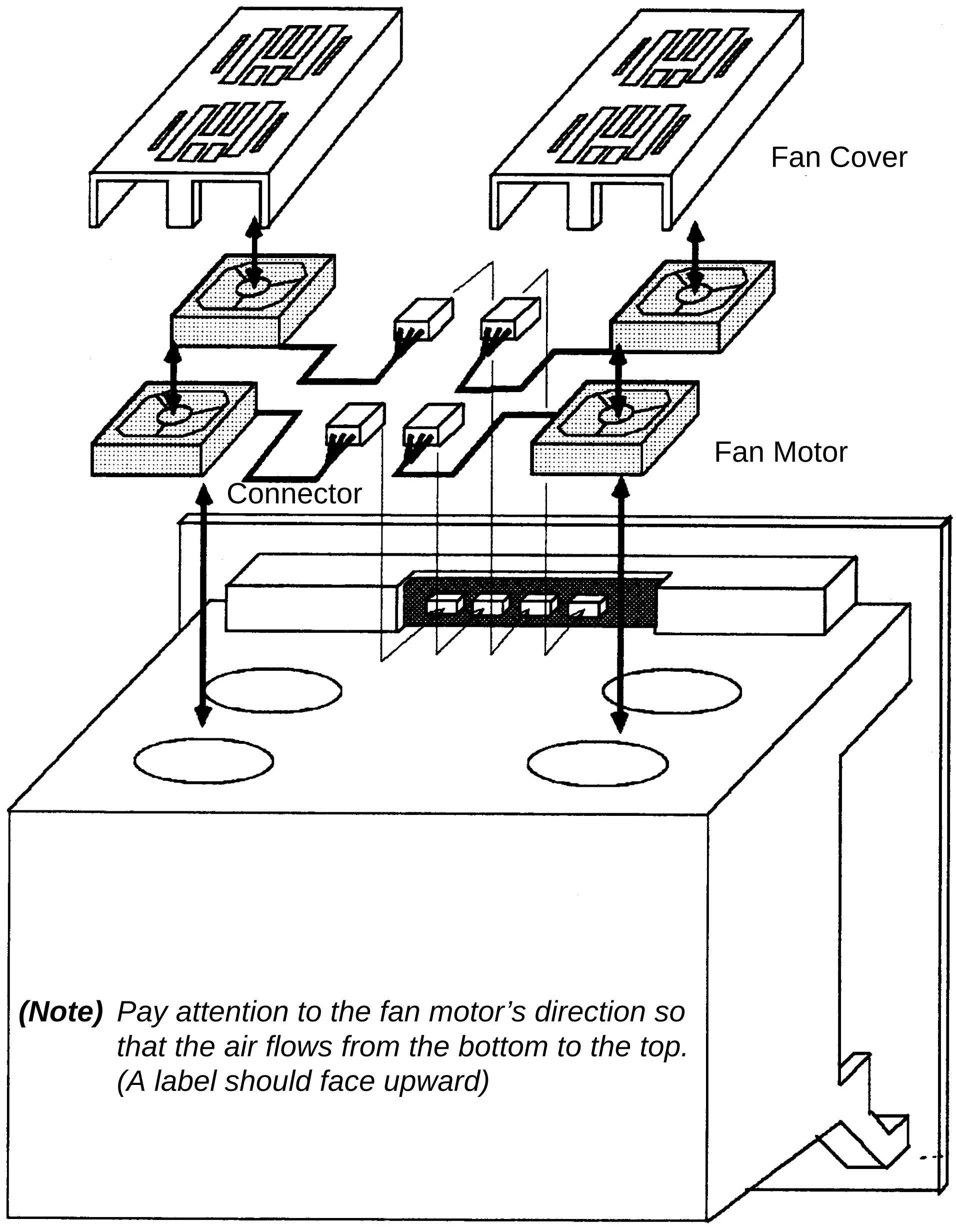
① When replacing the fan motor, be sure to turn off the power for the machine (CNC).

② Disconnect a connector from the fan motor you want to replace. The connector is latched. Holding down the latch at the lower part of the connector with a regular screwdriver, etc., pull it out.

③ Unlatch the fan cover and take it out.

④ The fan motor is fixed to the fan cover. Unlatch and take out the fan motor.

⑤ Attach a new fan motor to the fan cover. Then, reattach the fan cover to the unit and reconnect the connector.



5.4 Adjusting the Contrast of the Monochrome Display

When using the monochrome display, its contrast can be adjusted in the following manneIn the OVERALL screen, operate the keys in the following sequence:

[OPRE/MAINTE] → [F4/SYSTEM] → [3] [0] (F MENU) [INPUT] → (F SETTING) [INPUT]

The SETTING(HANDY) screen will appear at the lower right of the screen.

(Note) When other SETTING screen than HANDY is being displayed, use the page keys to dplay this screen.

Move the cursor to the CONTRAST item.

Press [F10/(OPRE)], followed by [F7/ON] or [F8/OFF] to adjust the contrast.S

```
SETTING(HANDY)

PARAMETER WRITE = 0  (0 :  DISABLE     1:  ENABLE)

          ~

contrast  (+ = [ON:1]  -= [OFF:0])

[       ]  [       ]  [       ]  [       ]  [ (OPRT) ]
```

↓

```
[       ]  [ ON:1  ]  [ OFF:0 ]  [       ]  [        ]
```

After adjustment, press [ALTER]. You will be returned to the F-MENU screen. In the seen, press [RETURN] to return to the OVERALL screen.

I-III RS-232C INTERFACE SPECIFICATION

1. CONNECTION INTERFACE

(1) For the Σ 10: Connectors (JD5A, JD5B) on the main CPU board

For the Σ 16/18: Connectors (JD36A, JD36B) on the motor board

[Connector type: PCR-EV20MDT]

(2) Junction Connector on Operator Panel

1	2	3	4	5	6	7	8	9	10
RD	0V	DR	0V	CS	0V	CD	0V		+24V
11	12	13	14	15	16	17	18	19	20
SD	0V	ER	0V	RS	0V		+24V		

[Connector type: DBM-25S]

1	2	3	4	5	6	7	8	9	10	11	12	13
FG	SD	RD	RS	CS	DR	SG	CD					

14	15	16	17	18	19	20	21	22	23	24	25
						ER					+24

2. DESCRIPTION OF SIGNALS

Signal	I/O	Description
FG		Frame Ground
SD	Output	Send Data
RD	Input	Receive Data
RS	Output	Request to Send When a control code is used: Turned to ON when transmission/reception is initiated, and turned to OFF when it is terminated When a control code is not used: Turned to ON when transmission/ reception is initiated. When this signal is turned to OFF, stop sending the data within 10 characters because a buffer is full.
CS	Input	Clear to Send. When this signal is turned to ON, the data is send out, regarding the other mating device ready to receive. When turned to OFF, data-sending stops within 2 characters.
DR	Input	Data Set Ready. When this signal is turned to ON, the other mating device is regarded ready to operate.
SG		Signal Ground
CD	Input	Data Carrier Detect. When this signal is turned to ON, the other mating device is regarded ready to operate.
ER	Output	Data Terminal Ready. When this signal is turned to ON, it means that the NC unit is ready to operate. It is normally left turned to ON since power-on.

3. TRANSMISSION METHOD

The RS-232C interface generally allows two kinds of transmission methods; synchronous and start-stop. This system uses a start-stop method. In the start-stop method, start bits precedes information bits, followed by parity and stop bits.

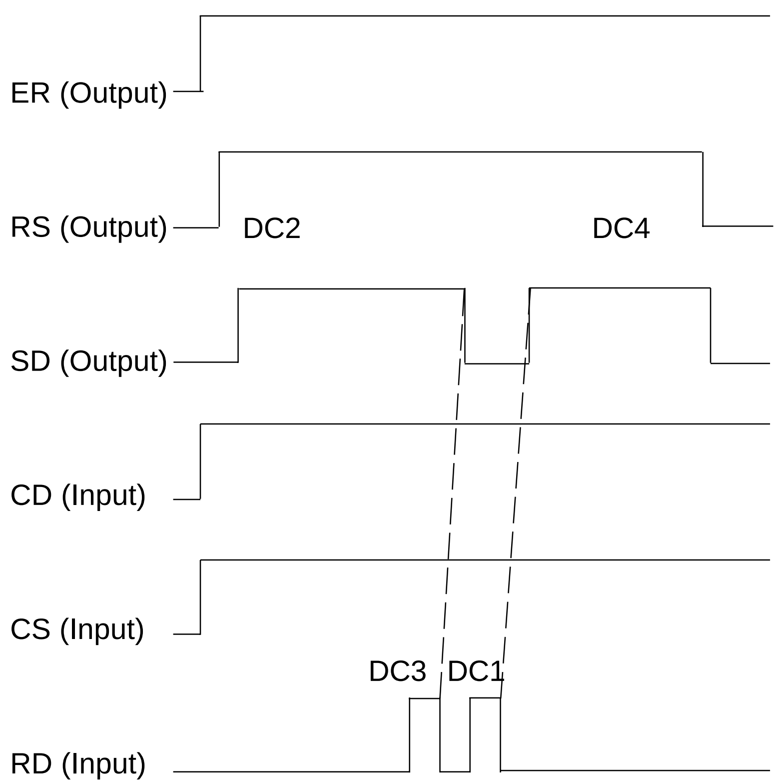
4. CONTROL CODES

Control codes can be used when transmitting/receiving from an external device. Use them normally by the following setting.

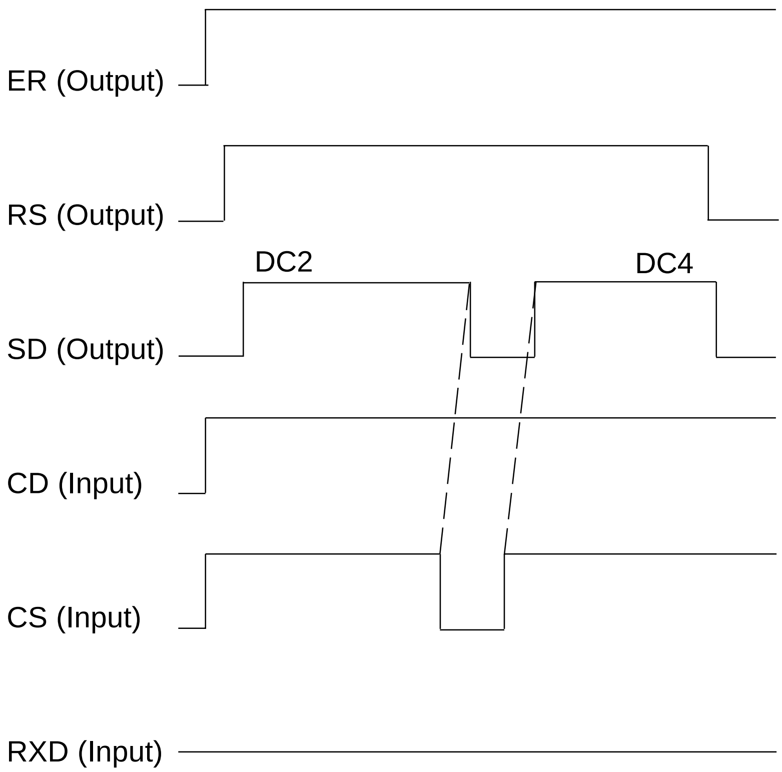
Code	Description	Bit Pattern								Hex.	Parameter
DC1	Request to Send	0	0	0	1	0	0	0	1	11	PRM0112
DC2	Start to Send	0	0	0	1	0	0	1	0	12	PRM0113
DC3	Request to Stop Send	1	0	0	1	0	0	1	1	93	PRM0114
DC4	End to Send	0	0	0	1	0	1	0	0	14	PRM0115

5. TRANSMISSION

① When the control code is used

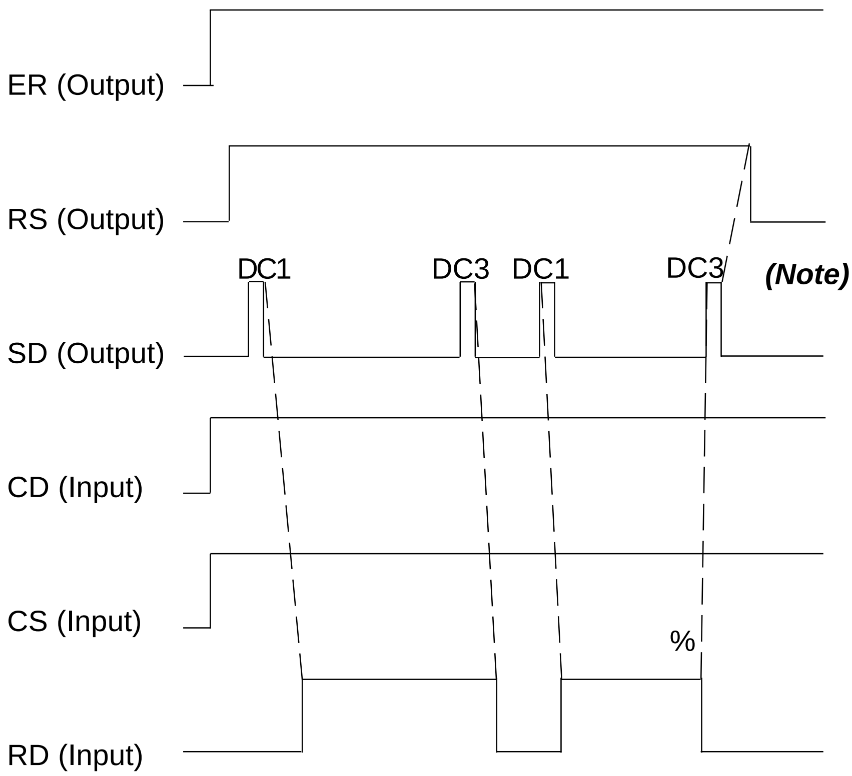


② When the control code is not used



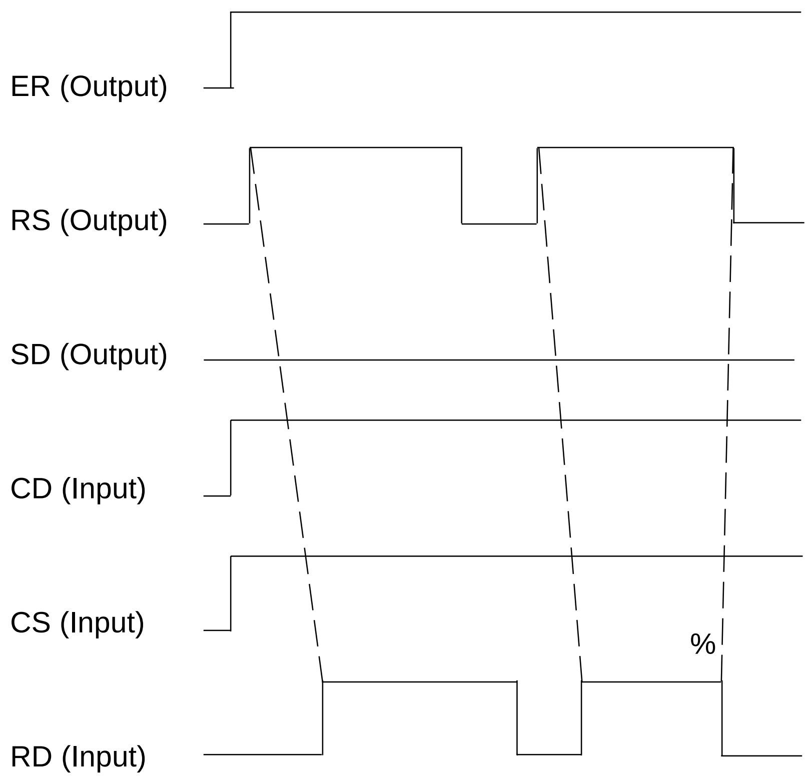
6. RECEPTION

① When the control code is used



(Note) *The DC3 code is not sent out according to setting.*

② When the control code is not used



7. INPUT/OUTPUT PORTS

This system uses the RS-232C as a standard interface and has one port ready for it. There are device numbers ranging from 1 to 6. It is necessary to specify the port numbers in setting specification for the device numbers.

Parameter No.	Description
PRM0132	NC data input device number
PRM0133	NC data output device number
PRM0135	Custom macro external output device number

Device No. 1: RS-232C (Port number is PRM0124)

Device No. 2: Tape reader (Port number is PRM0125)

Device No. 3: Tape puncher (Port number is PRM0126)

Device No. 4: Card (Port number is PRM0127)

Device No. 5: Auxiliary-1 (Port number in PRM0128)

Device No. 6: Auxiliary-2 (Port number in PRM0129)

8. SETTING THE SPECIFICATION FOR THE DEVICE NUMBERS

Set the specification for the device numbers used. You can set the following for each device number.

1. Parity bits
2. Data length

3. Whether the control code is used
4. Stop bits
5. Baud rate
6. Port number used

Their respective corresponding parameters are as follows]

Device No. 1 (RS-232C): PRM0104, 0116, 0124

Device No. 2 (Tape reader): PRM0105, 0117, 0125

Device No. 3 (Tape puncher): PRM0106, 0118, 0126

Device No. 4 (Card): PRM0107, 0119, 0127

Device No. 5 (Auxiliary-1): PRM0108, 0120, 0128

Device No. 6 (Auxiliary-2): PRM0109, 0121, 0129

PRM0104

7	6	5	4	3	2	1	0
			EVP	PRTY	DLN	RSB	STP

Setting of Device No. 1

EVP	PRTY	Parity Bit
0	0	None
0	1	Even number
1	0	None
1	1	Odd number

DLN	Data Length
0	8 bits
1	7 bits

RSB	Control Code
0	Used
1	Unused

STP	Stop Bits
0	2 bits
1	1 bit

Likewise, PRM0105 through PRM0109 are used to set the data for the device no. 2 through no. 6.

PRM 0116

Baud Rate

Set Value	Baud Rate
08	1200
11	2400
13	4800
15	9600
Others	4800

Likewise, PRM0117 through PRM0121 are used to set the baud rate for the device no. 2 through no. 6.

PRM0124 Port Number

1 ~ 2	RS232C1, 2
Others	RS232C1

Likewise, PRM0125 through PRM0129 are used to set the port number for the device no. 2 through no. 6.

(Note) *Two ports cannot be used simultaneously.*

9. OTHER SETTINGS

The following settings are common to all, regardless of the device number.

PRM0100

7	6	5	4	3	2	1	0
NOST	SPC	ICR2	ICR1	EIA	ISP	CTV	TVC

NOST	Outputs a request to stop send (control code DC3) upon completion of input
0	Yes
1	No

SPC	Adds a space code before each address
0	Yes
1	No

ICR2	ICR1	Format to punch EOB by ISO code
0	0	LF • CR • CR
0	1	LF • CR
1	0	LF
1	1	LF

EIA	ISP	Output Code Format
0	0	ISO
0	1	ASCII
1	0	EIA
1	1	EIA

Automatic distinction at input

CTV	Counts characters to make a TV check during control-out
0	Yes
1	No

Meaningless when TVC is 0

CTV	Makes a TV check
0	No
1	Yes

10. DATA FORMAT

% ; Significant Information %

- % — Data end code
- Significant Information — Program, parameter, etc.
- ; — Code distinction (used to distinguish a code at input)
- % — Data start code (skipped at input)

When punching multiple programs on one tape;

% ; One program ; One program • • • • • • • • • %

; — Means a seam when inputting/outputting multiple programs

11. FEED LENGTH

A feed can be inserted before or after the significant information (from % to %) or in between the NC programs when outputting multiple programs.

—— % ; Program ——— ; Program —— ; Program ————

Feed between Programs (Space Code)

Feed at Output (Null Code)

PRM0138	Feed Length at Tape Output
PRM0139	Program Interval at Tape Output

12. PARAMETER RELATED TO PROGRAM INPUT/OUTPUT

PRM3107

7	6	5	4	3	2	1	0
							NE89

NE89	Prohibits editing (input/output) of the programs O8000 through O9999
0	Yes
1	No

PRM3106

7	6	5	4	3	2	1	0
		NXTO	SM99	SM30	SM02	REP	RDL

NXTO	When the next O-number appears in registering a program
0	Prepares another file automaticlaly
1	Regards it as an end of the program

SM99	In registering a program, M99 is
0	Not regarded as an end of the program
1	Regarded as an end of the program

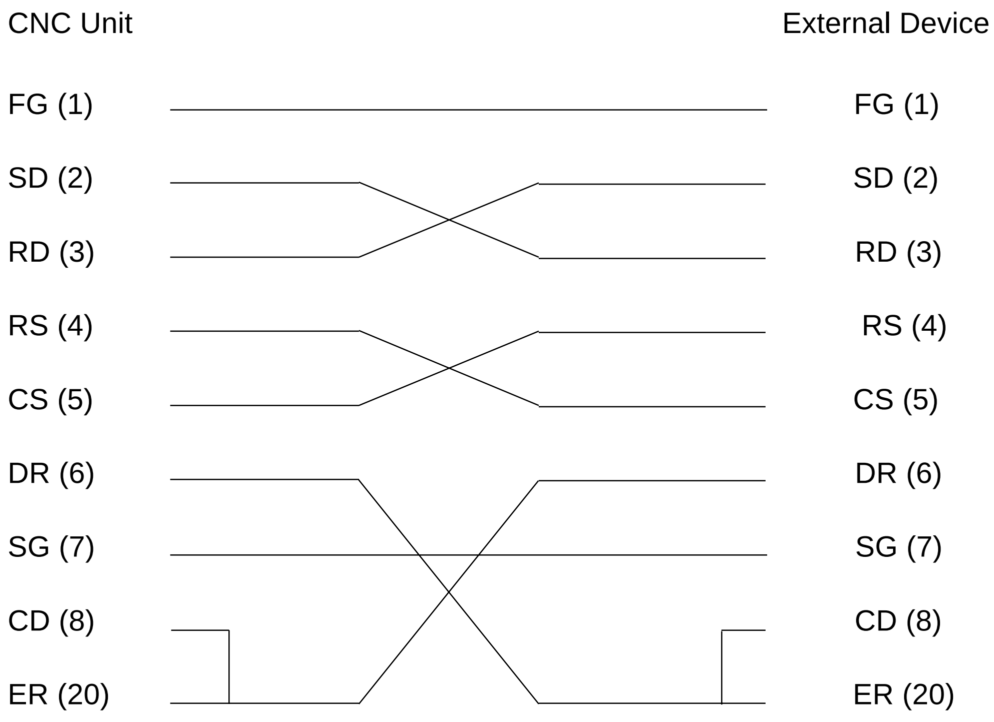
SM30	In registering a program, M30 is
0	Not regarded as an end of the program
1	Regarded as an end of the program

SM02	In registering a program, M02 is
0	Not regarded as an end of the program
1	Regarded as an end of the program

REP	When you tried to register a program whose O-number is the same as that of an already registered program
0	Results in an alarm
1	Registered after deleting the already registered one. When editing of the already registered program is prohibited, an alarm is issued without deleting it.

RDL	When registering all the programs at once in the foreground
0	Registered after the already registered programs
1	Registered after deleting the already registered programs. The programs whose editing is prohibited are not deleted.

13. CABLE CONNECTION



II. ALARM LIST

1. Alarms Related to Program and Operation (Alarm No. 100 to No. 799)
   (Alarm No. F000 to No. F299)
   (Alarm No. 5000 to No. 5999)

2. Alarms Related to Absolute Pulse Coder (APC) (Alarm No. F300 to No. F309)

3. Alarms Related to Serial Pulse Coder (SPC) (Alarm No. F350 to No. F351)

4. Alarms Related to Servo (Alarm No. F400 to No. F421)

5. Alarms Related to Overtravel (Alarm No. F500 to No. 511)

6. Alarms Related to Overheat (Alarm No. F700 to No. F702)

7. Alarms Related to Direct Tap (Alarm No. F740 to No. F742)

8. Alarms Related to Serial Spindle (Alarm No. F749 to No. F774)

9. System Alarms (Alarm No. 900 to No. 999)

1. Alarms Related to Program and Operation

100	(#△△△) G10 Command Error

[Description] A G10 command has an error.

A number indicating alarm details is displayed in parentheses.

#001: Short of a command
#002: Illegal command value
#003: There is an unnecessary command
#011: Parameter number error (N)
#012: Parameter axis number error (P)
#013: Parameter bit number error (Q) L50
#014: Parameter set value error (R)
#015: There is an unnecessary command
#016: A write disabled parameter has been specified
#061: P-command error
#062: R-command error L80
#063: Q-command error
#071: For the commands prior to Polygon mode, P or Q has not been commanded.
#072: For the commands during Polygon mode, only one of P ar has been commanded.
#073: P command value is outside the range. L110
#074: Q command value is outside the range.
#075: R command value is outside the range.
#076: R command exists in Phase Control Invalid (PRM7602, #5 (C0F) = 1).
#077: R command exists in Polygon by the servo motor.

[Remedy] Correct the program.

101	(△△△△) Zero Point Return Incomplete

[Description] You specified an axis which has not been returned to the zero point. Up to four alarmed axes are displayed in parentheses.

[Remedy] Return the axis to the zero point.

102	F-code Command Error

[Description] A F-code command has not been specified in cutting feed (G01, G02, G03, or G32) or F0 has been specified.

[Remedy] Correct the program.

103	(#△△△) Thread Cutting Command Error

[Description] A thread cutting command has an error.
A number indicating alarm details is displayed in parentheses.
#001: Three or more axes have been specified
#002: A start shift angle Q is beyond a specified range
(00 ≦ Q ≦ 3600)
[Remedy] Correct the program.

106	Plane Selection Command Error

[Description] A plane selection command (G17 to G19) has an error.
There are incorrect relations between the parameter no. 1023 (name of each axis) and parameter no. 1024 (which axis each axis assumes in the basic coordinate system). Or, you have specified a one of G17 to G19 commands which do not determine the plane.
【Example】 G17 X Y A ; (The A-axis is parallel with the X-axis)
[Remedy] Correct the parameter or program.
[Caution] The plane disappears at reset time and is recreated at start time. When starting from the reset state, therefore, this alarm may occur even if one of G17 to G19 commands has not been specified.

107	Offset Number Error

[Description] A specified tool offset number exceeds the maximum number of tool offset pairs.
[Remedy] Correct the program.

112	Tool Number Error

[Description] A specified tool number exceeds the maximum number of tool offset pairs.
[Remedy] Correct the program.

113	(#△△△) Polar Coordinate Interpolation Command Error

[Description] A polar coordinate interpolation command has an error.
A number indicating alarm details is displayed in parentheses.
#001: A G120/G121 command is not an independent block
#002: When G120/G121 was specified, it was not the tool diameter compensation cancel mode (G40)

#003: A work coordinate value of a linear axis was a minus value when G121 was specified, and G02/G03 was specified for the first move.

[Remedy] Correct the program.

114 (#△△△) Polar Coordinate Interpolation Mode Error

[Description] A wrong command was given in the polar coordinate interpolation mode.

A number indicating alarm details is displayed in parentheses.

#001: A disallowed G code has been specified.

#002: A T code has been specified (for the L-system only)

[Remedy] Correct the program.

115 Tool Diameter/Nose Radius Compensation Error

[Description] A G-code command other than G00/G01 was used to specify start-up or cancellation of tool diameter/nose radius compensation.

[Remedy] Correct the program.

117 (#△△△) Tool Diameter/Nose Radius Compensation Interference Error

[Description] There was an excessive depth of cut in tool diameter/nose radius compensation. (Interference error)

A number indicating alarm details is displayed in parentheses.

#001: Circular arc radius < Tool diameter compensation amount

#002: Other interference

[Remedy] Correct the program or tool diameter compensation amount.

118 Tool Diameter/Nose Radius Compensation Intersection Error

[Description] There is no intersection in tool diameter/nose radius compensation.

[Remedy] Correct the program or tool offset amount.

119 (#△△△) Tool Diameter/Nose Radius Compensation Mode Error

[Description] There was an erroneous command in the tool diameter/nose radius compensation mode.

A number indicating alarm details is displayed in parentheses.

#001: Plane change in the current block

#002: Plane change in the next block

#003: Erroneous G-code in the current block

#004: Erroneous G-code in the next block

#005: G38 command (holds an offset vector) other than G00/G01 in the current block

#006: G38 command (changes an offset vector) other than G00/G01 in the next block

#008: In-plane axis command (corner arc) by the G39 command in the next block

[Remedy] Correct the program.

120	(#△△△) Tool Length Automatic Measurement Command Error

[Description] A tool length automatic measurement command has an error.

A number indicating alarm details is displayed in parentheses.

#001: Not G90

#002: Specified axis abnormal

#003: Measured length = 0

#004: Measured length > Measured speed length

#005: Measured distance < Measured speed length

[Remedy] Correct the program.

121	(#△△△) Tool Length Automatic Measurement Command Error

[Description] An H-code command has an error in tool length automatic measurement.

A number indicating alarm details is displayed in parentheses.

#001: An H-code has been specified in the G37 command block.

#002: No H-code has been specified before the G37 command block.

[Remedy] Correct the program.

123	Tool Length Automatic Measurement Operation Error

[Description] A measurement position arrival signal was not turned on in a measurement range.

[Remedy] Correct the program or parameter.

124	(#△△△) Optional Angle Chamfering Corner R

[Description] An optional angle chamfering corner R command has an error.

A number indicating alarm details is displayed in parentheses.

#001: A ,C/ ,R command value is a minus value

#002: An identical block contains both ,C and ,R command

#003: The current block does not contain G01 through G03

#004: There is no axis move in the plane of the current block

#005: The current block contains an erroneous G-code

#006: The next block does not contain G01 through G3
#007: There is no axis move in the plane of the next block
#008: The next block contains an erroneous G-code
#009: There is a plane change in the next block.
#010: An original stroke was exceeded in the current block.
#011: An original stroke was exceeded in the next block.
#012: Calculation error

[Remedy] Correct the program.

126	(#△△△) Cylindrical Interpolation Command Error

[Description] A cylindrical interpolation command has an error.
A number indicating alarm details is displayed in parentheses.
#001: There is no rotary axis command
#002: Not an independent command
#003: Illegal model G-code

[Remedy] Correct the program.

127	(#△△△) Cylindrical Interpolation Mode Error

[Description] There was an erroneous command during the cylindrical interpolation mode.
A number indicating alarm details is displayed in parentheses.
#001: Erroneous G-code command
#002: T-code command (L-system only)
#003: Rotary axis command by G00
#004: Cylindrical interpolation command during the mode

[Remedy] Correct the program.

128	G68 Error	M

[Description] A G68 command format has an error or the plane was changed during the G68 mode.

[Remedy] Correct the program.

130	(#△△△) Block Command Error

[Description] There is an error in a method to specify a block.
A number indicating alarm details is displayed in parentheses.
#001: A G251 command is not an independent block.
#100: An-M-code other than M30 was specified in the simple 2nd series (feeder control) program.
#101: POUT/OUT command format error in the simple 2nd series (feeder control) program. (No output numbers specified)

#102: POUT/OUT command output number error in the simple 2nd series (feeder control) program.

[Remedy] Correct the program.

131	Radius Designation on Arc Error

[Description] A circular arc radius has been specified, whose circular arc center position cannot be calculated.

【Example】• A radius was specified with one-round circular arc
• A radius value is smaller than a length from a start point to an end point

[Remedy] Correct the program.

132	(#△△△) Circular Arc Interpolation Error

[Description] A circular arc interpolation command has an error.

A number indicating alarm details is displayed in parentheses.

#001: The center has not been specified (I, J, K)

#002: The center has been specified (I, J, K), but its value is 0

#003: A difference in a radius value at the start and end points exceeds a parameter set value.

[Remedy] Correct the program.

133	(#△△△) Canned Cycle Command Error

[Description] A canned cycle command for drilling has an error.

A number indicating alarm details is displayed in parentheses.

#000: A Z-point (hole bottom position) has not been specified in the first block of the canned cycle for drilling

#001: Back boring (G87) has been specified in the R-point return mode.

#100: When specifying a shift amount by Q in back boring (G87) or fine boring (M-system: G-76, L-system: G861) (parameter No. 5100, #2 (SIJ) = 0), the parameter no. 5127 has not been set (parameter for the drilling axis = 0)

#101: When specifying a shift amount by Q in back boring (G87) or fine boring (M-system: G76, L-system: G861) (parameter No. 5100, #2 (SIJ) = 0), the parameter no. 5127 has been illegally set (parameter for the drilling axis = drilling axis)

[Remedy] Correct the program or parameter.

134	(#△△△) Drilling Pattern Cycle Command Error

[Description] A drilling pattern cycle command has an error.

A number indicating alarm details is displayed in parentheses.

#000: L has not been specified or L = 0 has been specified

#001: I has not been specified by a G70 command

#002: When L is not equal to 1 in a G71 command, K or I has not been specified.

#003: When L is equal to 1 in a G71 command, I has not been specified.

#004: I has not been specified by a G72 command

#005: A has not been specified by a G77 command or A = 0 has been specified

#006: K, C, or I has not been specified by a G77 command.

#007: G70, G71, G72, or G77 has been specified in the G80 mode

[Remedy] Correct the program.

135	(#△△△) Circle Cutting Command Error

[Description] A circle cutting command has an error.

A number indicating alarm details is displayed in parentheses.

#002: No I-command (G302 to G305)

#003: No K-command (G304, G305)

#004: No U-command (G304, G305)

#005: I-command = 0 (G304, G305)

#006: K-command = 0 (G304, G305)

#007: U-command = 0 (G304, G305)

#008: Q-command = 0 (G302 to G305)

#009: Tool diameter ≧ | I-command | (G302 to G305)

#012: | R-command | > | I-command | (G302 to G305)

#013: | I-command | - | J-command | ≦ Tool diameter (G304, G305)

#014: | J-command | > | I-command | (G302 to G305)

#015: | U-command | > | K-command | (G304 to G305)

[Remedy] Correct the program.

136	(#△△△) Square Cutting Command Error

[Description] A square side external cutting/plane machining cycle command has an error.

A number indicating alarm details is displayed in parentheses.

#002: No I-command (G322 to G326)

#003: No J-command (G322 to G326)

#004: No K-command (G322 to G305)

#006: No P-command (G322 to G326)

#007: No Q-command (G322 to G326)

#010: I-command = 0 (G324 to G326)

#011: J-command = 0 (G324 to G326)

#012: K-command = 0 (G324 to G326)

#013: Q-command = 0 (G324 to G326)

#014: I-command ≦ 0 (G322, G323)

#015: J-command ≦ 0 (G322, G323)

#017: P-command < 0 (G322, G323)

#018: A-command < 0 (G322, G323)

#019: C-command < 0 (G322, G323)

#020: C-command < | K-command | (G322, G323)

#021: A-command > | I-command/2 | (G322, G323)

#022: A-command > | J-command/2 | (G322, G323)

#023: | K-command | > | J-command | (G324 to G326)

#024: Finish allowance > | J-command | - | K-command | (G325, G326)

#025: C-command is not 1 to 4 (G325, G326)

[Remedy] Correct the program.

137	(#△△△) Pocket Cutting Command Error

[Description] A pocket cutting command has an error.

A number indicating alarm details is displayed in parentheses.

#009: No I-command (G327 to G333)

#010: No J-command (G328 to G332)

#011: No K-command (G327 to G333)

#012: No P-command (G330 to G332)

#013: No Q-command (G327 to G333)

#014: No A-command (G329, G332)

#015: No Z-command (G327, G328, G330, G331)

#017: I-command = 0 (G333)

#018: K-command = 0 (G327 to G332)

#019: Q-command = 0 (G327 to G332)

#021: J-command < 0 (G330)

#022: C-command < 0 (G329)

#023: C-command ≦ 0 (332)

#024: P-command ≦ 0 (332)

#025: P-command < 0 (G330, G331)

#026: A-command - tool diameter ≦ 0 (G328)
A-command + tool diameter ≦ 0 (G331)

#027: | I-command | < tool diameter (G327)

#028: I-command < C-command (G333)

#029: I-command < | K-command | (G333)

#030: | I-command | < finish allowance (G327)

#031: [I-command/2] < tool diameter (G328)

#032: [I-command/2] < finish allowance (G328)

#033: [I-command/2] < [A command - tool diameter] (G328)
[I-command/2] < [A-command + tool diameter] (G331)

#035: | I-command | - | J-command | < |finish allowance x 2 | (G327)

#037: Finish allowance > [I-command - tool diameter] (G333)

#038: Tool diameter > [| I-command | - finish allowance] (G327)

#039: [(I-command/2) - finish allowance] < tool offset amount (G328)

#040: Tool diameter > [I-command - J-command - (finish allowance x 2)] (G327)

#042: Tool diameter > [J-command/2] (G328)

#043: Finish allowance > [J-command/2] (G328)

#044: [A-command - tool diameter] > [J-command/2] (G328), [A-command + tool diameter] > [J-command/2] (G331)

#045: Tool diameter > [(J-command/2) - finish allowance] (G328)

#046: Finish allowance > Q-command (G329, G332, G333)

#047: Finish allowance > K-command (G329, G332, G333)

#048: Finish allowance > C-command (G329, G332)

#049: C-command > | A-command | (G329)

#050: C-command < finish allowance (G328, G331)

#051: Tool diameter > [| A-command | - finish allowance] (G329)

#052: | R-command - Z-command | < finish allowance (G327, G328)

#053: Start radius < final radius (G330), Start width < final width (G331)

#055: The left and right circuit arc centers of the track are the same (G329, G332)

[Remedy] Correct the program.

138	(#△△△) Direct Tap Command Error

[Description] A direct tap command has an error.

A number indicating alarm details is displayed in parentheses.

#000: A Z-point (hole bottom position) has not been specified in the first direct tap block

#001: S-command = 0

#002: F-command = 0

#005: Other canned cycle has been specified in the same block as a cancel command (G80 or another G-code of Group 01)

#006: E-command = 0

#010: Direct tap has been specified in the thread cutting mode.

[Remedy] Correct the program.

139	Virtual Axis Command Error

[Description] Two or more virtual axes have been specified.

[Remedy] Correct the program.

140	(#△△△) Program Restart Error

[Description] Program restart operation has an error.

A number indicating alarm details is displayed in parentheses.

#001: It has not been reset when starting a restart block search (OP = 1)

#002: Pause signal (*SP) = 0 when starting a restart block search

#003: When an O-number was specified, there is no specified program when starting a restart block search after calling that program

#004: When an O-number is not specified, the program you want to run has not been called.

#005: Tool number error when starting a restart block search (L-system only)

#010: Restart signal (SRN) = 0 during a restart block search

#011: A restart block cannot be found (M02/M03 was detected)

#012: A restart block cannot be found (% was detected)

#013: A restart block contains a T-command (Only for the L-system ATC specification)

#020: A move completed axis was manually intervened when approaching a restart position

[Remedy] Reset and redo restart operation.

142	(# △△△) Scaling Command Error

[Description] A G51 command format has an error.

A number indicating alarm details is displayed in parentheses.

#001: A G51 command is not an independent block

[Remedy] Correct the program.

143	Scaling Mode Error

[Description] An unavailable G-code has been specified during the scaling mode.

[Remedy] Correct the program.

144	G511/G501 Block Format Error

[Description] A G511/G501 command is not an independent block.

[Remedy] Correct the program.

146	G53 Error

[Description] An axis has been specified by incremental programming in machine coordinate system selection (G53).

[Remedy] Correct the program.

149	Helical Cutting Command Error

[Description] Three or more linear axes have been specified.

[Remedy] Correct the program.

150	(# △△△) F15M Tape Format Error

[Description] The F15M tape format has an error. Displayed in parentheses is a number representing alarm details.

#001: Work coordinate system offset number error

[Remedy] Correct the program.

151	(# △△△) i80M Tape Format Error

[Description] The i80M tape format has an error. Displayed in parentheses is a number representing alarm details.

#001: Work coordinate system offset number error

[Remedy] Correct the program.

158	(# △△△) Three Dimensional Tool Offset Error

[Description] A three dimensional tool offset command format has an error.
A number indicating alarm details is displayed in parentheses.
#001: There is a G-code which cannot be specified in the offset mode
#002: One of the basic axes, X, Y, and Z, does not exist.

[Remedy] Correct the program or parameter.

159	Three Dimensional Tool Offset Mode Error

[Description] There is no intersection in three dimensional tool offset.

[Remedy] Correct the program or tool offset amount.

160	(# △△△) Tool Length Compensation Error

[Description] A tool length compensation command has an error.
A number indicating alarm details is displayed in parentheses.
#001: A tool length compensation command block contains a G-code which must not be specified.
#002: H has been independently specified n the G43/G44 mode, when tool length compensation is applied to two axes.
#003: You are trying to apply tool length compensation to three or more axes.
#004: A tool length compensation axis cannot be determined in the G43/G44 command block.

[Remedy] Correct the program.

161	Tool Offset Error

[Description] Tool offset was specified for a circular arc (G02/G03).

[Remedy] Correct the program.

162	(# △△△) M-code Canned Cycle Error	M

[Description] There is an error in a canned cycle command by an M-code.
A number indicating alarm details is displayed in parentheses.
<M06: ATC canned cycle>
#001: Canned cycle command in the canned cycle
#002: In normal directional control
#003: In tool diameter compensation

#004: G-code command error

#005: Address command error

#006: Axis command error

#007: Parameter error

#008: The specified tool and the spindle tool are the same (Only for HS)

#009: Additional axis command error (Only for HG)

[Remedy] Correct the program.

163	(#△△△) Multiple M-code Command Error

[Description] There is an error in one-block multiple M-code commands.

#001: Multiple M-commands contain M00, M01, M02, or M30.

#002: Multiple M-code commands are disabled by parameter setting.
Parameter no. 3408 #7 (M3B) = 0

[Remedy] Correct the program.

175	(#△△△) Multiple Repetitive Cycle Error

[Description] A multiple repetitive cycle command has an error.

A number indicating alarm details is displayed in parentheses.

Take a remedy according to the following table.

No.	Description	Remedy
#?01	Finish profile blocks overflow	Decrease the number of blocks.
#?02	No finish profile	Confirm a P/Q value/N-number. Decrease the number of blocks.
#?04	Bottom profiles overflow	
#?05	Top profiles overflow	
#?10	G71/G72 type-1 profile error	Draw a profile; Decimal point missing, G01 missing after G02/G03, X/Z moving direction error. Confirm P/Q command value/N-number.
#?11	G71/G72 type-1 D-command error	D0 command
#?20	G71/G72 cutting direction error	The X-axis (G71)/Z (G72) does not move in the 1st block.
#?40	G74/G75 X, Z, U, or W command error	X-U same time: Z-W same time: No Z-W (G74) X-U same time: No X-U: Z-W same time (G75)
#?43	G74/G75 depth of cut error	The z-axis (G74)/X-axis (G75) does not move.
#?44	G74/G75 I or K command error	K0: I0 when the X-axis moves (G74) I0: K0 when the Z-axis moves (G75)

No.	Description	Remedy
#?60	G76 DH command error	D ≦ 0, H ≦ 0, No DH
#?62	G76 A-command error	Beyond the A-range (Confirm a decimal point)
#?63	G76 E-/F-command error	E0, No EF
#?64	G76 X-, Z-, U-, or W-command error	X or Z stroke = 0, X stroke < K
#?65	G76 K-command error	K ≦ 0, K < finish allowance
#?70	Next block non-linear command error	Other than G01 in the block next to chamfering/corner R
#?71	Chamfering/corner R command error	Confirm the direction of an I-/J-/R-command
#?72	Chamfering/corner R too large	Confirm a profile. Decrease I, K, or R.
#?73	Chamfering/corner R next block error	Confirm the direction of an I-, J-, or R command.
#?74	Angle designation linear interpolation error	No X or Y
* #?75	A-command next block error	Confirm related parameters.
* #?76	A-command next block calculation error	Confirm related parameters.
#?77	Optional angle chamfering too large	Confirm a profile. Decrease C.
#?78	Optional angle chamfering/corner R command error	Other than G01 in the ,C or ,R block. ,C and ,R same time
#?79	Optional angle corner R too large	Confirm a profile. Decrease R.
#?7A	Radius designation on arc error	Increase R (decimal point missing). Confirm a profile (end point position command error)
#?90	Cannot find an N-number (P) at the beginning of the finish profile.	Confirm P/Q command value/N-number.
#?91	Cannot find an N-number (Q) at the end of the finish profile.	
#?92	Q was found before N-number P	
#?93	No P-command	Specify P.
#?94	No Q-command	Specify Q.
#?95	P-command = Q-command	Change a P-/Q-command value.
#?96	A finish profile contains a forbidden G-command.	Confirm a G-command.
#?97	The A-axis was used in a finish profile.	Eliminate an A-command.
#?98	A macro statement was used in a finish profile.	Eliminate a macro statement.
#?A0	G71/G72 type-2 profile error	Draw a profile; Decimal point missing, G01 missing after G02/G03, Z (G71) / X (G72) moving direction error. Confirm P-/Q-command value/N-number.
#?A1	G71/G72 type-2 cut-down error	Draw a profile. An error may be prevented by slightly altering a depth of cut (D).
#?A2	G71/G72 type-2 depth of cut error	
#?A3	G71/G72 chamfering error	
#?A4	G71/G72 type-2 top shape error	There is a point higher than a start point.
#?A5	G71/G72 type-2 D-command error	D0 command
% #?C0	Profile table preparation error	Change a profile slightly.
% #?C1	Tool nose radius calculation error	No. 6202, #6 ← 0
% #?C2	G71/G72 type-1 depth of cut error	Alter a D-command value slightly.
% #?C4	G73 start error	Alter a D-command slightly.
% #?C5	G76 depth of cut error	Alter a D-/K-command value slightly.
% #?C6	G76 division by 0	Alter a screw length/I-command value slightly.
% #?C7	Infinite loop	Alter a profile slightly.
#?OT	T-command error	Eliminate a T-command (cannot be given)

[Cautions] ① The symbol “?” in the No. column is replaced by a number ranging from 0 to 6. (0:G70, 2:G73, ..., 6:G76)

② The alarms marked with “*” do not occur in normal setting. If they do, check the set values of related parameters.

③ The alarms marked with “%” derive from NC internal calculations and normally do not occur. If they occur, let us know an alarm number, message, alarmed program, and related parameters.

176	(#△△△) Canned Cycle Error	L

[Description] A canned cycle command has an error.
A number indicating alarm details is displayed in parentheses.

#001: Axis command error.

- Two axes within the plane have not been specified in the G90, G92, or G94 command block.
- A non-plane axis command has been given during the canned cycle mode.

#002: As an I, J, or K value is incorrect, a moving direction at approach opposes to an original moving direction.

#004: A plane selection command (G17 to G19) has been given in a block other than the G90, G92, or G94 command block during the canned cycle mode.

[Remedy] Correct the program.

177	(#△△△) Angle Designation Linear Interpolation Error	L

[Description] An angle designation linear interpolation command has an error.
A number indicating alarm details is displayed in parentheses.

#001: An angle A is other than -3600 to 3600.

#002: An original moving direction opposes to a moving direction after calculation.

[Remedy] Correct the program.

178	(#△△△) Chamfering, Corner R Error	L

[Description] An angle designation linear interpolation command has an error.
A number indicating alarm details is displayed in parentheses.

#001: In the 1st block, a value of I, J, or K exceeds an original stroke.

#002: The 2nd block does not contain G01.

#003: The 2nd block contains one of G17 to G19 commands.

#004: The 2nd block does not contain a command which works perpendicularly to the 1st block.

#005: The 2nd block contains a G-command of Group 00 other than G09, G141, and G142.

#006: In the 2nd block, a value of I, J, or K exceeds an original stroke.

[Remedy] Correct the program.

179	(#△△△) Groove Width Offset Error	L

[Description] A groove width offset command has an error.
A number indicating alarm details is displayed in parentheses.
#001: There is an axis command in one of the G150 through G152 command blocks.
#002: Plane change during offset
#003: A tool nose point is not 1 to 4.

[Remedy] Correct the program or tool nose point.

180	G41/G42 Command Disabled	L

[Description] G41 or G42 was specified during the G140/G143 mode.

[Remedy] Correct the program.

182	(#△△△) T-command error	L

[Description] A T-command has an error.
A number indicating alarm details is displayed in parentheses.
#001: Digits error
#002: Turret number error
#003: Tool number error
#004: Offset number error
#005: Composite offset error (Tool nose radius ≠ 0 at tool nose point = 0)
#006: T9XXXXX ERROR (In ATC spec., Turret number = 90, 91, 99 command is erroneous.
#007: Composite offset start-up/cancel error (Axis command in the G02/G03 mode)
#008: Composite offset error (In composite offset, a turret number or tool number changed for the preceding T-code.)
#009: Composite offset error (In composite offset, G52 has been specified in the same block.)

[Only when the ATC is not attached]
#050: T-command execution disable signal from the machine side (‘TFDS’ :RG41, #6) = 1

[Only when the ATC is attached]
#100: No commanded tool (ALM2)
#101: Check error by each commanded tool type (ALM3)
#102: Arm tool provided on the tool rest side (ALM1)
#103: No empty pot on the magazine side (ALM2)
#104: No empty plane on the tool rest side (ALM2)

#105: ATC command to a stationary tool (ALM3)

#106: No dummy tool on the magazine in MG-TP-TP operation. (ALM2)

#107: G159 command error

#108: Axial command given in a same block with T command except in composite offset.

[Remedy] Correct the program or tool offset amount.

183	(#△△△) G128 Error	L

[Description] A G128 command has an error.

A number indicating alarm details is displayed in parentheses.

#001: Not G01 for G98

#002: Axis command error (Be sure to specify two axes, linear axis and rotary axis; the rest cannot be specified)

#003: An error related to the start and end point positions of a linear axis

[Remedy] Correct the program.

184	Back Machining Command Error	L

[Description] The front/back machining mode was changed in the constant surface speed control mode (G96/G196).

[Remedy] Correct the program.

186	(#△△△) WORKPIECE COOD. PRESET ERROR	M

[Description] An error has occurred concerning presetting of the work coordinate system.

- Work coordinate system presetting could not be executed on completion of manual zero point return following supply of power because of presence of a pre-read block.
- An axis not yet subject to work coordinate system presetting has been commanded in Auto run.

[Remedy] Preset the work coordinate system by performing manual zero point return one more time after resetting.

188	No Write-to Option	L

[Description] A G10 command was used to set the data for an unprovided optional function.

[Remedy] Correct the program.

189	(△△△△) Parameter Setting Error

[Description] Parameter setting related to each function has an error.
A function name is displayed in parentheses.
G121: Parameter no. 3418, no. 3419, and no. 1024
G271: Parameter no. 3426, no. 3427, and no. 1024
G128: Parameter no. 3418 and no. 3419
PRST: Program restart approach order, Parameter no. 8703

[Remedy] Correct the program.

191	(△△△△) Option Command

[Description] No option has been added for a specified command.
A G-code indicating a function is displayed in parentheses.
The following lists exceptions
G01A: Angle designation linear interpolatio
G10P: Programmable parameter input
G80N: Canned cycle for drilling
DTAP: Direct tap
HRCL: Helical interpolation
SFTQ: Multiple thread cutting
,C ,R: Optional angle chamfering corner R
BKCD: Back coordinate system (L-system only)
3OFS: Three dimensional tool offset (M-system only)
HPCC: High-precision contour control (M-system only)
ETWC: Additional work coordinate system (M-system only)

[Remedy] Correct the program or add an option.

196	(#△△△) Cannot run reversely any more 【WARNING】	M

[Description] While running reversely by a retrace function, the machine cannot run reversely any more.
A number indicating details is displayed in parentheses.
#001: There is a command disallowing a reverse run.
#002: There is no retraceable memory block.

[Remedy] Turning off the Retrace switch makes a warning message disappear and changes over to forward run.

198	(#△△△) Program End

[Description] “%” was read in other than MDI operation.

[Remedy] When “%” was read, processing on the NC unit side is determined as follows, depending on the parameter no. 3005, #3 (PEND).

PEND = 0: The NC unit applies a reset to search for the head of the program. PEND = 1: An alarm results

Alter the parameter or correct the program.

201	(#△△△) G25/G26 Command Error

[Description] A G25 or G26 command has an error. A number is displayed in the parentheses, which represents alarm details.

#001: Not an independent block command.

#002: The P-data beyond the G26 command range has been specified.

#003: The Q-data beyond the G26 command range has been specified.

#004: The R-data beyond the G26 command range has been specified.

[Remedy] Correct the program.

203	(#△△△) WHEEL CUT: RESTART ERROR	L

[Description] Operation of the Process Restart function is erroneous.

A number indicating the alarm details is displayed in parentheses.

#001: No reset state is available on starting of Restart Block Search. (‘OP’ = 1)

#002: Halt signal (‘*SP’) = 0 on starting of Restart Block Search.

#003: Either a program No. or a sequence No. is equal to 0 for the restarting block.

#004: A program to be executed has not been called on starting of Restart Block Search.

#005: Either a turret No. or a tool No. is equal to 0 on starting of Restart Block Search.

#010: The program restarting signal (‘SRN’) has become “0” while in Restart Block Search.

#011: The restart block cannot be found. (M02/M30/% are detected.)

#020: Although the program restarting signal has been turned OFF once on completion of Restart Block Search, the program restarting signal has been turned ON again before process restarting function is ended.

#030: Mode has been changed while in process restarting function. (Set to one other than Memory mode.)

#031: The order of approach axes (PRM8703) to the restart position has been erroneously set. (Check only axes subject to shifting.)

204	WHEEL CUT:TURN OFF RESTART SIG. [WARNING]	L

[Remedy] After turning OFF the program restarting signal, start Auto run.

209	(# △△△) Manual Coordinate System Setting Error	L

[Description] There is an error in manual coordinate system setting.

Displayed in parentheses is a number representing the alarm details.

#001: Turret head clamp signal = 0

#002: The face number of the turret head informed from the machine side differs from the one recognized by the NC unit.

210	(# △△△) Oscillation Command Error	M

[Description] An oscillation command has an error.

A number indicating alarm details is displayed in parentheses.

#000: Other G-code has been specified in the G113 command block.

#001: An illegal address has been specified in the G113 command block.

#002: There is no U-command in the G113 command block.

#003: In a G113 command, a feed rate E is 0.

#004: G113 was specified during the canned cycle mode.

#020: Other G-code has been specified in the G114 command block.

#021: An illegal address has been specified in the G114 command block

[Remedy] Correct the program.

211	(# △△△) Oscillation Mode Error	M

[Description] A command in the oscillation mode or operation has an error.

A number indicating alarm details is displayed in parentheses.

#010: A plane changed during the oscillation mode.

#011: A canned cycle was specified during the oscillation mode.

#012: An oscillation axis was specified during the oscillation mode.

#013: G113 was specified again during the oscillation mode.

#014: One of G322 through G333 was specified during the oscillation mode.

#030: Machine lock was turning on/off during the oscillation mode.

[Remedy] Correct the program. Or, do not change the machine lock state during the oscillation mode.

212	Safety Guard Tool Length Measurement Error	M

[Description] There is an error in the tool length measurement method.

- Tool length was measured at too slow a speed for measurement.
- Tool length was measured with two or more simultaneous controllable axes.

[Remedy] Redo from the beginning.

213	(#△△△) Safety Guard Tool Length Operation Error	M

[Description] There is an error in the safety guard tool length operation method. Displayed in parentheses is a number representing alarm details.

#001: A “tool length signal” was turned on in other than the reset mode (OP = 1).

#002: The “tool length signal” was turned off before a reset (M02, M30, Reset key) is applied after starting tool length measurement.

#003: Measurement was made with two or more simultaneous controllable axes.

#004: The horizontal spindle head is attached when starting tool length measurement for the 5-face machining equipment. Or, the horizontal spindle head was attached during measurement.

#005: The JOG or HANDLE mode switch was pressed.

[Remedy] ① Redo from the beginning.

② The horizontal spindle head for the 5-face machining equipment is not available.

214	(# △△△) Safety Guard Comparison Operation Error	M

[Description] There is an error in the safety guard comparison method. Displayed in parentheses in a number representing alarm details.

#001: A “comparison signal” was turned on in other than the reset mode (OP = 1).

#002: The “comparison signal” was turned off before a reset (M02, M03, Reset key) is applied after starting comparison.

#003: Measurement was made with two or more simultaneous controllable axes.

#004: The horizontal spindle head is attached when starting comparison and measurement for the 5-face machining equipment. Or, the horizontal spindle head was attached during measurement.

#005: The JOG or HANDLE mode switch was pressed.

[Remedy] ① Redo from the beginning.

② The horizontal spindle head for the 5-face machining equipment is not available.

215	Safety Guard Comparison Interference Error [Warning]	M

[Description] A tool entered the interference area in safety guard comparison.

[Remedy] Correct the program and redo from the begging. Or, apply a “start” as it is. Since a warning message disappears and operation continues, it is also possible to check all the warning-indicated parts and correct the program.

216	Safety Guard Command Error	M

[Description] The horizontal spindle head is being called in safety guard (comparison) operation for the 5-face machining equipment. (The horizontal spindle head in not available)

[Remedy] Do not perform safety guard (comparison) operation in the program which calls the horizontal spindle.

218	(# △△△) POLYGON COMMAND ERROR	L

[Description] Illegal command in the Polygon turning.

A number indicating the alarm details is displayed in parentheses.

#001: M code for starting or ending Polygon turning.

#002: A Polygon turn ratio has not been commanded before start of Polygon turning.

[Remedy] Correct the program.

220	(#△△△) Trochoid Cycle Command Error	M	

[Description] There is an error in a trochoid cycle command. Displayed in parentheses is a number representing alarm details.

#001: I-command = J-command = 0

#002: No K-command, or K-command ≦ 0

#003: No A-command, or A-command = 0

#004: | A-command | < K-command

#005: | A-command | ≦ Tool diameter

#006: No C-command, or neither C = 2 or 3

#007: W-command < A x 2

#008: The central position of the arc groove cannot be calculated.

#009: The machining starting position cannot be calculated.

#010: P-command < 0

#011: Q-command < 0

[Remedy] Correct the program.

221	(#△△△) Helical Drilling Cycle Command Error	M

[Description] There is an error in a helical drilling cycle command.

Displayed in parentheses is a number representing alarm details.

#000: No Z-command

#001: No I-command, or I-command = 0

#002: J-command ≦ 0

#003: I-command ≦ Tool diameter

#004: J-command ≦ Tool diameter

#005: No Q-command, or Q-command = 0

#006: The ,R-point is incorrect.

#007: The K-point is incorrect.

#008: Calculation error

#009: Concal cutting error

[Remedy] Correct the program.

222	(#△△△) High-speed Side Cutting Cycle Command Error	M

[Description] There is an error in the high-speed side cutting cycle command.

Displayed in parenthese is a number representing the alarm details.

#001: No Z-command
#002: No I-command, or I-command = 0
#003: No J-command, or J-command = 0
#004: No K-command, or K-command = 0
#005: No P-command
#006: No C-command, or C-command is not equal to 1 to 4

[Remedy] Correct the program.

223	(#△△△) z-feed Grooving Cycle Command Error	M

[Description] There is an error in the z-feed grooving cycle command.
Displayed in parrentheses is a number representing the alarm details.
#001: No Z-command
#002: I-command = 0, and J-command = 0
#003: A-command = 0, and Q-command = 0

[Remedy] Correct the program.

224	(#△△△) Corner Pocketing Cycle Command Error	M

[Description] There is an error in the corner pocketing cycle command.
Displayed in parentheses is a number representing the alarm details.
#001: No Z-command
#002: No I-command, or I-command = 0
#003: | I-command | ≦ J-command
#004: | I-command | ≦ Tool diameter
#005: J-command < Tool diameter
#006: No K-command, or K-command ≦ 0
#007: No C-command, or C-command is not equal to 1 to 4

[Remedy] Correct the program.

225	(#△△△) Square Pocketing Cycle Command Error	M

[Description] There is an error in the square pocketing cycle command.
Displayed in parentheses is a number representing the alarm details.
#001: No Z-command
#002: No I-command, or I-command = 0
#003: | I-command | ≦ Tool diameter x 2
#004: No J-command, or J-command = 0

#005: J-command ≦ Tool diameter x 2
#006: No-K-command, or K-command ≦ 0
#007: A-command ≦ Tool diameter

[Remedy] Correct the program.

260	(△△△△) HPCC Command Error	M

[Description] There is an error in the high-precision contour control start or end block.
A character indicating alarm details is displayed in parentheses.
#001: Not an independent block
SMIR: In setting mirror image
G△△△: Erroneous model G-code at start

[Remedy] Correct the program.

261	HPCC Mode Error	M

[Description] In the high-precision contour control mode, a command has an error.

[Remedy] Correct the program.

262	Precontrol Command Error	M

[Description] There is an error in the precontrol start or end block.

[Remedy] Correct the program.

263	Precontrol Mode Error	M

[Description] There is a command error in the precontrol mode.

[Remedy] Correct the program.

270	(#△△△) Soft Jaw Forming Error	L

[Description] There is an error in a soft jaw forming set value. A number is displayed in the parentheses, which represents alarm details.

#001	Data A ≦ 0
#002	Data B ≦ 0
#003	Data C ≦ 0
#004	Data D ≦ 0
#005	Data E ≦ 0
#006	Data T < 0
#007	Data F < 0
#008	Data G < 0
#009	Data H < 0
#00A	Data I < 0
#010	Data C ≧ Data A
#011	Data C ≦ Data A
#012	Data D ≧ Data A
#013	Data D ≦ Data A
#014	Data C ≧ Data D
#015	Data C ≦ Data D
#016	Data B ≧ Data E
#017	Too much chamfering
#018	Too much necking width
#019	Interference with a bolt
#020	Cutting speed (rough) ≦ 0
#021	Cutting speed (finish) ≦ 0
#022	Feed rate (rough) ≦ 0
#023	Feed rate (finish) ≦ 0
#024	Depth of cut ≦ 0
#030	Outside 1-step jaw form-1
#031	Outside 1-step jaw form-2
#032	Outside 1-step jaw form-3

#040	Inside 1-step jaw form-1
#041	Inside 1-step jaw form-2
#042	Inside 1-step jaw form-3
#050	Outside 2-step jaw form-1
#051	Outside 2-step jaw form-2
#052	Outside 2-step jaw form-3
#053	Outside 2-step jaw form-4
#054	Outside 2-step jaw form-5
#060	Inside 2-step jaw form-1
#061	Inside 2-step jaw form-2
#062	Inside 2-step jaw form-3
#063	Inside 2-step jaw form-4
#064	Inside 2-step jaw form-5
#070	Multiple cutting-down error
#071	Multiple cutting-in error
#072	Multiple cutting-up error
#073	Multiple crest up error
#074	When the nose radius was applied to the profile data, there was an uncalculable block.
#0F0	The profile cannot be specified
#0F1	Entered an infinite loop in calculation of an intersecting point.
#0FF	The Soft Jaw Forming screen is not being displayed.

[Remedy] Correct the setting data for the Soft Jaw Forming screen.

271	(#△△△) Soft Jaw Forming Operation Error	L

[Description] There is an error in soft jaw forming operation. A number is displayed in the parentheses, which represents alarm details.

#001: The machine was requested to perform machine lock operation when starting a soft jaw forming locus check, but a machine lock signal was not input.

#002: The machine was requested to perform dry run operation when starting a soft jaw forming locus check, but a dry run signal was not input.

#010: When starting to form the soft jaws, the selected tool offset amount (Y-axis) is not 0 (zero).

#011: When starting to form the soft jaws, the Y-axis is not at the origin. (Y-axis origin lamp OFF)

[Remedy] Check the PMC ladder program. (#001, #002)

Operate correctly . (#010, #011)

272	(#△△△) Premachining Graphic Display Error

[Description] There is an error in premachining graphic display operation.

A number is displayed in the parentheses, which represents alarm details.

#001: The machine was requested to perform machine lock operation when starting premachining graphic display, but a machine lock signal was not input.

#002: The machine was requested to perform dry run operation when starting premachining graphic display, but a dry run signal was not input.

#003: With the C-axis using the built-in spindle, polar coordinate interpolation or circular interpolation has been commanded in premachining graphic display. (L-system only)

[Remedy] Check the PMC ladder program. (#001, #002)

Link the C-axis, perform zero point return, and then, get down to premachining graphic display. (#003)

500	Block Exceeding Allowable Number of Characters

[Description] The number of characters in one block exceeds 256.

[Remedy] Correct the program.

501	Command Data Exceeding Allowable Number of Digits

[Description] Command data exceeds an allowable value.

[Remedy] Correct the program.

502	Inexistent Character String Variable

[Description] It was attempted to read an uncreated character string variable value.

[Remedy] Correct the program.

503	Uncreatable Character String Variable

[Description] A character string format has an error.

① There were more than 100 character string variables.

② A character string variable exceeded 22 characters.

③ A non-alphanumerical character was used.

[Remedy] Correct the program.

504	Undefined G-code

[Description] An undefined G-code was used.

[Remedy] Correct the program.

505	SETVN Instruction Format Error

[Description] It was attempted to name a variable other than #500 through #599.
[Remedy] ① Correct the program.
② Confirm the number of pairs of common variable.

506	Command Exceeding the Allowable System Variable Value

[Description] It was attempted to substitute a value over an allowable value for a system variable.
[Remedy] Correct the program.

507	Variable Value Search Disable	L

[Description] Scheduler’s conditions are not met.
[Remedy] Set the scheduler’s conditions.

508	Logical Operation Overflow

[Description] The OR, XOR, and AND operands are not within 32 bits.
[Remedy] Correct the program.

509	Macro Call Argument Designation Error

[Designation] There are too many arguments in argument designation 2 of custom macro call.
[Remedy] Correct the program.

510	Macro Statement Format Error

[Description] A macro statement format has an error.
① Two or more macro commands have been specified in the same block.
② Relations of [ ] are illegal.
③ An assignment statement does not have a right side.
④ Inexistent command
⑤ A print instruction format has an error.
⑥ A block IF statement has an error in the IF-ELSE relations.
⑦ CASE was specified instead of SEL.
⑧ An SPG command has more than 10 tool numbers.
[Remedy] Correct the program.

511	Faulty Use of Decimal Point "."

[Description] A decimal point was used in the address where it was not allowed. Or, the decimal point is duplicated.

[Remedy] Correct the program.

512	Faulty Use of Minus Sign "-"

[Description] A minus sign was used in the address where it was not allowed.

[Remedy] Correct the program.

513	Absence of Data Following the Address

[Description] There is no data following the address

[Remedy] Correct the program.

514	Formula Description Error

[Description] There is an error in the description of the formula.

① There is an error in the relations of brackets.

② There is an error in the function format.

③ An inexistent function was used.

④ The branch destination of GOTO has not been specified.

[Remedy] Correct the program.

515	Unavailable Variable Number

[Description] It was attempted to read or write an inexistent variable.

[Remedy] ① Correct the program.

② Confirm the number of pairs of common variable.

516	Illegal Characters

[Description] There is an unavailable character in the program.

① You specified an address beginning with a character other than "A to Z," ",", "/", "#", and "$".

② A character following "," is other than C, M, R, S, and T.

[Remedy] Correct the program.

517	Input to Input Disabled Variable

[Description] It was attempted to write into an inexistent variable.

[Remedy] ① Correct the program.

② Confirm the number of pairs of common variables.

518	Faulty Variable Value

[Description] A variable value has an error and cannot be read. Or, it was attempted to input a faulty value.

[Remedy] Correct the program.

519	Illegal Relations of Brackets

[Description] There is no left bracket "]" with respect to a right one "[".

[Remedy] Correct the program.

520	Mixture of NC Statement and Macro Statement

[Description] Both NC statement and macro statement were specified in the same block.

[Remedy] Correct the program.

521	Absence of Corresponding Sequence Number

[Description] There is no sequence number specified by GOTO or N-number specified in DNC operation after N-search.

[Remedy] Correct the program.

522	Absence of Corresponding Program

[Description] There is no program to call in subprogram call or macro call.

[Remedy] Correct the program.

523	Division by Divisor 0

[Description] It was attempted to divide by 0 halfway computation of the formula.

[Remedy] Correct the program.

524	Negative Square Root

[Description] It was attempted to obtain a negative square root.

[Remedy] Correct the program.

525	Function BCD/BIN for Negative Number

[Description] A function "BCD" or "BIN" was used for a negative number.

[Remedy] Correct the program.

526	Function BIN for Non-BCD Data

[Description] An operand for the function BIN is not BCD.

[Remedy] Correct the program.

527	Overflow Halfway Computation of Formula

[Description] An overflow occurred halfway computation of the formula. Or, the function "BCD" was used for a value exceeding 99999999.

[Remedy] Correct the program.

528	Faulty Identification Number of DO/END

[Description] An identified for DO or END is not 1 through 3.

[Remedy] Correct the program.

529	Branch Destination in DO Loop

[Description] A branch destination sequence number is in D to END.

[Remedy] Correct the program.

530	Intersection of DO and END Loops

[Description] DO/END is not used in a proper manner.

① A branch destination by GOTO is in DO to END.
② Multiplicity of DO to END exceeded threefold.
③ The identification numbers for DO to END are not matching.
④ There is no DO corresponding to END.
⑤ DO having the same number was specified in DO to END.
⑥ An identification number for DO is not 1 through 3.

[Remedy] Correct the program.

531	Absence of POPEN Command

[Description] It was attempted to print out without running POPEN.

[Remedy] Correct the program.

532	Subprogram + Macro Multiple Call Error

[Description] Multiplicity of subprogram and macro calls exceeded eightfold in total.

[Remedy] Correct the program.

533	Macro Multiple Call Error

[Description] Multiplicity of macro calls exceeded eightfold.

[Remedy] Correct the program.

534	Multiple Call Commands in One Block

[Description] One block contains multiple call commands.

[Remedy] Correct the program.

535	DO/END Command in DNC Program

[Description] a DO/END or M99 command was specified in the DNC main program.
[Remedy] Correct the program.

536	No Subprogram Specified

[Description] An address P has not been specified.
[Remedy] Correct the program.

537	(△△△△) Macro Function Error

[Description] There is an error in the custom macro function.

Displayed in parentheses is a type of error.

SPA: The tool has not been registered, which was specfied with the SPA function in the tool specific number system.

[Remedy] Correct the program.

538	Inexistent Function

[Description] A function name has an error.
[Remedy] Correct the program.

539	Function Description Error

[Description] There is an error in the description of the function.
[Remedy] Correct the program.

540	ADP Function Error

[Description] ADP is not allowed for this variable.
[Remedy] Correct the program.

541	No END for DO

[Description] There is no END for DO.
[Remedy] Correct the program.

542	No IF Statement for ENDIF

[Description] There is no IF statement for ENDIF.
[Remedy] Correct the program.

543	No ENDIF for Block IF Statement

[Description] There is no ENDIF statement for IF.
[Remedy] Correct the program.

544	Invalid Computation

[Description] An error occurred halfway computation.
[Remedy] Correct the program.

545	Macro in Multiple Repetitive Cycle Profile

[Description] No macro is allowed in the multiple repetitive cycle profile.
[Remedy] Correct the program.

546	Erroneous G-code in High-precision Contour Control

[Description] An unavailable G-code was specified during high-precision contour control.
[Remedy] Correct the program.

548	'ALM' Command	L

[Description] The ALM command was executed in the simple 2nd series (feeder control) program.
[Remedy] Confirm the program.

549	Illegal PF No.	L

[Description] In the simple 2nd series (feeder control) specifications, there is an error in the PF number you attempted to load with the 1st series program.
[Remedy] Correct the program. (Available PF numbers are 1 through 4)

560	(#△△△) External Output Open Error

[Description] It failed to open an external output command.
A number indicating alarm details is displayed in parentheses.
#001: Executed an output command without executing an open command (POPEN).
#002: Illegal setting of a device number
#003: Illegal setting of a port number
#004: An already used port has been specified
#005: Failed to open (The I/O device has not been connected.)

561	(#△△△) External Output Communication Error

[Description] A communication error occurred when outputting the data.
A number indicating alarm details is displayed in parentheses.
#010: “DSR signal” is held OFF.
#011: Overrun error
#012: Parity error
#013: Framing error

570	(#△△△) DNC Operation Start Error

[Description] DNC operation cannot start.
A number indicating alarm details is displayed in parentheses.
#003: The I/O channel for the remote buffer is set improperly.
(The parameter no. 180 is not “3”)
#004: The remote buffer board is defective

[Remedy] ③ Set “3” in the parameter no. 180.
④ Replace the remote buffer board.

580	(#△△△) TAPE Operation Start Error

[Description] Tape operation cannot start.
A number indicating alarm details is displayed in parentheses.
#002: Illegal setting of a device number
#003: Illegal setting of a port number
#004: An already used port has been specified
#005: Failed to open (The I/O device has not been connected.)

581	(#△△△) Tape Operation Communication Error

[Description] A communication error occurred during tape operation.
A number indicating alarm details is displayed in parentheses.

#010: “DSR signal” is held OFF.
#011: Overrun error
#012: Parity error
#013: Framing error
#014: Buffer overrun

590	(△△△△) Disk Operation Error

[Description] These is an error in disk operation.
Disk operation refers to data server operation by M198, or program operation

on the part of the sub-tape memory when the sub tape memory is attached.

Displayed in parentheses is a type of error.

<Error Codes from Data Server>

#001: The specified file is being used.

#002: Failed to open the file

#004: The specified file cannot be found.

#005: Failed to read from the file.

#014: The ring buffer overflowed.

2000: Data server interface error (Error code illegal)

2001: Data server interface error (Data server error)

2498: Data server interface error (Data server error)

2499: Data server interface error (Data server system error)

2600: Data server interface error (Status code illegal)

2606 Data server interface error (Data server unexecuted)

2710: Data server interface error (Download unexecuted)

<Errors on Execution Processing Side> --- Do not occur normally.

2900: No sub-tape memory specification

2901: No file has been opened.

2902: Oppened beyond the limit.

2903: Illegal channel is used.

2904: Attempted to open the channel beyond the maximum allowable number.

2905: Attempted to read from the closed channel.

2906: Failed to read.

2907: Task number error (Unreadable task)

701 to 708	1-axis Zero Point Return Deceleration Signal Error to 8-axis Zero Point Return Deceleration Signal Error

[Description] A zero point return deceleration signal was turned off and turned on again.

[Remedy] Confirm a change of the zero point return deceleration signal.

[Caution] In an actual message, the 1 to 8 axes are represented by axis names (X-axis, Y-axis, Z-axis, and so on)

709	Q-setter Data Error	L

[Description] There is an error in the data measured by the Q-setter.

When checking the difference between the old and new offset amounts through parameter setting (No. 6244, #7 = 1), it exceeds the allowable value of the parameter No. 6264.

[Remedy] Check the tool and offset amount.

710	W-setter Mode Error	M

[Description] The W-setter mode was selected without performing manual reference point return.

[Remedy] Perform manual reference point return.

711	(△△△△) W-setter Mode Error	M

[Description] There is an error in axis moving operation by the W-setter.

Characters indicating alarm details are displayed in parentheses.

0AXS: Since measurement was made at a very slow speed, a measuring axis cannot be distinguished.

2AXS: Measurement was made, controlling two or more axes simultaneously.

[Remedy] Make measurement by correct operation.

712	Q-setter Mode Error	L

[Description] The Q-setter mode was selected without performing manual reference point return.

[Remedy] Perform manual reference point return.

713	Q-setter Mode Error	L

[Description] Measurement (axis move) has been made by the Q-setter, controlling two or more axes simultaneously

[Remedy] Make measurement for each axis.

714	Q-setter Interlock	L

[Description] A tool nose point is being interlocked by the Q-setter.

[Remedy] Confirm a contacting direction and a tool nose point requirement.

For details, see the instruction manual for the Q-setter.

715	Measurement Error	M

[Description] Machine lock was used during measurement.

[Remedy] Cancel machine lock.

716	Tool Setter Measurement Error	M

[Description] Measurement was made in other than the TOOL screen. Or, a measuring direction is not correct.

[Remedy] Confirm operation.

719	Q-setter Number Error

[Description] There is an error in the Q-setter number.

When checking whether the offset number equals the tool number through parameter setting (No. 6244, #6 = 1), the measured offset number differs from the tool number.

[Remedy] Check the offset number and tool number.

721	Automatic operation cannot start. 【WARNING】

[Description] Automatic operation starting conditions are not met yet.

A number indicating the details is displayed in parentheses.

#001: Pause signal (*SP) = 0

#002: There is no program to run

#003: Different mode when restarting from a stop

#004: Program restart signal (SRN) = 1

#005: Block restart signal (BRN) = 1 ----- M-system only

#006: Reverse run signal = 1 ----- M-system only

#010: In the Soft Jaw Forming screen, you attempted to start in the non-MDI mode ----- L-system only

#011: In the Premachining Graphic Display screen, you attempted to start from the reset state by pressing the START button.

#012: The door is opened when soft jaw forming is started ---- L-system only

<The following is for the simple 2nd series (feeder control)> ---- L-system only

#102: There is no program to run

#120: Service request start condition error 1 (Call code ≠ 0 at 'OP' = 1)

#121: Service request start condition error 2 (Call code beyond the limits)

#122: Service request start condition error 3 (No setting of the program number corresponding to the M-code)

#123: Service request start condition error 4 (Setting program number search error)

[Remedy] Operate correctly.

[Caution] As a start signal is not monitored during an emergency stop, alarm, reset, or manual mode, this warning is not issued even if automatic operation cannot start.

724	Q-setter Repeat Error	L

[Description] No measurement has been made by the Q-setter.
[Remedy] Measure by the Q-setter.

729	Jaw End Face Position Setting Incomplete [Warning]	L

[Description] A jaw end face position for soft jaw forming has not been set.
[Remedy] Set the jaw end face position.

730	External Number Search Error

[Description] There is no O-number or N-number you want to search for.
[Remedy] Confirm the O-number or N-number.

732	External Data Input/Output Search Error

[Description] The higher 4 bits (EIA4 to EIA7) of an external data input/output address signal are not set properly.
[Remedy] Confirm a PMC ladder program.

733	External Data Input/Output Search Error

[Description] The lower 4 bits (EIA0 to EIA3) of an external data input/output address signal are not set properly.
[Remedy] Confirm the PMC ladder program.

734	External Data Input Error

[Description] A numerical value input by an external data input data signal (EID32 to EID47) is beyond an allowable range.
[Remedy] Confirm the PMC ladder program and an allowable range of objective data.

735	External Data Input Error

[Description] A numerical value input by an external data input data signal (EID0 to EID31) is beyond an allowable range.
[Remedy] Confirm the PMC ladder program and an allowable range of objective data.

736	External Data Output Error

[Description] There was an output request again while outputting the external data.
[Remedy] Confirm the PMC ladder program.

737	(#△△△) EXTERNAL TAPE I/O ERROR 【WARNING】

[Description] An error occurred during the external tape input/output.

A number indicating the error details is displayed in ( ).

#001: TV check error
#002: TH check error
#006: No registration is available.
#007: No registration is available.
#008: Edit inhibited.
#010: No corresponding 0 number
#011: No output file has been selected.
#012: 0 number unusable.
#013: Excess number of characters in a block.
#014: Serial board is unusable.
#015: DSR OFF
#016: Framing error
#017: Overrun error
#018: Parity error
#019: Buffer overrun
#020: Extension of 0 number is incorrect.
#021: No deletion enabled.
#023: File cannot be read in.
#024: Not identified.
#033: Registered capacity has been exceeded.
#039: Lack of memory for I/O
#040: Lack of memory for directry

738	Q-setter Repeat Error	L

[Description] A touch signal was not entered in Q-setter repeat.

[Remedy] ① When a Q-setter's sensor is touched, confirm a sensor signal.

② When a Q-setter's sensor is not touched, confirm a sensor position parameter and tool offset amount.

739	Q-setter Repeat Error	L

[Description] A Q-setter repeat measurement start point is erroneous. (A moving path interferes with the sensor)

The following lists the alarm conditions.

Tool Nose Point	Alarm Condition
1, 5, 6	Start position Z > Approach position (-Z) or Start position X > Approach position (+X)
4, 8	Start position Z > Approach position (-Z) or Start position X > Approach position (-X)
2, 3, 7 (0, 9)	Start position Z > Approach position (-Z)

(Note) *The above-mentioned positions are all in the machine coordinate system. The approach positions can be obtained by the following calculations.*

- *Approach position (+X) = +X sensor position (PRM6281X) + Tool offset (X) - Clearance amount (PRM6226) x 2*
- *Approach position (-X) = -X sensor position (PRM6282X) + Tool offset (X) - Clearance amount (PRM6226) x 2*
- *Approach position (-Z) = -Z sensor position (PRM8282Z) + Tool offset (Z) - Clearance amount (PRM6226)*

For details, see “Q-setter Repeat” in the Instruction Manual (Operation).

[Remedy] Change a Q-setter repeat start position and redo it.

749	Q-SETTER REPEAT ERROR	L

[Description] A rotary tool cannot be measured in Q-setter repeat.

770	Spindle overload alarm	【WARNING】
772	X-axis overload alarm	
773	Y-axis overload alarm	
774	Z-axis overload alarm	
775	Rotary tool overload alarm (L-system alarm)	

[Description] ① This is a detection alarm for the overload detecting function.

A load value kept exceeding an overload set value for an overload judgment time.

② This is an alarm for the adaptive control function.

A load value kept exceeding an adaptive upper-limit value for 2 seconds.

[Remedy] After replacing a defective tool by a new one, reset an alarm an clear the life use value and tool status.

771	No load Alarm	【WARNING】

[Description] This is a detection alarm for the no-load detection function.

In one cutting, a load value did not exceed a no-load set value even once.

[Remedy] After replacing a defective tool by a new one, reset an alarm an clear the life use value and tool status.

780	Broken Tool Selected	【WARNING】

[Description] A broken tool was called to the spindle.

[Remedy] After replacing a defective tool by a new one, reset an alarm an clear the life use value and tool status.

781	Out-of-Life Total Selected	【WARNING】

[Description] An out-of-life tool was called to the spindle.

[Remedy] After replacing a defective tool by a new one, reset an alarm an clear the life use value and tool status.

782	Premachining Tool Check Error	【WARNING】	M

[Description] One of the tools specified by a premachining tool check is defective.

[Remedy] Seeing a list of defective tools, find a defective tool and replace it by a new one. Reset an alarm clear the life use value and tool status.

783	Monitoring Program Format Error	【WARNING】	M

[Description] ① This is a format error for the premachining tool checking function.

Between M51 and M59 commands;

- An M-code (other than M59) has been specified.
- An S-code has been specified.

② This is a format error for the tool life management data setting function.

Between M57 and M59 commands;

- An M-code (other than M59) has been specified.
- A T-command has been specified continuously in two or more blocks.
- A S-command has been specified continuously in three or more blocks.

③ This is a format error for the cutting monitoring unit set setting function.
Between M58 and M59 commands;
- An M-code (other than M59) has been specified.
- A T-command has been specified continuously in two or more blocks.
- A S-command has been specified continuously in seven or more blocks.

[Remedy] Correct the program.

784	Specified Tool Registration Error 【WARNING】	M

[Description] A specified tool has not been registered in the specified tool area of the TOOL LIFE screen.

[Remedy] ① Register in the specified tool area the tool specified in the program.
② Specify in the program the tool registered in the specified tool area.

790	(△△△△) System Table Error

[Description] There is an error in setting of the system table.

① Overall check
The entire table is checked and if an error is found, it is indicated in parentheses.
[Basic RAM] → "BRAM-ERR.xx
[Extended RAM] → "ERAM-ERR.xx
- 01: A RAM capacity set value differs from an actual capacity.
- 02: There is a table having an erroneous offset value.
("Table offset" ≠ Previous "Table offset + Capacity")
- 03: A total of each table capacity exceeds setting of the RAM capacity.

② Each table check
When there is no error found in an overall check, each table is checked. When a reserved table name is faulty or a set capacity is smaller than a specified capacity, an error results and that table name is displayed in parentheses.
- "SYSTEM": System data
- "TOOL": Tool offset amount
- "SPARE": Tool life management
- "MONI": Cutting monitoring

- ”PRGRM”: Machining program
- ”HPCC”: M-system high-precision contour control
- ”TLFILE”: Automatic programming (L-system) tool file

  → The CNC only checks whether there is a table or not.
  A capacity is checked on the part of automatic programming.

[Remedy] Re-set the system table.

791	(PS △△△△) Execution Data Conversion Error

[Description] An error occurred in converting the preprocessing data into the execution data.

793	MMC4 Beyond Working Temperature Range 【Warning】

[Description] The MMC4 working temperature range is 5 to 40 ℃.

794	BATTERY ALARM 【WARNING】

[Description] The memory backup battery is running out.
[Remedy] Replace the battery.

795	Emergency Stop 【WARNING】

[Description] This is an emergency stop state. [F000] Turn off Power

F000	Turn off the power

[Description] A parameter was set, which requires you to turn off the power once.
[Remedy] Turn off the power.

F085	Communication Error

[Description] An overrun, parity, or framing error occurred in reading by the remote buffer. The number of bits of input data does not match, or a baud rate or I/O device specification number is not correct.

F086	Operation Ready Signal OFF

[Description] An operation ready signal (DR) for the I/O device is OFF in reading by the remote buffer. The I/O device is not turned on, a cable is disconnected, or a printed circuit board is defective.

F087	Buffer Overflow

[Description] Even if reading by the remote buffer has been stopped, an input does not stop after exceeding 10 characters. It is likely that the I/O device or printed circuit board is defective.

F090	Cannot Return to Origin

[Description] Reference point return cannot be performed successfully because the start point is too close to the reference point or the speed is too slow.

[Remedy] Move the start point sufficiently away from the referece point or increase the start speed to redo.

F092	Not Returned to Zero Point

[Description] A specified axis has not been returned to the reference point in G27 (reference point return check)/G28 (reference point return)/G30 (2nd to 4th reference point return)

[Remedy] Confirm the contents of the program.

F148	Erroneous Set Value

[Description] An automatic corner override deceleration ratio and judgment angle are beyond the setting range.

[Remedy] Correct the setvalues of the parameters 1710 to 1714.

F194	Spindle Cannot Be Specified as Synchronous Axis

[Description] The contour control mode or spindle positioning (Cs axis control)/direct tap mode has been specified during the serial spindle synchronous control mode.

[Remedy] Correct the program so that the synchronous control mode will be cancelled before giving a command.

F195	Mode Switching Error

[Description] In serial spindle control, a switch command to the contour control mode or Cs axis control/direct tap mode, or switching to the spindle control mode (spindle speed control) has not terminated properly.

This error occurs when the switching reaction of the spindle control unit is not properly activated with respect to a switch command from the NC unit. This is not a warning for operation miss, but taken for an alarm, because if the machine is operated continuously in this state, there may be a danger.

F197	A Move Command Cannot Be Run Because CON = 0

[Description] When a CON signal (DGN = G027.7) is OFF, a move command was given from the program to the Cs axis.

[Remedy] Check with the PMC ladder program why the CON signal is turned ON.

F205	Rigid Mode DI OFF

[Description] When an M-code internally generated and output to the machine is completed in a direct tap command block, a rigid mode signal (RGTAP: G061, #0) is OFF.

[Remedy] Confirm the PMC ladder program.

F221	ILLEGAL COMMAND IN SYNCHR-MODE	L

[Description] Polygon turning synchronous run and Cs contour control were to be performed simultaneously.

This, also, takes place due to the following factors:

Spindle Polygon Synchronous mode has been commanded while the spindle is executing any other function such as spindle synchronous control, Cs contour control, spindle positioning, and rigid tap.

[Remedy] Check the program details.

5000	ILLEGAL COMMAND CODE (HPCC)	M

[Description] A command code is wrong. (HPCC)

[Remedy] Correct the program.

5003	ILLEGAL PARAMETER (HPCC)	M

[Description] Parameter setting is erroneous. (HPCC)

[Remedy] Correct the parameter.

5004	HPCC NOT READY	M

[Description] The HPCC is not ready to operate. (HPCC mode only)

5006	TOO MANY WORD IN ONE BLOCK	M

[Description] The number of words in one block exceeds an allowable range (26 words). (HPCC mode only)

[Remedy] Correct the program.

5007	TOO LARGE DISTANCE	M

[Description] A stroke exceeded a maximum programmable dimension. (HPCC mode only)

[Remedy] Correct the program.

5009	PARAMETER ZERO (DRY RUN)	M

[Description] A maximum cutting feed rate (parameter no. 1422) or dry run speed (parameter no. 1410) has been set to 0. (HPCC mode only)

[Remedy] Correct the parameter.

5010	END OF RECODE	M

[Description] EOR% was specified. (HPCC mode only)

[Remedy] Correct the program.

5011	PARAMETER ZERO (CUT MAX)	M

[Description] Parameters for the maximum cutting feed rate (No. 1422/1430 to 1432) have been set to 0.

[Remedy] Correct the parameter.

5018	POLYGON SPINDLE SPEED ERROR	L

[Description] In Polygon Synchronous mode, speed of either one of the spindle or polygon synchronous axis has exceeded the clamp value, or has become too small to maintain the rpm ratio of the command value.

Details of the cause are displayed in Diagnosis No. 471 during occurrence of this alarm. While Alarm “5018” can be cancelled by resetting, the cause display remains unless the cause is removed.

[Details]

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	0471					SUO	QCL	PCL	

#0 ( ): The command speed is too small in polygon synchronization between spindles. (Unit speed for internal operation is made equal to 0.)

#1 (PCL): 1st spindle (polygon synchronous master axis) has been clamped.

#2 (QCL): 2nd spindle (polygon synchronous axis) has been clamped.
#3 (SU0): The command speed is too large in polygon synchronization between spindles. (Clamping has occurred at the upper limit for internal operation.)

5110	Unacceptable G-code

[Description] An unacceptable G-code was given in the AI contour control mode.

5111	Unacceptable Modal G-code

[Description] There is an unavailable model G-code in the AI contour control mode.

5112	Cannot Command G08

[Description] Leading control was commanded (G08) in the AI contour control mode.

5113	Cannot Command In the MDI Mode

[Description] AI contour control was commanded in the MDI mode.

5114	Wrong Stop Position

[Description] The coordinates have not returned to the stop position, when restarting after manual intervention in the AI contour control mode.

5115	SPL: Error

[Description] This is an NURBS interpolation error.

- There is an error in order setting.
- No knots have been specified.
- There is an error in the knot command.
- The number of axes is too many.
- Other program error

5116	SPL: Error

[Description] This is an NURBS interpolation error.

- There is a program error in the pre-read block.
- The knot is not increasing monotonously.
- An incompatible mode has been specified in the NURBS interpolation mode.

5117	SPL: Error

[Description] This is an MURBS interpolation error.

• There is an error at the 1st control point of NURBS.

5118	SPL: Error

[Description] This is an MURBS interpolation error.

• NURBS interpolation was resumed after manuak intervention at manual absolite ON.

No.5134 through No. 5198 are the alarms for the Σ 16/18/21 only.

5134	FSSB: Open Ready Time Out

[Description] Initialization did not place FSSB in the open ready state.

5135	FSSB: Error Mode

[Description] FSSB has entered error mode.

5136	FSSB: Number of Amps is Small

[Description] In comparison with the number of controlled axis, the number of amplifiers recognized by FSSB is not enough.

5137	FSSB: Configuration Error

[Description] FSSB detected a configuration error.

5138	FSSB: Axis Setting Not Complete

[Description] In automatic setting mode, axis setting has not been made yet. Perform axis setting on the FSSB setting screen.

5156	Illegal Axis Operation (SHPCC) (M series)	M

[Description] The control axis selectionsignal (PMC axis control) changed in the AI contour control mode. The simple synchronous axis selection signal changed in the AI countour control mode.

5197	FSSB: Open Time Out

[Description] The CNC permitted FSSB to open, but FSSB was not opened.

5198	FSSB: IN Data NOT Read

[Description] Temporary assignmentailed, so amplifier initial ID information could not be read.

2. Alarms Related to Absolute Pulse Coder (APC)

F300	N-th Axis Zero Return Request

[Description] Manually return the n-th axis (1st to 8th) to the reference point.

F301	APC Alarm: N-th Axis Communication

[Description] N-th axis (1st to 8th) APC communication error. (Data transfer error) It is likely that the APC, cable, or servo interface module is defective.

F302	APC Alarm: N-th Axis Overtime

[Description] N-th axis (1st to 8th) APC overtime error. (Data transfer error) It is likely that the APC, cable, or servo interface module is defective.

F303	APC Alarm: N-th Axis Framing

[Description] N-th axis (1st to 8th) APC framing error. (Data transfer error) It is likely that the APC, cable, or servo interface module is defective.

F304	APC Alarm: N-th Axis Parity

[Description] N-th axis (1st to 8th) APC parity error. (Data transfer error) It is likely that the APC, cable, or servo interface module is defective.

F305	APC Alarm: N-th Axis Pulse Miss

[Description] N-th axis (1st to 8th) APC pulse miss error. (APC alarm) It is likely that the APC or cable is defective.

F306	APC Alarm: N-th Axis Battery Voltage 0

[Description] An n-th axis (1st to 8th) APC battery voltage had dropped to the level which is too low to hold the data. (APC alarm) It is likely that the battery or cable is defective.

F307	APC Alarm: N-th Axis Battery Drop 1

[Description] An n-th axis (1st to 8th) APC battery voltage dropped to the battery replacement level. (APC alarm)

[Remedy] Replace the battery.

F308	APC Alarm: N-th Axis Battery Drop 2

[Description] An n-th axis (1st to 8th) APC battery voltage had dropped to the battery replacement level. (APC alarm)

[Remedy] Replace the battery.

F309	APC Alarm: N-th Axis Zero Return Disabled

[Description] Zero point return was attempted without running the motor by one revolution or more.

[Remedy] After running the motor by one revolution or more, turn off the power and perform zero point return.

3. Alarms Related to Serial Pulse Coder (SPC)

3.1 In Case of Σ10

F350	SPC Alarm: N-th Axis Pulse Coder

[Description] This is an error for the n-th axis (1st to 8th) serial pulse coder. The alarm details are displayed at no. 202 in the DIAGNOSE screen.

[Details]

#0 (SPH): Soft phase data alarm

Diagnosis No.	#7	#6	#5	#4	#3	#2	#1	#0
0202		CSA	BLA	PHA	RCA	BZA	CKA	SPH

#1 (CKA): Clock alarm

#2 (BZA): Battery zero alarm

#3 (RCA): Rpm count alarm

#4 (PHA): Phase data alarm

#5 (BLA): Battery low alarm

#6 (CSA): Checksum alarm

F351	SPC Alarm: N-th Axis Communication

[Description] This is a communication error for the n-th axis (1st to 8th) serial pulse coder. (Data transfer error)

The details are displayed at no. 203 in the DIAGNOSE screen.

[Details]

Diagnosis No.	#7	#6	#5	#4	#3	#2	#1	#0
0203	DTE	CRC	STB					

#5 (STB): Stop bit error

#6 (CRC): CRC error

#7 (DTE): Data error

3.2 In Case of Σ 16/18/21

The details of the serial pulse coder alarms are displayed at No. 202 and No. 203 in the Diagnosis screen. (Described later)

F360	n Axis: Abnormal Checksum (INT)

[Description] A checksum error occurred in the built-in pulse coder.

F361	n Axis: Abnormal Phase Data (INT)

[Description] A phase data error occurred in the built-in pulse coder.

F362	n Axis: Abnormal Rev. Data (INT)

[Description] A rotation speed count error occurred in the built-in pulse coder.

F363	n Axis: Abnormal Clock (INT)

[Description] A clock error occurred in the built-in pulse coder.

F364	n Axis: Soft Phase Alarm (INT)

[Description] The digital servo software detected invalid data in the built-in pulse coder.

F365	n Axis: Broken LED (INT)

[Description] An LED error occurred in the built-in pulse coder.

F366	n Axis: Pulse Miss (INT)

[Description] A pulse error occurred in the built-in pulse coder.

F367	n Axis: Count Miss (INT)

[Description] A count error occurred in the built-in pulse coder.

F368	n Axis: Serial Data Error (INT)

[Description] Communication data from the built-in pulse coder cannot be received.

F369	n Axis: Data Trans. Error (INT)

[Description] A CRC stop bit error occurred in the communication data being received from the built-in pulse coder.

F380	n Axis: Broken LED (EXT)

[Description] The separate detector is erroneous.

F381	n Axis: Abnormal Phase (EXT LIN)

[Description] A phase data error occurred in the separate linear scale.

F382	n Axis: Count Miss (EXT)

[Description] A pulse error occurred in the separate detector.

F383	n Axis: Pulse Miss (EXT)

[Description] A count error occurred in the separate detector.

F384	n Axis: Soft Phase Alarm (EXT)

[Description] The digital servo software detected invalid data in the separate detector.

F385	n Axis: Serial Data Error (EXT)

[Description] Communication data from the separate detector cannot be received.

F386	n Axis: Data Trans. Error (EXT)

[Description] A CRC or stop bit error occurred in the communication data being received from the separate detector.

[Details of Alarms Related to Serial Pulse Coder]

Diagnosis No.		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	0202		CSA	BLA	PHA	PCA	BZA	CKA	SPH

#6 (CSA): Check sum alarm has occurred.

#5 (BLA): Battery low alarm has occurred.

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

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

#2 (BZA): Battery zero alarm has occurred.

#1 (CKA): Clock alarm has occurred.

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

Diagnosis No.		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	203	DTE	CRC	STB	PRM				

#7 (DTE): Data error has occurred.

#6 (CRC): CRC error has occurred

#5 (STB): Stop bit error has occurred.

#4 (PRM): Parameter error alarm has occurred. In this case, a servo parameter error alarm (No. 417) is also output.

4. Alarms Related to Servo

4.1 In Case of Σ 10

F400	Servo Alarm: N-th Axis Overload

[Description] An n-th axis (1st to 8th) overload signal has been input.
[Remedy] For details, see Diagnose No.201.
[Details]

- When Diagnose No. 200, #7 (OVL) = “1”

Diagnosis No.		#7	#6	#5	#4	#3	#2	#1	#0
	0201	ALD			EXP				

#7 (ALD) 1: Motor overheat
0: Servo amplifier overheat

- When Diagnose No. 200, #1 (FBA) = “1”

ALD	EXP	Alarm Description
1	0	A built-in pulse coder is disconnected (hardware).
1	1	A separate pulse coder is disconnected (hardware).
0	0	The pulse coder is disconnected (software).

F401	Servo Alarm: N-th Axis V Ready OFF

[Description] A ready signal for the n-th axis (1st to 8th) servo amplifier (DRDY) was turned off.

F404	Servo Alarm: N-th Axis V Ready ON

[Description] Although a ready signal for the axis card (MCON) was turned off, the ready signal for the servo amplifier (DRDY) is not turned off. Or, MCON was not turned on at power-on, but DRDY was turned on.
[Remedy] Check the servo interface module and servo amplifier for their connection.

F405	Servo Alarm: (Zero Return Error)

[Description] This is an error for the position control system. It is likely that there was an error inside the NC unit or servo system at reference point return and the machine could not return to the reference point properly.
[Remedy] Redo from manual reference point return

F407	Servo Alarm: Excessive Error

[Description] A difference in the position deviation amount of a synchronous axis exceeded a set value.

F409	Servo Alarm: N-axis Abnomal Load

[Description] An abnormal load was detected at the servo motor or at the spindle motor in the Cs mode.

F410	Servo Alarm: N-axis Excessive Error

[Description] At the n-th axis (1st to 8th, a postion deviation value during a stop exceeded a set value.

F411	Servo Alarm: N-axis Excessive Error

[Description] At the n-th axis (1st to 8th, a postion deviation value during a move exceeded a set value.

F413	Servo Alarm: N-axis LSI Overflow

[Description] An n-th axis (1st to 8th) error register indicates beyond a range of ± 231. This error normally occurs in case of wrong setting.

F414	Servo Alarm: N-th Axis Detection System Error

[Description] This is an error for the n-th axis (1st to 8th) digital servo system.

[Remedy] For details, see Diagnose No. 200 and No. 204.

[Details]

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	0200	OVL	LV	OVC	HCA	HVA	DCA	FBA	OFA

#0 (OFA): Overflow alarm
#1 (FBA): Disconnection alarm
#2 (DCA): Regenerative discharge circuit alarm
#3 (HVA): Overvoltage alarm
#4 (HCA): Abnormal current alarm
#5 (OVC): Overcurrent alarm
#6 (LV): Low voltage alarm at the servo amplifier
#7 (OVL): Overload alarm

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	0204		OFS	MCC	LDA	PMS			

#3 (PMS): Improper feedback due to an error
#4 (LDA): Serial pulse coder's LED error
#5 (MCC): Melted contact of the electromagnetic switch of the servo amplifier
#6 (OFS): Digital servo current value A/D conversion error

F415	Servo Alarm: N-th Axis Excessive Stroke

[Description] At the n-th axis (1st to 8th), it was attempted to specify a speed greater than 511875 unit of detection/sec. This error occurs in case of wrong CMR setting.

F416	Servo Alarm: N-th Axis Disconnection

[Description] This is a position detection system error for the n-th axis (1st to 8th) pulse coder. (Disconnectino alarm.)

[Details]

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	0201	ALD			EXP				

- When Diagnose No. 200, #7 (OVL) = "1"
  #7 (ALD) 1: Motor overheat
  0: Servo amplifier overheat
- When Diagnose No. 200, #1 (FBA) = "1"

ALD	EXP	Alarm Description
1	0	A built-in pulse coder is disconnected (hardware).
1	1	A separate pulse coder is disconnected (hardware).
0	0	The pulse coder is disconnected (software).

F417	Servo Alarm: Illegal N-th Axis Parameter

[Description] This alarm occurs when the n-th axis (1st to 8th) meets one of the following conditions. (Digial servo system alarm)

① A value beyond a specified range has been set in the parameter no. 2020 for the motor type.

② A correct value (111 or -111) has been set in the parameter no. 2022 for the motor rotating direction.

③ Wrong data such as 0 or less has been set in the parameter no. 2023 for speed feedback pulses per revolution of the motor.

④ Wrong data such as 0 or less has been set in the parameter no. 2024 for position feedback pulses per revolution of the motor.

⑤ A flexible feed gear ratio has not been set in the parameter no. 2084 and no. 2085.

⑥ A value beyond a range of 1 to the number of controlled axes or an uncontinuous value has been set in the parameter no. 1025 (servo axis number).

⑦ The number of digital servo modules on the main CPU board (one for two axes) has not satisfied the set value for the number of control axes.

F420	Servo Alarm: Excessive N-axis Torque Difference

[Description] In simple synchronous control, a torque command difference between the master axis and slave axis exceeded a parameter set value (no. 2031).

F421	Servo Alarm: Excessive N-th Axis Error

[Description] While using a dual position feedback function, an error difference between the semi-closing side and fully closing side became excessive.

[Remedy] Confirm a set value of a dual position conversion factor (parameter no. 2078 and no. 2079).

4.2 In Case of Σ 16/18/21

The details of the amplifier related servo alarms are displayed at No. 200, No. 201, and No. 204 in the Diagnosis screen. (Described later)

F401	Servo Alarm: n-th Axis Vrdy OFF

[Description] The n-th axis (axis 1-8) servo amplifier READY signal (DRDY) went off.

F404	Servo Alarm: n-th Axis Vrdy ON

[Description] Even though the n-th axis (axis 1-8) READY signal (MCON) went off, the servo amplifier READY signal (DRDY) is still on.

Or, when the power was turned on, DRDY went on even though MCON was off.

Check that the servo interface module and servo amp are connected.

F405	Servo Alarm: (Zero Point Return Failt)

[Description] 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.

F407	Servo Alarm: Excess Error

[Description] The difference in synchronous axis position deviation exceeded the set value.

F409	Servo Alarm: n Axis Torque Alm

[Description] Abnormal servo motor load has been detected. Alternatively, abnormal spindle motor load has been detected in Cs mode.

F410	Servo Alarm: n-th Axis-Excess Error

[Description] The position deviation value when the n-th axis (axis 1-8) stops large than the set value.

F411	Servo Alarm: n-th Axis-Excess Error

[Description] The position deviation value when the n-th axis (axis 1-8) moves is large than the set value.

F413	Servo Alarm: n-th Axis-LSI Overflow

[Description] The contents of the error register for the n-axis (axis 1-8) exceeded ± 231 power. This error usually occurs as the result of an improperly set parameters.

F415	Servo Alarm: n-th Axis-Excess Shift

[Description] A speed higher than 511875 units/s was attempted to be set in the n-th axis (axis 1-8). This error occurs as the result of improperly set CMR.

F417	Servo Alarm: n-th Axis-Parameter Incorrect

[Description] This alarm occurs when the n-th axis (axis 1-8) is in one of the conditions listed below. (Digital servo system alarm)

① The value set in Parameter No. 2020 (motor from) is out of the specified limit.

② A power value (111 or -111) in not set in parameter No. 2022 (motor revolution direction).

③ Illegal data (a value below 0, etc.) was set in parameter No. 2023 (number of speed feedback pulses per motor revolution).

④ Illegal data (a value below 0, etc.) was set in parameter No. 2024 (number of position feedback pulses per motor revolution).

⑤ Parameters No. 2084 and No. 2085 (flexible field gear rate) have not been set.

⑥ A value outside the limit of {1 to the number of control axes} or a non-continuous value (Parameter 1023 (servo axis number) contains a value out of the range from 1 to the number of axes, or an isolated value (for example, 4 not preceded by 3). was set in parameter No. 1023 (servo axisnumber).

F420	Servo Alarm: n Axis Sync Torque (M series)

[Description] During simple synchronous control, the difference between the torque commands for the master and slave axes exceeded the value set in parameter No. 2031.

F421	Servo Alarm: n Axis Excess ER (D)

[Description] The difference between the errors in the semi-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.

F422	Servo Alarm: n Axis

[Description] In torque control of PMC axis control, a specified allowable speed has been exceeded.

F423	Servo Alarm: n Axis

[Description] In torque control of PMC axis control, the parameter-set allowable cumulative travel distance has been exceeded.

F430	n Axis: SV. Motor Overheat

[Description] A servo motor overheat occurred.

F431	n Axis: CNV. Overload

[Description] ① PSM: Overheat occurred.
② β series SVU: Overheat occurred.

F432	n Axis: CNV. Lowvolt CON./POWFAULT

[Description] 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.

F433	n Axis: CNV. Low Volt DC Link

[Description] 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.

F434	n Axis: INV. Low Volt Control

[Description] SVM: The control power supply voltage has dropped.

F435	n Axis: INV. Low Volt DC Link

[Description] SVM: The DC link voltage has dropped.

F436	n Axis: Softthermal (OVC)

[Description] The digital servo software the soft thermal state (OVC).

F437	n Axis: CNV. Overcurrent Power

[Description] PSM: Overcurrent flowed into the input circuit.

F438	n Axis: INV. Abnormal Current

[Description] 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.

F439	n Axis: CNV. Overvolt Power

[Description] 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.

F440	n Axis: CNV. EX Deceleration Pow.

[Description] 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.

F441	n Axis: Abnormal Current Offset

[Description] The digital servo software detected an abnormality in the motor current detection circuit.

F442	n Axis: CNV. Charge Fault/INV. DB

[Description] 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.

F443	n Axis: CNV. Cooling Fan Failure

[Description] ① PSM: The internal stirring fan failed.
② PSMR: The internal stirring fan failed.
③ **β** series SVU: The internal stirring fan failed.

F444	n Axis: INV. Cooling Fan Failure

[Description] SVM: The internal stirring fan failed.

F445	n Axis: Soft Disconnect Alarm

[Description] The digital servo software detected a broken wire in the pulse coder.

F446	n Axis: Hard Disconnect Alarm

[Description] A broken wire in the built-in pulse coder was detected by hardware.

F447	n Axis: Hard Disconnect (EXT)

[Description] A broken wire in the separate detector was detected by hardware.

F448	n Axis: Unmatched Feedback Alarm

[Description] The sign of feedback data from the built-in pulse coder differs from that of feedback data from the separate detector.

F449	n Axis: INV. IPM Alarm

[Description] ① SVM: IPM (intelligent power module) detected an alarm.
② α series SVU: IPM (intelligent power module) detected an alarm.

F460	n Axis: FSSB Disconnect

[Description] 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-voltage alarm was issued by the amplifier.

F461	n Axis: Illegal AMP Interface

[Description] The axes of the 2-axis amplifier were assigned to the fast type interface.

F462	n Axis: Send CNC Data Failed

[Description] Because of an FSSB communication error, a slave could not receive correct data.

F463	n Axis: Send Slave Data Failed

[Description] Because of an FSSB communication error, the servo system could not receive correct data.

F464	n Axis: Write ID Data Failed

[Description] An attempt was made to write maintenance information on the amplifier maintenance screen, but it failed.

F465	n Axis: Read ID Data Failed

[Description] At power-up, amplifier initial ID information could not be read.

F466	n Axis: MOTOR/AMP Combination

[Description] The maximum current rating for the amplifier does not match that for the motor.

F467	n Axis: Illegal Setting of Axis

[Description] 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 parameter No. 2008 = 1)
② High-speed current loop (bit 0 of parameter No. 2004 = 1)
③ High-speed interface axis (bit 4 of parameter No. 2005 = 1)

[Details of servo alarm]

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	200	OVL	LV	OVC	HCA	HVA	DCA	FBA	OFA

#7 (OVL): An overload alarm is being generated.
#6 (LV): A low voltage alarm is being generated in servo amp.
#5 (OVC): An overcurrent alarm is being generated inside of digital servo.
#4 (HCA): An abnormal current alarm is being generated in servo amp.
#3 (HVA): An overvoltage alarm is being enerated in servo amp.
#2 (DCA): A regenersative discharge circuit alarm is being generated in servo amp.
#1 (FBA): A disconnection alarm is being generated.
#0 (OFA): An overflow alarm is being generated inside of digital servo.

	#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No. 201	ALD			EXP				

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

#7 (ALD) 0: Motor overheating

1: Amplifier overheating

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

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

	#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No. 0204		OFS	MCC	LDA	PMS			

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

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

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

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

5. Alarms Related to Overtravel

When an overtravel alarm (F500 TO F507) occurred, move the machine in the opposite direction in the manual mode, and then, reset the alarm.

F500	Overtravel: +n

[Description] Exceeded a range of +n-axis stored stroke limit I. (Parameter no. 1320 or no. 1326)

[Caution] The parameter no. 1326 is valid when a stroke limit switching signal EXLM is turned on.

F501	Overtravel: -n

[Description] Exceeded a range of -n-axis stored stroke limit I. (Parameter no. 1321 or no. 1327)

[Caution] The parameter no. 1327 is valid when a stroke limit switching signal EXLM is turned on.

F502	Overtravel: +n

[Description] Exceeded a range of +n-axis stored stroke limit II. (Parameter no. 1322)

F503	Overtravel: -n

[Description] Exceeded a range of -n-axis stored limit II. (Parameter no. 1323)

F504	Overtravel: +n

[Description] Exceeded a range of +n-axis stored stroke limit III. (Parameter no. 1324)

F505	Overtravel: -n

[Description] Exceeded a range of -n-axis stored stroke limit III. (Parameter no. 1325)

F506	Overtravel: +n

[Description] The n-th axis exceeded “+” hard OT.

F507	Overtravel: -n

[Description] The n-th axis exceeded “-“ hard OT.

F510	Overtravel: +N

[Description] In stroke check before move, a block end point position is within the +N-th axis stroke limit prohibited area.

[Remedy] Correct the program.

F511	Overtravel: -N

[Description] In stroke check before move, the block end point position is within the -N-th axis stroke limit prohibited area.

[Remedy] Correct the program.

F512	Overtravel: +n	L

[Description] The machine exceeded the range of stored stroke limit IV on the n-axis plus side. (Parameter no. 1328)

F513	Overtravel: -n	L

[Description] The machine exceeded the range of stored stroke limit IV on the n-axis minus side. (Parameter no. 1329)

6. Alarms Related to Overheat

F700	Overheat: Control Unit

[Description] The control unit is overheated.
[Remedy] Check a fan motor for operation and clean an air filter.

F701	Overheat: Fan Motor

[Description] The fan motor on the upper rack of the control unit is overheated.
[Remedy] Check the fan motor for operation and replace by a new one if not functioning properly.

F704	Overheat: Spindle

[Description] Overheated spindle due to detection of spindle fluctuation
① Reduce a cutting condition in case of heavy duty cutting.
② Check whether or not a cutting tool is sharp.
③ The spindle amplifier may be defective.

7. Alarms Related to Direct Tap

F740	Rigid Tap Alarm: Excessive Error

[Description] In the direct tap mode, a position deviation amount exceeded a set value while the spindle was stopping.

F741	Rigid Tap Alarm: Excessive Error

[Description] In the direct tap mode, a position deviation amount exceeded a set value while the spindle was moving.

F742	Rigid Tap Alarm: LSI Overflow

[Description] An LSI overflow occurred on the part of the spindle in the direct tap mode.

8. Alarms Related to Serial Spindle

F749	S-Spindle LSI Error

[Description] This alarm is issued when a serial communication error occurs while the system is starting after power-on.

The following lists possible causes.

① Contact failure, missing, or disconnection of an optical cable

② Defective main CPU board or option-2 board

③ Defective spindle amplifier printed circuit board

[Remedy] When this alarm is issued upon turning on the CNC or when this alarm cannot be reset even if the CNC is reset, turn off the power once, including the spindle power, and then, restart.

F750	Spindle Serial Link Start Failure

[Description] This alarm is issued when the spindle amplifier is not started properly upon turning on the system with a serial spindle. Largely, there are the following four possible causes.

① Optical cable contact failure or spindle amplifier OFF

② The spindle amplifier•fs display showed "SU-01" or the NC unit was turned on in the alarm status of AL-24. This alarm mainly occurs when the power is turned off while the serial spindle is running. If this is the case, turn off the spindle amplifier and restart.

③ Others (erroneous hardware combination). Once the system is started, including the spindle control unit, this alarm is not issued.

④ When the 2nd spindle (parameter no. 3701, #4 (SP2) = 1) is one of the above-mentioned states ① through ③

[Remedy] For details, see Diagnose No. 409

[Details]

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis No.	0409					SPE	S2E	S1E	SHE

#0 (SHE): A serial communication module error for the CNC was detected.

#1 (S1E): An error was detected with the 1st spindle in starting spindle serial control.

#2 (S2E): An error was detected with the 2nd spindle in starting spindle serial control.

#3 (SPE): In spindle serial control, a serial spindle parameter is not meeting a spindle amplifier starting condition.

F751	1st Spindle Alarm Detection

[Description] With the system having the serial spindle, this is warning alarm which allows to display a spindle amplifier alarm on the CRT of the NC unit.

[Remedy] AL-xx (xx = number) is displayed on the spindle amplifier to indicate an alarm number. For its details, see “Digital AC Spindle” or the Maintenance Manual for the AC spindle servo unit. For the alarm number, the system latches and displays a spindle alarm number detected by the CNC as a cause for this alarm.

F752	1st Spindle Mode Changeover Error

[Description] Serial spindle control has not changed over properly to the contour control mode, spindle positioning, direct tap mode, or spindle control mode. This alarm is issued when the spindle amplifier reacted improperly to a changeover command from the NC unit.

F754	1st Spindle Abnormal Load Detection

[Description] An abnormal load was detected with the 1st spindle motor.

F761	2nd Spindle Alarm Detection

[Description] Same as the alarm no. 751

F762	2nd Spindle Mode Changeover Alarm

[Description] Same as the alarm no. 752

F764	2nd Spindle Abnormal Load Detection

[Description] Same as the alarm no. 754 (For the 2nd spindle)

F771	3rd Spindle Alarm Detection

[Description] Same as the alarm no. 751 (For the 3rd spindle)

F772	3rd Spindle Mode Changeover Alarm

[Description] Same as the alarm no. 752 (For the 3rd spindle)

F774	3rd Spindle Abnormal Loader Detection

[Description] Same as the alarm no. 754 (For the 3rd spindle)

9. System Alarms

(These alarms cannot be reset by the RESET key)

9.1 In Case of Σ 10

No.	Message	Description
900	ROM PARITY	This is a CNC, macro, or servo ROM parity error. Rewrite the flash ROM whose ROM number is displayed.
914	SRAM PARITY (2N)	This is a RAM parity error for the tape storage RAM or additional SRAM. Clear the memory or replace the main CPU board or additional SRAM. After this operation, re-set all the data such as parameters.
915	SRAM PARITY (2N+1)	
916	DRAM PARITY	This is a RAM parity error for the DRAM module. Replace the DRAM module.
920	SERVO ALARM (MAIN)	This is a servo alarm (main CPU board). A RAM parity error occurred in a watchdog alarm or the servo module. Replace the servo control module on the main CPU board.
922	SERVO ALARM (OPT2)	This is a servo alarm (option-2 board). A RAM parity error occurred in a watchdog alarm or the servo module. Replace the servo control module on the main CPU board. Replace the servocontrol module on the option-2 board.
924	SERVO MODULE SETTING ERROR	The digital servo module has not been mounted. Check the mounting condition of the servo control module on the main CPU board or option-2 board.
930	CPU INTERRUPT	This is a CPU error (abnormal interrupt). The main CPU board is defective.
950	PMC SYSTEM ALARM	The PMC system has an error. It is likely that the PMC control module or option-3 board on the main CPU board is defective.
951	PMC WATCH DOG ALARM	The PMC system has an error. (Watchdog alarm) It is likely that the PMC control module or option-3 board on the main CPU board is defective.
972	NMI OCCURRED IN OTHER MODULE	NMI occurred with a board other than the main CPU board. It is likely that one of the option-1 to option-3 or PMC control module is defective.
973	NON MASK INTERRUPT	Ill-defeined NMI occurred.
974	F-BUS ERROR	This is a FANUC bus error. It is likely that the main CPU board or one of the option-1 to option-3 boards is defective.
975	BUS ERROR (MAIN)	This is a main CPU board bus error. It is likely that the main CPU board is defective.

9.2 In Case of Σ 16/18/21

No.	Message	Description
900	ROM PARITY	A CNC, Macro, or Servo ROM parity error. Rewrite the Flash ROM corresponding to the displayed ROM number.
910	SRAM PARITY:(BYTE0)	A parity error for the SRAM where the machining programs, parameters, etc. are stored. Clear the memory or replace the SRAM module or mother board. After this operation, re-set all the data such as parameters.
	SRAM PARITY:(BYTE1)	
912	DRAM PARITY:(BYTE0)	A RAM parity error for the DRAM module. Replace the DRAM module.
913	DRAM PARITY:(BYTE1)	
914	DRAM PARITY:(BYTE2)	
915	DRAM PARITY:(BYTE3)	
916	DRAM PARITY:(BYTE4)	
917	DRAM PARITY:(BYTE5)	
918	DRAM PARITY:(BYTE6)	
919	DRAM PARITY:(BYTE7)	
920	SERVO ALARM (1-4 AXIS)	A servo alarm (1st to 4th axis). There occurred a watchdog alarm or a RAM parity error in the axis control card. Replace the axis control card.
921	SERVO ALARM (5-8 AXIS)	A servo alarm (5th to 8th axis). There occurred a watchdog alarm or a RAM parity error in the axis control card. Replace the axis control card.
926	FSSB ALARM	An FSSB alarm. Replace the axis control card.
930	CPU INTERRUPT	A CPU error (abnormal interrupt). The mother board or CPU card is faulty.
950	PMC SYSTEM ALARM	The PMC has an alarm. It is likely that the PMC control circuit on the mother board is faulty.
951	PMC WATCH DOG ALARM	The PMC has an alarm. (Watchdog alarm) It is likely that the mother board is faulty.
972	NMI OCCURRED IN OTHER MODULE	NMI occurred with the board other than the mother board. It is likely that the option board is faulty.
973	NON MASK INTERRUPT	Unaccountable NMI occurred.
974	F-BUS ERROR	A bus error of the FANUC bus. It is likely that the mother board and option board are faulty.
975	BUS ERROR	A bus error of the mother board. It is likely that the mother board is faulty.
976	L-BUS ERROR	A bus error of the local bus. It is likely that the mother board is faulty.

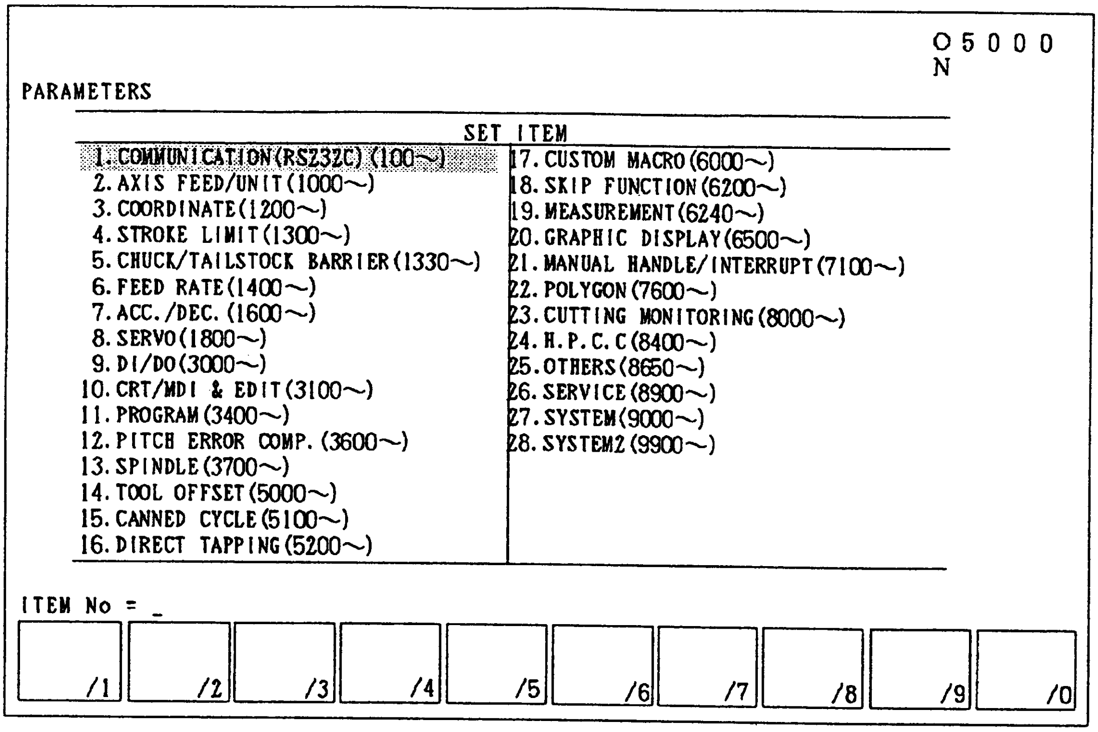
III. PARAMETERS

1. DISPLAY, SETTING, AND OUTPUT OF PARAMETERS

1.1 Displaying the Parameters

① Press the OPRE/MAINTE key, F4/SYSTEM soft key, following by the 1 and INPUT keys to display the PARAMETER screen.

② Press the N key, enter the parameter number you want to display, and press one of the cursor keys ↓, ↑, →, and ← keys. It is also possible to change the screen by the Page key, instead of entering the parameter number.



1.2 Setting the Parameters

(1) Parameter tape format

The parameters are classified as follows depending on the data format.

Data Format	Data Range
Bit type	0 or 1
Bit axis type	0 or 1
Byte type	-128 ~ 127
Byte axis type	-128 ~ 127
Word type	-32768 ~ 32767
Word axis type	-32768 ~ 32767
Long type	-99999999 ~ 99999999
Long axis type	-99999999 ~ 99999999

(Note 1) *The axis type means that the data can be set for each controlled axis.*

For example, the parameter No. 1023 (program axis name) has 8 axes worth of data. You can set the data for each axis (1st to 8th axis)

1023 X 88 ← Setting of the 1st axis

1023 Y 89 ← Setting of the 2nd axis

1023 Z 90 ← Setting of the 3rd axis

⁝

(Note 2) *The data range indicates a general range. As the data range differs depending on the parameter, see the description of each parameter for details.*

(Note 3) *The word type means 2 bytes and the long type 4 bytes.*

(Note 4) *A parameter data format looks like the following.*

"N_ P_ R_ ;"

N_: A numerical value following N. Parameter number

P_: A numerical value following P. Subnumber

R_: A numerical value following R. Parameter value

The parameters are classified as follows depending on the numerical value following N.

N0 to N9999: Regular parameters

N10000 onward: Pitch error

N20000 onward: SLBUS table

N30000 onward: System table

(2) Input the MDI panel

① Select the MDI mode.

② Turn on the MEMORY WRITE switch.

③ Press the [F5/SETTING] key to enable writing of parameters.

④ Reset the NC unit.

⑤ Press the [OPRE/MAINTE] (◁) key , [F4/SYSTEM] soft key, followed by the [1] and [INPUT] keys to display the PARAMETER screen.

⑥ Select a parameter item you want to set and move the cursor to your desired number. When searching, press [N], enter the [parameter number], and press the [cursor] move key.

⑦ Enter the data you want to set and press the [INPUT] key.

⑧ Press the [F5/SETTING] key to disable writing of parameters.

(3) Input by the parameter tape

① Press the EMERGENCY STOP switch.

② Turn on the Parameter Write switch.

③ Enable to write the data into the parameters.

④ Enter the data into the parameters by tape input/output.

⑤ Disable to write the data into the parameters.

1.3 Outputting the Parameters

① Connect a punching device to an input/output interface.

② Press the F8/IN/OUTPUT key to display the INPUT/OUTPUT screen.

③ Select input/output related parameters and set a baud rate, and so on.

④ Enter a parameter number you want to output.

Any desired parameter can be output by specifying an N-number. When you enter (Parameter) = N0;N1000-N1999;N8000, the parameters no. 0, 1000 through 1999, and 8000 are output. When no N-number is specified, all the parameters are output.

⑤ Pressing the F2/OUTPUT soft key outputs the parameters.

2. DESCRIPTION OF PARAMETERS

The parameters are sorted as follows by their numbers.

(Note 1) *Some parameters are described in two vertical fields. If this is the case, the top field is for the L-system only and the bottom one for the M-system only. The parameters with one-field description is common to both L- and M-systems.*

	#7	#6	#5	#4	#3	#2	#1	#0	
5101	KGL	KDH							L
						FEP	FTP	FXY	M

Top field: KDH and KGL are valid for the L-system only.

Bottom field: FXY, FTP, and TEP are valid for the M-system only.

	#7	#6	#5	#4	#3	#2	#1	#0
1301	PLC							

PLC is valid for both L- and M-systems.

(Note 2) *The units of travel amount include an input increment, least input increment, least command increment, and detection increment. They are outlined in the following.*

The input increment is determined by a combination of the least input increment (unit of input) and least command increment (Unit of output). The least input increment is the least increment of the travel amount you program, and the least command increment is the least increment of the machine's travel amount. They are both express in mm, in., or deg.

There are two kinds of increment systems; IS-B and IS-C (IS-A is currently not available). Use the parameter no. 1003, #1 (IS-C) to select either increment system.

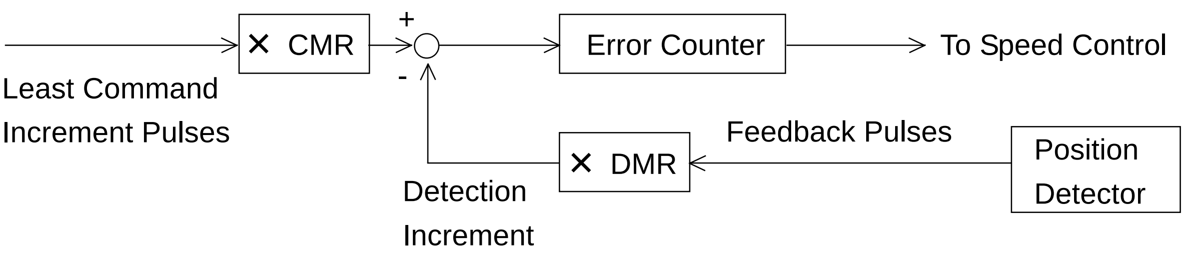
[Increment Systems, Least Input Increments, and Least Command Increments]

Increment System		Least Input Increment	Least Command Increment
IS-B	Metric system	0.001 mm (Diameter designation)	0.0005 mm
		0.001 mm (Radius designation)	0.001 mm
		0.001 deg	0.001 deg
	Inch system	0.0001 inch (Diameter designation)	0.0005 mm
		0.0001 inch (Radius designation)	0.001 mm
		0.0001 deg	0.001 deg
IS-C	Metric system	0.0001 mm (Diameter designation)	0.00005 mm
		0.0001 mm (Radius designation)	0.0001 mm
		0.0001 deg	0.0001 deg
IS-C	Inch system	0.00001 inch (Diameter designation)	0.00005 mm
		0.00001 inch (Radius designation)	0.0001 mm
		0.00001 deg	0.0001 deg

[※] Diameter designation is allowed only for the L-system.

The detection increment is the increment of feedback pulses from the position detector divided by detection multiply (DMR). It must be the same increment as the least command increment divided by command multiply (CMR).

[Least Command Increment versus Detection Increment]



In the figure above, set the magnifications of CMR and DMR so that the pulse significances of plus and minus inputs to the error counter will be equal.

$$\frac{\text{Least Command Increment}}{\text{CMR}} = \text{Detection Increment} = \frac{\text{Feedback Pulse Increment}}{\text{DMR}}$$

The feedback pulse increment differs depending on the type of the detector.

$$\text{Feedback pulse increment} = \frac{\text{Travel amount per revolution of the pulse coder}}{\text{Pulses per revolution of the pulse coder}}$$

CMR is set with the parameter No. 1820 and DMR with the parameter No. 1816 or those No. 2084 and 2085, respectively.

2.1 Parameters Related to Communication (RS-232C) (No. 0100 onward)

Data format: Bit type

	#7	#6	#5	#4	#3	#2	#1	#0
0100	NOST	SPC	ICR2	ICR1	EIA	ISP	CTV	TVC

- TVC 0: Does not make a TV check
  1: Makes a TV check
- CTV 0: Does not count the characters for a TV check during control-out.
  1: Counts the characters for a TV check during control-out.
- ISP 0: ISO code with parity bits (TH check ON)
  1: ISO code without parity bits (ASC code: TH check OFF)
- EIA 0: ISO punch code
  1: EIA punch code
- ICR1, ICR2 EOB punching format by the ISO code.

ICR2	ICR1	EOB Punching Format
0	0	LF-CR-CR
0	1	LF-CR
1	0	LF
1	1	LF

- SPC 0: Does not add a space code to the beginning of each address
  1: Adds a space code to the beginning of each address
- NOST 0: Outputs a "DC3" code after completion of input.
  1: Does not output a "DC3" code after completion of input.

	#7	#6	#5	#4	#3	#2	#1	#0	
0101	D2M99						D2BCC	D2DCD	L

Data format: Bit type

- D2DCD In DNC2, DCD signal checking is:
  0: Performed
  1: Not performed.
- D2BCC In DNC2, BCC value checking is:
  0: Performed.
  1: Not performed. (BCC, itself cannot be omitted.)
- D2M99 When executing M99 in the main program in status communication to the DNC2 host;
  0: Does not output M30
  1: Outputs M30

	#7	#6	#5	#4	#3	#2	#1	#0	
0102	DHD2	NCDR						EIO	L
	DHD2	NCDR					GIOC	EIO	M

Data format: Bit type

- EIO 0: Does not calls the last program after reading an external tape input.
  1: Calls the last program after reading an external tape input.
- G10C L11 and L12 of the G10 command for tool offset amount tape output
  0: L11 is a tool diameter profile and L12 is tool length wear
  1: L11 is tool length wear and L12 is a tool diameter profile (Standard)
- NCDR While in communication, "DSR signal" checking is:
  0: Performed.
  1: Not performed. (Checking, however, is always performed on start of communication.)
- DHD2 Commands to be used in the directory display in Don-don FD are:
  0: "HD command" alone
  1: "HD command" + HD2 command"

	#7	#6	#5	#4	#3	#2	#1	#0
0103	POT8	POT7	POT6	POT5	POT4	POT3	POT2	POT1

Data format: Bit type

- POT1 to POT8
  0: Does not output the n-th (n = 1 to 8 axis of the axis type parameter.
  1: Output the n-th (n = 1 to 8 axis of the axis type parameter)

(Note) *When all the bits are "0", all the controlled axes are output.*

	#7	#6	#5	#4	#3	#2	#1	#0
0104				EVP	PRTY	BLN	RSB	STP

Data format: Bit type

Set the stop bits, etc. for the device number 1.

- STP 0: 2 stop bits
  1: 1 stop bit
- RSB 0: Uses a control code.
  1: Does not use a control code.
- DLN 0: 8-bit data length
  1: 7-bit data length

- PRTY 0: Without parity bits
  1: With parity bits
- EVP 0: Even parity
  1: Odd parity

As with 0104, set the stop bits, etc. for the device number 2 through 7 as to 0105, 0106, 0107, 0108, 0109, and 0110.

0105	Set the stop bits, etc. for the device number 2.
0106	Set the stop bits, etc. for the device number 3.
0107	Set the stop bits, etc. for the device number 4.
0108	Set the stop bits, etc. for the device number 5.
0109	Set the stop bits, etc. for the device number 6.
0110	Set the stop bits, etc. for the device number 7.

	#7	#6	#5	#4	#3	#2	#1	#0
0112								

Data format: Bit type

Set a bit pattern for the "DC1" code. When all the bits are "0", it is assumed to be 11 H (hexadecimal).

	#7	#6	#5	#4	#3	#2	#1	#0
0113								

Data format: Bit type

Set a bit pattern for the "DC2" code. When all the bits are "0", it is assumed to be 12 H (hexadecimal).

	#7	#6	#5	#4	#3	#2	#1	#0
0114								

Data format: Bit type

Set a bit pattern for the "DC3" code. When all the bits are "0", it is assumed to be 93 H (hexadecimal).

	#7	#6	#5	#4	#3	#2	#1	#0
0115								

Data format: Bit type

Set a bit pattern for the "DC4" code. When all the bits are "0", it is assumed to be 14 H (hexadecimal).

0116	Baud rate for the device number 1

0117	Baud rate for the device number 2

0118	Baud rate for the device number 3

0119	Baud rate for the device number 4

0120	Baud rate for the device number 5

0121	Baud rate for the device number 6

0122	Baud rate for the device number 7

Data format: Byte type

Unit of data: None

Data range: None

Set the baud rates for the device number 1 through 7 according to the following table.

Set Value	Baud Rate (bps)
8	1200
11	2400
13	4800
15	9600
Others	4800

0124	Port number for the device number 1

0125	Port number for the device number 2

0126	Port number for the device number 3

0127	Port number for the device number 4

0128	Port number for the device number 5

0129	Port number for the device number 6

0130	Port number for the device number 7

Data format: Byte type

Unit of data: None

Data range: 1 to 2

Set the port numbers for the device numbers 1 through 7.

For setting value = 0, it is taken as 1.

0132	Device number for data input

0133	Device number for data output
0135	Device number for custom macro external output
0136	Device number for DNC2

Data format: Byte type

Unit of data: None

Data range: 1 to 7

Set the device numbers for data input, data output, and custom macro external output.

Device No.	Device
1	RS-232C
2	Taper reader
3	Tape puncher
4	Card

Device No.	Device
5	Auxiliary 1
6	Auxiliary 2
7	FD card
Others	Card

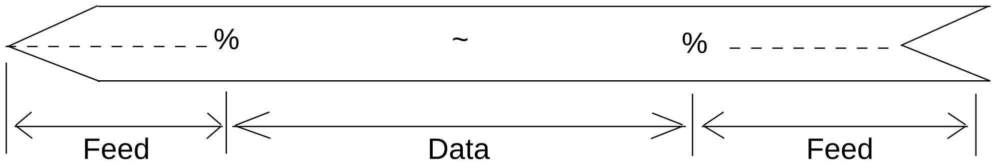
0138	Feed length at tape output time

Data format: Byte type

Unit of data: cm

Data range: 0 to 127

Set a feed length at tape output time. Normally, set a value about 90 cm.



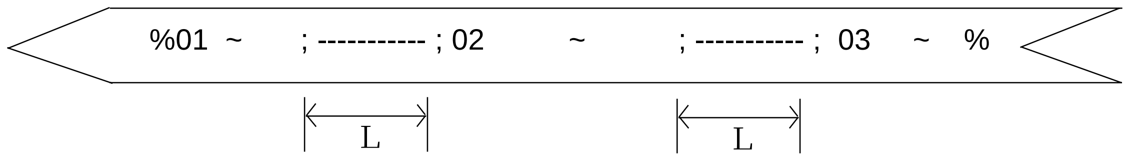
0139	Program interval length at tape output

Data format: Byte type

Unit of data: cm

Data range: 0 to 127

Set a program interval length (L) at tape output. (A space code is output between the programs.) Normally, set a value of about 30 cm.



0140	Floppy disk type you initialize (format) by an FD card

Data format: Byte type

Unit of data: None

Data range: 0 to 4

Set a type of the floppy disk you initialize (format) by the FD card.

Set Value	Floppy Type
0	2HD (1.22 M)
1	2HC (1.44 M)
2	PG format
3	Automatic
4	Automatic

(Note 1) *When a set value is "4", the floppy disk type follows parameter setting in the FD card.*

(Note 2) *The data beyond a range is assumed to be "4".*

0142	DNC2: Time-out of non-response timer

0143	DNC2: Time-out of EOT timer

Data format: Byte type

Unit of data: sec.

Data range: 1 to 127

Time-out lengths for the non-response timer and the EOT timer in DNC2 function are set.

(Note) *With a value outside the range having been set, it is assumed to be equal to 5 seconds (standard value) for both parameters.*

0144	DNC2: Number of times of retrial

0145	DNC2: Number of times of NAK retrial

Data format: Byte type

Unit of data: Number of times

Data range: 1 to 127

The number of times of retrial in DNC2 function is set.

- No. 0144: The upper limit for incorrect transfer order in the data link layer or the number of times of urges to non-response. (standard value: x 5)
- No. 0145: The upper limit for the number of times that message can be resent by NAK. (standard value: x 3)

(Note) *A value outside the range, if having been set, is assumed to be 5 times (standard value) for No. 0144 and 3 times (standard value) for No. 0145.*

0146	DNC2: Maximum length of datagram (data section)

Data format: Byte type

Unit of data: Byte

Data range: 80 to 255

The maximum length of the datagram (data section) is DNC2 function is set.

The maximum packet length in DNC2 sending is defined by this parameter.

The maximum packet length is equal to "this parameter value + 9 characters", consisting of the beginning 2 characters, four characters for the command part and 3 characters at the end.

Packet Length						
DLE	STX	COMMAND	DATA SECTION	DLE	EXT	BCC
2 bytes		4 bytes	80 to 256 bytes	3 bytes		

(Note) *A value outside the range, if having been set, is assumed to be equal to 256 (standard value).*

	#7	#6	#5	#4	#3	#2	#1	#0
0164	ENS		ND3	SCS			CTV	

Data format: Bit type

Make necessary setting when using a remote buffer.

- CTV 0: Does not count the characters for a TV check in the comment section of the program.
  1: Counts the characters for a TV check in the comment section of the program.
- SCS Be sure to set 1. (At power-on, "1" is set automatically)
- ND3 0: Reads the program block by block at DNC operation. (Out puts the "DC3" code for each block)
  1: Reads the program until the buffer becomes full. (Outputs the "DC3" code when the buffer becomes full)
- ENS 0: When there is a "NULL" code while reading the EIA code, it is assumed to be an alarm.
  1: When there is a "NULL" code while reading the EIA code, it is ignored.

	#7	#6	#5	#4	#3	#2	#1	#0
0165					ASI			SB2

Data format: Bit type

Set the stop bits, etc. when using the remote buffer.

- SB2 0: 1 stop but
  1: 2 stop bits
- ASI 0: EIA or ISO code at data input (Automatic distinction)
  1: ASCII code

0166	#7	#6	#5	#4	#3	#2	#1	#0
			CLK	NCD		SYN	PRY	

Data format: Bit type

Set the parity bits, etc. when using the remote buffer.

- PRY 0: Without parity bits
  1: With parity bits
- SYN 0: In case of protocol B, an NC reset/alarm is not informed to the host.
  1: In case of protocol B, an NC reset/alarm is informed to the host by the "SYN" or "NAK" code.
- NCD 0: Checks the RS-232C interface for CD (signal quality detection).
  1: Does not check the RS-232C interface for CD (signal quality detection).
- CLK 0: When using the RS-422 interface, an internal clock is used as a baud rate clock.
  1: When using the RS-422 interface, an external clock is used as a baud rate clock.

0167	#7	#6	#5	#4	#3	#2	#1	#0
	RMS				R42	PRA	EXT	ASC

Data format: Bit type

Make necessary setting when using the remote buffer.

- ASC 0: All the communication codes except the NC data are ISO codes
  1: All the communication codes except the NC data are ASCII codes
- EXT 0: The end code for the protocol A or extended protocol A is the ASCII/ISO code, CR.
  1: The end code for the protocol A or extended protocol A is the ASCII/ISO code, EXT.
- PRA 0: A communication protocol is protocol B.
  1: A communication protocol is protocol A.
- R42 0: Uses the RS-232C as an interface.
  1: Uses the RS-422C as an interface.
- RMS 0: In case of the protocol A, always sends the "status of remote/tape operation" for the SAT command as "0".
  1: Returns the contents of the "remote/tape operation changeover request" for the SET command from the host.

0180	I/O channel when using the remote buffer

Data format: Byte type

Set an I/O channel when using the remote buffer. (Be sure to set "3")

0181	Specification number for an input/output device when using the remote buffer

Data format: Byte type

Set the specification number for the input/output device corresponding to the I/O channel 3 (remote buffer) according to the following table.

Set Value	Input/Output Device
0	RS-232C (Uses the control codes, DC1 to DC4)
4	RS-232C (Does not uses the control codes, DC1 to DC4)

0182	Baud rate when using the remote buffer

Data format: Byte type

Set the baud rate for the input/output device corresponding to the I/O channel 3 (remote buffer) according to the following table.

Set Value	Baud Rate (bps)
1	50
2	100
3	110
4	150
5	200
6	300
7	600
8	1200

Set Value	Baud Rate (bps)
9	2400
10	4800
11	9600
12	19200
13	38400
14	76800
15	86400

(Note) *The set values 13 to 15 are available for the RS-422 only.*

2.2 Parameters Related to Axis Control/Input Increment

	#7	#6	#5	#4	#3	#2	#1	#0
1000						INI		

Data format: Bit type

- INT 0: The units of input are of the metric system.
  1: The units of input are of the inch system.

	#7	#6	#5	#4	#3	#2	#1	#0
1001								INM

Data format: Bit type

- INM 0: The least command increment for the linear axis is of the metric system. (Machines with the metric system)
  1: The least command increment for the linear axis is of the inch system. (Machines of the inch system)

(Note) *Be sure to set "0".*

	#7	#6	#5	#4	#3	#2	#1	#0
1002				XIK		SFD		JAX

Data format: Bit type

- JAX 0: The number of simultaneously controlled axes is one at the time of jog feed, manual rapid traverse, and manual reference point return.
  1: The number of simultaneously controlled axes is three at the time of jog feed, manual rapid traverse, and manual reference point return.
- SFD 0: Does not use the reference point shift function.
  1: Uses the reference point shift function.
- XIK 0: When per-axis interlock is applied in non-linear positioning (parameter no. 1401, #1 (LPR) = 0), only the interlocked axis is stopped. The other axes continue to move.
  1: When per-axis interlock is applied in non-linear positioning (parameter no. 1401, #1 (LPR) = 0), all the axes are stopped.

	#7	#6	#5	#4	#3	#2	#1	#0	
1003	IPR					ISC			L
	IPR					ISC		ISA	M

Data format: Bit type

- ISA, ISC Set the least input increment and least command increment.

ISC	ISA	Least Input Increment, Least Command Increment	Symbol
0	0	0.001 mm, 0.001 deg., or 0.0001 in.	IS-B
0	1	0.01 mm, 0.01 deg., or 0.001 in.	IS-A
1	0	0.0001 mm, 0.0001 deg., or 0.00001 in.	IS-C

(Note) *IS-A is currently not available.*

- IPR   0: With the input increments IS-B and IS-C, the least input increment for each axis is not 10 times larger than the least command increment.
  1: With the input increments IS-B and IS-C, the least input increment for each axis is 10 times larger than the least command in crement.

When IPR = 1 is set, the least input increment will be as shown in the table below.

Type	Least input Increment
IS-B	0.01 mm, 0.01 deg., or 0.001 in.
IS-C	0.001 mm, 0.001 deg., or 0.0001 in.

(Note) *When the type of units is IS-A, the least input increment cannot be 10 times larger than the least command increment.*

	#7	#6	#5	#4	#3	#2	#1	#0
1005	JZR							ZDC

Data format: Bit type

- ZDC   0: Enables a reference point return deceleration signal check.
  1: Enables a reference point return deceleration signal check.
- JZR   0: Does not perform reference point return in the JOG mode.
  1: Performs reference point return in the JOG mode.

	#7	#6	#5	#4	#3	#2	#1	#0	
1006	WIPS								L
								RPC	M

Data format: Bit type

RPC   In Return (G29) from the reference point, axial switching is:
0: Not applied.
1: Applied.

WIPS   <Valid for the 18L/21L>
0: Does not use the imposition check extension function.
1: Uses the imposition check extension function.

(Note) *The imposition check extension function uses the imposition width C of the parameter No. 1028 at the end point of the G28/G30 block and that of the G00 block when switching from G00 to the T-code command (multiple offset excluede).*

	#7	#6	#5	#4	#3	#2	#1	#0
1008	RMBx							MIRx

Data format: Bit axis type

- MIRx Prohibited (Be sure to set 0)
- PMVx 0: Does not detach the controlled axis.
  1: Detaches the control axis.

(Note) *RMVx is enabled when the parameter no. 1009, #7 (RMBx) is "1".*

	#7	#6	#5	#4	#3	#2	#1	#0
1009	RMBx	MCCx	EDMx	EDPx	HJZx			ZRNx

Data format: Bit axis type

- ZRNx 0: When a non-G28 command accompanied by a move is given without initial reference point return performed, it is assumed to be an alarm.
  1: When a non-G28 command accompanied by a move is given without initial reference point return performed, it is assumed to be an alarm.
- HJZx 0: When the reference point has been already established, manual reference point return is a low-speed type (reference point return using a deceleration dog).
  1: When the reference point has been already established, manual reference point return is a high-speed type (positioning to the reference point regardless of the deceleration dog)
- EDPx 0: An external deceleration signal in the plus direction of each axis valid for rapid traverse only.
  1: An external deceleration signal in the plus direction of each axis valid for rapid traverse and cutting feed.
- MCCx 0: Turns off MCC when the controlled axis is detached.
  1: Does not turn off MCC when the controlled axis is detached. (Although the servo motor becomes unexcited, a servo amplifier's MCC signal is not turned off.)

*(**Note**) This parameter is used when a two-axis or three-axis amplifier is used and only one of those axes is to be detached. When the two-axis or three-axis amplifier is used and only one of those axes is detached, a servo alarm (401 (V-READY OFF) normally results, but the servo alarm can be prevented by setting this parameter to "1".*

- RMBx 0: Disables detachment of each controlled axis (signal input and setting of the parameter no. 1008, #7 (RMVx)).
  1: Enables detachment of each controlled axis (signal input and setting of the parameter no. 1008, #7 (RMVx)).

	#7	#6	#5	#4	#3	#2	#1	#0	
1010			ZMIx		DIAx		ROSx	ROTx	L
			ZMIx				ROSx	ROTx	M

Data format: Bit axis type

- ROTx Sets either a linear axis or rotary axis

ROSX	ROTx	Meaning
0	0	Linear axis ① 1 Makes inch/metric conversion. ② All the coordinate values are a linear axis type. (Does not round at 0 to 3600) ③ Stored pitch error compensation is a linear axis type. (See Parameter No. 3624)
0	1	Rotary axis (A Type) ① Does not make inch/metric conversion. ② Rounds the machine coordinate values at 0 to 3600. You can use the parameter no. 1011 #0 (ROAx) and #2 (RRLx) to select whether or not the work coordinate values and relative coordinate values are to be rounded, respectively. ③ Stored pitch error compensation is a rotary axis type. (See Parameter No. 3624)
1	0	Setting prohibited (Disallowed to use)
1	1	Rotary axis (B-type) ① Does not make inch/metric conversion. ② The machine coordinate value, work coordinate value, and relative coordinate value are of linear axis type. (Not rounded to 0 to 360°) ③ Stored pitch error compensation is of linear axis type. (See Parameter No. 3624) ④ Cannot be jointly used with the rollover function of the rotary axis.

- DIAx 0: Uses a radius to specify a stroke for each axis.
  1: Uses a diameter to specify a stroke for each axis.
- ZMIx 0: The reference point return direction for each axis and the initial backlash direction at power-on are the plus direction.
  1: The reference point return direction for each axis and the initial backlash direction at power-on are the minus direction.

	#7	#6	#5	#4	#3	#2	#1	#0
1011						RRLx		ROAx

Data format: Bit axis type

- ROAx 0: Does not round a work coordinate value by a stroke per revolution.
  1: Rounds a work coordinate value by a stroke per revolution.
- RRLx 0: Does not round a relative coordinate value by a stroke per revolution.
  1: Rounds a relative coordinate value by a stroke per revolution.

(Note 1) *ROAx and RLLx are valid for the rotary axis type A (parameter no. 1010 #0 (ROTx) = 1, #1 (ROSx) = 0) only.*

(Note 2) *Set a stroke per revolution in the parameter no. 1232.*

	#7	#6	#5	#4	#3	#2	#1	#0	
1012	JZMVx	IDFCx					RAASx	RACBx	L
	JZMVx						RAASx	RACBx	M

Data format: Bit axis type

- RACBx 0: Rotary axis control type is A.
  1: Rotary axis control type is B.
- RAASx 0: Does not take a shortcut by absolute programming when rotary axis control type is A.
  1: Takes a shortcut by absolute programming when rotary axis control type is A.
- IDFCx 0: Does not provide independent axis speed control.
  1: Provides independent axis speed control.

  (Note) *Independent axis speed control can be specified for only one of the CNC controlled axes. If it is specified for two or more axes, it will be effected only for the smaller-number axis.*

• JZMVx 0: Cannot move from the reference point to the reference point return direction in the JOG mode when the reference point return is valid (parameter no. 1005 #7 (JZR) = 1) in the JOG mode and high-speed reference point return (parameter no. 1009 #3 (HJZx) = 1) is selected for the second time onward.

1: Can move from the reference point to the reference point return direction in the JOG mode when the reference point return is valid (parameter no. 1005 #7 (JZR) = 1) in the JOG mode and high-speed reference point return (parameter no. 1009 #3 (HJZx) = 1) is selected for the second time onward.

1015	Number of CNC Controlled Axes

Data format: Byte type

Data range: 1 to total number of controlled axes

Set the maximum number of axes controlled by the CNC.

[Example] When the total number of controlled axes is 4 and they are the X-axis, Y-axis, Z-axis, and A-axis, respectively, starting at the 1st axis, and a set value is 3;

X-axis, Y-axis, Z-axis ----- Axes controlled by the CNC and PMC

A-axis ------ Axis controlled by the PMC

1018		L
	Axis switching number	M

Data format: Byte type

Data range: 0 to 5

A number to define correspondence regarding program axes and Machine axes in axis switching function is set here. Correspondence among axis switching numbers, program axes (X, Y, Z) and Machine axes (x, y, z) is as shown below:

Axis Switching No.	Program Axes		
	X	Y	Z
0	x	y	z
1	x	z	y
2	y	x	z
3	y	z	x
4	z	x	y
5	z	y	z

(Note) *Depending on the type of axis switching, method of use of this parameter varies.*

[Axis Switching Type A]

With G248 [Axis Switching ON] command, axis switching selected by this parameter is performed.

[Axis Switching Type B]

With the plane selection G code following commanding of G248 (Axis Switching ON), axis switching is performed as follows. Also, a value of this parameter is automatically set here.

Work Plane Select G Code	Program Axis X	Y	Z	Axis Switching No.
G240	x	y	z	0
G241	x	z	-y	1
G242	y	z	x	3
G243	-x	z	y	1
G244	-y	z	-x	3

1020	2nd Miscellaneous Function Command Address

Data format: Byte type

According to the table below, set the address to specify the 2nd miscellaneous function.

Address	Set Value
U	85
V	86
W	87

Address	Set Value
A	65
B	66
C	67

(Note 1) *For the G-code system, A of the L-system, U, V, or W cannot be used as an address for the 2nd miscellaneous function.*

(Note 2) *When the address for the 2nd miscellaneous function has been set for the axis name (parameter no. 1023), the axis name has priority, overroding the 2nd miscellaneous function.*

1023	Program Axis Name for Each Axis

Data format: Byte axis type

According to the table below, set a program axis name for each controlled axis.

Axis Name	Set Value
X	88
Y	89
Z	90

Axis Name	Set Value
U	85
V	86
W	87

Axis Name	Set Value
A	65
B	66
C	67

(Note 1) *For the G-code system, A of the L-system, U, V, or W cannot be used as an address for the 2nd miscellaneous function.*

(Note 2) *The same axis name cannot be set for multiple axes.*

(Note 3) *When the 2nd miscellaneous function has been added, the address used as the 2nd miscellaneous function (parameter no. 1020) is not available as an axis name.*

(Note 4) *When the A-axis is used for the axis name is the L-system, the angle designation linear interpolation function is disabled.*

1024	Setting of Each Axis Used as Which Axis of the Basic Coordinate System

Data format: Byte axis type

Specify whether each controlled axis is one of the three basic axes of the basic coordinate system (X-, Y-, and Z-axis) or their parallel axes in order to determine the planes such as circular interpolation, tool diameter compensation (M-system), tool nose radius compensation (L-system).

G17: Xp-Yp plane

G18: Zp-Xp plane

G19: Xp-Zp plane

Set Value	Description
0	Neither basic 3 axes or their parallel axes (rotary axes)
1	X-axis of the 3 basic axes
2	Y-axis of the 3 basic axes
3	Z-axis of the 3 basic axes
4	Axis parallel to the X-axis
5	Axis parallel to the Y-axis
6	Axis parallel to the Z-axis

(Note 1) *Only one of the three basic axes can be selected to be set as a controlled axis, but two or more parallel axes can be selected.*

(Note 2) *When the Y-axis is not available in the L-system, drilling by the z-axis cannot be done in the canned cycle for drilling, because the G17 plane cannot be created (an alarm is issued). If this is the case, set the Y-axis (set value = 2) in the parameter for beyond the number of controlled axes. This will allow a virtual Y-axis to exist, enabling the G17 plane to be created.*

1025	Servo Axis Number for Each Axis

Data format: Byte axis type

Data range: 1 to number of controlled axes

Set to which servo axis each controlled axis corresponds. Normally, a controlled axis number should be the same as a servo axis number.

Controlled axis number: Represents an axis type parameter or axis type machine signal arrangement number.

Servo axis number: Represents an axis number actually linked hardware-wise.

- In Case of **Σ** 10

Represents a servo connector number on the main CPU board. Set "-1" to the axis where Cs contour control is to be performed.

- In Case of **Σ** 16/18/21

  Since a high-speed serial servo bus (FSSB) is used, which connects between the CNC controller and multiple servo amplifiers with one optical fiber cable, define a linkage with the servo amplifiers in terms of relations with not only this parameter, but other parameters.

  (Details are omitted)

  <Related Parameters> Nos. 1902, 1904, 1905, 1910 to 1919, 1920 to 1929, 1932, 1933, 1934, 1936, and 1937

1027	All Axes Reference Point Return Order

Data format: Byte type

Data range: 1 to number of CNC controlled axes

Set the order in which each axis is to be returned to the reference point when returning all the axes. A set value of 1 represents the first, 2 the second, and so on. The same value can be set for the axis to be simultaneously returned, but set it within the number of manual simultaneously controllable axes (1 or 3: parameter no. 1002, #0 (JAX)).

[Example] When the number of CNC controlled axes is 4 (axis names are X, Y, Z, and C sequentially);

When you set parameter no. 1027 = X 1, X 2, Z 2, C3;

1st axis -------- X-axis

2nd axis ------- X- and Z-axis returned simultaneously

3rd axis ------- C-axis

(Note) *The all axes reference point return function is not available for the axis for which a value beyond the data range has been set.*

1028	Axis Imposition Width C	L
		M

Data format: Word Imposition Width C <Valid for **Σ** 18L/21L>

Unit of data: Unit of detedtion

Data range: 0 to 32767

Set the imposition width for each axis when using the imposition check extension function (parameter No. 1006, #7(WIPS) = 1).

2.3 Parameters Related to Coordinate System

	#7	#6	#5	#4	#3	#2	#1	#0	
1200	BSM								L
						RSFO	FOTP	ROF	M

Data format: Bit type

- ROF
  0: An offset amount rotates when local coordinate system setting (G52) is specified during the coordinate rotation (type A) mode.
  1: An offset amount does not rotate when local coordinate system setting (G52) is specified during the coordinate rotation (type A) mode.
- FOTP
  When vector of the rotary table dynamic fixture offset has changed:
  0: Shifting takes place. (The work coordinate system does not change, whereas the Machine coordinate changes.)
  1: Shifting does not take place. (The work coordinate system changes, whereas the Machine coordinate does not change.)
- RSFO
  With Reset, rotary table dynamic fixture offset is:
  0: Cancelled. (The mode is cancelled and the vector cleared.)
  1: Not cancelled (Both the mode and vector are retained.)
- BSM
  0: When back machining is enabled, the B-axis coordinate system is set by an all axes coordinate system setting command.
  1: When back machining is enabled, the B-axis coordinate system is not set by an all axes coordinate system setting command.

	#7	#6	#5	#4	#3	#2	#1	#0	
1201	EWCP								L
	EWCP						RWS	EWT	M

Data format: Bit type

- EWT
  0: An external work zero point offset is enabled in the blocks where any of G54 to G59 (G540 to G599) has been given.
  1: An external work zero point offset is enabled in the block next to the one where an offset amount was altered.
- RWS
  0: Does not cancel by reset an offset amount specified by G92.
  1: Cancels by reset an offset amount specified by G92.
- CGW
  When the currently used work offset (G54 to G59) is changed by key input or G10 command;
  0: The new offset becomes valid, starting from the next work offset selection command (G54 to G59).
  1: The new offset becomes valid immediately.

(Note) When this parameter is set to “1”, the work offset being selected during automatic operation canot be changed by key input operation.

- EWCP In order to take thermal displacement offset data into the external work zero point offset or thermal displacement work zero point offset:
  0: External data are input through RADA. (conventional system)
  1: CNC directly takes in offset data.

	#7	#6	#5	#4	#3	#2	#1	#0	
1202	TRCHK				RTN				L
					RTN	ZRN		ZRNP	M

Data format: Bit type

- ZRNP 0: At the time of manual reference point return, the work coordinate system is preset in the reset state.
  1: At the time of manual reference point return, the work coordinate system is preset without fail.
- ZRN 0: At the time of manual reference point return, the work coordinate system is preset according to setting of the parameter no. 1202 #0 (ZRNP).
  1: At the time of manual reference point return, the work coordinate system is not preset.
- RTN 0: When starting from the reset state, the work coordinate system is not preset.
  1: When starting from the reset state, the work coordinate system is preset for all the axes.

(Note) *In case of the L-system, even if this parameter is set to "1";*

- The rotary axis (parameter no. 1010 #0 (ROTx) is not preset.
- The B-axis with back machining follows setting of the parameter no. 1200 #7 (BSM).

- TRCHK When changing the machining reference point shift amount or inputting the removal amount through manual operation;
  0: Does not check the turret head face number input form the machine and the turret head clamp signal.
  1: Checks the turret head face number input from the machine and the turret head clamp signal.

	#7	#6	#5	#4	#3	#2	#1	#0
1203							PSN2	PSN1

Data format: Bit type

PSN1, PSN2 Set how many position switches should be used in the position switch function.

PSN2	PSN1	No. of Position Switches
0	0	4 switches
0	1	8 switches
1	0	12 switches
1	1	16 switches

	#7	#6	#5	#4	#3	#2	#1	#0	
1208									L
								FAXx	M

Data format: Bit axis type

FAXx Rotary table dynamic fixture offset is made:

0: Invalid

1: Valid

1209	Work Length Shift Amount 1 (K)	L
		M
1210	Work Length Shift Amount 2 (L)	L
		M

Data format: Long type

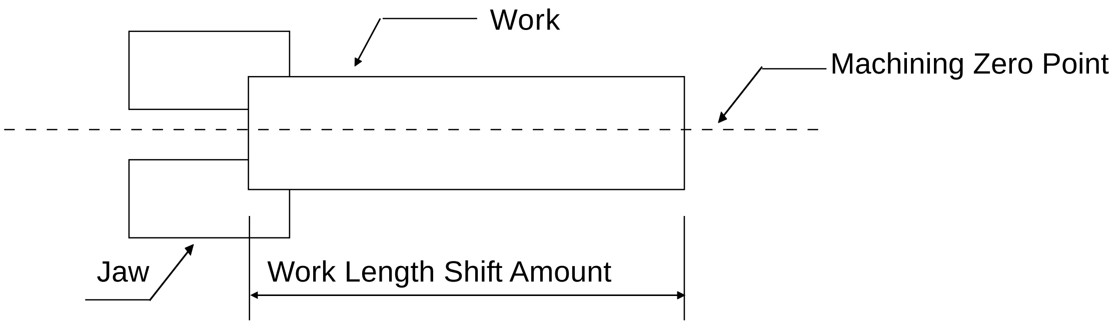
Units of data:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set the length between an end face of a jaw and machining zero point.

A work shift amount-1 is used on the part of the spindle (front) and a work shift amount-2 on the part of the sub-spindle (back).



1225	Machine Coordinate Value of the 1st Reference Point per Axis
1226	Machine Coordinate Value of the 2nd Reference Point per Axis

1227	Machine Coordinate Value of the 3rd Reference Point per Axis

1228	Machine Coordinate Value of the 4th Reference Point per Axis

Data format: Long axis type

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set the coordinate values of the 1st through 4th reference points in the machine coordinate system.

1229	Machine Coordinate Value of Floating Reference Point Per Axis

Data format: Long axis type [Disallowed for the **Σ** 21 (function not provided)]

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set the coordinate values of the floating reference point for each axis in the machine coordinate system. This parameter is automatically set when the floating reference point is set by operating the soft keys in the POSITION screen.

1232	Rotary Axis Stroke per Revolution

Data format: Long axis type

Data unit:

	IS-A	IS-B	IS-C	Unit
Rotary axis	0.01	0.001	0.0001	deg
Standard set value	36000	360000	3600000	

Data range: 10000 to 9999999

Set a stroke per revolution for the rotary axis.

1233	Work Coordinate System Shift Amount per Axis (Machining Reference point Shift Amount)	L
		M

Data format: Long axis format

Data unit:

	IS-A	IS-B	IS-C	Unit
Linear axis (metric)	0.01	0.001	0.0001	mm
Linear axis (inch)	0.001	0.0001	0.00001	inch
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set a work coordinate system shift amount for each axis. Set the distance between a reference tool nose position at a machine zero point position and the machining zero point.

1237	Axis Number Corresponding to 1st Position Switch
∫	
1252	Axis Number Corresponding to 16th Position Switch

Data format: Byte type

Data range: 0 to maximum number of controllable axes

Set sequentially the controllable axis number corresponding to the 1st through 16th position switch functions.

(Note 1) *Set value = 0 means that the position switch for that number is not used.*

(Note 2) *The relation between the position switch related parameter numbers and position switch (PS) numbers are listed after the parameter no.1284.*

1253	Maximum Operating Range for 1st Position Switch
∫	
1268	Maximum Operating Range for 16th Position Switch

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set sequentially the maximum operation range (coordinate value of the plus side) for the 1st through 16th position switch functions in the machine coordinate system.

(Note 1) *The relations between the position switch related parameter numbers and position switch (PS) numbers are listed after the parameter no. 1284*

1269	Minimum Operating Range for 1st Position Switch
∫	
1284	Minimum Operating Range for 16th Position Switch

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set sequentially the minimum operating range (coordinate value on the plus side) for the 1st through 16th position switch function in the machine coordinate system.

The following lists the relations between the parameter numbers are positioning switch (PS) numbers.

PS NO.	Parameter Nos.		
	Axis No.	Maximum Value	Minimum Value
1	1237	1253	1269
2	1238	1254	1270
3	1239	1255	1271
4	1240	1256	1272
5	1241	1257	1273
6	1242	1258	1274
7	1243	1259	1275
8	1244	1260	1276
9	1245	1261	1277
10	1246	1262	1287
11	1247	1263	1279
12	1248	1264	1280
13	1249	1265	1281
14	1250	1266	1282
15	1251	1267	1283
16	1252	1268	1284

(Note) *Set the number of position switches used in the parameter no. 1203, #0 (PSN1) to #1 (PSN2).*

1285		L
	Rotary axis number for which rotary table dynamic fixture offset is performed.	M

1286		L
	Axis member for the linear axis 1 which constitutes a plane where rotary table synamic fixture offset is performed.	M

1287		L
	Axis number for the linear axis 2 which constitutes a plane where rotary table dynamic fixture offset is performed.	M

Data format: Byte type

Data range: 1 to no. of control axes

Axis numbers for one rotary axis and two linear axes where rotary table dynamic fixture offset is performed are set here.

Perform setting so that turning from the positive direction of the linear axis 1 to the positive direction of the linear axis 2 is made in the positive direction of the rotary axis.

(EX.) In case of a 4-spindle machine for which an axis rotating around Z axis counterclockwise forwardly is made C axis when you look from the positive side of Z axis of the right-hand coordinate system (X, Y, Z) into the negative direction, this parameter become as follows:

Axis number of rotary axis: 4 (C axis)
Axis number of linear axis 1 (X axis)
Axis number of linear axis 2 (Y axis)

2.4 Parameters Related to Stroke Limit

	#7	#6	#5	#4	#3	#2	#1	#0
1300	DFA	LZR	RL3			LMS		OUT

Data format: Bit type

- OUT 0: Assumes the inside of the stored stroke limit-2 to be a prohibited area.
  1: Assumes the outside of the stored stroke limited-2 to be prohibited area.
- LMS 0: Disables a stored stroke limit-1 selector signal EXLM.
  1: Enables a stored stroke limit-1 selector signal EXLM.
- RL3 0: Disables a stored stroke limit-3 release signal RLSOT3.
  1: Enables a stored stroke limit-3 release signal RLSOT3.
- LZR 0: Checks stored stroke limit until manual reference point return is performed after power-on.
  1: Does not check stored stroke limit until manual reference point return is performed after power-on.

  (Note) *When an absolute position detector is used and the reference point has been already established at power-on, stored stroke limit-1 is checked immediately after power-on regardless of setting.*
- BFA 0: When there was a command which caused to exceed a stored stroke limit, an alarm results after exceeding the stroke limit.
  1: When three was a command which caused to exceed a stored stroke limit, an alarm results before exceeding the stroke limit.

	#7	#6	#5	#4	#3	#2	#1	#0
1301	PLC					NPC		

Data format: Bit type

- NPC 0: Checks a G31 (skip) block for a move in a stroke limit check before move.
  1: Does not check a G31 (skip) block for a move in a stroke limit check before move.
- PLC 0: Does not perform a stroke limit check before move.
  1: Performs a stroke limit check before move.

	#7	#6	#5	#4	#3	#2	#1	#0	
1310						OT4x	OT3x	OT2x	L
							OT3x	OT2x	M

Data format: Bit axis type

- OT2x Set whether to check stored stroke limit-2 per axis.
  0: Does not check stored stroke limit-2
  1: Checks stored stroke limit-2.
- OT3x Set whether to check stored stroke limit-3 per axis.
  0: Does not check stroke limit-3.
  1: Check stored stroke limit-3.
- OT4x Set whether to check stored stroke limit-4 per axis.
  0: Does not check stored stroke limit-4.
  1: Checks stored stroke limit-4.

1320	Stored stroke limit-1 plus directional coordinate value per axis I
1321	Stored stroke limit-1 minus directional coordinate value per axis I

Data format: Long axis type

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set stored stroke limit-1 plus and minus directional coordinate values in the machine coordinate system for axis. The outside of the area specified by a parameter becomes a prohibited area.

(Note 1) *For an axis which requires diameter designation, set a diameter value.*

(Note 2) *A stroke is made infinite by setting as follows.*

(Parameter no. 1320) < (Parameter no. 1321)

When the stroke is set infinite for a certain axis, only incremental programming is allowed for a move command for that axis. If absolute programming is used, an absolute register may overflow and the axis will not move properly in general.

1322	Stored stroke limit-2 plus directional coordinate value per axis
1323	Stored stroke limit-2 minus directional coordinate value per axis

Data format: Long axis type

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set stored stroke limit-2 plus and minus directional coordinate values in the machine coordinate system for axis. Use a parameter no. 1300 #0 (OUT) to set whether the outside or inside is to be designated as a prohibited area.

(Note 1) *For an axis which requires diameter designation, set a diameter value.*

(Note 2) *When the inside is prohibited, the stored stroke limit 2 is made invalid in relation to the axis for which the same value has been set for plus and minus directions. (Same as Parameter No. 1310, #0 (0T2x) = 0.)*

1324	Stored stroke limit-3 plus directional coordinate value per axis

1325	Stored stroke limit-3 minus directional coordinate value per axis I

Data format: Long axis type

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set stored stroke limit-3 plus and minus directional coordinate values in the machine coordinate system for axis. The inside of the area specified by a parameter becomes a prohibited area.

(Note 1) *For an axis which requires diameter designation, set a diameter value.*

(Note 2) *For the axis where the same value has been set for plus and minus directions, the stored stroke limit 3 is made invalid. (Same as Parameter No. 1310, #1 (0T3x) = 0.)*

1326	Stored stroke limit-1 plus directional coordinate value per axis II

1327	Stored stroke limit-1 minus directional coordinate value per axis II

Data format: Long axis type

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set stored stroke limit-1 plus and minus directional coordinate values in the machine coordinate system for axis. When a stroke limit selector signal EXLM is turned on, the stroke limit is checked using this parameter, not no. 1320 or 1321. The outside of the area specified by a parameter becomes a prohibited area.

(Note 1) *For an axis which requires diameter designation, set a diameter value.*

(Note 2) *The EXLM signal is valid only when the parameter no. 1300 #2 (LMS) is set to "1".*

1328	Plus Directional Coordinate Values for Stored Stroke Limit 4 per Axis	L M

1329	Minus Directional Coordinate Value for Stored Stroke Limit 4 per Axis	L M

Data format: Long axis type

Units of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set the plus and minus directional coordinate value for stored stroke limit 4 per axis in terms of machine coordinate system. The inside of the boundaries set with parameters will be a prohibited area.

(Note 1) *The axes designated with a diameter value should be set in terms of diameter value.*

(Note 2) *For the axis where the same value has been set for plus and minus directions, the stored stroke limit 4 is made invalid. (Same as Parameter No. 1310, #2 (0T4x) = 0.)*

2.5 Parameters Related to Chuck Tail Stock Barrier (L-system)

1330	Chuck Shape Selection TY	L M

Data format: Byte type

Data range: 0, 1

Select a shape of the chuck. (See the next page)

0: Inner diameter clamping chuck

1: Outer diameter clamping chuck

1331	Chuck Jaw Dimension L	L M

1332	Chuck Jaw Dimension W	L M

1333	Chuck Jaw Dimension L1	L M

1334	Chuck Jaw Dimension W1	L M

1335	Chuck Position CX (X-axis)	L M

1336	Chuck Position CZ (Z-axis)	L M

Data format: Long axis type

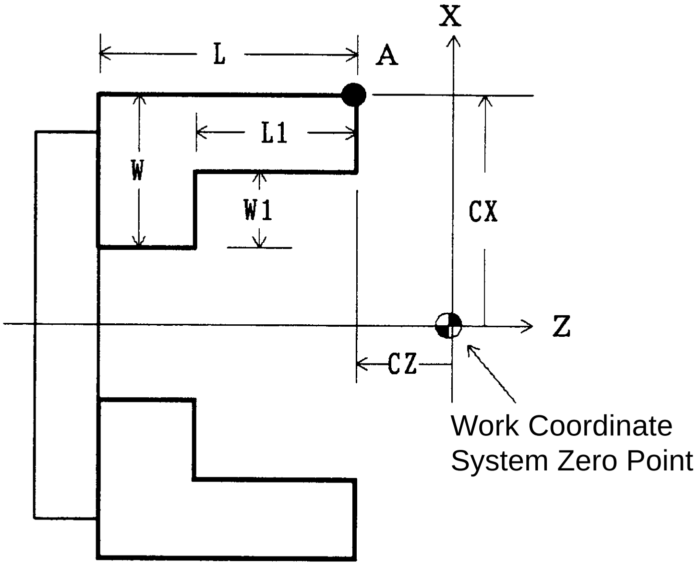
Units of data:

	IS-A	IS-B	IS-C	Unit
Metric	0.01	0.001	0.0001	mm
Inch	0.001	0.0001	0.00001	inch

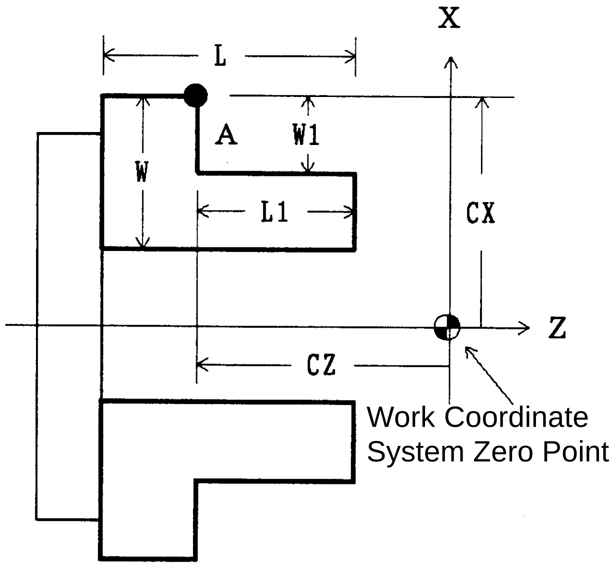
Data range: No. 1331 to No. 1334: 0 to 99999999

No. 1335 to No. 1336: -99999999 to 99999999 Set the shape of the chuck. (See the next page)

Outer Diameter Clamping Chuck
(TY = 1)



Inner Diameter Clamping Chuck
(Ty = 0)



Symbol	Description
TY	Chuck shape selection (0: Inner diameter clamping, 1: Outer diameter clamping)
CX	Chuck position (X-axis)
CZ	Chuck position (Z-axis)
L	Chuck jaw dimension
W	Chuck jaw dimension (Radius input)
L1	Chuck jaw dimension
W1	Chuck jaw dimension (Radius input)

TY Select the shape of the jaw; "0" selects an inner diameter clamping chunk and "1" selects an outer diameter clamping chuck. The chuck is assumed parallel to the Z-axis.

CX, CZ Set a chuck position (A-point) in terms of the coordinate values in the work coordinate system, not those in the machine coordinate system.

(Note) *Whether you set with a diameter value or radius value depends on whether a relevant axis is a diameter designation type or radius designation type. In case of diameter designation type, set with a diameter value.*

L, L1, W, W1 Define the shape of the chuck.

(Note) *W and W1 should be always set with a radius value. When the z-axis requires radius designation, L and L1 should be set with a radius value.*

1341	Tail Stock Length L	L
		M
1342	Tail Stock Diameter D	L
		M
1343	Tail Stock Length L1	L
		M
1344	Tail Stock Diameter D1	L
		M
1345	Tail Stock Length L2	L
		M
1346	Tail Stock Diameter D2	L
		M
1347	Tail Stock Hole Diameter D3	L
		M
1348	Tail Stock Position TZ (z-axis)	L
		M

Data format: Long axis type

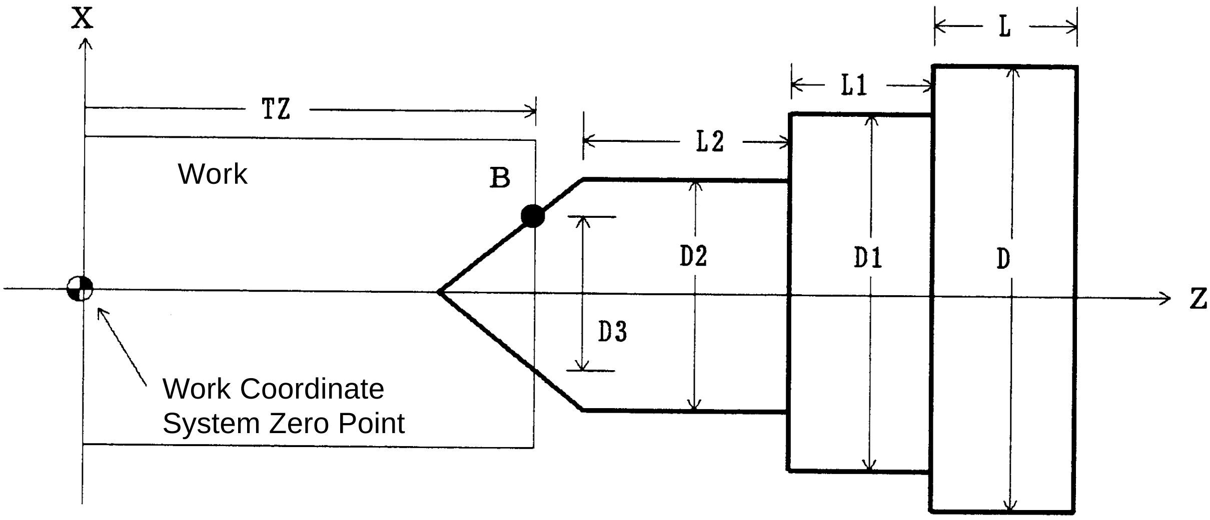
Units of data:

	IS-A	IS-B	IS-C	Unit
Metric	0.01	0.001	0.0001	mm
Inch	0.001	0.0001	0.00001	inch

Data range: No. 1341 to No. 1347: 0 to 99999999

No. 1348: -99999999 to 99999999

Set the shape of the tail stock. (See the next page)



Symbol	Description
TZ	Tail stock position (Z-axis)
L	Tail stock length
D	Tail stock diameter (Diameter input)
L1	Tail stock length (1)
D1	Tail stock diameter (1)
L2	Tail stock length (2)
D2	Tail stock diameter (2) (Diameter input)
D3	Tail stock hole diameter (Diameter input)

TZ Set a tail stock position (B-point) in terms of the coordinate values in the work coordinate system, not those in the machine coordinate system. The tail stock is assumed symmetrical about the Z-axis.

(Note) *Whether you set with a diameter value or radius value depends on whether the Z-axis is a radius designation type or diameter designation type.*

L, L1, L2, D, D1, D2, D3 Define the shape of the tail stock.

(Note) *D, D1, D2, and D3 should be always set with a diameter value. When the Z-axis requires radius designation, L, L1, and L2 should be set with a radius value.*

2.6 Parameters Related to Feed Rate

		#7	#6	#5	#4	#3	#2	#1	#0	
1401			RDR	TDR	RFO		JZRO	LRP	RPD	L
			RDR	TDR	RFO			LRP	RPD	M

Data format: Bit type

- RPD 0: Disables manual rapid traverse until reference point return is completed after power-on. (Results in manual continuous feed)
  1: Enables manual rapid traverse until reference point return is completed after power-on. (Results in manual continuous feed)
- LRP 0: Non-linear interpolation type positioning (Each axis moves independently at a rapid traverse rate)
  1: Linear interpolation type positioning (A tool path becomes linear)
- JZR0 Be sure to set 0.
- RFO 0: The machine does not stop at cutting feed rate override = 0 in rapid traverse operation.
  1: The machine stops at cutting feed rate override = 0% in rapid traverse operation.
- TDR 0: Enables dry run during thread cutting and tapping (tapping cycle G74/G84, direct tap).
  1: Disables dry run during thread cutting and tapping (tapping cycle G74/G84, direct tap).
- RDR 0: Disables dry run for a rapid traverse command.
  1: Enables dry run for a rapid traverse command.

		#7	#6	#5	#4	#3	#2	#1	#0	
1402					JRV					L
										M

Data format: Bit type

- JRV 0: Manual continuous feed (jog feed) assumes feed per minute.
  1: Manual continuous feed (jog feed) assumes feed per revolution.
  (Note) *Set a feed rate in the parameter no. 1423.*

		#7	#6	#5	#4	#3	#2	#1	#0	
1403		RTV								L
										M

Data format: Bit type

- RTV 0: Enables an override during thread cutting retract.
  1: Disables an override during thread cutting retract.

	#7	#6	#5	#4	#3	#2	#1	#0	
1404							DLF	HFC	L
							DLF	HFC	M

Data format: Bit type

- HFC 0: A feed rate for helical cutting is clamped so that feed rates for the circular arc and linear axes will not exceed the maximum cutting feed rate set by a parameter.

  1: A feed rate for helical cutting is clamped so that a composite feed rate of the circular arc and linear axes will not exceed the maximum cutting feed rate set by a parameter.

  (Note) *The **Σ** 21 does not have the helical interpolation function.*

- DLF 0: After establishing the reference point, manual reference point return (high-speed type) is positioned to the reference point at a rapid traverse rate (parameter no. 1420).

  1: After establishing the reference point, manual reference point return (high-speed type) is positioned to the reference point at a manual rapid traverse rate (parameter no. 1424).

1410	Dry Run Speed

Data format: Word type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a dry run speed for a position where a jog feed rate override is 100%.

(Note) *Jog feed rate override is informed from the Machine side (PMC LADDER) and the range applied includes 0.00 to 655.34%*
As the actual dry run speed gets equal to "this parameter x override value", the maximum jog feed rate of Machine operation panel is not necessarily equal to this parameter.

1420	Rapid Traverse Rate per Axis

Data format: Long axis type

Units of data: mm/min, deg./min.

Data range:

IS-A, IS-B	IS-C
30 ~ 240000	30 ~ 100000

Set a rapid traverse rate for each axis applied when a rapid traverse override is 100%.

1421	Rapid Traverse Override F0 Speed per Axis

Data format: Word axis type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a rapid traverse override F0 speed for each axis.

(Note) *When using a "rapid traverse override in an increment of 1%" for a signal from the machine, it is unnecessary to set this parameter.*

1422	Maximum Cutting Feed Rate (Common to All Axes)

Data format: Long type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 240000	6 ~ 100000

Set a maximum cutting feed rate. In cutting feed, a feed rate in the tangential direction is clamped not to exceed a rate set in this parameter.

(Note) *When you want to set the maximum cutting feed rate for each axis, use a parameter no. 1430, not this parameter.*

1423	Manual Continuous Feed (Jog Feed) Rate per Axis

Data format: Word axis type

(1) In case of the M-system or when the parameter no. 1402 #4 (JRV) is set to "0" (feed per minute) in the L-system;

Set a manual continuous feed rate (feed amount per minute) at a jog feed rate override of 100%.

Units of data: mm/min., deg./min.

Data range: 6 to 32767

(2) When the parameter no. 1402 #4 (JRV) is set to "1" (feed per revolution) (L-system);

Set a manual continuous feed rate (feed amount per spindle revolution) at a jog feed rate override of 100%.

Units of data: mm/min., deg./min.

Data range: 6 to 32767

(Note) *Jog feed rate override is informed from the Machine side (PMC LADDER) and the range applied includes 0.00 to 655.34%.*

As the actual dry run speed gets equal to "this parameter x override value", the *maximum jog feed rate of Machine operation panel is not necessarily equal to this parameter.*

1424	Manual Rapid Traverse Rate per Axis

Data format: Long type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
30 ~ 240000	30 ~ 100000

Set a manual rapid traverse rate for each axis at a rapid traverse override of 100%.

(Note) *When a set value is zero (0), this parameter is assumed to be the same as no. 1420.*

1425	FL Speed per Axis at Reference Point Return

Data format: Word axis type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a feed rate after deceleration (FL speed) for each axis at the time of reference point return.

1426	External Deceleration Speed at Cutting Feed

Data format: Word type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set an external deceleration speed at the time of cutting feed rate.

1427	External Deceleration Speed per Axis at Rapid Traverse

Data format: Word axis type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set an external deceleration speed for each axis at the time of rapid traverse.

1428	Reference Point Return Speed per Axis

Data format: Long axis type [Disabled for the Σ 21]

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
30 ~ 240000	30 ~ 100000

Set a rapid traverse rate for reference point return with deceleration dog, or reference point return with no reference point fixed. This parameter is used as a feed rate when a rapid traverse command (G00) is given in automatic operation before fixing the reference point.

(Note) *This parameter is valid when a reference point return speed setting function is provided. A set value of 0 (zero) is equivalent to having no reference point return speed setting function.*

<table>
<tr><td colspan="2" rowspan="3"></td><td colspan="2">Before Fixing Ref. Point</td><td colspan="2">After Fixing Ref. Point</td></tr>
<tr><td colspan="2">Ref. Point Return Speed Setting Function</td><td colspan="2">Ref. Point Return Speed Setting Function</td></tr>
<tr><td>Unprovided</td><td>provided</td><td>Unprovided</td><td>Provided</td></tr>
<tr><td colspan="2">Ref. point return by G 28</td><td rowspan="2">No. 1420</td><td rowspan="4">No. 1428</td><td colspan="2" rowspan="2">No. 1420</td></tr>
<tr><td colspan="2">Rapid traverse command (G00) in automatic operation</td></tr>
<tr><td rowspan="2">Manual reference point return</td><td>W/o dog*1</td><td rowspan="2">No. 1424</td><td colspan="2">No. 1420 or no. 1424*3</td></tr>
<tr><td>W/ dog*1</td><td>No. 1424</td><td>No. 1428</td></tr>
<tr><td colspan="2">Manual rapid traverse</td><td colspan="2">No. 1424 or no. 1424*2</td><td colspan="2">No. 1424</td></tr>
</table>

*1 W/o dog or w/ dog: Reference point return not using or using a deceleration dog

*2 Before the reference point is established, manual rapid traverse assumes a jog feed rate (parameter no. 1423) or manual rapid traverse rate (parameter no. 1424).

*3 When performing reference point return without dog or manual high-speed type reference point return after fixing the reference point, that is, when positioning to the reference point by rapid traverse, not by the deceleration dog, a rapid traverse rate set in the parameter no. 1424 or 1420 is made valid by setting of the parameter no. 1404 #1 (DLF).

1430		L
	Maximum Cutting Feed Rate per Axis	M

Data format: Long axis type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 240000	6 ~ 100000

Set a maximum cutting feed rate for each axis. In cutting feed, a feed rate for each axis is clamped at a maximum speed not exceeding a maximum cutting feed rate for each axis.

(Note 1) *This parameter is valid only for linear interpolation and circular interpolation. Clamping at the maximum cutting feed rate by the parameter no. 1422 is enabled during polar coordinate interpolation, cylindrical interpolation, and involute interpolation.*

(Note 2) *When all the set values for each axis are 0, clamping at the maximum cutting feed rate by the parameter no. 1422 is enabled.*

1431		L
	Maximum Cutting Feed Rate in Precontrol Mode (Common to All Axes)	M

Data format: Long type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
0 ~ 240000	0 ~ 100000

Set the maximum cutting feed rate effective in the procontrol mode.

In cutting feed, a feed rate in the tangential direction is clamped not to exceed a rate set in this parameter.

(Note 1) *When you want to set the maximum cutting feed rate for each axis, use the parameter no. 1432, not this parameter.*

(Note 2) *When you are not in the precontrol mode, clamping at the maximum cutting feed rate set in the parameter no. 1422 or no. 1430 is enabled.*

1432		L
	Maximum Cutting Feed Rate per Axis in Precontrol Mode	M

Data format: Long axis type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
0 ~ 240000	0 ~ 100000

Set the maximum cutting feed rate for each axis effective in the precontrol mode. In cutting feed, a feed rate for each axis is clamped at a maximum speed not exceeding the maximum cutting feed rate for each axis.

(Note 1) *This parameter is valid only for linear interpolation and circular interpolation. Clamping at the maximum cutting feed rate by the parameter no. 1431 is enabled during polar coordinate interpolation, cylindrical interpolation, and involute interpolation.*

(Note 2) *When all the set values for each axis are 0, clamping at the maximum cutting feed rate by the parameter no. 1431 is enabled.*

(Note 3) *When you are not in the precontrol mode, clamping at the maximum cutting feed rate set in the parameter no. 1422 or no. 1430 is enabled.*

1450		L
	Feed Rate Change Amount per Graduation of Manual Pulse Generator at F 1-digit Feed	M

Data format: Byte type

Units of data:

Data range: 1 to 127

At the time of 1-digit F-command feed, set a constant which determines a speed change amount when the manual pulse generator is turned by one graduation.

$$\triangle F = \frac{Fmaxi}{100\ n} \quad (i = 1 \text{ or } 2)$$

Set "n" mentioned in the formula above; set how many time the manual pulse generators should be turned to allow a feed rate to amount to Fmaxi. In the formula above, Fmaxi is an upper-limit value of the feed rate given by an 1-digit F-command and is set in the parameters no. 1460 and no. 1461.

Fmax1: Upper-limit value of the F1 to F4 fed rates (Parameter no. 1460)

Fmax2: Upper-limit value of the F5 to F9 fed rates (Parameter no. 1461)

1451		L
	Feed Rate for 1-digit F-command F1	M

1452		L
	Feed Rate for 1-digit F-command F2	M

1453		L
	Feed Rate for 1-digit F-command F3	M

1454		L
	Feed Rate for 1-digit F-command F4	M

1455		L
	Feed Rate for 1-digit F-command F5	M

1456		L
	Feed Rate for 1-digit F-command F6	M

1457		L
	Feed Rate for 1-digit F-command F7	M

1458		L
	Feed Rate for 1-digit F-command F8	M

1459		L
	Feed Rate for 1-digit F-command F9	M

Data format: Long type

Units of data: 0.1 mm/min., 0.1 deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 150000	6 ~ 120000

Set feed rates for 1-digit F-commands F1 through F9. When a 1-digit F-command is given and the manual pulse generator is turned to change a feed rate, a value of this parameter also changes accordingly.

1460		L
	Feed Rate Upper-limit Value of 1-digit F-command (F1 to F4)	M

1461		L
	Feed Rate Upper-limit Value of 1-digit F-command (F5 to F9)	M

Data format: Long type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 150000	6 ~ 120000

Set a feed rate upper-limit value of a 1-digit F-command. When a feed rate is increased by the manual pulse generator, it will be clamped at the upper limit value of the parameter no. 1460 if the F-command is one of F1 to F4, and at that of the parameter no. 1461 if the F-command is one of F5 to F9.

2.7 Parameters Related to Acceleration/Deceleration Control

	#7	#6	#5	#4	#3	#2	#1	#0	
1601			NCI	RTO					L
		ACD	NCI	RTO		OVB			M

Data format: Bit type

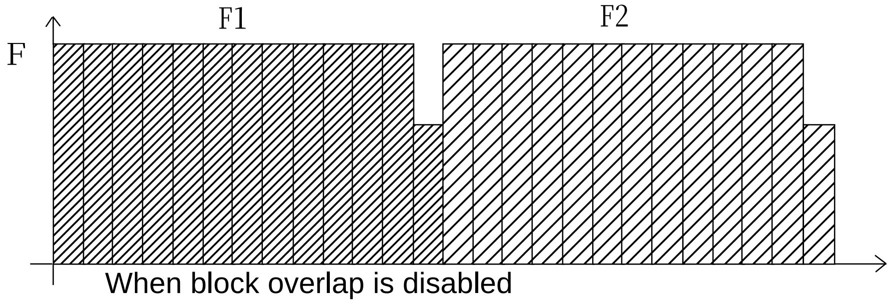
• OVB 0: Does not perform block overlap between the cutting feed blocks.
1: Performs block overlap between the cutting feed blocks.

When block overlap is performed, surplus pulses output upon completion of one-block distribution are output in combination with distribution pulses of the next block to eliminate speed fluctuation between the blocks.

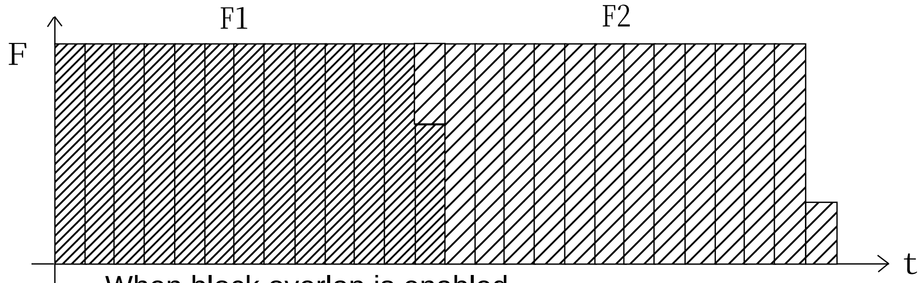
However, this parameter is valid when the G01, G02, and G03 blocks continue in the G64 mode. When very small blocks continue, block overlap may not be performed. When interpolation pulses migrate from the F1 block to the F2 block, the last interpolation pulses of the F1 block is compensated by the following pulses from the F2 block.

$$\text{(Pulses compensated)} = \text{F2 x } \frac{\text{(Pulses wanted in the F1 block)}}{\text{F1}}$$

When F1 equals F2



When block overlap is disabled



When block overlap is enabled

• RTO 0: Does not perform block overlap between rapid traverse blocks
1: Performs block overlap between rapid traverse blocks.
(Note) *See the description of the parameter no. 1722.*

• NCI 0: Makes an in-position check at deceleration time.
1: Does not make an in-position check at deceleration time.

• ACD 0: Does not use an automatic corner deceleration function.
1: Uses an automatic corner deceleration function.

	#7	#6	#5	#4	#3	#2	#1	#0
1602								FWB
		LS2		CSD	BS2			FWB

Data format: Bit type

- FWB
  0: Assumes an A-tye pre-cutting feed interpolation linear acceleration/deceleration.
  1: Assumes a B-type pre-cutting feed interpolation linear acceleration/deceleration.

<A-type>

When a feed rate command is changed, acceleration/deceleration starts from the block where it is changed.

<B-type>

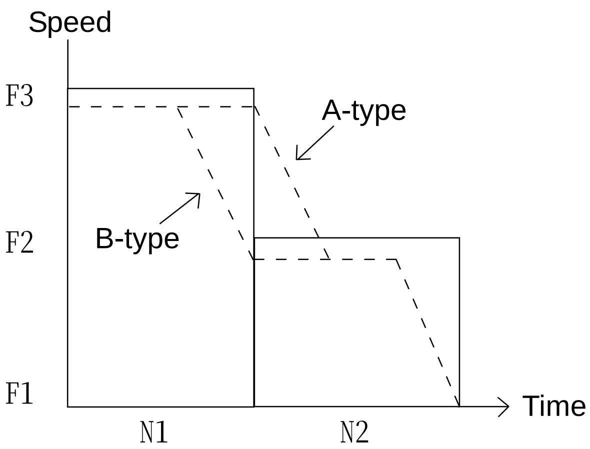
Deceleration ----- When the feed rate command is changed, deceleration starts from the preceding block so that deceleration will be completed before entering the block where it is changed.

Acceleration ----- When the feed rate command is changed, acceleration start from the block where it is changed.

<Deceleration Example>

- - - Specified Speed

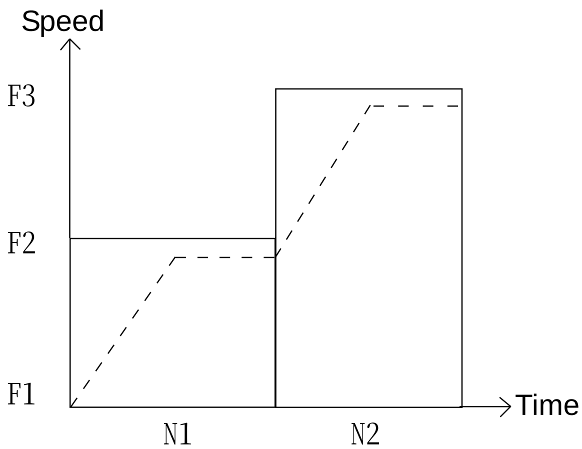
—— Speed after pre-interpolation Acceleration/Deceleration



<Acceleration Example>

- - - Specified Speed

—— Speed after pre-interpolation Acceleration/Deceleration



To deceleration from F3 to F2, it is necessary to decelerate from the point-1

- BS2
  0: Selects exponential acceleration/deceleration or linear acceleration/deceleration as post-cutting feed interpolation acceleration/deceleration in the leading control mode/high-precision contour control mode. (Follows RPM1602, #6 (LS2))
  1: Selects bell-type acceleration/deceleration as post-cutting feed interpolation acceleration/deceleration in the leading control mode/high-precision contour control mode. (Requires the post-cutting feed interpolation bell-type acceleration/deceleration function)

• CSD 0: Enables control by angle in the automatic corner deceleration function.

1: Enables control by speed difference in the automatic corner deceleration function.

• LS2 0: Selects exponential acceleration/deceleration as post-cutting feed interpolation acceleration/deceleration in the precontrol mode.

1: Selects linear acceleration/deceleration as post-cutting feed in terpolation acceleration/deceleration in the precontrol mode. (A post-cutting feed interpolation linear acceleration/deceleration function is required)

	#7	#6	#5	#4	#3	#2	#1	#0
1603								
	BEL							

Data format: Bit type

• BFL 0: Selects pre-preread interpolation linear acceleration/deceleration as acceleration/deceleration in the simple high-precision contour mode.

(Note) *This parameter is valid only for the **Σ** 16 M/18 M.*

	#7	#6	#5	#4	#3	#2	#1	#0
1610				JGLx			CTBx	CTLx

Data format: Bit axis type

• CTLx 0: Selects exponential functional acceleration/deceleration as cutting feed (including feed by dry run) acceleration/deceleration.

1: Selects post-interpolation linear acceleration/deceleration as cutting feed (including seed by dry run) acceleration/deceleration.

(Note) *When an option, "post-cutting feed interpolation linear acceleration/ deceleration function" is not provided, exponential functional acceleration/ deceleration is selected regardless of setting.*

When using post-interpolation bell type acceleration/deceleration, set this parameter to 0 and select post-interpolation bell type acceleration/ deceleration with the parameter no. 1610 #1 (CTBx).

Parameter		Acceleration/Deceleration
CTBx	CTLx	
0	0	Exponential functional acceleration/deceleration
0	1	Post-interpolation linear acceleration/deceleration
1	0	Post-interpolation bell type acceleration/deceleration

- CTBx 0: Selects exponential functional acceleration/deceleration or post-interpolation linear acceleration/deceleration as cutting feed (including feed by dry run) acceleration/deceleration. (Complies with setting of the parameter no. 1610 #0 (CTLx))

  1: Selects post-interpolation bell type acceleration/deceleration as cutting feed (including feed by dry run) acceleration/deceleration.

  (Note) *This parameter is valid only when a "post-cutting feed interpolation bell type acceleration/deceleration function" is provided. When this function is not provided, acceleration/deceleration complies with setting of the parameter no. 1610 #0 (CTLx) regardless of setting of this parameter.*

- JGLx 0: Selects exponential functional acceleration/deceleration as manual continuous feed (jog feed) acceleration/deceleration.

  1: Selects the same acceleration/deceleration as cutting feed. (You can specify either post-interpolation acceleration/deceleration or post-interpolation bell type acceleration/deceleration)

1620	Rapid Traverse Linear Acceleration/Deceleration Time Constant per Axis or Rapid Traverse Bell Type Acceleration/Deceleration Time Constant T (T1) per Axis

Data format: Word type

Units of data: ms

Data range: 0 to 4000

Set a rapid traverse acceleration/deceleration time constant. (Rapid traverse acceleration/deceleration assumes a bell type when a "rapid traverse bell type acceleration/deceleration function" is provided, and a linear type when not provided.)

(1) When the "rapid traverse bell type acceleration/deceleration function" is provided

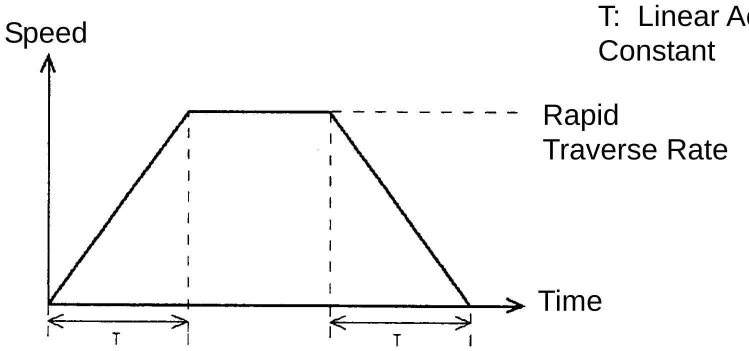
Set a rapid traverse bell type acceleration/deceleration time constant T1 in this parameter and set a time constant T2 in the parameter no. 1621.

(2) When the "rapid traverse bell type acceleration/deceleration function" is not provided.

Set a linear acceleration/deceleration time constant.

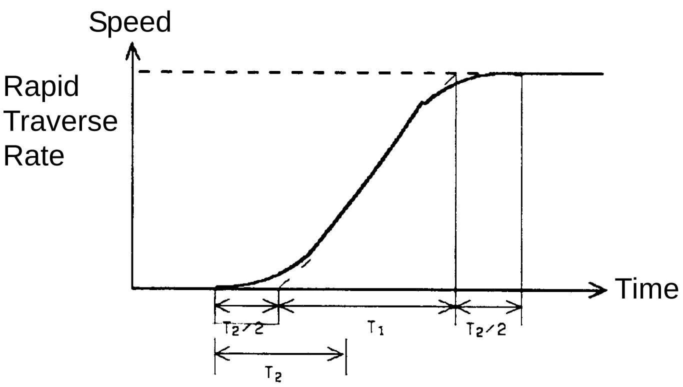
(Note 1) *When the parameter no. 1621 (rapid traverse bell type acceleration/deceleration time constant T2) is set t 0, even if the "rapid traverse bell type acceleration/deceleration function" is provided, linear acceleration/deceleration is assumed to be rapid acceleration/deceleration. When this is done, this parameter refers to the rapid traverse linear acceleration/deceleration time constant.*

<Rapid Traverse Linear Acceleration/Deceleration>



T: Linear Acceleration/Deceleration Time Constant

<Rapid Traverse Bell Type Acceleration/Deceleration>



T1: Set a time constant in terms of linear acceleration/deceleration

T2: Set a time to round a corner

Total time : T1 + T2

Time for linear section: T1 - T

Time for curved section: T2

Set a value at rapid traverse override = 100%. When less than 100%, the total time is reduced. (Constant acceleration system)

A value of T1 is determined according to a motor torque. A value of T2 is normally 24 msec or 32 msec.

1621	Rapid Traverse Bell Type Acceleration/Deceleration Time Constant T2 per Axis

Data format: Word axis type

Units of data: ms

Data range: 0 to 51

Set a rapid traverse bell type acceleration/deceleration time constant T2 for each axis.

(Note 1) *This parameter is valid when the "rapid traverse bell type acceleration/ deceleration function" is provided. Set the traverse bell type acceleration/ deceleration time constant T1 in the parameter no. 1620 and T2 in this parameter. For the time constants T1 and T2, see the description of the parameter no. 1620.*

(Note 2) *When this parameter is set to 0, linear acceleration/deceleration is assumed to be rapid traverse acceleration/deceleration. (A value of no. 1620 is used for the linear acceleration/deceleration time constant)*

1622	Cutting Feed Exponential Functional Acceleration/Deceleration per Axis or Post-cutting Feed Interpolation Bell Type Acceleration/Deceleration Time Constant per Axis or Post-interpolation Linear Type Acceleration/ Deceleration Time Constant per Axis

Data format: Word axis type

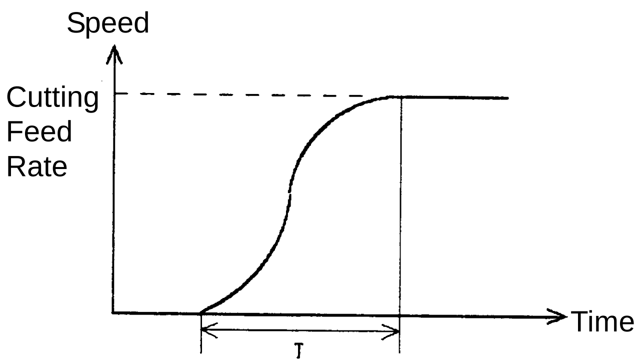
Units of data: ms

Data range: 0 to 4000

Set the cutting feed exponential functional acceleration/deceleration time constant, post-interpolation bell type acceleration/deceleration time constant, or post-interpolation linear acceleration/deceleration time constant for each axis.

no. 1610 #0 (CTLx) or #1 (CTRx) to select which type is to be used. Be sure to set the same time constant in this parameter for all the axes except in case of a special usage. If a different time constant is set, you cannot obtain a correct linear or circular arc shape.

<Post-cutting Feed Interpolation Bell Type Acceleration/Deceleration>



T: Set a total time. Constant regardless of a feed rate.

(Constant time constant system)

There is no linear section because this is euivalent to T1 and T2 of the parameters 1620 and 1621 = T/2.

1623	Cutting Feed Exponential Functional Acceleration/Deceleration FL Speed per Axis

Data format: Word axis type

Units of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a lower-limit speed (FL speed) for cutting feed exponential functional acceleration/ deceleration for each axis. Be sure to set 0 (zero) in this parameter for all the axes except in case of a special usage If a non-zero value is set, you cannot obtain a correct linear or circuit arc shape.

1624	Manual Continuous Feed Exponential Functional Acceleration/ Deceleration Time Constant, Bell Type Acceleration/Deceleration Time Constant, or Post-interpolation Linear Acceleration/Deceleration Time Constant for Each Axis

Data format: Word axis type

Units of data: ms

Data range: 0 to 4000

Set manual continuous feed exponential functional acceleration/deceleration, bell type acceleration/deceleration, or post-interpolation linear acceleration/deceleration time constant for each axis. Use a parameter no. 1610 #0 (CTLx), #1 (CTRx), #4 (JGLx) to select which type is to be used.

1625	Manual Continuous Feed Exponential Functional Acceleration/ Deceleration FL Speed per Axis

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a lower-limit speed (FL speed) for manual continuous feed exponential functional acceleration/deceleration for each axis.

1626	Exponential Functional Acceleration/Deceleration Time Constant per Axis in Thread Cutting Cycle	L
		M

Data format: Word axis type

Units of data: ms

Data range: 0 to 4000

Set an exponential functional acceleration/deceleration time constant for each axis in the thread cutting cycle (G76/G78 (G92 in the G-code system A)

1627	Exponential Functional Acceleration/Deceleration FL Speed per Axis in Thread Cutting Cycle	L
		M

Data format: Word axis type

Units of data: mm/min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a lower-limit speed (FL speed) for functional acceleration/deceleration for each axis in the thread cutting cycle (G76/G78 (G92 in the G-code system A)

1630	Parameter-1 for Setting Pre-interpolation Linear Acceleration (Maximum Machining Speed in Pre-interpolation Linear Acceleration/Deceleration)

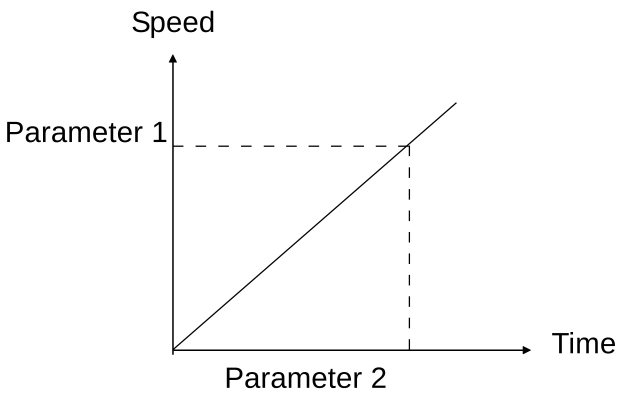
Data type: Long type

Units of data: mm/min., deg., min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

This is a parameter to set pre-interpolation linear acceleration. Set in this parameter a maximum machining speed in pre-interpolation linear acceleration/deceleration and set in a parameter no. 1631 a time required to reach the maximum machining speed.



Parameter 1: Parameter no. 1630

Parameter 2: Parameter no. 1631

(Note 1) *When either parameter no. 1630 or no. 1631 is set to 0, preinterpolation linear acceleration/deceleration cannot be applied.*

(Note 2) *In the precontrol mode, parameters no. 1770 and no. 1771 are valid.*

1631	Parameter-2 for Setting Pre-interpolation Linear Acceleration (Time required to Reach the Maximum Machining Speed in Preinterpolation Linear Acceleration/Deceleration)

Data type: Word type

Units of data: ms/

Data range: 0 to 4000

This is a parameter to set Pre-interpolation linear acceleration.

Set a time (time constant) required to reach the speed set in the parameter no. 1630.

(Note 1) *When either parameter no. 1630 or no. 1631 is set to 0, pre-inter-polation linear acceleration/deceleration cannot be applied.*

(Note 2) *Set a value which meets the following condition*
Parameter no. 1630/Parameter no. 1631 ≧ 5

(Note 3) *In the precontrol mode, parameters no. 1770 and no. 1771 are valid.*

1710	Inside Circular Arc Cutting Speed Minimum Deceleration Ratio (MDR) for Automatic Corner Override

Data format: Byte type

Unit of data: %

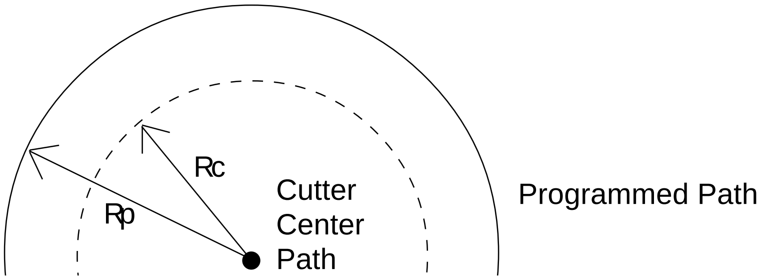
Data range: 0 to 100

Set a minimum deceleration ratio (MDR) in changing an inside circular arc speed for automatic corner override. When circular arc cutting has been offset inside, set an actual feed rate as follows with respect to a specified feed rate (F) so that a cutting speed in a programmed path will comply with a specified F-code.

$$F \times \frac{Rc}{Rp}$$

Rc: Radius of a cutter center path

Rp: programmed radius



If Rc is very small compared with Rp, Rc/Rp will be nearly equal to 0 and the cutter will stop. Therefore, set the minimum deceleration ratio (MDR) to adjust an actual speed to "F x MDR" when Rc/Rp is nearly equally to 0.

1711	Inside Judgment Angle for Inside Corner Automatic Override (θ p)

Data format: Byte type

Unit of data: Degrees

Data range: 0 to 179 (Standard setting value = 91)

Set an inside judgment angle for inside corner automatic override in automatic corner override.

1712	Inside Corner Automatic Override Amount

Data format: Byte type

Unit of data: %

Data range: 0 to 100 (Standard setting value = 50)

Set an inside corner automatic override amount in automatic corner override.

1713	Inside Corner Automatic Override Start Distance Le

Data format: Word type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	1	0.1	0.01	mm
Inch input	0.01	0.01	0.001	inch

Data range: 0 to 3999

Set an inside corner automatic override start distance Le in automatic corner override.

1714	Inside Corner Automatic Override End Distance Ls

Data format: Word type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	1	0.1	0.01	mm
Inch input	0.01	0.01	0.001	inch

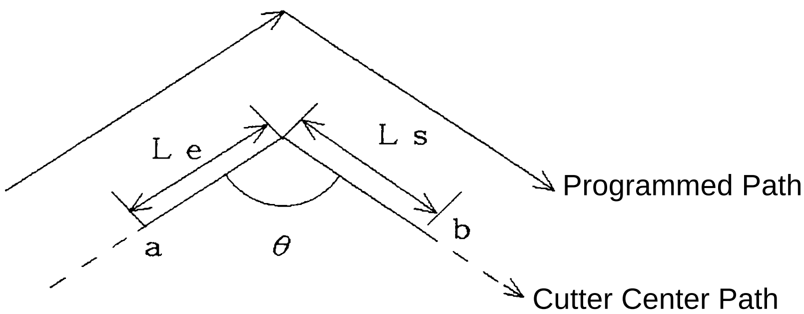
Data range: 0 to 3999

Set an inside corner automatic override end distance Ls in automatic corner override.

When $\theta \leqq \theta$ p, it is judged inside. (Set θ p in the parameter no. 1711.)

When it is judged an inside corner, an override is applied to a feed rate between an intersecting point of that corner and Le of the previous block., and between the intersecting point and Ls of the next block.

The distance Ls and Le are linear distances from the points on the cutter center path to the intersecting points of the corner. Set Ls an Le in the parameter no. 1713 and no. 1714.



An Override is applied between “a” and “b”.

1722	Rapid Traverse Deceleration Ratio at Overlap between Rapid Traverse Blocks

Data format: Byte axis type

Unit of data: %

Data range: 0 to 100

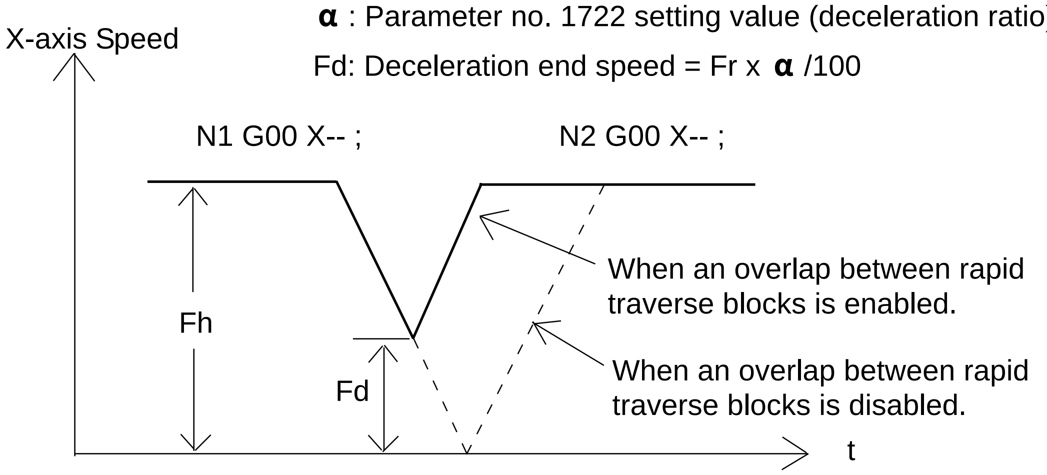
When there are continuous rapid traverse blocks or the block next to the rapid traverse block has no move command, execution of the next block is initiated when each axis feed rate in the rapid traverse block is decelerated to a deceleration ratio specified by this parameter.

[Example]

Fh: Rapid traverse rate

α : Parameter no. 1722 setting value (deceleration ratio)

Fd: Deceleration end speed = Fr x α /100



(Note) *A setting value for the parameter no. 1722 becomes valid when "1" is set in the parameter no. 1601, #4 (RTO).*

1730		L
	Feed Rate Upper-limit Value for Circular Arc Radius	M

Data format: Word type

Unit of data: mm/min.

Data range:

IS-A, IS-B	IS-C
0 ~ 15000	0 ~ 12000

Set a feed rate upper-limit value for a circuit arc radius set in the parameter no. 1731. Set this parameter when a "feed rate clamping function by circular arc radius" is added.

1731		L
	Circular Arc Radius Value Corresponding to Feed Rate Upper-limit Value	M

Data format: Long type

Unit of data:

IS-A	IS-B	IS-C	Unit
0.01	0.001	0.0001	mm

Data range: 1000 to 99999999

Set a circular arc radius value corresponding to a feed rate upper-limit value set in the parameter no. 1730. Set this parameter when the "feed rate clamping function by circular arc radius" is added.

1732		L
	Feed Clamp Lower Limit Value by Circular Arc Radius RVmin	M

Data format: Word type

Unit of data: mm/min.

Data range:

IS-A, IS-B	IS-C
0 ~ 15000	0 ~ 12000

In the "feed rate clamping function by circular arc radius," a feed rate upper-limit value is lowered as a circular arc radius becomes smaller. When a feed rate upper-limit value is lower than a speed clamp lower-limit value by a circular arc radius, RVmin, the feed rate upper-limit value is adjusted to RVmin.

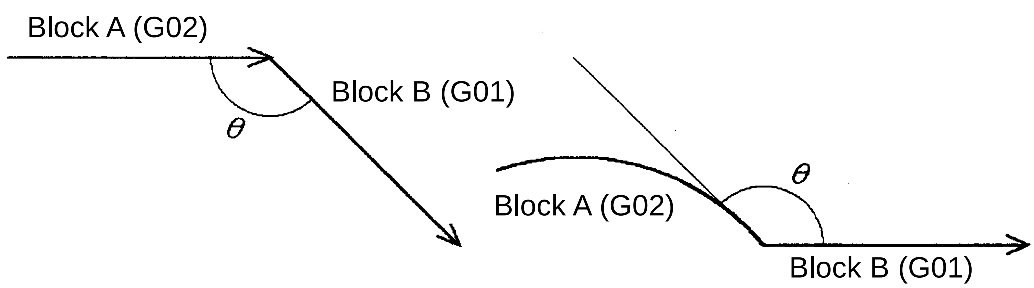
1740		L
	Critical Angle Formed by Two Automatic Corner Deceleration Blocks	M

Data format: Long type

Unit of data: 0.001 deg.

Data range: 0 to 180000

Set a critical angle formed by two corner deceleration blocks in an automatic corner deceleration function by angle. An angle formed by two blocks refers to θ shown in the figure below.



Angle formed by straight lines

Incase of a circular arc, it will be an angle formed by a tangent of the circular arc and a straight line

1741		L
	Feed Rate Considered End of Deceleration at Automatic Corner Deceleration (For Post-interpolation Acceleration/Deceleration)	M

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a feed rate considered an end of deceleration at automatic corner deceleration.

1762		L
	Exponential Functional Acceleration/Deceleration Time Constant for Cutting Feed in Pre-control Mode	M

Data format: Word axis type

Unit of data: msec.

Data range: 0 to 4000

Set an exponential functional acceleration/deceleration time constant for cutting feed in the precontrol mode.

1763		L
	Exponential Functional Acceleration/Deceleration Lower-limit Speed for Cutting Feed in Pre-control Mode	M

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set an exponential functional acceleration/deceleration lower-limit speed (FL) for cutting feed in the precontrol mde.

1768		L
	Linear Acceleration/Deceleration Time Constant for Cutting Feed in Pre-control Mode	M

Data format: Word type

Unit of data: ms

Data range: 8 to 512

Set a linear acceleration/deceleration time constant for cutting feed in the precontrol mode.

(Note) *A cutting feed post-interpolation linear acceleration/deceleration function is required.*

1770		L
	Pre-interpolation Linear Acceleration Setting Parameter-1 (For Precontrol) (Maximum Machining Speed in Pre-interpolation Linear Acceleration/Deceleration)	M

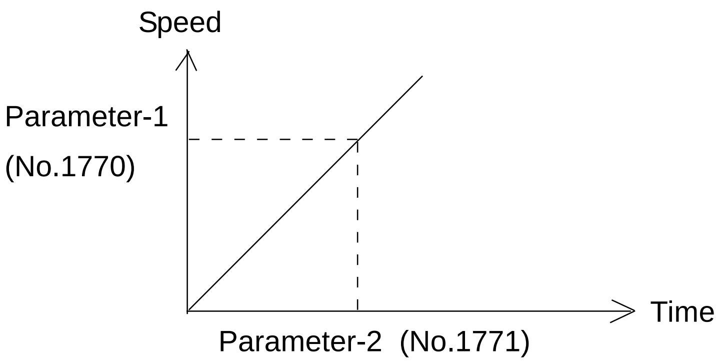
Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 240000	6 ~ 100000

This is a parameter to set pre-interpolation linear acceleration in the precontrol mode. Set a maximum machining speed during pre-interpolation linear acceleration/deceleration in this parameter, set in the parameter no. 1771 a time reaching the maximum machining speed.



(Note 1) *If you set "0" in either parameter no. 1770 or no. 1771, pre-interpolation linear acceleration/deceleration will not be applied.*

1771		L
	Pre-interpolation Linear Acceleration Setting Parameer-2 (For Precontrol) (Time Required to Reach Maximum Machining Speed in Pre-interpolation Linear Acceleration/Deceleration)	M

Data format: Word type

Unit of data: msec

Data range: 0 to 4000

This is a parameter to set pre-interpolation linear acceleration in the precontrol mode. Set a time (time constant) required to reach a speed set in the parameter no. 1770.

(Note 1) *If you set "0" in either parameter no. 1770 or no. 1771, pre-interpolation linear acceleration/deceleration will not be applied.*

(Note 2) *Set a value which allows the parameter no. 1770 divided by parameter no. 1771 to equal to or become larger than 5.*

1772	Time Constant for Pre-preread Interpolation Acceleration Time Constant Bell-type Acceleration/Deceleration	L M

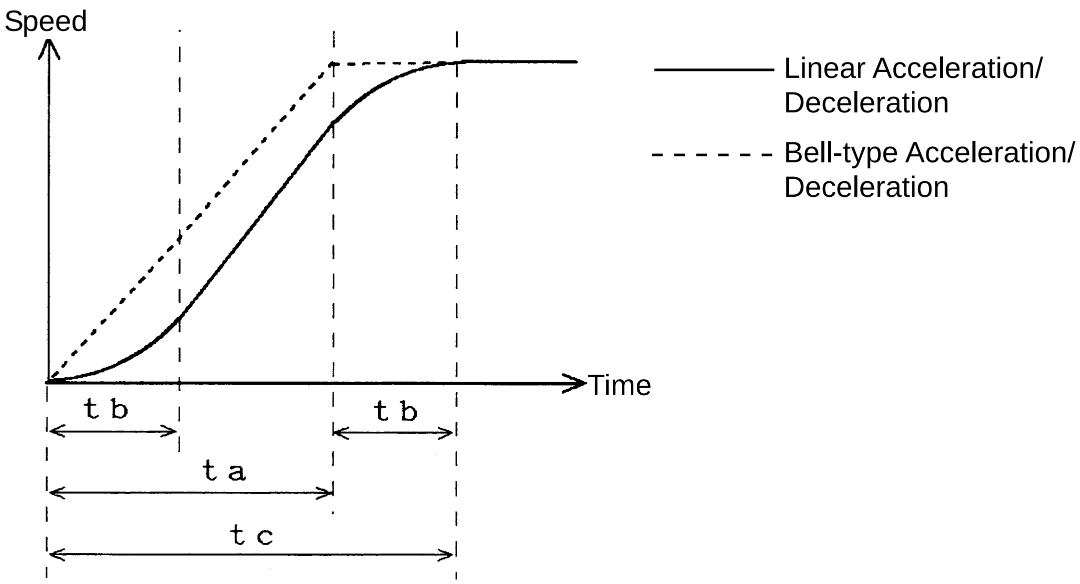
Data format: Byte type [Valid for the Σ 16/18]

Unit of data: msec

Data range: 0 to 100

When pre-preread interpolation bell-type acceleration/deceleration is selected as acceleration/deceleration in the simple high-precision contour control mode, set the time constant of (PRM1603, #7 (BEL) = 1)). Set tb shown in the figure below.

(Note) *When a set value is 0, pre-interpolation linear acceleration/deceleration is assumed.*



1775	Disabled

1776	Disabled

1777	Automatic Corner Deceleration Function Lower-limit Speed (For Precontrol)	L M

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a speed which considers remaining pulses at deceleration to be zero, when pre-interpolation linear acceleration/deceleration is used.

1778	Automatic Corner Deceleration Function Lower-limit Speed (For Pre-interpolation Linear Acceleration/Deceleration)	L M

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a speed which considers remaining pulses at deceleration to be zero, when pre-interpolation linear acceleration/deceleration is used.

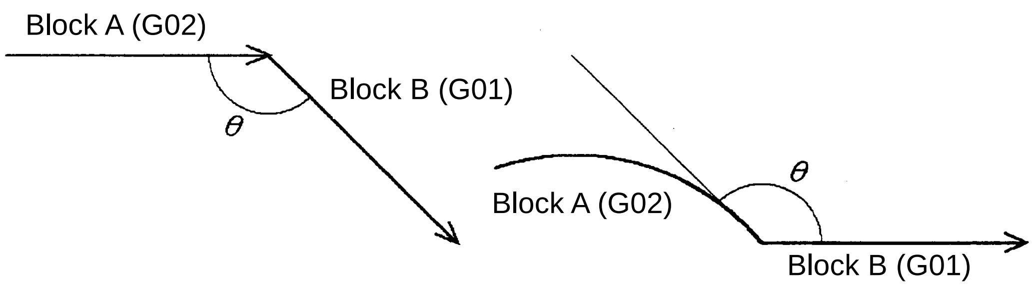
1779	Critical Angle Formed by Two Automatic Corner Deceleration Blocks (For Precontrol)	L M

Data format: Long type

Unit of data: 0.001 deg.

Data range: 0 to 180000

Set a critical angle formed by two corner deceleration blocks in an automatic corner deceleration function by angle. An angle formed by two blocks refers to θ shown in the figure below.



Angle formed by straight lines

In case of a circular arc, it will be an angle formed by a tangent of the circular arc and a straight line

1780	Allowable Speed Difference for Automatic Corner Deceleration Function by Speed Difference (For Linear Acceleration/Deceleration befor Interpolation)	L M

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a speed difference for the automatic corner deceleration function by speed difference, when pre-interpolation linear acceleration/deceleration is used.

1781		L
	Allowable Speed Difference for Automatic Corner Deceleration Function by Speed Difference (For Post-interpolation Acceleration/Deceleration)	M

Data format: Word axis type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

Set a speed difference for the automatic corner deceleration function by speed difference, when post-interpolation linear acceleration/deceleration is used.

1783		L
	Each Axis Allowable Speed Difference for Automatic Corner Deceleration by Speed Difference (For Pre-interpolation Linear Acceleration/ Deceleration)	M

Data format: Word axis type

Unit of data: mm/min., deg./min

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

You can set an allowable speed difference to a different value for each axis. Each axis allowable speed difference is made valid by setting a value in this parameter. A deceleration speed at a corner is calculated, based on one of the axes which exceeds the allowable speed difference and whose ratio of an actual speed difference to the allowable speed difference is the biggest.

1784		L
	Speed upon Occurrence of Overtravel Alarm in Pre-interpolation Linear Acceleration/Deceleration (For leading control)	M

Data format: Word type

Unit of data: mm/min., deg./min.

Data range:

IS-A, IS-B	IS-C
6 ~ 15000	6 ~ 12000

When an overtravel alarm is likely to occur during pre-interpolation linear acceleration/ deceleration, deceleration is made in advance so that a speed set in an parameter will be obtained when the alarm occurs (when reaching a limit.)

By using this parameter, an overrun amount can be reduced when the overtravel alarm occurs.

(Note 1) *When "0" is set, the above-mentioned control is not performed.*

(Note 2) *Select pre-interpolation linear acceleration/deceleration Type-B (parameter no. 1602, #0 (FWB) = "1").*

(Note 3) *The above-mentioned control is valid to stored stroke limit-1 only.*

1785		L
	Parameter for Determining Allowable Acceleration in Speed Setting by Acceleration	M

Data format: Word axis type [Valid for the **Σ** 16/18]

Unit of data: msec

Data range: 0 to 32767

Set the time required to reach the maximum cutting feed rate in order to determine allowable acceleration required for speed setting by acceleration in the simple high-precision contour control mode.

The allowable acceleration is the data set by the maximum cutting feed rate and this parameter.

The parameter used for the maximum cutting feed rate is No. 1432 (maximum cutting feed rate in the simple high-precision contour control mode).

2.8 Parameters Related to Servo

	#7	#6	#5	#4	#3	#2	#1	#0
1800			TRC	RBK	FFR		CVR	

Data format: Bit type

- CVR When a speed control ready signal VRDY is turned on before a position control ready signal PRDY is turned on
  0: Results in a servo alarm
  1: Does not result in a servo alarm
- FER 0: Feed forward control is valid to cutting feed only
  1: Feed forward control is valid to cutting feed and rapid traverse
- RBK 0: Does not compensate a backlash by cutting/rapid traverse
  1: Compensates a backlash by cutting/rapid traverse
- TRC 0: Disables a servo trace function
  1: Enables a servo trace function (Set also the parameter no. 1870)

	#7	#6	#5	#4	#3	#2	#1	#0	
1801			CIN	CCI			PM2	PM1	L
			CIn	CCI					M

Data format: Bit type

PM1, PM2 Set a spindle and motor gear ratio when using the "speed control function by the servo motor."

Magnification	PM2	PM1
1/1	0	0
1/2	0	1
1/4	1	0
1/8	1	1

$$\text{Magnification} = \frac{\text{Spindle rpm}}{\text{Motor rpm}}$$

- CCI 0: An in-position width at cutting feed assumes a value set in the parameter no. 1826 (Common to rapid traverse)
  1: in-position width at cutting feed follows setting of the parameter no. 1801, #5 (CIN).
- CIN When the parameter no. 1801, #4 (CCI) is "1";
  0: The in-position width at cutting feed assumes a value set in the parameter no. 1827 when the next block is also for cutting feed, or assumes that set in the parameter no. 1826 when the next block is not for cutting feed.
  1: The in-position width at cutting feed assumes a value set in the parameter no. 1827, regardless of the next block. (A value set in the parameter no. 1826 is valid at rapid traverse, and that in no. 1827 is valid at cutting feed)

	#7	#6	#5	#4	#3	#2	#1	#0	
1802			DPS					CTS	L
									M

Data format: Bit type

- CTS 0: Does not use the speed control function by the servo motor
  1: Uses the speed control function by the servo motor
- DPS 0: Uses a position coder when controlling a speed by the servo motor
  1: Does not use a position coder when controlling a speed by the servo motor

	#7	#6	#5	#4	#3	#2	#1	#0
1803				TQF			TQA	TQI

Data format: Bit type [Valid for the **Σ** 16/18/21]

- TQI 0: Makes an in-position check during torque control.
  1: Does not make an in-position check during torque control.
- TQA 0: Makes an error excessive during stop/move check during torque control.
  1: Does not make an error excessive during stop/move check during torque control.
- TQF 0: Performs follow-up during torque control by an axis control command for the axis control function by the PMC.
  1: Does not perform follow-up during torque control by an axis control command for the axis control function by the PMC.

	#7	#6	#5	#4	#3	#2	#1	#0
1804		SAK	ANA	IVO				

Data format: Bit type [#4 and #5 valid for the **Σ** 16/18/21]

- IVO 0: Does not reset an emergency stop until the VRDY OFF alarm ignorance signal IGNVRY is set to 0 when it is attempted to cancel the emergency stop with the VRDY OFF alarm ignorance signal IGNVRY = 1.
  1: Resets an emergency stop until the VRDY OFF alarm ignorance signal IGNVRY is set to 0 when it is attempted to cancel the emergency stop with the VRDY OFF alarm ignorance signal IGNVRY = 1.
  (Note) *When it is reset with the VRDY OFF alarm ignorance signal IGNVRY = 1 and the motor de-excited, a reset state is canceled.*
- ANA 0: Stops all the axes, resulting in a servo alarm, when an abnormal load is detected.

1: Stops in an interlock state only the axes of the group to which the abnormal load detected axis belongs, without resulting in a servo alarm, when an abnormal load is detected. (Set the group number of each axis in Parameter No. 1881)

- SAK When a VRDY OFF alarm ignorance signal IGNVRY is "1" or VRDY OFF alarm ignorance signals IGVRY1 through IGVRY8 for all controlled axes are "1";

  0: A servo ready completion signal SA is turned to "0"

  1: A servo ready completion signal SA holds "1"

	#7	#6	#5	#4	#3	#2	#1	#0
1815	ZMGx		APCx	APZx			OPTx	

Data format: Bit axis type

- OPTx 0: Does not use a separate pulse coder as a position detector.

  1: Uses a separate pulse coder as a position detector.

- APZx 0: When using an absolute position detector as a position detector, the machine and absolute position detector have not been positionally associated with each other.

  1: When using an absolute position detector as a position detector, the machine and absolute position detector have been positionally associated with each other.

(Note) *When using the absolute position detector, be sure to set "0" at the time of primary on-site adjustment or when the absolute position detector is replaced, and after turning on the power again perform manual reference point return. This will relate the position of the machine to that of the absolute position detector, and this parameter will be set to "1" automatically.*

- APCx The position detector is;

  0: Other than the absolute position detector

  1: Absolute position detector (absolute pulse coder)

- ZMGx The reference point return method is;

  0: Grid method

  1: Magnet switch method

	#7	#6	#5	#4	#3	#2	#1	#0
1816		DM3x	DM2x	DM1x				

Data format: Bit axis type

DM1x to DM2x Setting of detection multiply

Setting Values			Detection Multiply
DM3x	DM2x	DM1X	
0	0	0	1/2
0	0	1	1
0	1	0	3/2
0	1	1	2
1	0	0	5/2
1	0	1	3
1	1	0	7/2
1	1	1	4

(Note) *When using a flexible feed gear, this parameter is not used. Set a numerator and denominator of DMR in the parameter no. 2084 and no. 2085, respectively.*

	#7	#6	#5	#4	#3	#2	#1	#0
1817		TAN						

Data format: Bit axis type

- TAN 0: Does not provide tandem control
  1: provides tandem control

(Note) *Set for both master and slave axes.*

	#7	#6	#5	#4	#3	#2	#1	#0	
1819							CRFx	FUPx	L
	NAHx						CRFx	FUPx	M

Data format: Bit axis type

- FUPx Set for each axis whether to perform follow-up when the servo is turned off.
  0: Follows a follow-up signal *FLWU.
  Performs follow-up when *FLWU is "0".
  Does not perform follow-up when *FLWU is "1"
  1: Does not perform follow-up.
- CRFx 0: A reference point established state does not change when a servo alarm (No. 445 (soft disconnection), No. 446 (hard disconnection), No. 447 (hard disconnection; standalone), or No. 421 (dual position feedback error excessive)) takes place.
  1: A reference point unestablished state results when a servo alarm (No. 445 (soft disconnection), No. 446 (hard disconnection), No. 447 (hard disconnection; standalone), or No. 421 (dual position feedback error excessive)) takes place.
- NAHx 0: Uses preforward in the precontrol mode
  1: Does not use preforward in the precontrol mode

(Note) *Set "1" for the controlled axes by the PMC.*

1820	Set Value for Command Multiply (CMR) per Axis

Data format: Byte axis type

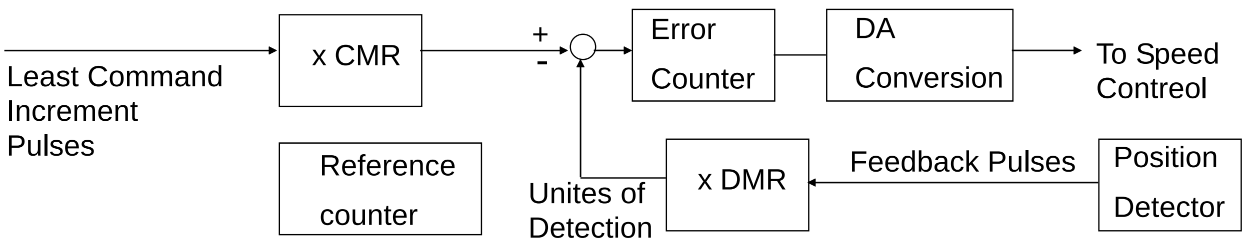
Set per axis the value wich determines Command Multiply which represents a ratio of the least command increment to the unit of detection.

Least command increment = Units of detection x Command multiply

[Unit of Setting versus Least Command Increment]

	IS-A	IS-B	IS-C	Unit
Linear axis (Diameter designation)	0.005	0.0005	0.00005	mm
Linear axis (Radius designation)	0.01	0.001	0.0001	
Rotary axis	0.01	0.001	0.0001	deg

Setting Values of Command Multiply (CMR), Detection Multiply (DRM), and Reference Counter Capacity



Set CMR and DMR magnifications so that significance of positive and negative input pulses to an error counter will be uniformized in the figure.

$$\frac{\text{Least input increment}}{\text{CMR}} = \text{Unit of detection} = \frac{\text{Unit of feedback pulses}}{\text{DMR}}$$

The unit of feedback pulses differs depending on the type of the detector.

$$\text{Unit of feedback pulses} = \frac{\text{Stroke per rotation of the pulse coder}}{\text{Pulses per rotation of the pulse coder}}$$

(2,000, 2,500, or 3,000)

For a reference counter capacity, specify a grid interval for grid-method reference point return.

$$\text{Reference counter capacity} = \frac{\text{Grid interval}}{\text{Unit of detection}}$$

Grid interval = Stroke per rotation of the pulse coder

A parameter setting value will be as follows:

(1) When the command multiply is 1/2 to 1/27

$$\text{Setting value x } \frac{1}{\text{(Command multiply)}} + 100$$

Data range: 102 to 127

(2) When the command multiply is 0.5 to 48

Setting value = 2 x Command multiply

Data range: 1 to 96

Normally, set “1” for the diameter designation axis and “2” for the radius designation axis.

1821	Per-axis Reference Counter Capacity

Data format: Long axis type

Data range: 0 to 99999999

Set a capacity of the reference counter.

1825	Per-axis Servo Loop Gain

Data format: Long axis type

Least input increment: 0.01 sec.-1

Data range: 1 to 9999

Set a position control loop gain for each axis. For the machine which performs linear or circular interpolation (cutting), set the same value for all the axes. For the machine which performs only positioning, you may set different values for each axis. A larger loop gain value results in a higher position control response. If the gain is too large, however, the servo system will become unstable.

$$\text{Position deviation amount} = \frac{\text{Feed rate}}{60} \text{ x (Loop gain)}$$

Units: Position deviation amount ---- mm, inch, or deg.,

Feed rate ---- mm/min. inch/min., or deg./min,

Loop gain ---- sec. -1

1826	Per-axis In-position Width

Data format: Word axis type

Unit of data: Unit of detection

Data range: 0 to 32767

Set an in-position width for each axis. When a deviation of the machine position from a specified position (absolute value of a position deviation amount) is smaller than an in-position width, it is assumed that the machine has reached the specified position, that is, in-position.

1827	Per-axis In-position Width in Cutting Feed

Data format: Word type

Unit of data: Unit of detection

Data range: 0 to 32767

Set an in-position width in cutting feed for each axis. This parameter becomes valid when the parameter no. 1801, #4 (CCI) is set to "1".

1828	Per-axis Position Deviation Limit Value in Move

Data format: Long axis type

Unit of data: Unit of detection

Data range: 0 to 99999999

Set a position deviation limit value in move for each axis. While the machine is moving, if a position deviation amount exceeded a position deviation amount in move, the machine will stop instantaneously, resulting in a servo alarm (same as in case of an emergency stop). Normally, set the position deviation amount in rapid traverse plus some allowances.

1829	Per-axis Position Deviation Limit Value in Stop

Data format: Word axis type

Unit of data: Unit of detection

Data range: 0 to 32767

Set a position deviation limit value in stop for each axis. If a position deviation amount exceeded a position deviation amount in stop at the time of stop, the machine will stop instantaneously, resulting in a servo alarm (same as in case of an emergency stop). [1832] Per-axis Feed Stop Position Deviation Amount

1830	Position Deviation Limit Value at Servo-off per Axis

Data format: Long axis type [Valid for the **Σ** 16/18/21]

Unit of data: Unit of detection

Data range: 0 to 99999999

Set a position deviation limit value at servo-off for each axis.

When a position deviation value at servo-off exceeds a position deviation limit value at servo-off, a servo alarm (No. 410) results and stop the system instantaneously (same as an emergency stop). Normally, set the same value as the position deviation limit value (Parameter No. 1829).

(Note) *When this parameter is "0", the position deviation limit value at servo-off is not checked.*

1832	Feed Stop Position Deviation Amount for Each Axis

Data format: Long axis type

Unit of data: Unit of detection

Data range: 0 to 99999999

Set a feed stop position deviation amount for each axis. When a position deviation amount exceeded a feed stop position deviation amount of the time of move, pulse distribution and acceleration/deceleration control are stopped temporarily. When it comes lower than the feed stop position deviation amount, pulse distribution and acceleration/deceleration control are resumed. The feed stop function is mainly used to reduce an overshoot at the time of acceleration/deceleration of a large servo motor.
As the feed stop position deviation amount, set normally an intermediate value between the position deviation limit value in move and that in rapid traverse.

1836	Per-axis Servo Error Amount Allowed for Reference Point Return

Data format: Byte axis type

Unit of data: Unit of detection

data range: 0 to 127

In manual reference point return, set a servo error amount which is allowed for reference point return. Set 0 normally. (A setting value of 0 is regarded as 128.)

(Note) *When the parameter no. 2000, #0 (PLC01) is "1", check with a value ten times larger than a parameter set value.*

[Example] When a setting value is 10 with parameter no. 2000, #0 = 1, reference point return will be enabled if a servo error amount is 100 or greater.

1850	Per-axis Grid Shift Amount/Reference Shift Point Amount

Data format: Long axis type

Unit of data: Unit of detection

Data range: -99999999 to 99999999

In order to shift a reference point position, set a grid shift amount or reference point shift amount for each axis. You can set the grid shift amount smaller than the reference counter capacity.

When the parameter SFD (no. 1002, #2) equals 0, the grid shift amount is set, and when it equals 1, the reference point shift amount is set.

1851	Per-axis Backlash Compensation Amount

Data format: Word axis type

Unit of data: Unit of detection

Data range: -99999999 to 99999999

Set a backlash compensation amount for each axis. When the spindle moved in the direction opposite to the reference point return after power-on, first backlash compensation is performed.

1852	Per-axis Backlash Compensation Amount in Rapid Traverse

Data format: Word axis type

Unit of data: Unit of detection

Data range: -9999 to 9999

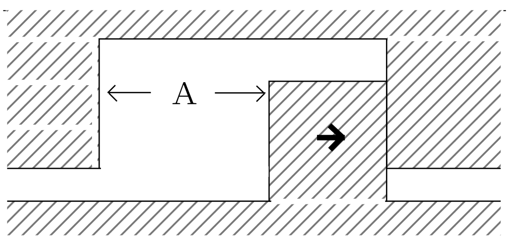
Set a backlash compensation amount in rapid traverse for each axis. (Valid when the parameter no. 1800, #4 (RBK) is set to "1") Higher-accuracy machining can be performed by changing the backlash compensation amount in cutting feed or rapid traverse.

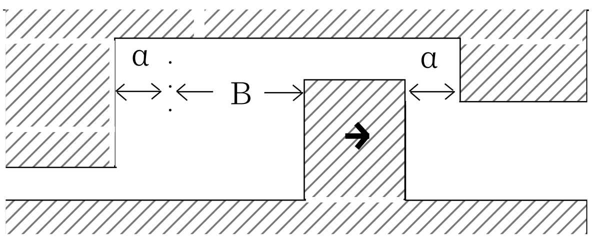
Suppose a backlash amount measured value in cutting feed is A and that in rapid traverse is B, a backlash compensation amount output will be as shown in the table below as a feed (cutting feed/rapid traverse) and moving direction change.

Change of Feed / Change of Moving Direction	Cutting Feed to Cutting Feed	Rapid Traverse to Rapid Traverse	Rapid Traverse to Rapid Traverse	Cutting Feed to Rapid Traverse
Same direction	0	0	± **α**	± (- **α**)
Reverse direction	± A	± B	± (B + **α**)	± (B + **α**)

(Note 1) *α = (A = B)/2*

(Note 2) *A sign for the compensation amount (+/-) is the same as the moving direction.*





(Note 3) *Set the backlash amount measured value (A) in cutting feed in the parameter no. 1851, and that (B) in rapid traverse in the parameter no. 1852.*

(Note 4) *Manual continuous feed in considered the same as cutting feed.*

(Note 5) *After turning on the power, backlash compensation by cutting feed/rapid traverse is not performed until the first reference point return is completed; normal backlash compensation is performed. (Compensation based on setting of the parameter no. 1851)*

(Note 6) *Backlash compensation by cutting feed/rapid traverse is performed only when the parameter no. 1800, #4 (RBK) is set to "1". When RBK is set to "0", normal* *backlash compensation is performed.*

1860	Absolute Pulse Coder Stored Value 1 per Axis

Dataformat: Long axis type

Data range: -99999999 to 99999999

1861	Absolute pulse Coder Stored Value 2 per Axis

Data format: Word axis type

Data range: -32768 to 32767

The parameters No. 1860 and 1861 are the storage data when the absolute pulse coder is used. Do not alter their setting becuse they are automatically set when the origin is set.

1874	Per-axis Numerator of Inductosyn Position Detecting Conversion Coefficient

1875	Per-axis Denominator of Inductosyn Position Detecting Conversion Coefficient

Data format: Word axis type

Data range: 1 to 32767

Set an Inductosyn position detecting conversion coefficient for each axis. A setting value is obtained by the following formula.

$$\frac{\text{No. 1874}}{\text{No. 1875}} = \frac{\text{Position feedback pulses per rotation of motor}}{1{,}000{,}000}$$

1876	Per-axis Industrosyn Single Pitch Interval

Data format: Word axis type

Unit of data: Unit of detection

Data range: 1 to 32767

Set an Inductosyn single pitch interval for each axis.

1877	Per-axis Industrosyn Shift Amount

Data format: Word axis type

Unit of data: Unit of detection

Data range: -32767 to 32767

Set an Inductosyn shift amount for each axis. Using this parameter, calculate the machine position by the following formula.

$$\text{Machine position} = \left(\frac{\text{M - S - (Parameter No. 1877)}}{\boldsymbol{\lambda}} \right)_{\text{Round}} \times \boldsymbol{\lambda} + \text{S}$$

M: Motor absolute position (Unit of detection)

S: Offset data from the Inductosyn (Unit of detection)

λ : Inductosyn single pitch interval (Unit of detection) (Parameter no. 1876)

This can bring a remainder of (M - S) divided by **λ** closer to 0. (Normally, set a value of Diagnose No. 380.)

1880	Abnormal Load Detection Alarm Timer

Data format: Word type

Unit of data: ms

Data range: 0 to 32767 (A value of 0 is assumed to be 200 msec.)

Set a required to issue a servo alarm after an abnormal load is detected. Fractions less than 8 msec. is raised to a unit.

[Example] Setting value = 30 ------ Assumed to be 32 msec.

1881	Group Number at Abnormal Load Detection

Data format: Byte axis type [Valid for the **Σ** 16/18/21]

Data range: 0 to 8

Set the group number of each axis when an abnormal load is detected. When a certain axis detects an abnormal load, only the axes of the group to which that axis belongs stop. When a set value is 0, the axes stop if any axis detects an abnormal load.

[Example]	Under the following settings, if the 1st axis detects an abnormal load is detected, the 1st, 3rd, and 4th axes stop. If the 2nd axis detects the abnormal load, the 2nd and 4th axes stop.

Parameter No. 1881	Set Value
(1st axis)	1
(2nd axis)	2
(3rd axis)	1
(4th axis)	0

(Note) *This parameter is valid when Parameter No. 1804, #5 (ANA) is "1".*

1885	Allowable Move Total Value during Torque Control

Data format: Word type [Valid for the **Σ** 16/18/21]

Unit of data: Unit of detection

Data range: 0 to 32767

Set an allowable move total value (error counter value) during torque control as to the axis you want to provide torque control with an axis control command for the axis control function by the PMC. If the move total value becomes larger than a set value torque control, a servo alarm (No. F423) results.

(Note) *This parameter is valid when Parameter No. 1803, #4 (TQF) is "0".*

1886	Position Deviation Value at Torque Control Cancellation

Data format: Word type [Valid for the **Σ** 16/18/21]

Unit of data: Unit of detection

Data range: 0 to 32767

Set a position deviation value existing when canceling torque control to return to position control, as to the axis yo want to provide torque control with an axis control command for the axis control function by the PMC. Control is switched to position control after the position deviation value has come to the set value of this parameter of lower.

(Note) *This parameter is valid when Parameter No. 1803, #4 (TQF) is "0".*

1890	Servo Motor Detection Rotating Speed

Data format: Word type [Invalid for the **Σ** 21]

Unit of data: rpm

Data range: 0 to 8,000

A servo motor rotating speed for each axis is monitored and it is output to a motor speed detection signal (Y-address set in the parameter no. 1891) whether the rotating speed for each axis is exceeding the rotating speed set in this parameter.

(Note) *When a servo/spindle motor speed detecting function is not provided or a value of 0 is set, the motor speed detection signal is not output.*

1891	First Value of Y-address to Which Motor Speed Detection Signal Is Output

Data format: Word type [Invalid for the **Σ** 21]

Data range: 0 to 126, 1000 to 1013, 1020 to 1033

Set a Y-address to which the motor speed detection signal is to be output. A spindle motor rotating speed and servo motor rotating speed for each axis are monitored and it is output as a motor speed detection signal to the Y-address set in this parameter or the Y-address + 1 whether the rotating speed is exceeding the rotating speed set in the parameter.

-Y-address n: A servo motor speed detection signal is output. (See the parameter no 1890)

-Y-address n+1: A spindle motor speed detection signal is output. (See the parameter no. 4345)

	#7	#6	#5	#4	#3	#2	#1	#0
Y(n+0)	DSV8	DSV7	DSV6	DSV5	DSV4	DSV3	DSV2	DSV1
Y(n+1)	←			Reserved		→	DSP2	DSP1

n: Setting value

DSV1 to DSV8: 1st to 8th axis servo motor speed detection signals

DSP1, DSP2: Serial spindle motor speed detection signals for the 1st and 2nd spindles, respectively

(Note 1) *When the servo/spindle motor speed detecting function is not provided, a setting value is 0 or beyond a data range, or an unexisting I/O address is specified, even if the value is within the data range, the motor speed detection signal is not output.*

(Note 2) *Be sure to specify the Y-address which has not been used in the PMC sequence program (ladder).*

	#7	#6	#5	#4	#3	#2	#1	#0
1902							ASE	FMD

Data format: Bit type [Valid for the Σ 16/18/21]

- FMD
  0: Selects the automatic setting mode as the FSSB setting mode. (If the relations between the axes and amplifiers are prescribed in the FSSB Set screen, the parameters 1025, 1905, 1910 to 1919, 1936, and 1937 are automatically set.)

  1: Selects the manual setting-2 mode as the FSSB setting mode. (Manually set the parameters 1025, 1905, 1910 to 1919, 1936, and 1937)

  (Note) *When FMD is “1”, ASE is “0”, and the parameters No. 1910 to 1919 are “0”, the manual setting-1 mode takes effect.*

- ASE
  0: Automatic setting has not been completed when the FSSB setting mode is the automatic setting mode (Parameter no. 1902, #0 (FMD) = 0).

  1: Automatic setting has been completed when the FSSB setting mode is the automatic setting mode (Parameter no. 1902, #0 (FMD) = 0). (This bit is automatically set to "1" upon completion of automatic setting.)

	#7	#6	#5	#4	#3	#2	#1	#0
1904								DSP

Data format: Bit type [Valid for the Σ 16/18/21]

- DSP 0: Two axes uses one axis. (Normal axes)
  1: One axis occupies one DSP. (Learning control axis, etc.)

(Note) *Do not directly enter this parameter because it is set in the FSSB Set screen. In case of the FSSB manual setting-2 mode, you need not to set it.*

	#7	#6	#5	#4	#3	#2	#1	#0
1905	PM2	PM1						FSL

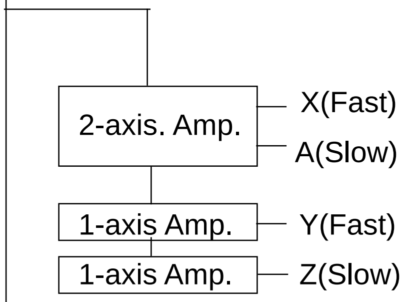
Data format: Bit type [Valid for the Σ 16/18/21]

- FSL 0: An interface type between the servo amplifier and servo software is the Fast type.
  1: An interface type between the servo amplifier and servo software is the Slow type.

(Note) *There are two types of servo data transfer interfaces; Fast and Slow. They have been set in a manner to satisfy the following conditions.*

- *When the 1-axis amplifier is used, both Fast and Slow types are available.*
- *When the 2-axis amplifier is used, do not use the Fast type for both axes. The Slow type is available for both axes.*
- *When the 3-axis amplifier is used, the 1st and 2nd aces confirm to the 2-axis amplifier and the 3rd axis to the 1-axis amplifier, respectively.*
- *Use the Fast type for the axis where an odd number has been set in Parameter No. 1025. For the EGB axis, learning control axis, high-speed current loop axis, and high-speed interface axis, however, the Slow type is also available.*
- *Only the Slow type is available for the axis where an even number has been set in Parameter No. 1025. (Be sure to see "1" in this bit.)*

Controlled Axis No.	Program Axis Name PRM1023	Servo Axis No. PRM1025	Interface Type Fast/Slow
1	X	1	F
2	Y	3	F
3	Z	4	S
4	A	2	S



- PM1 0: Does not use the 1st pulse module.
  1: Use the 1st pulse module.
- PM2 0: Does not use the 2nd pulse module.
  1: Use the 2nd pulse module.

(Note) *When the FSSB setting mode is the automatic setting mode (Parameter 1902, #0 (FMD) = 0), Parameter 1905 is automatically set by an entry in the FSSB Set screen. Be sure to set it in case of the manual setting -2 mode (Parameter 1902, #0 (FMD) = 1). When using the pulse module, it is necessary to separately set the connector numbers (Parameters 1936 and 1937).*

1910	Address Conversion Table Value for Slave 1 (ATR)
1911	Address Conversion Table Value for Slave 2 (ATR)
1912	Address Conversion Table Value for Slave 3 (ATR)
1913	Address Conversion Table Value for Slave 4 (ATR)
1914	Address Conversion Table Value for Slave 5 (ATR)
1915	Address Conversion Table Value for Slave 6 (ATR)
1916	Address Conversion Table Value for Slave 7 (ATR)
1917	Address Conversion Table Value for Slave 8 (ATR)
1918	Address Conversion Table Value for Slave 9 (ATR)
1919	Address Conversion Table Value for Slave 10 (ATR)

Data format: Byte type [Valid for the **Σ** 16/18/21]

Data range: 0 to 7, 16, 40, 48

Set the address conversion table values for the slaves 1 to 10.

The slave is a general term for the servo amplifiers and pulse modules connected to the CNC unit with the FSSB's optical cables. They are numbered 1 through 10, starting at the one closest to the CNC unit. The 2-axis amplifier consists of two slaves and the 3-axis amplifier consists of the three slaves.

Set the following values in these parameters, depending on whether the slave is an amplifier or a pulse module, or whether it is existing or not.

- When the slave is an amplifier:

  Set the set value of Parameter No. 1025 for the axis to which the amplifier is to be allocated minus 1.

- When the slave is a pulse module:

  Set 16 for the 1st pulse module (connected closest to the CNC unit) and 48 for the 2nd one (connected farther from the CNC unit).

- When the slave is not existing:

  Set 40.

(Note) *When the FSSB setting mode is the automatic setting mode (Parameter 1902, #0 (FMD) = 0), Parameters 1910 to 1919 are automatically set by an entry in the FSSB Set screen. Be sure to enter directly in case or the manual setting-2 mode (Parameter 1902 #0 = 1).*

[Axis Configuration and Parameter Setting Example]

Controlled Axis No.	Program Axis Name PRM1023	Servo Axis No. PRM1025
1	X	1
2	Y	3
3	Z	4
4	A	2

	Slave No.	ATR PRM1910 ~1919	Axis
1-axis Amp.	1	0	X
2-axis Amp.	2	1	A
	3	2	Y
M1	4	16	(M1)
1-axis Amp.	5	3	Z
M2	6	48	(M2)
	7	40	(None)
	8	40	(None)
	9	40	(None)
	10	40	(None)

Controlled Axis No.	Program Axis Name PRM1023	Servo Axis No. PRM1025
1	X	1
2	Y	2
3	Z	3
4	A	4

	Slave No.	ATR PRM1910 ~1919	Axis
1-axis Amp.	1	0	X
2-axis Amp.	2	1	Y
	3	2	Z
1-axis Amp.	4	3	A
M1	5	16	(M1)
M2	6	48	(M2)
	7	40	(None)
	8	40	(None)
	9	40	(None)
	10	40	(None)

1920	Controlled Axis Number for Slave 1 (For FSSB Set Screen Only)
1921	Controlled Axis Number for Slave 2 (For FSSB Set Screen Only)
1922	Controlled Axis Number for Slave 3 (For FSSB Set Screen Only)
1923	Controlled Axis Number for Slave 4 (For FSSB Set Screen Only)
1924	Controlled Axis Number for Slave 5 (For FSSB Set Screen Only)
1925	Controlled Axis Number for Slave 6 (For FSSB Set Screen Only)
1926	Controlled Axis Number for Slave 7 (For FSSB Set Screen Only)
1927	Controlled Axis Number for Slave 8 (For FSSB Set Screen Only)
1928	Controlled Axis Number for Slave 9 (For FSSB Set Screen Only)
1929	Controlled Axis Number for Slave 10 (For FSSB Set Screen Only)

Data format: Byte type [Valid for the **Σ** 16/18/21]

Data range: 0 to 8

Set the controlled axis numbers for the slave 1 to 10.

(Note) *Normally, do not directly enter these parameters because they are set in the FSSB Set screen. You need not to set them in case of the FSSB manual setting-2 mode.*

1931	Connector Number for 1st Pulse Module (For FSSB Set Screen Only)
1932	Connector Number for 2nd Pulse Module (For FSSB Set Screen Only)

Data format: Byte axis type [Valid for the **Σ** 16/18/21]

Data range: 0 to number of connectors owned by the pulse modules

When using the pulse module, set the connector number of the pulse module for each axis.

(Note) *Normally, do not directly enter these parameters because they are set in the FSSB Set screen. You need not to set them in case of the FSSB manual setting-2 mode.*

1933	Cs Contour Control Axis (For FSSB Set Screen Only)

Data format: Byte axis type [Valid for the **Σ** 16/18/21]

Data range: 0, 1

When performing Cs contour control, set "1" for the relevant axis.

(Note) *Normally, do not directly enter this parameter because it is set in the FSSB Set screen. You need not to set it in case of the FSSB manual setting-2 mode.*

1934	Master and Slave Numbers for Tandem Control (For FSSB Set Screen Only)

Data format: Byte axis type [Valid for the **Σ** 16/18/21]

Data range: 0 to 8

When performing tandem control, set the continuous odd and even numbers for the master and slave axes, respectively.

(Note) *Normally, do not directly enter this parameter because it is set in the FSSB Set screen. You need not to set it in case of the FSSB manual setting-2 mode.*

1936	Connector Number for 1st Pulse Module (For FSSB Set Screen Only)

1937	Connector Number for 2nd Pulse Module (For FSSB Set Screen Only)

Data format: Byte axis type [Valid for the **Σ** 16/18/21]

Data range: 0 to 7

When using the pulse module, set the connector number of the pulse module for each axis minus 1. In short, set 0 to 7 for the connector numbers 1 to 8, respectively. It is also necessary to set for Parameter 1905, #6 and #7. Set o for the axes which do not use the pulse module. It is up to you which axis uses which connector, but use the connector numbers, starting from the smaller ones. That is, you cannot use the connector no. 4 before using the no. 3.

Controlled Axis	1st Connector No.	2nd Connector No.	PRM1936	PRM1937	PRM1905 (#7, #6)
X	1	Unused	0	0	0, 1
Y	Unused	2	0	1	1, 0
Z	Unused	1	0	0	1, 0
A	Unused	Unused	0	0	0, 0

(Note) *When the FSSB setting mode is the automatic setting mode (Parameter 1902, #0 (FMD) = 0), this parameter is automatically set by an entry in the FSSB Set screen. Be sure to set it directly in case of the manual setting-2 mode (Parameter 1902, #0 = 1).*

The details of the following parameters are omitted.

No.	Data Format	Description							
2000	Bit axis type				PGEX	PRMC		DGPR	PLCO
2002	Bit axis type	AMR7	AMR6	AMR5	AMR4	AMR3	AMR2	AMR1	AMR0
2003	Bit axis type	VFSE				PFSE			
2003	Bit axis type	VOFS	OVSC	BLEN	NPSP	PIEN	OBEN	TGAL	
2004	Bit axis type		DLY0						
2005	Bit axis type	SFCM	BRKC					FEED	
2006	Bit axis type		DCBE		ACCF	SPVE	PKVE	SBSM	FCBL
2007	Bit axis type	FRCA	FAD						
2008	Bit axis type	LXAD	PFBS	VCTM	SPPC	SPPR	VFBA	TNOM	
2009	Bit axis type	BLST	BLCU				ADBL	IQOD	SERD
2010	Bit axis type	POLE		HBBL	HBPE	BLTE	LINE		
2011	Bit axis type			RCCL				FFALWY	SYCMOD
2012	Bit axis type	STNG		VCM2	VCM1			MSFE	
2013	Bit axis type								
2014	Bit axis type								
2015	Bit axis type		BLAT	TDOU				SSG1	PGTW
2016	Bit axis type	NFL8	NFL7	NFL5		K2VC			ABNT
2017	Bit axis type	PK25	OVCR	RISC	HTNG				DBST
2018	Bit axis type	PFBC						MOVO	
2019	Bit axis type	DPFB			SPSY				
2020	Word axis type	Motor type							
2021	Word axis type	Load inertia ratio							
2022	Word axis type	Motor rotating direction							
2023	Word axis type	Speed detection feedback pulses							
2024	Word axis type	Position detection feedback pulses							
2025	Word axis type								
2026	Word axis type								
2027	Word axis type								
2028	Word axis type	Position gain switching effective speed							
2029	Word axis type	Low-speed integrating function effective acceleration speed							
2030	Word axis type	Low-speed integrating function effective acceleration speed							
2031	Word axis type								
2032	Word axis type								
2033	Word axis type	Position feedback pulse							
2034	Word axis type	Vibration-damping control gain							
2035	Word axis type								
2036	Word axis type								
2037	Word axis type								
2038	Word axis type								
2039	Word axis type	2nd-step acceleration amount of 2-step type backlash acceleration							
2040	Word axis type	Power loop integral gain (PK1)							
2041	Word axis type	Power loop proportional gain (PK2)							
2042	Word axis type	Power loop gain (PK3)							
2043	Word axis type	Speed loop integral gain (PK1V)							
2044	Word axis type	Speed loop proportional gain (PK2V)							

No.	Data Format	Description
2045	Word axis type	Speed loop incomplete integral gain (PK3V)
2046	Word axis type	Speed loop gain (PK4V)
2047	Word axis type	Observer parameter (POA1)
2048	Word axis type	Backlash acceleration amount
2049	Word axis type	Dual position feedback maximum amplitude
2050	Word axis type	Observer parameter (POK1)
2051	Word axis type	Observer parameter (POK2)
2052	Word axis type	
2053	Word axis type	Current dead zone compensation (PPMAX)
2054	Word axis type	Current dead zone compensation (PDDP)
2055	Word axis type	Current dead zone compensation (PHYST)
2056	Word axis type	Counter electromotive voltage compensation (EMFCMP)
2057	Word axis type	Current phase lead control (PVPA)
2058	Word axis type	Current phase lead compensation (PALPH)
2059	Word axis type	Counter electromotive voltage compensation (EMFBAS)
2060	Word axis type	Torque limit
2061	Word axis type	Counter electromotive voltage compensation (EMFLMT)
2062	Word axis type	Overload protection coefficient (OVC1)
2063	Word axis type	Overload protection coefficient (OVC2)
2064	Word axis type	Software disconnection alarm level
2065	Word axis type	Overload protection coefficient (OVCLMT)
2066	Word axis type	250 LLL sec acceleration feedback
2067	Word axis type	Torque command filter
2068	Word axis type	Feed forward coefficient
2069	Word axis type	Speed feedback forward factor
2070	Word axis type	Backlash acceleration timing
2071	Word axis type	Backlash acceleration enabled time
2072	Word axis type	Static friction compensation amount
2073	Word axis type	Stop judgment parameter
2074	Word axis type	Speed dependent current loop gain
2075	Word axis type	
2076	Word axis type	1 msec acceleration feedback gain
2077	Word axis type	Overshoot preventive counter
2078	Word axis type	Numerator of dual position feedback conversion coefficient
2079	Word axis type	Denominator of dual position feedback conversion coefficient
2080	Word axis type	Dual position feedback primary delay time constant
2081	Word axis type	Dual position feedback zero width
2082	Word axis type	Backlash acceleration stop amount
2083	Word axis type	Brake control timer
2084	Word axis type	Numerator of the flexible feed gear
2085	Word axis type	Denominator of the flexible feed gear
2086	Word axis type	Rated current parameter
2087	Word axis type	Torque offset
2088	Word axis type	Machine speed feedback factor gain
2089	Word axis type	Backlash acceleration base pulse
2090	Word axis type	
2091	Word axis type	Non-linear control
2092	Word axis type	Prefeed forward coefficient

No.	Data Format	Description
2093	Word axis type	
2094	Word axis type	
2095	Word axis type	
2096	Word axis type	
2097	Word axis type	Statis friction compensation stop parameter
2098	Word axis type	Phase lead compensation factor
2099	Word axis type	N-pulse suppress level
2100	Word axis type	
2101	Word axis type	Overshoot compensation enabled level
2102	Word axis type	Real current limit final clamp value
2103	Word axis type	Abnormal load detected pull-back amount
2104	Word axis type	Abnormal load detection alarm threshold value
2105	Word axis type	Torque constant
2106	Word axis type	
2107	Word axis type	
2108	Word axis type	
2109	Word axis type	Fine acceleration/deceleration time constant (BELLTC)
2110	Word axis type	Magnetism saturation compensation (Base/factor)
2111	Word axis type	Torque limit at deceleration (Base/factor)
2112	Word axis type	AMR conversion factor 1
2113	Word axis type	Notch filter center frequency
2114	Word axis type	
2115	Word axis type	
2116	Word axis type	Abnormal load detection dynamic friction cancellation
2117	Word axis type	
2118	Word axis type	Dual position feedback semi/full error excessive level
2119	Word axis type	Proportional gain variable stop level at stop
2120	Word axis type	
2121	Word axis type	Conversion factor for feedback pulses
2122	Word axis type	Detection resistance conversion factor
2123	Word axis type	
2124	Word axis type	
2125	Word axis type	
2126	Word axis type	Position feedback changeover time constant
2127	Word axis type	Non-interference control factor
2128	Word axis type	Magnetic flux weak compensation (Factor)
2129	Word axis type	Magnetic flux weak compensation (Base/limit)
2130	Word axis type	Two-time thrust ripple compensation for each pair of magnetic poles
2131	Word axis type	Four-time thrust ripple compensation for each pair of magnetic poles
2132	Word axis type	Six-time thrust ripple compensation for each pair of magnetic poles
2133	Word axis type	
2134	Word axis type	
2135	Word axis type	
2136	Word axis type	
2137	Word axis type	
2138	Word axis type	AMR conversion factor 2
2139	Word axis type	
2140	Word axis type	

No.	Data Format	Description							
2141	Word axis type								
2142	Word axis type	Abnormal load detection threshold at rapid traverse							
2143	Word axis type	Fine acceleration/deceleration time constant 2 (msec)							
2144	Word axis type	Cutting position feed forward factor							
2145	Word axis type	Cutting speed feed forward factor							
2146	Word axis type								
2147	Word axis type								
2148	Word axis type								
2149	Word axis type								
2150	Word axis type								
2151	Word axis type								
2152	Word axis type								
2153	Word axis type								
2154	Word axis type								
2155	Word axis type								
2156	Word axis type								
2157	Word axis type								
2158	Word axis type								
2159	Word axis type								
2160	Word axis type								
2161	Word axis type								
2162	Word axis type								
2163	Word axis type								
2164	Word axis type								
2165	Word axis type	Amplifier maximum current value							
2200	Word axis type					ABGO	IQOB		
2201	Word axis type		CPEE		SPVC				CROF
2202	Word axis type				DUAL	OVS1			FAGO
2203	Word axis type				FRC2				
2204	Word axis type								
2205	Word axis type								
2206	Word axis type								
2207	Word axis type								
2208	Word axis type								
2209	Word axis type					FADL			

2.9 Parameters Related to DI/DO

	#7	#6	#5	#4	#3	#2	#1	#0
3000	HMI							

Data format: Bit type

- HMI 0: Normal M-, S-, T-, and B-code strobe signals and completion signals
  1: High-speed M-, S-, T-, and B-code strobe signals and completion signals

	#7	#6	#5	#4	#3	#2	#1	#0
3001				IOV				

Data format: Bit type

- IOV 0: A cutting feed speed override signal, and rapid traverse override signal are of negative logic
  1: A cutting feed speed override signal, and rapid traverse override signal are of positive logic

	#7	#6	#5	#4	#3	#2	#1	#0
3002		MVX	DEC		DIT	ITX		ITL

Data format: Bit type

- ITL 0: Enables an interlock signal
  1: Disables an interlock signal
- ITX 0: Enables an interlock signal for each axis
  1: Disables an interlock signal for each axis
- DIT 0: Enables an interlock signal by axis direction
  1: Disables an interlock signal by axis direction
- DEC 0: A manual reference point return deceleration signal (*DEC1 to *DEC8) is of negative logic (Decelerates when a signal is turned to 0)
  1: A manual reference point return deceleration signal (*DEC1 to *DEC8) is of positive logic (Deceleration when a signal is turned to 1)
- MVX 0: An axis moving signal is turned to 0 upon completion of distribution of that axis ("0" during deceleration)
  1: An axis moving signal is turned to 0 when deceleration of that axis is completed and it is placed in the in-position state (Turned to "0" upon completion of deceleration when no in-position check is made at the time of deceleration depending on parameter setting)

	#7	#6	#5	#4	#3	#2	#1	#0
3003			OTH					BSL

Data format: Bit type

- BSL 0: Disables the block start interlock signal (*BSL) and cutting block start interlock signal (*CSL)
  1: Enables the block start interlock signal (*BSL) and cutting block start interlock signal (*CSL).
- OTH 0: Checks an overtravel limit signal
  1: Does not check an overtravel limit signal

(Note) *For safety, set "0" normally to check the overtravel limit signal.*

	#7	#6	#5	#4	#3	#2	#1	#0
3004								GDC

Data format: Bit type

- GDC 0: A reference point return deceleration signal use X009
  1: A reference point return deceleration signal use G196 (X009 is invalid)

	#7	#6	#5	#4	#3	#2	#1	#0
3005	RW3	RW2	RW1	MRES	PEND			RMT

Data format: Bit type

- RMT1, RMT2 Setting whether or not Remote Run is performed when Memory mode has been selected:

RMT2	RMT1	DETAILS OF RUN
0	0	Remote run not performed. (Memory run)
0	1	DNC run performed. (Remote buffer)
1	0	Disk run performed. (Data Server)

- PEND When '%' is read in automatic operation (MEMORY, TAPE, DNC) other than MDI operation.
  0: The NC unit applies a reset to search for the head of the program.
  1: An alarm results. (Alarm no. 198, "Program end")

(Note) *Even if a reset is applied with this parameter set to 0, a "resetting" signal is not output to the PMC side.*

- MRES When M02/M03 execution is completed.
  0: The NC unit applied a reset and a program head search follows #5 (RW1) and #6 (RW2).
  1: Does not apply a reset. (After execution is completed, the next block will be run.)

(Note 1) Even if a reset is applied with this parameter set to 0, a "resetting" signal is not output to the PMC side.

(Note 2) When M02/M03 is executed with this parameter set to 1, enter an "external reset" or "reset & rewind" signal from the PMC side.

- RW1 0: Searches for the program head upon completion of M30
  1: Does not search for the program head upon completion of M30.
  (Note) *This parameter is invalid at #3 (MRES) = 1.*
- RW2 0: Does not search for the program head upon completion of M02.
  1: Searches for the program head upon completion of M02.
  (Note) *This parameter is invalid at #3 (MRES) = 1.*
- RW3 0: Searches for the beginning of the program by external reset
  1: Does not search for the beginning of the program by external reset

	#7	#6	#5	#4	#3	#2	#1	#0
3007						ECOCC	ECOWL	ECOST

Data format: Bit type

ECOST 0: Disables the Eco/eco stting function.
1: Enables the Eco/eco setting function.

ECOWL 0: Disables Eco/eco setting, Work Write-off function.
1: Enables Eco/eco setting, Work Write-off function.

ECOCC 0: Disables Eco/eco setting, Chip Conveyor Auto OFF function
1: Enables Eco/eco setting, Chip Conveyor Auto OFF function.

3009	Eco/eco Setting: Auto Work Write-off Setting Time

3010	Eco/eco Setting: Chip Conveyor Auto OFF Setting Time

Data format: Byte type

Unit of data: seconfs

Data range: 0 to 255

Set the time required to execute the Eco/eco setting functions, Auto Work Write-off and Chip Conveyor Auto OFF.

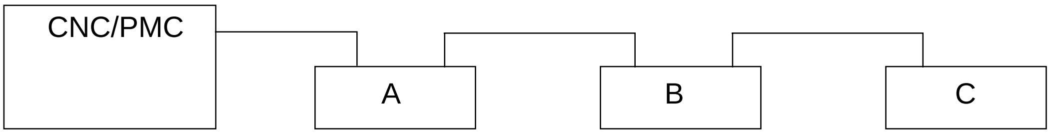
(Note) *When the set value is 0, that function is overridden.*

3016	I/O Link Additional Data Communication Group No.

Data format: Byte type [Valid for **Σ** 16/18/21]

Data range: 0 to 16

When using multiple I/O link modules, set where the I/O link modules which makes a pair with the FIOSL board is to be connected, counting from the CNC.



The set value differs depending on which modules makes a pair with the FIOSL board.

A: Set value = 0

B: Set value = 1

C: Set value = 2

(Note) *When using only the I/O link module which makes a pair with the FIOSL board (only A in the example above), be sure to set to 0.*

3017	Strobe signal (MF, SF, TF, or BF) delay tme

Data format: Word type

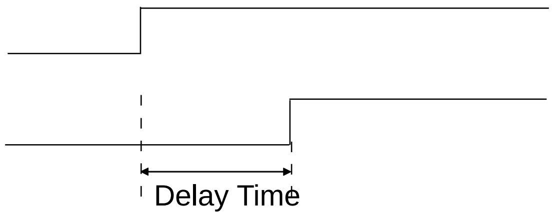
Unit of data: msec.

Data range: 16 to 32767

Set a time required to send a strobe signal (MF, SF, TF or BF) after sending an M-, S-, T-, or B-code.

M-, S-, T-, or B-code

MF, SF, TF, BF



(Note 1) *A time is counted every 8 msec. and functions less than 8 msec. are raised to a unit.*

[Example] Setting value = 30 --------- Regarded as 32 msec.

Setting value = 32 --------- Regarded as 32 msec.

Setting value = 100 ------- Regarded as 104 msec.

(Note 2) *In case of high-speed MSTB interface (parameter no. 3000, #7 (HMI) = 1), this parameter has not meaning.*

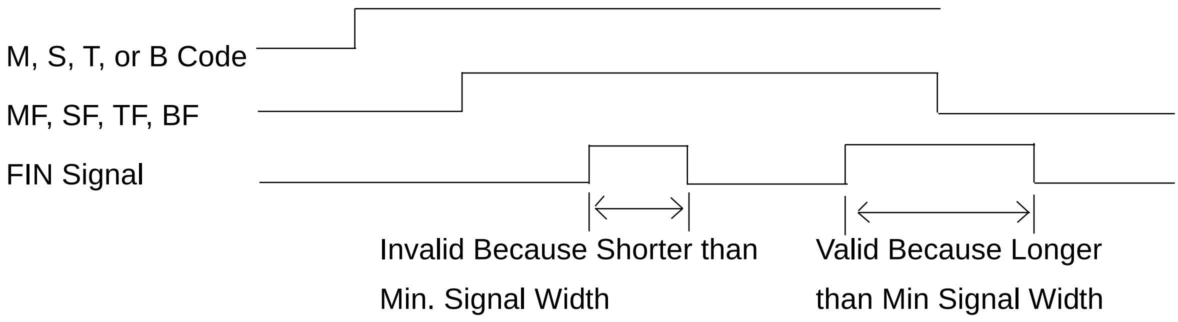
3018	M/S/T/B/ Function Finish Signal (FIN) Acceptance Width

Data format: Word type

Unit of data: msec.

Data range: 0 to 32767

Set a minimum signal width which considers an M/S/T/B function finish signal (FIN) valid.



(Note 1) *A time is counted every 8 msec. and fractions less than 8 msec. are raised to a unit.*

[Example] Setting value = 30 ----- Regarded as 32 msec.

(Note 2) *In case of high-speed MSTB interface (parameter no. 3000, #7 (HMI) = 1), this parameter has no meaning.*

3019	Reset Signal (RST) Output Time

Data format: Word type

Unit of data: 16 msec.

Data range: 0 to 255

Set an extension time when you want to extend a reset signal (RST) output time.

[RST signal output time] = [Resetting time] + [Parameter value x 16 msec.]

3024	Simple 2nd Series: POUT Command Standard Output Time	L
		M

Data format: Word type

Unit of data: 0.01 second

Data range: 0 to 32767

When an output time is not specified (T) in the POUT command for the simple 2nd series (feeder control), set the output time. When the output time is specified by the program, the specified time becomes valid, not this parameter.

2.10 Parameters Related to CRT/MDI, Display, and Editing

	#7	#6	#5	#4	#3	#2	#1	#0
3100					FKY1			

Data format: Bit type

- FKY1 Be sure to set 1. (At power-on, "1" is set automatically)

	#7	#6	#5	#4	#3	#2	#1	#0
3101					FKY1			

Data format: Bit type

(Note) *As this parameter is automatically set on supply of power, do not change setting.*

	#7	#6	#5	#4	#3	#2	#1	#0
3103	FNPA	OPS	OPM			SVP	SPS	SVS

Data format: Bit type

- SVS 0: Does not display the Servo Setting screen
  1: Displays the Servo Setting screen
- SPS 0: Does not display the Spindle Setting screen
  1: Displays the Spindle Setting screen
- SVP 0: A synchronous error is displayed with an instantaneous value in the Spindle Control screen
  1: A synchronous error is displayed with a peak hold value in the Spindle Control screen
- ORM 0: Does not display on the operating monitor
  1: Displays on the operating monitor
- OPS 0: A speed meter for the operating monitor screen indicates a spindle motor speed
  1: A speed meter for the operating monitor screen indicates a spindle speed
- FNPA Be sure to set "1" (At power-on, "1" is set automatically)

	#7	#6	#5	#4	#3	#2	#1	#0
3104								SGD

Data format: Bit type

- SGD 0: Does not display a servo waveform
  1: Displays a servo waveform

  (Note) *Normally, set 0.*

	#7	#6	#5	#4	#3	#2	#1	#0
3106			NXTO	SM99	SM30	SM02	REP	RDL

Data format: Bit type

- RDL When registering a program by tape input;
  0: Registers it as it is
  1: Registers it after deleting an already registered one
- REP When trying to register an already registered program by tape input;
  0: Issues an alarm
  1: Registers it after deleting the already registered program
- SM02 0: Does not take M02 as an end of the program in program registration by tape input
  1: Takes M02 as an end of the program in program registration by tape input
- SM30 0: Does not take M30 as an end of the program in program registration by tape input
  1: Takes M30 as an end of the program in program registration by tape input
- SM99 0: Does not take M99 as an end of the program in program registration by tape input
  1: Takes M99 as an end of the program in program registration by tape input
- NXTO 0: When the next O-number appears in program registration by tape input, another file is created
  1: When the next O-number appears in program registration by tape input, it is take as an end of the program

	#7	#6	#5	#4	#3	#2	#1	#0
3107	SBM					SB89	NB89	NE89

Data format: Bit type

- NE89 0: Prohibits editing of the programs O8000 through O9999
  1: Does not prohibit editing of the programs O8000 through O9999
- ND89 0: Does not display the programs O8000 through O9999
  1: Displays the programs O8000 through O9999
- SB89 0: Does not make an SBK stop by a macro statement in the programs O8000 through O9999
  1: Makes an SBK stop by a macro statement in the programs O8000 through O9999

  (Note) *When the parameter no. 3107, #7 (SMB) is set to "0", no SBK stop is made regardless of this parameter.*
- SBM 0: Does not make an SBK stop by a macro statement in all the programs
  1: Makes an SBK stop by a macro statement in all the programs

	#7	#6	#5	#4	#3	#2	#1	#0	
3108	SBDG				DCR				L
	SBDG				DCR	DTL		RELP	M

Data format: Bit type

• RELP The coordinate value displayed in the TOOL OFFSET screen is;
0: Machine coordinates
1: Relative coordinates

• DTL 0: During tool length compensation, a work coordinate value indicates an actual position, taking a compensation amount into account
1: During tool length compensation, a work coordinate value indicates a programmed position, excluding a compensation amount

• DCR 0: During tool diameter/tool nose radius compensation, a work coordinate value indicates an actual position, taking a compensation amount into account
1: During tool length compensation, a work coordinate value indicates a programmed position, excluding a compensation amount

• SBDG 0: When there is a preread block, a stroke in the next block is not displayed in a remaining stroke at SBK stop
1: When there is a preread block, a stroke in the next block is displayed in a remaining stroke at SBK stop

	#7	#6	#5	#4	#3	#2	#1	#0
3109	PFT	PGS	PGLS				ACTF	

Data format: Bit type

• ACTF The display of the feed rate F (F per minute/F per revolution for the L-system, and F % for the M-system) is;
0: For the L-system → Abides by PRM3110, #3 (FCM).
For the M-system → Automatic mode (not dry run): Feed rate selected by PRM3110, #3(FCM) x Feed override
→ Automatic mode (dry run): Dry run rate x Jog override
→ JOG mode: Jog feed rate x Jog override
→ HANDLE mode: Actual rate
1: Actual rate

• PGLS 0: Displays the machining program in the OVERALL screen, Starting from the 2nd leftmost column. (The leftmost column is blank)
1: Displays the machining program in the OVERALL screen, starting from the leftmost column.

• PGS 0: Displays a machining program using half-size characters
1: isplays a machining program using full-size characters

• PFT 0: At inch input, a program length is displayed in meters (m).
1: At inch input, a program length is displayed in feet (FT).

	#7	#6	#5	#4	#3	#2	#1	#0	
3110		MRW	PDS		FCM		NCO	NOS	L
		MRW	PDS		FCM		NCO		M

Data format: Bit type

• NOS Actual rpm indication of the spindle on the general screen is:
0: Not performed.
1: Performed.

• NCO 0: Does not display parenthesized characters in displaying a buffered block
1: Displays parenthesized characters in displaying a buffered block

• FCM Indication data of feed rate F on the general screen is:
0: F for the command
(F which has been commanded alone is displayed. Speed assigned by E is not displayed.)
1: F for inside
(Feed rate for the internal block including canned cycle, etc. is displayed.)

• PDS Sub-pro. Search for calling selection in I/O screen is:
0: Performed by comment remarks.
1: Performed by Sub-pro. calling of the program.

• MRW 0: Does not search for the beginning of the program by key reset in the MEMORY mode
1: Searches for the beginning of the program by key reset in the MEMORY mode

	#7	#6	#5	#4	#3	#2	#1	#0	
3111	TSDP			TLAND	APSL	QAND	TTND	GTPC	L
									M

Data format: Bit type

• GTPC Updating of nose point display of the general screen by groove width offset is:
0: Not performed.
1: Performed.

• TTND 0: Displays a type of the tool
1: Does not display a type of the tool

- QAND 0: Displays the Q-setter screen or auto presetter screen for the maintenance function F1.
  1: Does not display the Q-setter screen or auto presetter screen for the maintenance function F1.

  (Note) *Select 3with #3 (APSL) whether the Q-setter or auto presetter screen should be displayed.*

- APSL 0: The maintenance function F1 is the Q-setter screen.
  1: The maintenance function F1 is the auto presetter screen.
- TLAND 0: Provides the arm display in the Tools List screen if the ATC is attached.
  1: Does not provided the arm display in the Tools List screen if the ATC is attached.
- TSDP "ToolS" indication of the general screen is:
  0: Not performed.
  1: Performed.

	#7	#6	#5	#4	#3	#2	#1	#0	
3112									L
	AXB	AXC	MMDT	SNCN	WCSN	WSD3		WSD1	M

Data format: Bit type

- WSD1 0: Displays "F2: REF. GAUGE" and “F3: TOOL CHANGE” in the TOOL screen
  1: Does not display "F2: REF. GAUGE" in the TOOL screen
- WSD3 0: Displays "F2: 2-POINT MEAS." and "F3: 3-POINT MEAS." in the WORK COORDINATE screen
  1: Does not display "F2: 2-POINT MEAS." and "F3: 3-POINT MEAS." in the WORK COORDINATE screen
- WCSN 0: Displays "F5: COOR. DATA SET" in the WORK COORDINATE screen
  1: Does not display "F5: COOR. DATA SET" in the WORK COORDINATE screen
- SNCN 0: Displays "F8: Set Sensor" in the Tool screen and Work Coordinate screen.
  1: Does not display "F8: Set Sensor" in the Tool screen and Work Coordinate screen.
- MMDT The title indicated for the matrix magazine is:
  0: Matrix Magazine
  1: Special Tool
- AXC 0: Does not switches addresses for the work coordinate system and remaining stroke according to an axis switching number

1: Switches addresses for the work coordinate system and remaining stroke according to an axis switching number

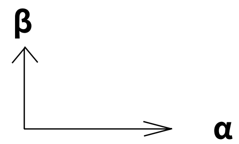
- AXB
  0: When switching an axis, the signs for the work coordinate system and remaining stroke are the same as after switching the axis
  1: When switching an axis, the signs for the work coordinate system and remaining stroke are the same as before switching the axis

	#7	#6	#5	#4	#3	#2	#1	#0	
3113		PMND	AXD2	AXD1				VRDP	L
	TCPG							VRDP	M

Data format: Bit type

- VRDP
  0: Does not display a version for each screen
  1: Displays a version for each screen
- RMN1 When displaying the Modification/Correction screen (parameter No. 3113, #6 (RMND) = 0);
  0: Displays “Check & Correct Zero Point.”
  1: Does not display “Check & Correct Zero Point.”
- RMN5 When displaying the Modification/Correction screen (parameter No. 3113, #6 (RMND) = 0);
  0: Displays “Correct ATC Failure,” if the ATC is attached.
  1: Does not display “Correct ATC Failure.”
- RMN4 When displaying the Modification/Correction screen (parameter No. 3113, #6 (RMND) = 0);
  0: Displays “Correct Turret Index Failure.”
  1: Does not display “Correct Turret Index Failure.”
- AXD1, AXD2 X/Y axes directions in "Soft Jaw Forming screen", "Q Setter Repeat screen" "Set 2nd Zero Point Screen" and "Maintenance Q setter (Auto Presetter) screen" is: (Where **α** and **β** are set as follows)

AXD2	AXD1	X/Z Axes Directions
0	0	**α** = +Z, **β** = +X (standard)
0	1	**α** = -X, **β** = -Z (For CS)



- RMND Modification/Correction screen indication is:
  0: Performed.
  1: Not performed.
- TCPG A program to be run by "F3: TOOL CHANGE" in the TOOL screen is;
  0: M06 T (input value); ----- When an ATC canned cycle is added
  1: G65 P_ T (input value); ----- When an ATC canned cycle is not added

(Note) *When this parameter is set to "1", set in the parameter no.3130 a number (P_) of a macro program you want to call.*

	#7	#6	#5	#4	#3	#2	#1	#0	
3114	S20UT						S2PDH	S2CDP	L
									M

Data format: Bit type

- S2CDP 0: Does not display the dialog screen for the simple 2nd series (feeder control).
  1: Displays the dialog screen for the simple 2nd series (feeder control).
- S2PSH 0: Does not show the work pusher related display in the dialog screen (machine peculiar data) for the simple 2nd series (feeder control).
  1: Shows the work pusher related display in the dialog screen (machine peculiar data) for the simple 2nd series (feeder control).
- S2OUT 0: Does not show "F6: OUT" and "F7: (ON/OFF)" in the screen for the simple 2nd series (feeder control).
  1: Shows "F6: OUT" and "F7: (ON/OFF)" in the screen for the simple 2nd series (feeder control).

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

Data format: Bit axis type

- ADMx 0: Displays an axis together with coordinate values
  1: Does not display an axis together with coordinate values

3118	Shift Time to GOOD-NIGHT Screen

Data format: Byte type

Unit of data: min.

Data range: 0 to 255

Set a shift time to the GOOD-NIGHT screen. If you do not operate the screen for a period of the set time, you will be taken to the GOOD-NIGHT screen automatically.

(Note) *When a value of 0 is set, you are not switched to the GOOD-NIGHT screen.*

3119	Shading of Reverse Video Display of Program Preread Block in Monochrome Screen

3120	Shading of Characters of Program Executed Block in Monochrome Screen

Data format: Byte type

Data range: Parameter no. 3119: -1 to 7

Parameter no. 3120: 0 to 7

Specify "shading of the reverse video display of the preread block" and "shading of the characters of the executed block", with the program running, in case of the monochrome display.

There are three levels of shading. The following table shows the set values versus degrees of shading.

Shading	Set Values	
	Preread Block (Parameter No. 3119)	Executed Block (Parameter No. 3120)
Dark	7 (6, 4, 3, 2)	7 (0, 6, 4, 3, 2)
Medium	5	5
Light	1	1

(Note 1) *When the parameter No. 3119 is either 0 or -1, it has special meaning. - Set value = 0 Displays the pre-read block, enclosing it with a frame.*

- *Set value = 0 Displays the pre-read block, enclosing it with a frame.*
- *Set value = -1Does not display the pre-read block in reverse video.*

(Note 2) *Both parameters assume the data beyond the setting range to be zero (0).*

(Note 3) *For the color display, these parameter are meaningless.*

3122	Name of Load Meter Display Axis (1st)

3123	Name of Load Meter Display Axis (2nd)

3124	Name of Load Meter Display Axis (3rd)

3125	Name of Load Meter Display Axis (4th)

Data format: Byte type

Select the axis you want to display for the load meter in the Overall screen. Set the axis name in accordance with the following table.

No	Axis Name	Set Value
01	Spindle (S)	83
02	X-axis	88
03	Y-axis	89
04	Z-axis	90
05	A-axis	65
06	B-axis	66
07	C-axis	67

No	Axis Name	Set Value	
08	2nd spindle (S2)	84	L-system only
09	3rd spindle (S3)	115	
10	U-axis	85	M-system only
11	V-axis	86	
12	W-axis	87	

(Note) *When the parameters no. 3112 through no. 3125 are all 0, the display looks like the following.*

- *1st axis: Spindle*
- *2nd axis: Servo 1st axis*
- *3rd axis: Servo 2nd axis*
- *4th axis: Servo 3rd axis (In case of the L-system, only when the 3rd axis exists)*

3130		L
	Macro Program Number Called by "F3: TOOL CHANGE" in TOOL Screen	M

Data format: Word type

Data range: 1 to 32767

Set a program number required for calling a macro program by "F3: TOOL CHANGE" in the TOOL screen (parameter no. 3113, "7 (TCPG) = 1).

(Note) *"G65 P (this parameter's value) T (input value)" is executed by operating "F3: TOOL CHANGE." Crete a macro program for tool change (ATC) in the program whose program number has been set.*

2.11 Parameters Related to Program

	#7	#6	#5	#4	#3	#2	#1	#0	
3400	GSC	CSB	DWL	FE24	FE34		F61	DPI	L
			DWL			G60MDL	F61	DPI	M

Data format: Bit type

- DPI 0: Conventional decimal point input
  1: Pocket calculator type decimal point input
- F61 0: If the feed-per-minute F-format for millimetric input is F61 and F is given without a decimal point, the least input increment is 1 (mm/min.)
  1: If the feed-per-minute F-format for millimetric input is F61 and F is given without a decimal point, the least input increment is 0.1 (mm/min.).
  0: 1 (mm/min)
  1: 0.1 (mm/min)
- G60MDL 0: A G-code group for single direction position (G60) is 00
  1: A G-code group for single direction position (G60) is 01 (modal)
- FE34, FE24 Setting of the unite if F- and E-codes are specified without a decimal point, when the F-format for thread cutting is F35 (parameter No.3401, #5(MS6) = 0) in millimetric programming

FE24	FE34	Units of F and E for Thread Cutting	
		F (mm/rev)	E (mm/rev)
0	0	0.00001	0.00001
0	1	0.001	0.0001
1	0	0.01	0.0001

(Note) *This parameter converts the data when buffering the NC program sothat F- and E-codes for thread cutting specified without the decimal point will fit the F35 format. Since F35 is assumed upon entering the NC buffer, the command value and F per minute willbe 0.00001 (mm/rev).*

- DWL 0: Always per-second dwell
  1: Per-second dwell in the feed per minute mode, and per-revolution dwell in the feed per revolution mode
- GSB, GSC Selection of the G-code system

GSC	GSB	G-code system
0	0	A-system
0	1	B-system
1	0	C-system

		#7	#6	#5	#4	#3	#2	#1	#0	
3401		FCLR		MS6	IS7	MM1	IM2	MR3	IR4	L
			MM2	MS6	IS7	MM1	IM2	MR3	IR4	M

Data format: Bit type

- IR4 0: At inch input, an F-code format for feed per revolution is F23
  1: At inch input, an F-code format for feed per revolution is F24
- MR3 0: At metric input, an F-code format for feed per revolution is F32
  1: At metric input, an F-code format for feed per revolution is F33
- IM2 0: At inch input, an F-code format for feed per minute is F51
  1: At inch input, an F-code format for feed per minute is F52
- MM1 0: At metric input, an F-code format for feed per minute is F60
  1: At metric input, an F-code format for feed per minute is F61
- IS7 0: At inch input, an F-code format for thread cutting is F26
  1: At inch input, an F-code format for thread cutting is F17
- MS6 0: At metric input, an F-code format for thread cutting is F35
  1: At metric input, an F-code format for thread cutting is F26
- MM2 0: At metric input, an F-code format for feed per minute follows setting of the parameter no. 3401, #3 (MM1)
  1: At metric input, an F-code format for feed per minute is F62
- FCLR 0: Does not clear an F-code for feed per revolution by that for feed per minute or vice versa
  1: Clears an F-code for feed per revolution by that for feed per minute or vice versa

(Note) *When specifying a speed, the units for F and E are the same.*

		#7	#6	#5	#4	#3	#2	#1	#0	
3402		NCM	MBF		G95			G90	G01	L
		NCM	MBF	G18	G95	G44	G43	G90	G01	M

Data format: Bit type

- G01 0: G00 mode at the time of power-on or reset
  1: G01 mode at the time of power-on or reset
- G90 0: G91 mode at the time of power-on or reset
  1: G90 mode at the time of power-on or reset

(Note) *In the L-system, this is valid only when the G-code system is Type B or C.*

- G43, G44 G43/G44/G49 mode setting at the time of power-on or reset

GSC	GSB	Mode Setting
0	0	G49 mode
0	1	G43 mode
1	0	G44 mode

(Note) *When tool offset by the tool number is enabled, the G43 mode is selected regardless of this parameter.*

- G95
  0: G94 mode at the time of power-on or reset (G98 for the G-code system A in the L-system)
  1: G95 mode at the time of power-on or reset (G99 for the G-code system A in the L-system)
- G18
  0: G17 mode at the time of power-on or reset
  1: G18 mode at the time of power-on or reset

  (Note) *For the L-system, the G18 mode is selected.*
- MBF
  0: Turns off the multibuffer mode at the time of power-on or reset
  1: Turns on the multibuffer mode at the time of power-on or reset
- NCM
  0: Initializes part of modal G-codes (those selected by the parameter no. 3402, #2 to #5) by reset
  1: Does not initialize part of modal G-codes (those selected by the parameter no. 3402, #2 to #5) by a reset (Remains in the last specified state)

At the time of reset and power-on, the G-codes will be as follows: (The L-system is described in terms of G-code system A)

Group	L-system		M-system	
	At Reset	At Power-on	At Reset	At Power-on
00	---	---	---	---
01	*	G00 / G01	*	G00 / G01
02	*	G18	*	G17 / G18
03	*	G90 / G91	*	G90 / G91
04	G22 ‖ G23	G22 ‖ G23	G22 ‖ G23	G22 ‖ G23
05	*	G98 /G99	*	G94 /G95
06	State held	G20 : G21	State held	G20 : G21
07	G40	G40	G40	G40
08			*	G43/G44/G49
09	G80	G80	G80	G80
10	G198	G198	G98	G98
11			G50	G50
12	---	---	*	G54
13	G64	G64	G64	G64
14	G67	G67	G67	G67
15	G501	G501	G501	G501
16	G150	G150	G69	G69
17	State held	G97	State held	G97
18	G130 ‖ G131	G130 ‖ G131	G130 ‖ G131	G130 ‖ G131
19			G401	G401

Group	L-system		M-system	
	At Reset	At Power-on	At Reset	At Power-on
20			G15	G15
21			G114	G114
22	G120	G120	G120	G120
23	State held	G25	State held	G25
24			G240	G240
25	State held	G170	G264	G264
26			G249	G249
27	G143	G143		
28				
29				
30				
31				

(Note 1) *The symbols in the table above have the following meanings:*

- */ ------- Capable of selecting initialization by parameter setting.*
- *: ------- Holds the state existing when the power is turned off.*
- *‖ ---Selects a function enabling G-code when an option is added, and selects a function disabling G-code when not added*
- ** ------ Capable of selecting whether to initialize or not by a parameter (NCM). However, Group 01 is always initialized when it is not G00 to G03.*

(Note 2) *Group 03 in the L-system is valid only for the G-code system B or C.*

	#7	#6	#5	#4	#3	#2	#1	#0	
3403	SLE	UVW		INC			SMX		L
		UVW		INC		SPMA	SMX	MABS	M

Data format: Bit type

- MABS 0: Manual absolute ON/OFF remains set to ON
  1: The manual absolute switch complies with a manual absolute signal
  (Note) *In the L-system, this parameter is set to "0".*
- SMX 0: An S-code specified by G92 (G50 for the G-code system A in the L-system) is taken as a maximum spindle speed command
  1: An S-code specified by G92 (G50 for the G-code system A in the L-system) is not taken as a maximum spindle speed command
- SPMA With starting following manual intervention taking place during Single Block Halt:
  0: Manual intervention volume is not reflected on the internal coordinate value. (Special kind of Manual Absolute processing.)

1: Manual intervention volume is reflected on the internal coordinate value. (Special kind of Manual Absolute processing.)

- INC
  0: In the block next to manual intervention with manual absolute ON, incremental programming follows the same path as absolute programming
  1: In the block next to manual intervention with manual absolute ON, incremental programming follows the same path as manual absolute OFF
- UVW
  0: With manual absolute ON, an axis is returned by a manual intervention amount in an axis move block (The axis is not returned if an axis command is given, but no stroke is specified)
  1: With manual absolute ON, an axis is returned by a manual intervention amount in an axis command block (The axis is returned regardless of a stroke if an axis command is given)
- SLE
  0: An E-code specified in thread cutting is a thread lead
  1: An E-code specified in thread cutting is the number of threads per inch

	#7	#6	#5	#4	#3	#2	#1	#0	
3404	PLXR	PLYC		PLRN	AINC	THRQ		BFSPM	L
				PLRN					M

Data format: Bit type

- BFSPM
  0: Disables the preread stop fixed M-codes (M12, M31 through M33).
  1: Enables the preread stop fixed M-codes (M12, M31 through M33).
- THRQ
  0: The least input increment for the thread cutting start shift angle Q is 10
  1: The least input increment for the thread cutting start shift angle Q is 0.0010
- AINC
  0: In case of the G-code system A, an A-axis command by G28, G30, or G301 is of absolute programming
  1: In case of the G-code system A, an A-axis command by G28, G30, or G301 is of incremental programming
- PLRN
  0: Upon completion of polar coordinate interpolation (G120), the work coordinates of a rotary axis are not rounded by 3600
  1: Upon completion of polar coordinate interpolation (G120), the work coordinates of a rotary axis are rounded by 3600

  (Note) *This parameter is valid only when a rollover (work coordinate rounding) function for the rotary axis is not provided.*
- PLYC
  0: In case of polar coordinate interpolation special specification A, the Y-axis command in the polar coordinate interpolation (G121) mode is operated as a Y-axis command.

1: In case of polar coordinate interpolation special specification A, a Y-axis command in the polar coordinate interpolation (G121) mode is replaced by a C-axis command.

(Note) *Even if PLYC = 1 is set, a C-axis command works as a C-axis command.*

- PLXR
  - 0: In case of polar coordinate interpolation special specification A, a selection of diameter/radius designation of the X-axis command in the polar coordinate interpolation (G121) mode depends on the parameter no. 1010, #3 (DIAx).
  - 1: In case of polar coordinate interpolation special specification A, a selection of diameter/radius designation of the X-axis command in the polar coordinate interpolation (G121) mode is radius designation.

(Note) *A display of coordinate values complies with setting of the parameter no. 1010, #3 (DIAx) regardless of this parameter.*

	#7	#6	#5	#4	#3	#2	#1	#0	
3405									L
	G54R				RTW	RTR	SCR	RIN	M

Data format: Bit type

- RIN
  - 0: A rotation angle (R) command in coordinate rotation (G68) is always absolute
  - 1: A rotation angle (R) command in coordinate rotation (G68) complies with the G90/g91 mode.
- SCR
  - 0: Magnification for scaling (G51) is 0.001
  - 1: Magnification for scaling (G51) is 0.00001
- RTR
  - 0: The least input increment of the rotation angle (R) in coordinate rotation (G68) is 0.0010
  - 1: The least input increment of the rotation angle (R) in coordinate rotation (G68) is 0.000010
- RTW
  - 0: In case of a coordinate rotation command of "G68;," the center of rotation is the zero point of G54 to G59 and the angle of rotation complies with a set value R of G54 to G59.
  - 1: In case of a coordinate rotation command of "G68;," the center of rotation is the current position and the angle of rotation complies with a set value of the parameter no. 3461.
- G54R
  - 0: Does not apply coordinate rotation with G54 to G59 commands.
  - 1: Applies coordinate rotation with G54 to G59 commands. (Be sure to set #3 (RTW) = 0)

		#7	#6	#5	#4	#3	#2	#1	#0	
3406					HZGR	SMRZ			ICR	L
							MRC	MIR	ICR	M

Data format: Bit type

- ICR 0 Alteration of the inner circular cutting speed for automatic corner override is valid regardless of the G62 mode.

  1: Alteration of the inner circular cutting speed for automatic corner override is valid only in the G62 mode.

  (Note) *Alteration of the inner circular cutting speed is part of the automatic corner override function. When the automatic corner override function is not added, this parameter is meaningless.*

- MIR 0: Mirror image conversion is performed before scaling and coordinate rotation

  1: Mirror image conversion is performed after scaling and coordinate rotation

- MRC When an intermediate point of G28, G30, etc. is specified by incremental programming in case of mirror image, coordinate rotation, or axis switching;

  0: An intermediate point position is converted into an absolute value inside the NC unit

  1: An intermediate point position remains as an incremental value.

- SMRZ 0: A mirror point for setting mirror image is a buffering position

  1: A mirror point for setting mirror image is a position of 0

- HZGR 0: Does not apply groove width compensation (G151/G152) if it is specified at tool width = 0.

  1: Applies groove width compensation (G151/G152) if it is specified at tool width = 0. (The coordinate system does not change, but only the tool nose point does)

		#7	#6	#5	#4	#3	#2	#1	#0	
3407			SBF				SBR	SBO	SBC	L
			SBF	NOT			SBR	SBO	SBC	M

Data format: Bit type

- SBC 0: Does not make an SBK stop in each step of a canned cycle for drilling

  1: Makes an SBK stop in each step of a canned cycle for drilling

- SBO 0: Does not make an SBK stop in a block generated inside the NC unit for tool diameter compensation/tool nose radius compensation

  1: Makes an SBK stop in a block generated inside the NC unit for tool diameter compensation/tool nose radius compensation

• SBR 0: Does not make an SBK stop at a start point of a block inserted by chamfering/corner R(optional) angle included)

1: Makes an SBK stop at a start point of a block inserted by chamfering/ corner R (optional angle included)

• NOT 0: Performs tool offset by a tool number

1: Does not perform tool offset by a tool number

• SBF 0: Disables prereading of a single block

1: Enables prereading of a single block

(Note) *Even a single block is preread regardless of this parameter in the tool diameter compensation/automatic tool nose radius compensation mode or in the multibuffer mode.*

	#7	#6	#5	#4	#3	#2	#1	#0	
3408	M3B								L
	M3B								M

Data format: Bit type

• M3B 0: Only one M-code can be specified in one block

1: Up to three M-codes can be specified in one block

	#7	#6	#5	#4	#3	#2	#1	#0	
3409							M21C	YKFM	L
	F15M	I80M							M

Data format: Bit type

• YKFM Selection of a G-code to specify polar coordinate interpolation and stored stroke limit 2

YKFM	Polar Coordinate Interpolation		Stored Stroke Limit 2	
	ON	OFF	ON	OFF
0	G121	G120	G22	G23
1	G126	G127	G36 or G38	G37 or G39

(Note) *This parameter is referred to when the machining program is read into the NC buffer. When this parameter is "1", it is converted into a standard G-code ('YKFM' = 0) and subsequent processing is performed, assuming it to be a standard G-code. Therefore, command values and alarms associated with both functions are displayed in standard G-codes.*

• M21C 0: Turns on/off the exact stop mode with G61 (ON)/G64 (OFF).

1: Turns on/off the exact stop mode with G61/M21 (ON) or G64/M22 (OFF).

(Note) *When this parameter is "1", M21/M22 will be an NC internal processing M-code and not output to the machine.*

- I80M 0: Disables the i80M tape format.
  1: Enables the i80M tape format.
- F15M 0: Disables the F15M tape format.
  1: Enables the F15M tape format.

	#7	#6	#5	#4	#3	#2	#1	#0
3410							AFC	

Data format: Bit type

- AFC 0: Does not perform automatic override and automatic speed clamp in the polar coordinate interpolation mode
  1: Performs automatic override and automatic speed clamp in the polar coordinate interpolation mode

	#7	#6	#5	#4	#3	#2	#1	#0	
3411									L
					IROT	IMIN	IG90	IAGL	M

Data format: Bit type

- IAGL 0: Does not round a word coordinate value of an index table indexing axis by 3600
  1: Rounds a word coordinate value of an index table indexing axis by 3600
- IG90 0: An index table indexing command complies with a G90/G91 command
  1: An index table indexing command is always absolute
- IMIN 0: A minimum indexing angle for the index table is 10
  1: A minimum indexing angle for the index table is 50
- IROT 0: When the index table is indexed, it rotates, taking a shortcut
  1: When the index table is indexed, it does not rotate, taking a shortcut

	#7	#6	#5	#4	#3	#2	#1	#0	
3413									L
								CT3	M

Data format: Bit type

- CT3 0: Disables simple positioning for three-dimensional coordinate change
  1: Enables simple positioning for three-dimensional coordinate change

	#7	#6	#5	#4	#3	#2	#1	#0	
3414									L
							HDM	HDC	M

Data format: Bit type

- HDC 0: In parabolic direction control, the C-axis takes a shortcut
  1: In parabolic direction control, the C-axis does not take a shortcut
- HDM 0: When the parameter no. 3414, #0 (HDC) is set to "1", the C-axis rotates in the positive (plus) direction
  1: When the parameter no. 3414, #0 (HDC) is set to "1", the C-axis rotates in the positive (minus) direction

	#7	#6	#5	#4	#3	#2	#1	#0	
3416								MIRx	L
				XSCx	SCLx			MIRx	M

Data format: Bit axis type

- MIRx 0: Disables a setting mirror image for each axis (OFF)
  1: Enables a setting mirror image for each axis (ON)
- SCLx 0: Disables scaling for each axis
  1: Enables scaling for each axis

(Note) *When SCLx = 0 is set for an axis, it is not scaled regardless of a programmed command or other parameter setting.*

- XSCx 0: Enables scaling magnification setting for each axis
  1: Disables scaling magnification setting for each axis

(Note) *When XSCx = 0 is set for a certain axis, a value set in the parameter no. 3475 is used as its scaling magnification. When XSCx = 0 is set for a certain axis, a programmed command value P or a value set in the parameter no. 3460 is used as its scaling magnification.*

3418	Number of Linear Axis to Perform Polar Coordinate Interpolation
3419	Number of Rotary Axis to Perform Polar Coordinate Interpolation

Data format: Byte type

Data range: 1 to maximum control axis number

Set control axis numbers for the linear and rotary axes which perform polar coordinate interpolation.

3420	Automatic Override Tolerance in Polar Coordinate Interpolation Mode

Data format: Byte type

Unit of data: %

Data range: 0 to 100

Set a tolerance to obtain an allowable speed for a rotary axis in the polar coordinate interpolation mode. The allowable speed is obtained by multiplying a maximum cutting feed rate (parameter no. 3464) by the tolerance.

Allowable speed for the rotary axis = Maximum cutting feed rate x Tolerance

In the polar coordinate interpolation mode, a speed component of the rotary axis increases as a tool approaches the center of a workpiece, and it may exceed the allowable speed near the center.

In order to prevent this, the below-mentioned override is applied automatically when the speed component of the rotary shaft exceeds the allowable speed in the polar coordinate interpolation mode. (Automatic override)

$$\text{Override} = \frac{\text{Allowable speed of the rotary speed}}{\text{Speed component of the rotary speed}} \times 100\ (\%)$$

When the speed component of the rotary axis is still exceeding the allowable speed even if an override is applied, a feed rate is clamped so that the speed component of the rotary axis will not exceed the maximum cutting feed rate. (Automatic speed clamp)

(Note) *When "0" is set in this parameter, it is taken as 90%. When a value exceeding 100 is set, it is taken as 100%. To enable the automatic override and automatic speed clamp functions, it is necessary to set "1" in the parameter no. 3410. #1 (AFC).*

3421		L
	Number of Rotary Axis to Provide Normal Direction Control	M

Data type: Byte type

Data range: 1 to maximum control axis number

Set a control axis number for a rotary axis which provides normal direction control.

Data format: Byte type

Data range: 1 to maximum control axis number

Set control axis numbers for the linear and rotary axes which perform exponential function interpolation, and a linear axis which is perpendicular to the feed direction.

3426	Number of Linear Axis to Perform Cylindrical Interpolation
3427	Number of Rotary Axis to Perform Cylindrical Interpolation

Data format: Byte type

Data range: 1 to maximum control axis number

Set control axis numbers for the linear and rotary axes which perform cylindrical interpolation.

3434	Non-buffering M-code 1
3435	Non-buffering M-code 2
3436	Non-buffering M-code 3
3437	Non-buffering M-code 4
3438	Non-buffering M-code 5
3439	Non-buffering M-code 6
3440	Non-buffering M-code 7
3441	Non-buffering M-code 8

Data format: Word type

Data range: 0 to 65535

Set a non-buffering M-code. When there is an M-code under which you do not want the next block to be buffered until the M-code has been processed on the part of the machine, set such an M-code.

(Note) *M00, M01, M02, and M30 are non-buffering M-codes regardless of parameter setting.*

3442	Minimum Value of Non-buffering M-code Group-1
3443	Minimum Value of Non-buffering M-code Group-1
3444	Minimum Value of Non-buffering M-code Group-2
3445	Minimum Value of Non-buffering M-code Group-2
3446	Minimum Value of Non-buffering M-code Group-3
3447	Minimum Value of Non-buffering M-code Group-3
3448	Minimum Value of Non-buffering M-code Group-4
3449	Minimum Value of Non-buffering M-code Group-4

Data format: Word type

Data range: 0 to 65535

Set a non-buffering M-code group. Although the parameters no. 3434 through no. 3441 are used to set individual M-codes, you can set a group (range) of M-codes in this parameter.

When an M-code is specified, which belongs to the ranges specified by the parameters no. 3442 to no. 3443, no. 3444 to no. 3445, no. 3446 to no. 3447, and no. 3448 to no. 3449, the next block is not buffered until that block has been executed.

(Note 1) *When a minimum value is larger than a maximum value, set values for that group are invalid.*

(Note 2) *When there is only one data, set the maximum value equal to the maximum value.*

3458		L
	Per-axis Single Direction Positioning and Overrun Amount	M

Data format: Word axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

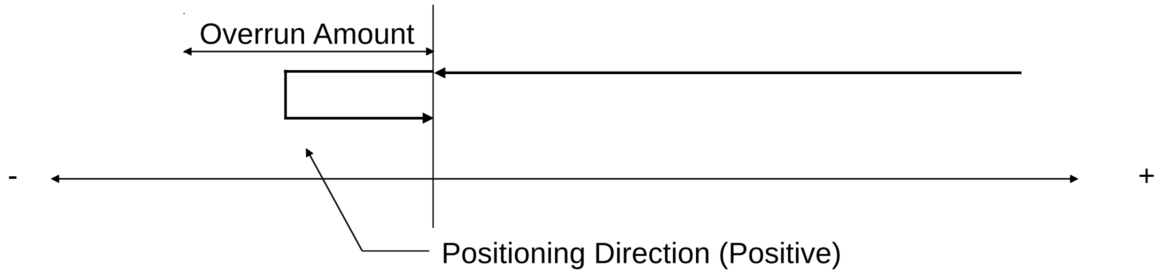
Data range: -16383 to 16383

Set a positioning direction and overrun amount in single direction positioning (G60) for each axis. Specify the positioning direction by a sign of set data, and specify the overrun amount by a value of the set data.

Set value (overrun amount) > 0 ---- Positions in the positive direction

Set value (overrun amount) < 0 ---- Positions in the negative direction

Set value (overrun amount) = 0 ---- Does not perform single direction positioning



3459	Arc Radius Error Limit Value

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

In a circular interpolation (G02/G03) command, set a limit value which can be allowed as a difference between a radius value at a start point and that at an end point. When the difference in the radius value exceeds the limit value, it results in an alarm (no. 132, circular interpolation error).

3460		L
	Default Scaling Magnification	M

Data format: Long type

Least input increment: 0.0001/0.00001 (time)

Data range: 1 to 99999999

Set a default magnification when a scaling (G51) magnification (P) has not been specified. When the scaling magnification has not been specified in the program, this set value is assumed to be the scaling magnification.

(Note) *The least input increment complies with setting of the parameter no. 3405, #1 (SCR).*

3461		L
	Default Coordinate Rotation Angle	M

Data format: Long type

Least input increment: 0.0001/0.00001 (time)

Data range: -36000000 to 36000000

Set a magnification when a coordinate rotation (G68) angle (R) has not been specified. When the coordinate rotation angle has not been specified in the program, this set value is assumed to be the rotation angle.

(Note 1) *This parameter is valid when parameter no. 3405, #3 (RTW) = 1 is set.*

(Note 2) *The least input increment complies with setting of the parameter no. 3405, #2 (RTR).*

3462		L
	Limit Angle Beyond Which Rotary Insertion of Normal Direction Control Is Ignored	M

Data format: Long type

Least input increment: 0.001 (degree)

Data range: 0 to 36000000

Set a limit angle beyond which rotary insertion of normal direction control is ignored.

3463		L
	Limit Stroke Value at Normal Directional Angle in Previous Block	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

In normal direction control, set a limit stroke value at a normal directional angle in the previous block.

3464	Maximum Cutting Feed Rate at Polar Coordinate Interpolation

Data type: Long type

Unit of data:

Data range:

Unit of Data	Data Range	
	IS-A, IS-B	IS-C
1 mm/min	0, 6 ~ 20000	0. 6 ~ 20000

Set a cutting feed rate upper-limit value which is valid only during polar coordinate interpolation. When a speed higher than this upper-limit value is given during polar coordinate interpolation, it is clamped to this limit. When a value of 0 is set, the speed is clamped to a normal maximum cutting feed rate (parameter no. 1422).

3465		L
	Initial Angle Error Limit Value for Involute Interpolation	M

Data format: Long type

Least inpt increment:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

With an involute interpolation command, set a limit value which is allowable as a shift amount between an involute curve passing through a start point and that passing through an end point.

3473	Program Number for Sequence Number Comparison and Stop

3474	Sequence Number for Sequence Number Comparison and Stop

Data format: Long type

Data range: 0 to 99999999

Set a program number and sequence number for sequence number comparison and stop. Set a program number which contains a sequence number to be stopped at in the parameter no. 3473, and set the sequence number to be stopped at in the parameter no. 3474.

If you run a program block having the same sequence number as the set one while running the program set in the parameter no. 3473, the program will stop after completing that block. (Single block stop)

(Note 1) *When the program number (parameter no. 3473) is 0 (zero), the program stops only on conditions that the sequence number matches, without comparing the program number.*

(Note 2) *Both parameters no. 3473 and no. 3474 are cleared to 0 when the sequence number is compared and the program stops, or the system is reset.*

(Note 3) *When a value of 0 is set as a sequence number (parameter no. 3474), sequence number stop is disabled.*

3475		L
	Per-axis Scaling Magnification	M

Data format: Long axis type

Least input increment: 0.001/0.00001 (time)

Data range: 1 to 99999999

Set a scaling (G51) magnification for each axis. This parameter is valid when scaling for each axis is valid (parameter no. 3416, #3 (SCLx) = 1) and the scaling magnification for each axis is valid (parameter no. 3416, #4 (XSLx) = 1).

(Note) *The least input increment complies with setting of the parameter no. 3405, #1 (SCR).*

2.12 Parameters Related to Pitch Error Compensation

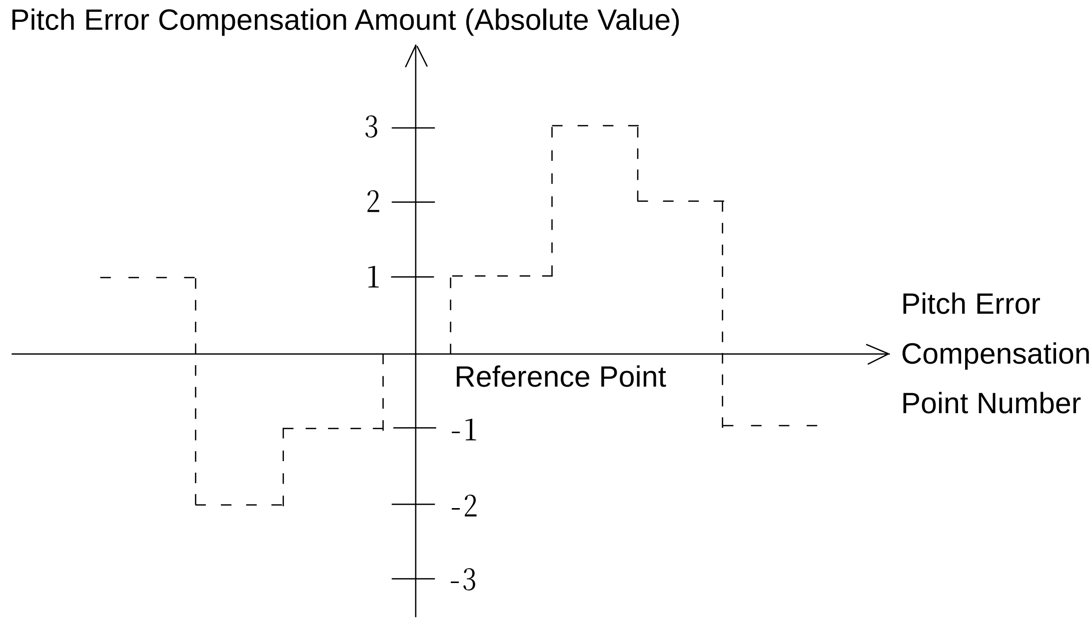
3620	Per-axis Pitch Error Compensation Point Number Corresponding to Reference Point

Data format: Word axis type

Unit of data: Number

Data range: 0 to 1023

Set a pitch error compensation point number corresponding to the reference point.



Compensation Point Number	31	32	33	34	35	36	37
Set Compensation	+3	-1	-1	+1	+2	-1	-3

Amount in the example above, set 33 as a pitch error compensation point number corresponding to the reference point.

3621	Per-axis Most Negative Pitch Error Compensation Point Number

Data format: Word axis type

Unit of data: Number

Data range: 0 to 1023

Set the most negative pitch error compensation point number for each axis.

3622	Per-axis Most Positive Pitch Error Compensation Point Number

Data format: Word axis type

Unit of data: Number

Data range: 0 to 1023

Set the most positive pitch error compensation point number for each axis.

(Note) *It is necessary to set a value larger than that set in the parameter no. 3620.*

3623	Per-axis Pitch Error Compensation Magnification

Data format: Byte axis type

Least input increment: 1 (time)

Data range: 0 to 100

Set a pitch error compensation amount for each axis. When "1" is set as a pitch error compensation magnification, the unit of compensation data equals the unit of detection.

3624	Per-axis Pitch Error Compensation Point Inverval

Data format: Long axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Linear axis	0.01	0.001	0.0001	mm
Rotary axis	0.01	0.001	0.0001	deg

Data range: 0 to 99999999

Pitch error compensation points are at equal intervals. Set that interval for each axis.

A minimum pitch error compensation point interval is limited and determined by the following formula.

Minimum pitch error compensation point interval = Maximum feed rate (Rapid traverse rate)/ 3750

Unit: mm/deg.

[Example] When the maximum rapid traverse rate is 15,000 mm/min., the minimum pitch error compensation point interval is 4 mm.

Parameter Setting Examples

[Example 1] For the Linear Axis

Assuming that;
- Machine stroke = -400 mm to +800 mm
- Pitch error compensation point interval = 50 mm
- Reference point compensation point number = 40mm

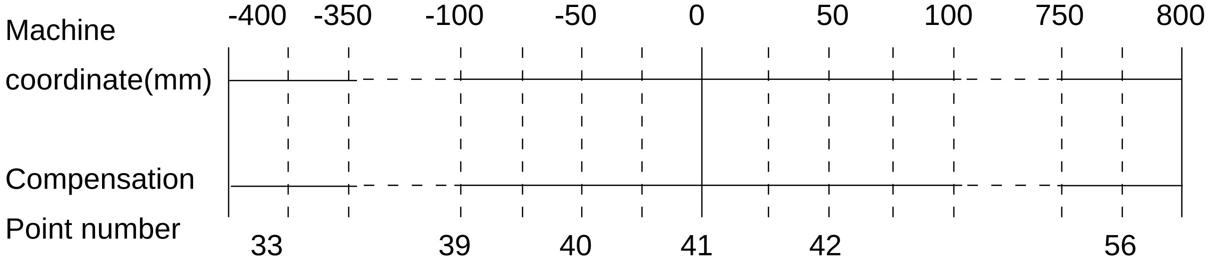
The most negative compensation point number is;

Reference point compensation point number - (Machine stroke on the negative side/ compensation point interval) + 1 = 40 - 400/50 + 1 = 33

The most positive compensation point number is;

Reference point compensation point number + (Machine stroke on the positive side/ compensation point interval) + 1 = 40 + 800/5 = 56

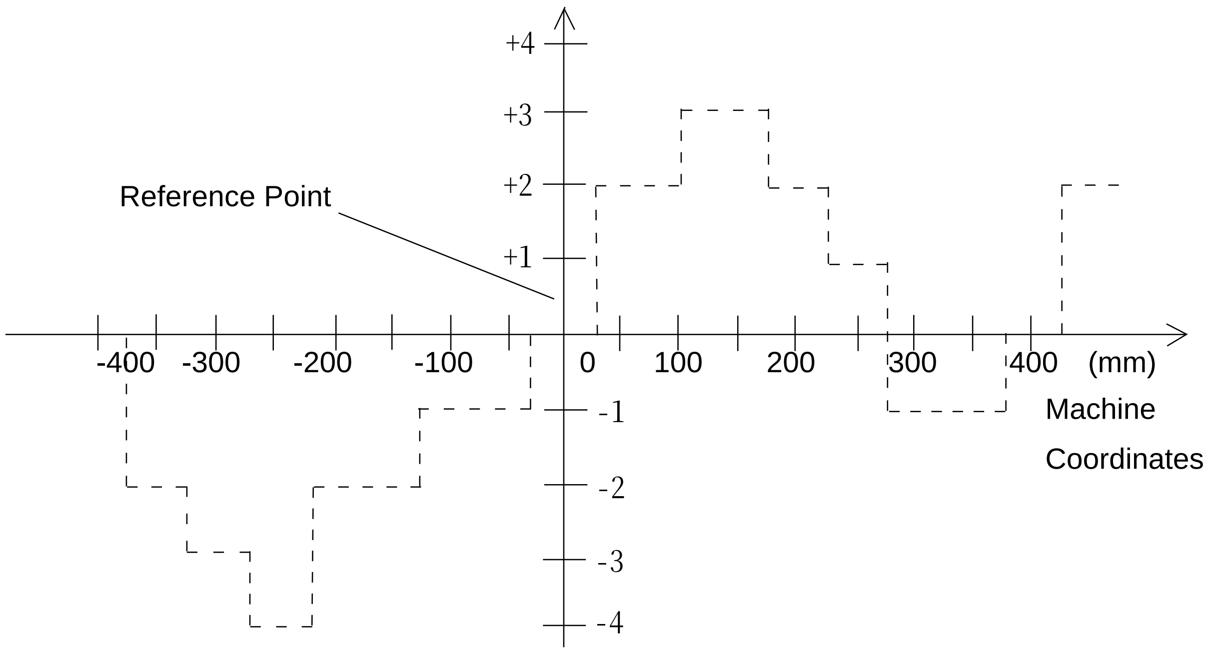
The machine coordinates and compensation point number have the following relations.



A compensation amount is output at the compensation point number corresponding to the respective sections. The following lists an example of compensation amounts.

Number	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Comp. amount	+2	+1	+1	-2	0	-1	0	-1	+2	+1	0	-1	-1	-2	0	+1	+2

Pitch Error Compensation Amount (Absolute Value)



[Example 2] For the Rotary Axis

Assuming that; • Stroke per rotation = 3600

• Pitch error compensation point interval = 450

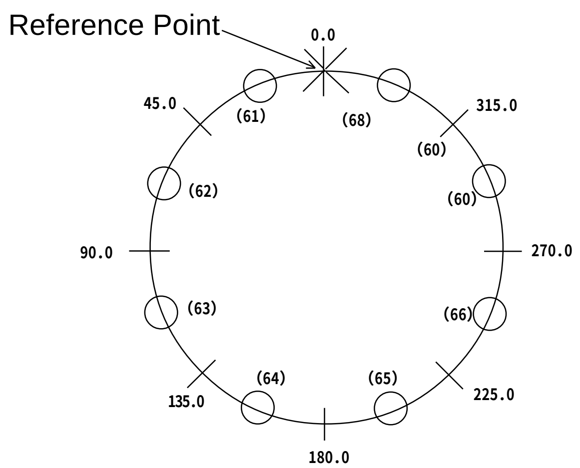
• Reference point compensation point number = 60

The most negative compensation point number for the rotary axis always equals the reference point compensation point number.

The most positive compensation point number is;

Reference point compensation point number + (Stroke per rotation/compensation point interval) = 60 + 360/45 = 68

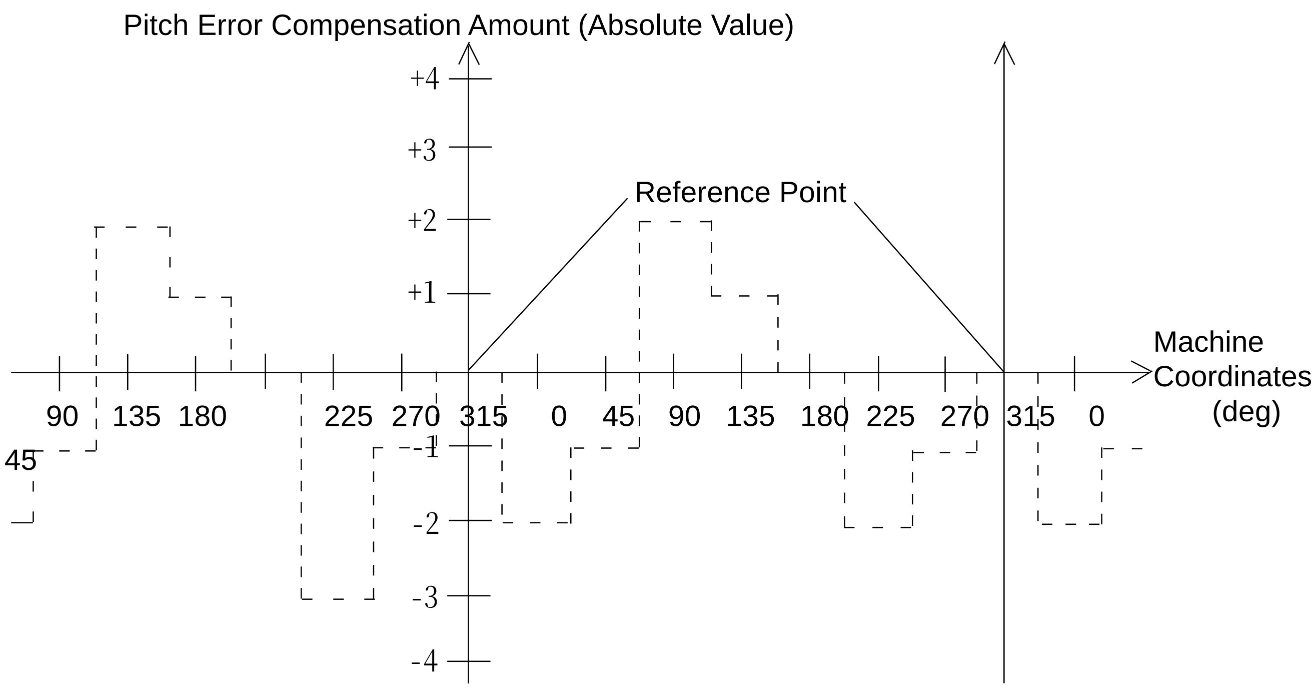
The machine coordinates and compensation point number have the following relations.



A compensation amount is output at a position of ◯. When the sum of compensation amounts for the compensation point numbers 61 through 68 is not zero, a pitch error is accumulated per rotation, thus causing a position shift. Input to the compensation point number 60 the same compensation amount as that for 68.

The following shows an example of compensation amounts.

Comp. point number	60	61	62	63	64	65	66	67	68
Set comp. amount	+1	-2	+1	+3	-1	-1	-3	+2	+1



2.13 Parameters Related to Spindle Control

	#7	#6	#5	#4	#3	#2	#1	#0
3701			SS3	SS2			ISI	

Data format: Bit type

- ISI
  0: Uses the 1st/2nd serial spindle interface
  1: Do not use the 1st/2nd serial spindle interface

  (Note) *This parameter is valid only when an optional serial spindle interface is added. It is used when disabling the serial spindle interface temporarily to start up the NC unit in adjusting the NC unit upon its start-up. Normally, set 0.*

- SS2
  0: Does not use the 2nd serial spindle in serial spindle control.
  1: Use the 2nd serial spindle in serial spindle control.
- SS3
  [Only for Σ 16/18]
  0: Does not use the 3rd serial spindle in serial spindle control.
  1: Use the 3rd serial spindle in serial spindle control.

	#7	#6	#5	#4	#3	#2	#1	#0	
3702						OR2	OR1		L
						OR2	OR1		M

Data format: Bit type

- OR1
  0: The 1st spindle motor does not use a stop position external setting type spindle orientation function
  1: The 1st spindle motor uses a stop position external setting type spindle orientation function
- OR2
  0: The 2nd spindle motor does not use a stop position external setting type spindle orientation function
  1: The 2nd spindle motor uses a stop position external setting type spindle orientation function

	#7	#6	#5	#4	#3	#2	#1	#0	
3705				EVS				ESF	L
		SFA	NSF		SGT	SGB	GST	ESF	M

Data format: Bit type

- ESF
  When a spindle control function (S-analog output and S-serial output) is added and a constant surface speed control is also added or "1" is set in the parameter no. 3706, #4 (GTT);
  0: Outputs an S-code and SF to all the S-commands
  1: Does not output an S-code or SF to a constant surface speed control (G96 mode) S-command or maximum spindle rpm clamp S-command (G50 S_;).

(Note) *For the L-system, this parameter is valid when the parameter no. 3705, #4 (EVS) is set to "1". For the M-system, SF is output in the following cases:*

(1) Maximum spindle rpm clamp S-command (G92 S_;) for constant surface speed control

(2) When the parameter no. 3705, #5 (NSF) is set to "1"

- GST
  - 0: Performs spindle orientation by an SOR signal
  - 1: Shifts the gear by an SOR signal
- SGB
  - 0: Selects the gear change system A (selects the gear depending on the parameters no. 3741 to no. 3743 (maximum rpm corresponding to each gear)
  - 1: Selects the gear change system B (selects the gear depending on the parameters no. 3751 to no. 3752 (spindle rpm at each gear's change point)
- SGT
  - 0: Selects the gear change system A at the time of tapping cycle (G84, G74) (Same as the normal gear change system)
  - 1: Selects the gear change system B (changes the gear at spindle rpm set in the parameter no. 3761 or no. 3762 at the time of tapping cycle)
- EVS

  When a spindle control functions (S-analog output or S-serial output) is added;
  - 0: Does not output an S-code or SF to an S-command
  - 1: Outputs an S-code and SF to an S-command

  (Note) *Setting of the parameter no. 3705, #0 (ESF) determines whether to output the S-code and SF to a constant surface speed control (G96) S-command or maximum spindle rpm clamp S-command (G50 S_;).*
- NSF
  - 0: Outputs SF when an S-code is specified in constant surface speed control
  - 1: Does not output SF when an S-code is specified in constant surface speed control
- SFA
  - 0: Outputs SF when the gear is changed
  - 1: Outputs SF even if the gear is not changed

	#7	#6	#5	#4	#3	#2	#1	#0	
3706	TCW	CWM	CRM				PG2	PG1	L
	TCW	CWM	ORM	GTT			PG2	PG1	M

Data format: Bit type

• PG1, PG2 Gear ratio of the spindle to the position coder

Magnification	PG2	PG1
x 1	0	0
x 2	0	0
x 4	0	0
x 8	0	0

$$\text{Magnification} = \frac{\text{Spindle rpm}}{\text{Position coder rpm}}$$

• GTT 0: Selects the M-type spindle gear selection system
1: Selects the T-type spindle gear selection system

(Note 1) *M-type*

No gear selection signal is input. The CNC selects the gear based on rpm range for each gear set in a parameter in advance according to an S-command and notifies which gear is to be selected by outputting a gear selection signal. A spindle speed is also output according to the gear selected by outputting the gear selection signal.

T-type

The gear selection signal is input and the CNC outputs the spindle speed corresponding to the gear selected by this signal.

(Note 2) *When constant surface speed control is provided, the T-type is always assumed regardless of this parameter.*

(Note 3) *When the spindle gear selection system is the T-type, the following parameters are invalid: No. 3705, #2 (SGB), #3 (SGT), #6 (SFA), No. 3735, No. 3736, No, 3751, No, 3752, No, 3761 No, 3762 The parameter no. 3744 is valid.*

• ORM 0: Voltage polarity is plus (+) at the time of spindle orientation.
1: Voltage polarity is minus (-) at the time of spindle orientation.

• TCW, CWM Voltage polarity at the time of spindle speed output

TCW	CWM	Voltage Polarity
0	0	Plus (+) for both M03 and M04
0	1	Minus (-) for both M03 and M04
1	0	Plus (+) for M03 and minus (-) for M04
1	1	Minus (-) for M03 and plus (+) for M04

	#7	#6	#5	#4	#3	#2	#1	#0	
3707							P22	P21	L
									M

Data format: Bit type

- P21, PSSGear ratio of the spindle to the 2nd position coder

Magnification	P22	P21
x 1	0	0
x 2	0	1
x 4	1	0
x 8	1	1

$$\text{Magnification} = \frac{\text{Spindle rpm}}{\text{Position coder rpm}}$$

	#7	#6	#5	#4	#3	#2	#1	#0	
3708				SVD				SAR	L
				SVD				SAR	M

Data format: Bit type

- SAR 0: Does not check a spindle speed reach signal
  1: Checks a spindle speed reach signal
- SVD 0: Disables spindle speed fluctuation detection when a SIND signal is turned on
  1: Enables spindle speed fluctuation detection when a SIND signal is turned on

	#7	#6	#5	#4	#3	#2	#1	#0	
3709						MSI		SAM	L
									M

Data format: Bit type

- SAM 0: Samples 4 times when averaging the spindle rpm (Normally, set 0)
  1: Samples one time when averaging the spindle rpm
- MSI 0: In multispindle control, an SIND singla is valid only when the 1st spindle is being selected.
  1: In multispindle control, an SIND signal is unique to each spindle. It is valid to each spindle regardless of whether the spindle is being selected.

3730	Spindle Speed Analog Output Gain Control Data

Data format: Word type

Unit of data: 0.1%

Data range: 700 to 1250

Set spindle speed analog output gain control data.

[Adjustment Method]

① Set a standard set value of 1000.

② Specify a spindle speed which allows a spindle speed analog output to be a maximum voltage (10 V).

③ Measure an output voltage.

④ Set in parameter no. 3730 a value obtained by the following formula.

$$\text{Set value} = \frac{10\ (\text{V})}{\text{Measuring power (V)}} \times 1000$$

⑤ After setting the parameter, specify again the spindle speed which allows the spindle speed analog output to be the maximum voltage, and make sure that the output voltage is 10 V.

(Note) *This setting is not required for the serial spindle.*

3731	Offset Value for Spindle Analog Output Offset Voltage

Data format: Word type

Unit of data: Velo

Data range: -1024 to +1024

Set an offset value for spindle speed analog output offset voltage.

Set value = -8191 x Offset voltage (V)/12.5

[Adjustment Method]

① Set a standard set value of 0.

② Specify a spindle speed which allows a spindle speed analog output to be 0.

③ Measure an output voltage.

④ Set in the parameter no. 3731 a value obtained by the following formula.

$$\text{Set value} = \frac{\text{Offset voltage (V)}}{12.5}$$

⑤ After setting the parameter, specify again the spindle speed which allows the spindle speed analog output to be 0, and make sure that the output voltage is 0 V.

(Note) *This setting is not required for the serial spindle.*

3732	Spindle Rpm at Spindle Orientation or Spindle Motor Speed at Spindle Gear Shift

Data format: Long type

Data range: 0 to 20000

Set the spindle rpm at spindle orientation or the spindle motor speed at spindle gear shift. When "0" is set in the parameter no. 3705, #1 (GST), set the spindle rpm at spindle orientation in the unit of rpm. When "1" is set in the parameter no. 3705, #1 (GST), set the spindle motor speed at spindle gear shift by the following formula.

$$\text{Set value} = \frac{\text{Spindle motor rpm at spindle gear shift}}{\text{Max. spindle motor rpm}} \times 16383 \text{ (For the serial spindle)}$$

$$\text{Set value} = \frac{\text{Spindle motor rpm at spindle gear shift}}{\text{Max. spindle motor rpm}} \times 4095 \text{ (For the analog spindle)}$$

3735		L
	Minimum Spindle Motor Clamp Speed	M

Data format: Word type

Data range: 0 to 4095

Set a minimum spindle motor clamp speed.

$$\text{Set value} = \frac{\text{Min. spindle motor clamp rpm}}{\text{Max. spindle motor rpm}} \times 4095$$

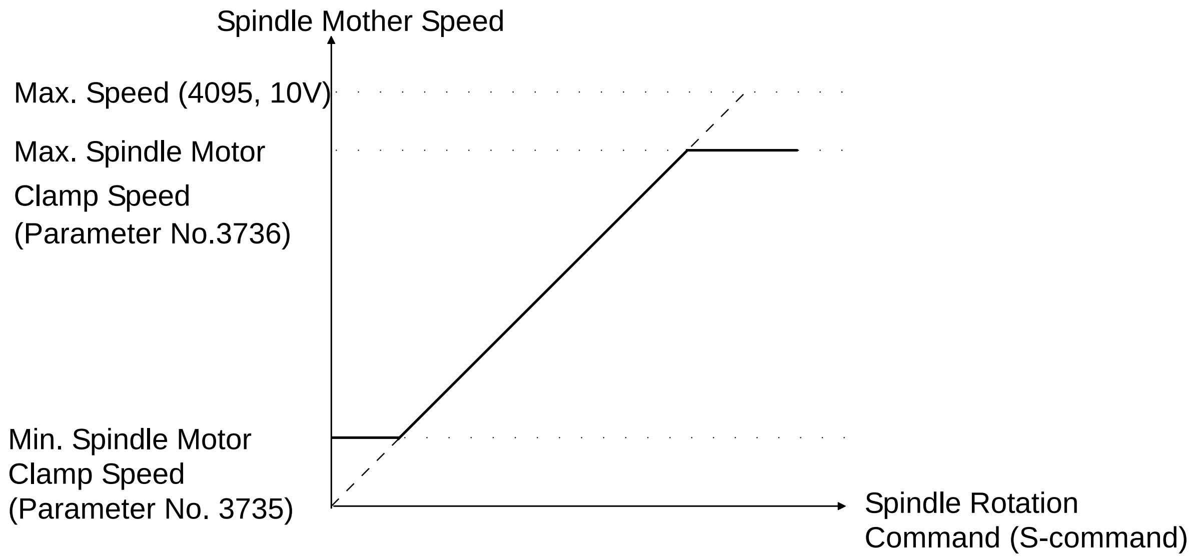
3736		L
	Maximum Spindle Motor Clamp Speed	M

Data format: Word type

Data range: 0 to 4095

Set a maximum spindle motor clamp speed.

$$\text{Set value} = \frac{\text{Min. spindle motor clamp rpm}}{\text{Max. spindle motor rpm}} \times 4095$$



3740	Spindle Speed Reach Signal Check Time

Data format: Byte type

Unit of data: msec.

Data range: 0 to 255

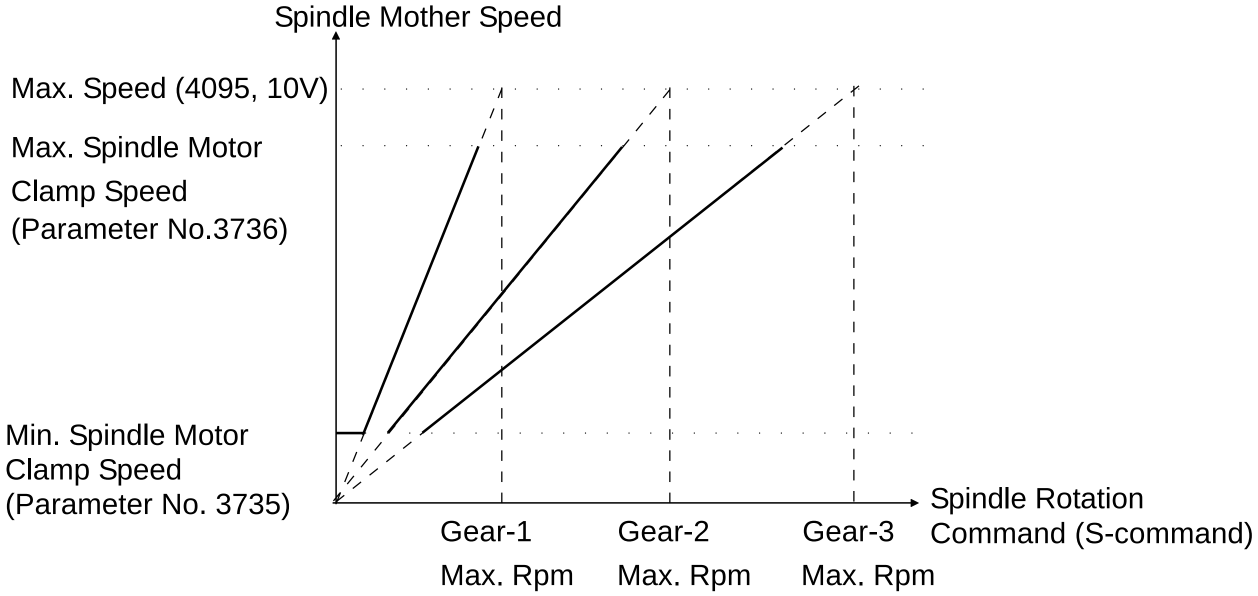
Set a time until a spindle speed reach signal is checked after an S-function is executed.

3741	Maximum Spindle Rpm Corresponding to Gear-1
3742	Maximum Spindle Rpm Corresponding to Gear-2
3743	Maximum Spindle Rpm Corresponding to Gear-3
3744	Maximum Spindle Rpm Corresponding to Gear-4

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767



3751		L
	Spindle Motor Speed at Gear 1-2 Change Point	M

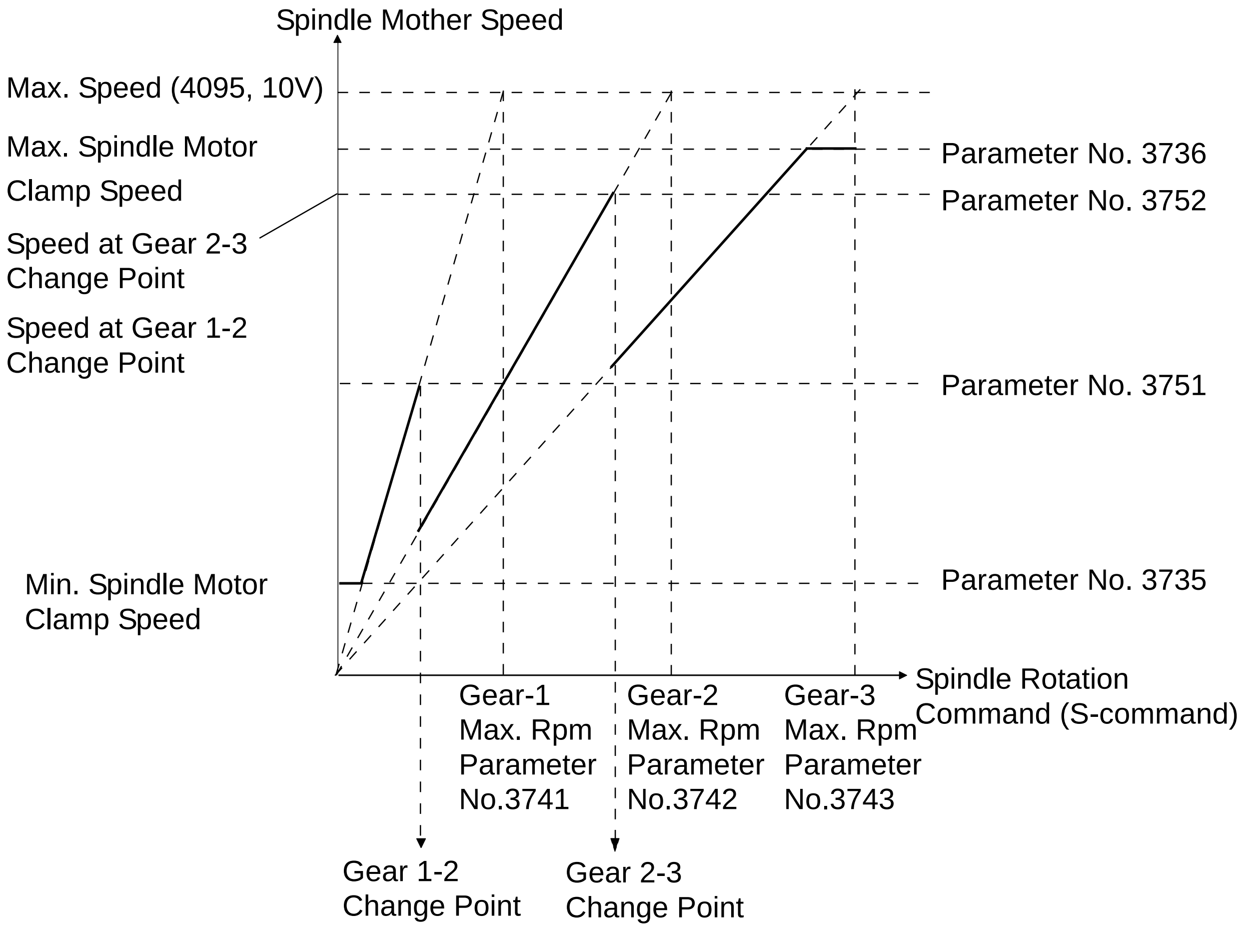
3752		L
	Spindle Motor Speed at Gear 2-3 Change Point	M

Data format: Word type

Data range: 0 to 4095

Set a spindle motor speed at the gear change point for the gear change system B.

$$\text{Set value} = \frac{\text{Spindle motor rpm at gear change point}}{\text{Max. spindle motor rpm}} \times 4095$$



3761		L
	Spindle Rpm at Gear 1-2 Change Point in Tapping Cycle	M

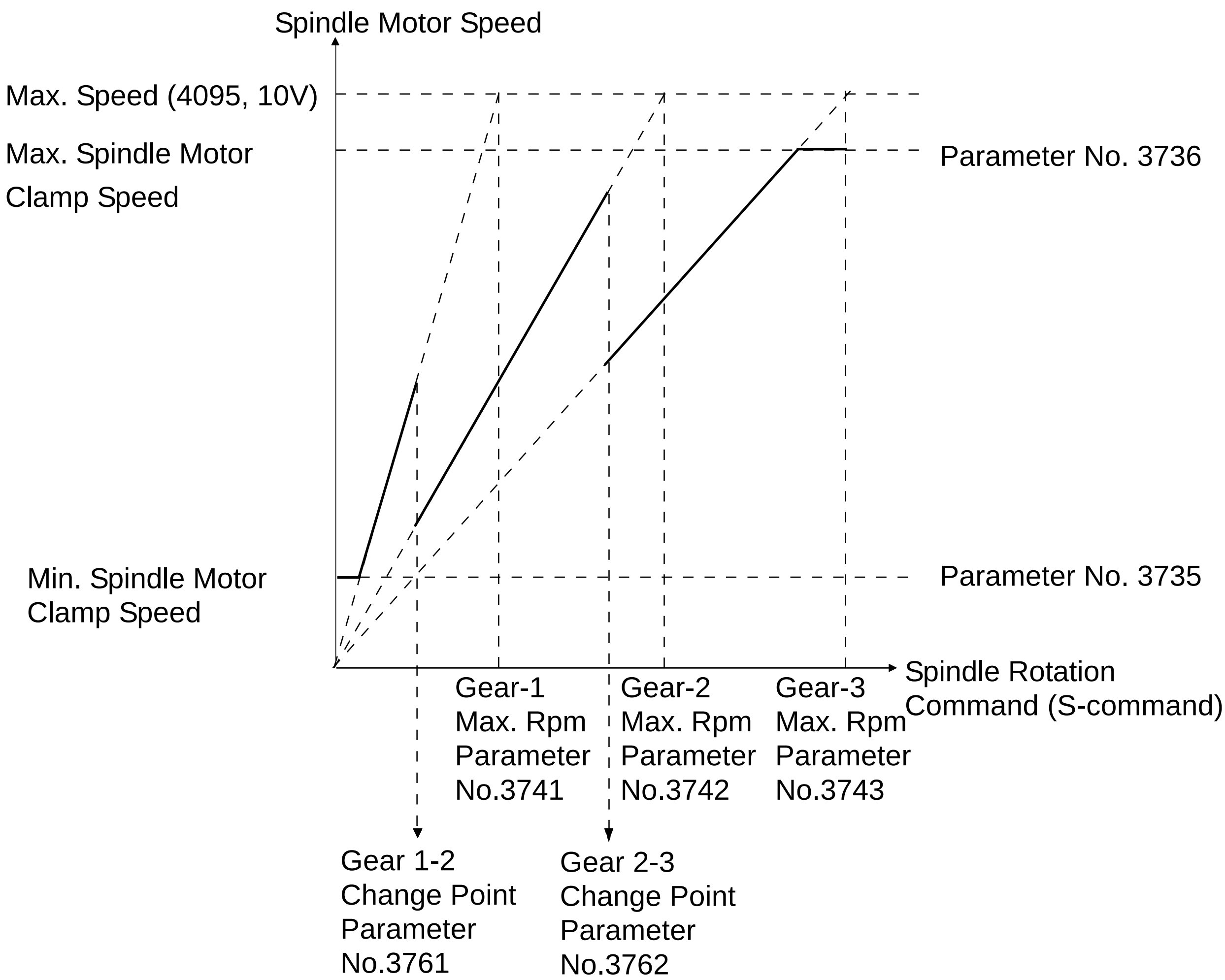
3762		L
	Spindle Rpm at Gear 2-3 Change Point in Tapping Cycle	M

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

When the gear change system B is selected for the tapping cycle (parameter no. 3705, #3 (SGT) = 1), select the spindle rpm at each gear's change point.



3770		L
	Axis as Calculation Basis in Constant Surface Speed Control	M

Data format: Byte type

Data range: 1 to maximum controlled axes

Set an axis which serves as a calculation basis in constant surface speed control.

3771	Minimum Spindle Rpm in Constant Surface Speed Control Mode (G96)

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set the minimum spindle rpm in the constant surface speed control (G96). When the spindle rpm comes lower than the rpm set in the parameter during constant surface speed control, it is clamped to the rpm set in the parameter.

3772	Upper-limit Spindle Rpm

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set the upper-limit spindle rpm. When you specified the rpm exceeding the upper-limit spindle rpm, or when the spindle rpm exceeds the upper-limit rpm because a spindle speed override is applied, the rpm is clamped so that the actual spindle rpm will not exceed the upper-limit rpm set in the parameter.

(Note 1) *In case of the M-system, this parameter is valid when the optional constant surface control speed function is added.*

(Note 2) *When the optional constant surface control speed function is added, the spindle speed is clamped to the upper-limit spindle rpm in either G96 or G97 mode.*

(Note 3) *When a set value is 0, the spindle rpm is not clamped.*

(Note 4) *This parameter is invalid while spindle speed command control is provided by the PMC. The spindle rpm is not clamped to the upper-limit rpm.*

(Note 5) *When multispindle control is provided (L-system), set each spindle's upper-limit rpm in the following parameters.*

Parameter no. 3772 ---- Set the upper-limit rpm of the 1st spindle

Parameter no. 3802 ---- Set the upper-limit rpm of the 2nd spindle

Parameter no. 3822 ---- Set the upper-limit rpm of the 3rd spindle

3802	2nd Spindle Upper-limit rpm	L
		M

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set the 2nd spindle upper-limit rpm. When you specified the rpm exceeding the upper-limit spindle rpm, or when the spindle rpm exceeds the upper-limit rpm because a spindle speed override is applied, the rpm is clamped so that the actual spindle rpm will not exceed the upper-limit rpm set in the parameter:

(Note 1) *In case of the M-system, this parameter is valid when the optional constant surface control speed function is added.*

(Note 2) *When the optional constant surface control speed function is added, the spindle speed is clamped to the upper-limit spindle rpm in either G96 or G97 mode.*

(Note 3) *When a set value is 0, the parameter (no. 3772) for the 1st spindle upper-limit rpm becomes valid. When that parameter is also set to "0", the spindle rpm is not clamped.*

(Note 4) *This parameter is invalid while spindle speed command control is provided by the PMC. The spindle rpm is not clamped to the upper-limit rpm.*

3811	Maximum Spindle Rpm Corresponding to Gear-1 of 2nd Spindle	L M

3812	Maximum Spindle Rpm Corresponding to Gear-2 of 2nd Spindle	L M

Data format: Word type Unit of data: rpm Data range: 0 to 32767

Set the maximum spindle rpm corresponding to each gear of the 2nd spindle.

(Note) *This is a multispindle control parameter.*

3820	3rd Spindle Speed Along Output Gain Control Data	L M

Data format: Word type

Least input increment: 0.1%

Data range: 700 to 1250

Set the 3rd spindle speed analog output gain control data.

(Note) *This is a multispindle control parameter.*

3821	3rd Spindle Speed Analog Output Offset Voltage Offset Value	L M

Data format: Word type

Unit of data: Velo

Data range: -1024 to +1024

Set an offset value for 3rd spindle speed analog output offset voltage in performing multispindle control.

(Note) *This is a multispindle control parameter.*

3822	3rd Spindle Upper-limit Rpm	L M

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set the 2nd spindle upper-limit rpm. When you specified the rpm exceeding the upper-limit spindle rpm, or when the spindle rpm exceeds the upper-limit rpm because a spindle speed override is applied, the rpm is clamped so that the actual spindle rpm will not exceed the upper-limit rpm set in the parameter.

(Note 1) *In case of the M-system, this parameter is valid when the optional constant surface control speed function is added.*

(Note 2) *When the optional constant surface control speed function is added, the spindle speed is clamped to the upper-limit spindle rpm in either G96 or G97 mode.*

(Note 3) *When a set value is 0, the parameter (no. 3772) for the 1st spindle upper-limit rpm becomes valid. When that parameter is also set to "0", the spindle rpm is not clamped.*

(Note 4) *This parameter is invalid while spindle speed command control is provided by the PMC. The spindle rpm is not clamped to the upper-limit rpm.*

3831	Maximum Spindle Rpm Corresponding to Gear-1 of 3rd Sindle	L
	Maximum Spindle Rpm Corresponding to Gear-2 of 3rd Sindle	M

3832	3rd Spindle Upper-limit Rpm	L
		M

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set the maximum spindle rpm corresponding to each gear of the 3rd spindle.

(Note) *This is a multispindle control parameter.*

Serial Interface Spindle Cs Contour Control Parameters List

No.	Data Format		Description
3900	Byte type	Group-1 for 1st spindle	Axis number of the servo axis which requires a loop gain change depending on the respective set values of the parameters no. 3901 to no. 3904 in case of Cs contour axis control (Set value 0 to 8)
3901	Word type	Group-1 for 1st spindle	Loop gain for the servo axis at Cs contour control whedle gear-1 in the spin is selected
3902	Word type	Group-1 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-2 is selected
3903	Word type	Group-1 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-3 is selected
3904	Word type	Group-1 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-4 is selected
3910	Byte type	Group-2 for 1st spindle	Axis number of the servo axis which requires a loop gain change depending on the respective set values of the parameters no. 3911 to no. 3914 in case of Cs contour axis control (Set value 0 to 8)
3911	Word type	Group-2 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-1 is selected
3912	Word type	Group-2 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-2 is selected
3913	Word type	Group-2 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-3 is selected
3914	Word type	Group-2 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-4 is selected
3920	Byte type	Group-3 for 1st spindle	Axis number of the servo axis which requires a loop gain change depending on the respective set value of the parameters no. 3921 to no. 3924 in case of Cs contour axis control (Set value 0 to 8)
3921	Word type	Group-3 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-1 is selected
3922	Word type	Group-3 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-2 is selected
3923	Word type	Group-3 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-3 is selected
3924	Word type	Group-3 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-4 is selected
3930	Byte type	Group-4 for 1st spindle	Axis number of the servo axis which requires a loop gain change depending on the respective set values of the parameters no. 3931 to no. 3934 in case of Cs contour axis control (Set value 0 to 8)
3931	Word type	Group-4 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-1 is selected
3932	Word type	Group-4 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-2 is selected
3933	Word type	Group-4 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-3 is selected
3934	Word type	Group-4 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-4 is selected
3940	Byte type	Group-5 for 1st spindle	Axis number of the servo axis which requires a loop gain change depending on the respective set values of the parameters no. 3941 to no. 3944 in case of Cs contour axis control (Set value 0 to 8)
3941	Word type	Group-5 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-1 is selected
3942	Word type	Group-5 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-2 is selected
3943	Word type	Group-5 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-3 is selected
3944	Word type	Group-5 for 1st spindle	Loop gain for the servo axis at Cs contour control when the spindle gear-4 is selected

<Setting Method>

Select the Cs contour axis and servo axis which requires interpolation. (You can select up to 5 axes) When there is no Cs contour axis or servo axis which requires interpolation, set 0 in the parameters no. 3900, no. 3910, no. 3920, no. 3930, and no. 3940. Then, you are finished with setting of these parameters.

When there are the Cs contour axis and the servo axis which requires interpolation, set each parameter for each of those axes in the following procedure.

① Set in the parameter No. 39n0 (n = 0, 1, 2, 3, or 4) the axis numbers (1 to 8) of the Cs contour axis and the servo axis which requires interpolation.

② Set loop gain values of the servo axes selected in ‡@ at Cs contour axis control in the parameters no. 39n1, 39n2, 39n3, and 39n4 (there are 4 stages with respect to the main gear used) in terms of Cs contour axis position loop gain or required value.

③ When the number of Cs contour axis and the servo axes which require interpolation is less than 5, set 0 in the remaining parameter no. 39n0. Then, you are finished with setting of these parameters.

When the axis number of the Cs contour control axis is set in the parameter no. 39n0, it is equivalent to setting 0.

(Note) *A loop gain change at Cs contour axis control is made according to the then selected gear when initializing from the spindle mode to the Cs contour control mode. It would be hardly necessary to change the gear during Cs contour control in normal operation. Note that if the gear is changed during the Cs contour control mode, however, the loop gain will not be changed.*

No.	Data Format	For Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4000 to No. 4135)
4000	Bit type	Bit parameter
4001	Bit type	Bit parameter
4002	Bit type	Bit parameter
4003	Bit type	Bit parameter
4004	Bit type	Bit parameter
4005	Bit type	Bit parameter
4006	Bit type	Bit parameter
4007	Bit type	Bit parameter
4008	Bit type	Bit parameter
4009	Bit type	Bit parameter
4010	Bit type	Bit parameter
4011	Bit type	Bit parameter
4012	Bit type	Bit parameter
4013	Bit type	Bit parameter
4014	Bit type	Bit parameter
4015	Bit type	Bit parameter (Cannot be set by the user --- Note 1)
4016	Bit type	Bit parameter
4017	Bit type	Bit parameter
4018	Bit type	Bit parameter
4019	Bit type	Bit parameter (For parameter automatic setting ---- Note 2)
4020	Word type	Maximum motor rpm
4021	Word type	Maximum rpm at Cs contour control
4022	Word type	Speed reach level
4023	Word type	Speed detection level
4024	Word type	Speed zero detection level
4025	Word type	Torque control value setting
4026	Word type	Load detection level-1
4027	Word type	Load detection level-2
4028	Word type	Output limit pattern setting
4029	Word type	Output limit value

No.	Data Format	For Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4000 to No. 4135)
4030	Word type	Soft start/stop set time
4031	Word type	Position coder style orientation stop position
4032	Word type	Acceleration/deceleration time constant at spindle synchronous control
4033	Word type	Spindle synchronous rpm reach level
4034	Word type	Shift amount at spindle phase synchronous control
4035	Word type	Spindle phase synchronous compensation data
4036	Word type	Feed forward coefficient
4037	Word type	Speed loop feed forward coefficient
4038	Word type	Orientation speed
4039	Word type	Slide compensation gain
4040	Word type	Speed loop proportional gain at normal operation (High)
4041	Word type	Speed loop proportional gain at normal operation (Low)
4042	Word type	Loop proportional gain at orientation speed (High)
4043	Word type	Loop proportional gain at orientation speed (Low)
4044	Word type	Speed loop proportional gain at servo mode/synchronous control (High)
4045	Word type	Speed loop proportional gain at servo mode/synchronous control (Low)
4046	Word type	Speed loop proportional gain at Cs contour control (High)
4047	Word type	Speed loop proportional gain at Cs contour control (Low)
4048	Word type	Speed loop integral gain at normal operation (High)
4049	Word type	Speed loop integral gain at normal operation (Low)
4050	Word type	Loop integral gain at orientation speed (High)
4051	Word type	Loop integral gain at orientation speed (Low)
4052	Word type	Speed loop integral gain at servo mode/synchronous control (High)
4053	Word type	Speed loop integral gain at servo mode/synchronous control (Low)
4054	Word type	Speed loop integral gain at Cs contour control (High)
4055	Word type	Speed loop integral gain at Cs contour control (Low)
4056	Word type	Gear ratio (High)
4057	Word type	Gear ratio (Medium high)
4058	Word type	Gear ratio (Medium low)
4059	Word type	Gear ratio (Low)

No.	Data Format	For Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4000 to No. 4135)
4060	Word type	Position gain at orientation (High)
4061	Word type	Position gain at orientation (Medium high)
4062	Word type	Position gain at orientation (Medium low)
4063	Word type	Position gain at orientation (Low)
4064	Word type	Position gain change ratio at orientation finish
4065	Word type	Position gain at servo mode/synchronous control (High)
4066	Word type	Position gain at servo mode/synchronous control (Medium high)
4067	Word type	Position gain at servo mode/synchronous control (Medium low)
4068	Word type	Position gain at servo mode/synchronous control (Low)
4069	Word type	Position gain at Cs contour control (High)
4070	Word type	Position gain at Cs contour control (Medium high)
4071	Word type	Position gain at Cs contour control (Medium low)
4072	Word type	Position gain at Cs contour control (Low)
4073	Word type	Grid shift amount at servo mode
4074	Word type	Zero point return speed at Cs contour control/servo mode
4075	Word type	Orientation finish signal detection level
4076	Word type	Motor speed limit value at orientation
4077	Word type	Orientation stop position shift amount
4078	Word type	MS signal constant = $(L/2)/(2 \times \pi \times H) \times 4096$
4079	Word type	MS signal gain adjustment
4080	Word type	Rotating power limitation
4081	Word type	Delay time until motor power shutoff
4082	Word type	Acceleration/deceleration time setting
4083	Word type	Motor voltage setting at normal rotation
4084	Word type	Motor voltage setting at orientation
4085	Word type	Motor voltage setting at servo mode/synchronous control
4086	Word type	Motor voltage setting at Cs contour control
4087	Word type	Overspeed detection level
4088	Word type	Speed deviation excessive detection level at motor constraint
4089	Word type	Speed deviation excessive detection level at motor rotation

No.	Data Format	For Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4000 to No. 4135)
4090	Word type	Overload detection level
4091	Word type	Position gain change ratio at servo mode zero point return
4092	Word type	Position gain change ratio at Cs contour control zero point return
4093	Word type	Spare
4094	Word type	Disturbance torque compensation constant (Acceleration feedback gain)
4095	Word type	Speed meter output voltage adjustment value
4096	Word type	Load meter output voltage adjustment value
4097	Word type	Spindle speed feedback gain
4098	Word type	Position coder signal detectable maximum rpm
4099	Word type	Delay time for motor excitation
4100	Word type	Base speed for motor output specification
4101	Word type	Output control value for motor output specification
4102	Word type	Base speed
4103	Word type	Magnetic flux weaking start speed
4104	Word type	Current loop proportional gain data
4105	Word type	Current loop proportional gain data (At Cs contour control)
4106	Word type	Current loop integral gain data
4107	Word type	Current loop integral gain data (At Cs contour control)
4108	Word type	Current loop integral gain zero speed
4109	Word type	Current loop proportional gain speed coefficient
4110	Word type	Current change constant
4111	Word type	Secondary current coefficient to exciting current
4112	Word type	Current expectation constant
4113	Word type	Slide constant
4114	Word type	Slide compensation constant for high-speed rotation
4115	Word type	Motor applied voltage compensation constant by dead zone
4116	Word type	Starting voltage compensation factor
4117	Word type	Starting voltage phase compensation factor
4118	Word type	Starting voltage compensation speed factor
4119	Word type	Starting voltage compensation voltage filter time constant

No.	Data Format	For Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4000 to No. 4135)
4120	Word type	Dead zone compensation data
4121	Word type	Torque change time constant
4122	Word type	Speed detection filter time constant
4123	Word type	Short-time overload detection time
4124	Word type	Voltage compensation coefficient at deceleration
4125	Word type	Timer setting for automatic operation
4126	Word type	Speed command at automatic operation mode
4127	Word type	Load meter indication value at maximum output
4128	Word type	Maximum output limit zero speed
4129	Word type	Secondary current coefficient at rigid tap
4130	Word type	Supervoltage phass compensation constant at deceleration
4131	Word type	Speed detection filter time constant (At Cs contour control)
4132	Word type	V-phase current change constant
4133	Word type	Motor model code
4134	Long type	Spare
4135	Long type	Grid shift amount at Cs countour control

No.	Data Format	For Low-speed Characteristics When Output Change Function Is Used on Part of Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4136 to No. 4175)
4136	Word type	Motor voltage setting at normal rotation
4137	Word type	Motor voltage setting at servo mode/synchronous control
4138	Word type	Base speed for motor output specification
4139	Word type	Output limit value for motor output specification
4140	Word type	Base speed
4141	Word type	Magnetic flux weaking start speed
4142	Word type	Current loop proportional gain data
4143	Word type	Current loop integral gain data
4144	Word type	Current loop integral gain zero speed
4145	Word type	Current loop proportional gain speed coefficient
4146	Word type	Current change constant
4147	Word type	Secondary current coefficient to exciting current
4148	Word type	Current expectation constant
4149	Word type	Slide constant
4150	Word type	Slide compensation constant for high-speed rotation
4151	Word type	Motor applied voltage compensation constant by dea d zone
4152	Word type	Electromotive voltage compensation coefficient
4153	Word type	Electromotive voltage phase compensation coefficient
4154	Word type	Electromotive voltage compensation speed coefficient
4155	Word type	Voltage compensation coefficient at deceleration
4156	Word type	Slide compensation gain
4157	Word type	Torque change time constant
4158	Word type	Maximum output limit zero speed
4159	Word type	Secondary current coefficient at rigid tap
4160	Word type	Hysteresis at speed detection level
4161	Word type	Electromotive voltage phase compensation constant at deceleration
4162	Word type	Speed loop integral gain at Cs contour control cutting feed (High)
4163	Word type	Speed loop integral gain at Cs contour control cutting feed (Low)
4164	Word type	V-phase current change constant
4165	Word type	Voltage filter time constant for electromotive voltage compensation

No.	Data Format	For Low-speed Characteristics When Output Change Function Is Used on Part of Main Spindle When Spindle Change Function Is Not Used or Spindle Is Changed (No. 4136 to No. 4175)
4166	Word type	Limitation of regenerative power
4167	Word type	Spare
4168	Word type	Overload current alarm detection level (For low-speed characteristic)
4169	Word type	Overload current alarm detection time constant
4170	Word type	Overload current alarm detection level (For high-speed characteristic)
4171	Word type	Arbitrary gear data spindle-side gear tooth count (HIGH)
4172	Word type	Arbitrary gear data position coder-side gear tooth count (HIGH)
4173	Word type	Arbitrary gear data spindle-side gear tooth count (LOW)
4174	Word type	Arbitrary gear data position coder-side gear tooth count (LOW)
4175	Word type	Delay timer setting when unit internal electromagnetic contactor is ON (S-series) Spindle analog override zero level (**α** -series)

No.	Data Format	For Subspindle When Spindle Change Function Is Added (No. 4176 to No. 4283)
4176	Bit type	Bit parameter
4177	Bit type	Bit parameter
4178	Bit type	Bit parameter
4179	Bit type	Bit parameter
4180	Bit type	Bit parameter
4181	Bit type	Bit parameter
4182	Bit type	Bit parameter
4183	Bit type	Bit parameter
4184	Bit type	Bit parameter
4185	Bit type	Bit parameter
4186	Bit type	Bit parameter
4187	Bit type	Bit parameter
4188	Bit type	Bit parameter
4189	Bit type	Bit parameter
4190	Bit type	Bit parameter
4191	Bit type	Bit parameter (Cannot be set by the user --- Note 1)
4192	Bit type	Bit parameter
4193	Bit type	Bit parameter
4194	Bit type	Bit parameter
4195	Bit type	Bit parameter (For parameter automatic setting --- Note 2)
4196	Word type	Maximum motor rpm
4197	Word type	Speed reach level
4198	Word type	Speed detection level
4199	Word type	Speed zero detection level
4200	Word type	Torque control value setting
4201	Word type	Load detection level-1
4202	Word type	Output limit pattern setting
4203	Word type	Output limit value
4204	Word type	Position coder style orientation stop position
4205	Word type	Orientation speed

No.	Data Format	For Subspindle When Spindle Change Function Is Added (No. 4176 to No. 4283)
4206	Word type	Speed loop proportional gain at normal operation (High)
4207	Word type	Speed loop proportional gain at normal operation (Low)
4208	Word type	Speed loop proportional gain at orientation (High)
4209	Word type	Speed loop proportional gain at orientation (Low)
4210	Word type	Speed loop proportional gain at servo mode (High)
4211	Word type	Speed loop proportional gain at servo mode (Low)
4212	Word type	Speed loop integral gain at normal operation
4213	Word type	Speed loop integral gain at orientation
4214	Word type	Speed loop integral gain at servo mode
4215	Word type	Spare
4216	Word type	Gear ratio (High)
4217	Word type	Gear ratio (Low)
4218	Word type	Position gain at orientation (High)
4219	Word type	Position gain at orientation (Low)
4220	Word type	Position gain change ratio at orientation finish
4221	Word type	Position gain at servo mode (High)
4222	Word type	Position gain at servo mode (Low)
4223	Word type	Grid shift amount at servo mode
4224	Word type	Spare
4225	Word type	Spare
4226	Word type	Orientation finish signal detection level
4227	Word type	Motor speed limit value at orientation
4228	Word type	Orientation stop position shift amount
4229	Word type	MS signal constant = $(L/2)/(2 \times \pi \times H) \times 4096$
4230	Word type	MS signal gain adjustment
4231	Word type	Regenerative power limitation
4232	Word type	Delay time unit motor power shutoff
4233	Word type	Acceleration/deceleration limit setting
4234	Word type	Spindle load monitor observer gain 1
4235	Word type	Spindle load monitor observer gain 2

No.	Data Format	For Subspindle When Spindle Change Function Is Added (No. 4176 to No. 4283)
4236	Word type	Motor voltage setting at normal rotation
4237	Word type	Motor voltage setting at orientation
4238	Word type	Motor voltage setting at servo mode
4239	Word type	Position gain change ratio at servo mode zero point return
4240	Word type	Feed forward coefficient
4241	Word type	Speed loop feed forward coefficient
4242	Word type	Spare
4243	Word type	Arbitrary gear data spindle-side gear tooth count (HIGH)
4244	Word type	Arbitrary gear data position coder-side gear tooth count (HIGH)
4245	Word type	Arbitrary gear data spindle-side gear tooth count (LOW)
4246	Word type	Arbitrary gear data position coder-side gear tooth count (LOW)
4247	Word type	Spindle load monitor magnetic flux compensation time constant (For main-side high-speed characteristic)
4248	Word type	Spindle load monitor torque constant (For main-side high-speed characteristic)
4249	Word type	Spindle load monitor observer gain 1 (For main side)
4250	Word type	Spindle load monitor observer gain 2 (For main side)
4251	Word type	Spindle load monitor magnetic flux compensation time constant (For main-side low-speed characteristic)
4252	Word type	Spindle load monitor magnetic flux compensation time constant (For high-speed characteristic)
4253	Word type	Spindle load monitor magnetic flux compensation time constant (For low-speed characteristic)
4254	Word type	Slide compensation gain (For high-speed characteristic)
4255	Word type	Slide compensation gain (For low-speed characteristic)
4256	Word type	Base speed for motor output specification
4257	Word type	Output limit value for motor output specification
4258	Word type	Base speed
4259	Word type	Magnetic flux weaking start speed
4260	Word type	Current loop proportional gain data
4261	Word type	Current loop integral gain data
4262	Word type	Current loop integral gain zero speed
4263	Word type	Current loop proportional gain speed coefficient
4264	Word type	Current change constant
4265	Word type	Secondary current coefficient to exciting current

No.	Data Format	For Subspindle When Spindle Change Function Is Added (No. 4176 to No. 4283)
4266	Word type	Current expectation constant
4267	Word type	Slide constant
4268	Word type	Slide compensation constant for high-speed rotation
4269	Word type	Motor applied voltage compensation constant by dead zone
4270	Word type	Electromotive voltage compensation coefficient
4271	Word type	Electromotive voltage phase compensation coefficient
4272	Word type	Electromotive voltage compensation speed coefficient
4273	Word type	Torque change time constant
4274	Word type	Load meter indication value at maximum output
4275	Word type	Maximum output limit zero speed
4276	Word type	Secondary current coefficient at rigid tap
4277	Word type	Electromotive voltage phase compensation constant at deceleration
4278	Word type	Speed detection filter time constant
4279	Word type	Spare
4280	Word type	Voltage filter time constant for electromotive voltage compensation
4281	Word type	Spindle load monitor torque constant (For main-side low-speed characteristic)
4282	Word type	Spindle load monitor torque constant (For high-speed characteristic)
4283	Word type	Spindle load monitor torque constant (For low-speed characteristic)

No.	Data Format	For Low-speed Characteristic When Spindle Change Function Is Also Used for Subspindle (No.4284 to No. 4351)
4284	Word type	Motor voltage setting at normal rotation
4285	Word type	Motor voltage setting at servo mode
4286	Word type	Base speed for motor output specification
4287	Word type	Output limit value for motor output specification
4288	Word type	Base speed
4289	Word type	Magnetic flux weaking start speed
4290	Word type	Current loop proportional gain
4291	Word type	Current loop integral gain
4292	Word type	Current loop integral gain zero speed
4293	Word type	Current loop proportional gain speed coefficient
4294	Word type	Current change constant
4295	Word type	Secondary current coefficient to exciting current
4296	Word type	Current expectation constant
4297	Word type	Slide constant
4298	Word type	Slide compensation constant for high-speed rotation
4299	Word type	Motor applied voltage compensation constant by dead zone
4300	Word type	Electromotive voltage compensation coefficient
4301	Word type	Electromotive voltage phase compensation coefficient
4302	Word type	Electromotive voltage compensation speed coefficient
4303	Word type	Torque change time constant
4304	Word type	Maximum output limit zero speed
4305	Word type	Secondary current coefficient at rigid tap
4306	Word type	Electromotive voltage phase compensation constant at deceleration
4307	Word type	Regenerative power limitation
4308	Word type	Voltage filter time constant for electromotive voltage compensation
4309	Word type	Motor model code
4310	Long type	Spare
4311	Long type	Spare
4312	Word type	Position coder style orientation finish signal width 2 (Main)
4313	Word type	Magnetic sensor style orientation finish signal width 1 (Main)

No.	Data Format	For Low-speed Characteristic When Spindle Change Function Is Also Used for Subspindle (No.4284 to No. 4351)
4314	Word type	Magnetic sensor style orientation finish signal width 2 (Main)
4315	Word type	Magnetic sensor style orientation stop position shift amount (Main)
4316	Word type	Position coder style orientation finish signal 2 (Sub)
4317	Word type	Magnetic sensor style orientation finish signal width 1 (Sub)
4318	Word type	Magnetic sensor style orientation finish signal width 2 (Sub)
4319	Word type	Magnetic sensor style orientation stop position shift amount (Sub)
4320	Long type	Spindle orientation deceleration constant (MAIN/HIGH)
4321	Long type	Spindle orientation deceleration constant (MAIN/MEDIUM HIGH)
4322	Word type	Spindle orientation deceleration constant (MAIN/MEDIUM LOW)
4323	Word type	Spindle orientation deceleration constant (MAIN/LOW)
4324	Word type	Spindle orientation deceleration constant (SUB/HIGH)
4325	Word type	Spindle orientation deceleration constant (SUB/LOW)
4326	Word type	Spindle orientation deceleration changeover pulses (MAIN)
4327	Word type	Spindle orientation deceleration changeover pulses (SUB)
4328	Word type	Position coder system spindle orientation command multiply (MAIN)
4329	Word type	Position coder style spindle orientation command multiply (SUB)
4330	Long type	Delay time for motor excitation at spindle orientation (MAIN)
4331	Long type	Delay time for motor excitation at spindle orientation (SUB)
4332	Word type	Spare
4333	Word type	Spare

No.	Data Format	For Low-speed Characteristic When Spindle Change Function Is Also Used for Subspindle (No.4284 to No. 4351)
4334	Word type	Speed detector arbitrary pulses (MAIN)
4335	Word type	Speed detector arbitrary pulses (SUB)
4336	Word type	Magnetic flux change point for spindle synchronous acceleration/ deceleration time constant calculation
4337	Word type	Speed loop gain speed compensation coefficient (Main)
4338	Word type	Speed loop gain speed compensation coefficient (Sub)
4339	Word type	Torque clamp level
4340	Long type	Bell type acceleration/deceleration time constant at spindle synchronous control
4341	Long type	Abnormal load detection level
4342	Word type	Spare
4343	Word type	Spare
4344	Word type	Prefeed forward coefficient
4345	Word type	Spindle motor speed command detection level
4346	Word type	Incomplete integral factor
4347	Word type	Speed difference allowable level between spindles 1 and 2 at dependent operation
4348	Word type	Overload current alarm detection level (For low-speed characteristic)
4349	Word type	Overload current alarm detection time constant
4350	Long type	Overload current alarm detection level (For high-speed characteristic)
4351	Long type	Current detection offset compensation

(Note 1) *Of the serial interface spindle parameters, the user cannot change setting of no. 4015 and no. 4191. These parameters require a CNC soft option and are set automatically depending on its setting.*

(Note 2) *To set the parameters related to the serial interface spindle amplifier automatically, set "1" in the 7th bit of no. 4019 (No. 4195 when setting the subspindle with the spindle change function), set the model code of the motor used in no. 4133 (no. 4309 when setting the subspindle with spindle change function), turn off the CNC and spindle control unit, and then, restart them.*

For the model code of the motor used, see the materials for the spindle control unit, and so on.

(Note 3) *Basically, the parameters no. 4000 through no. 4351 are used for processing on the spindle control unit. For the details of these parameters, see the maintenance manual for the serial interface spindle amplifier.*

(Note 4) *This CNC can control up to two serial interface spindle amplifiers. When the spindle control amplifier has the spindle change function, two spindle motors can be controlled for one spindle control amplifier by changing them over.*

Each spindle motor connected can use an output change function. The refore, up to 4 spindle (8 characteristics) motors can be used by changing them over. (You can control simultaneously the same number of spindles as that of spindle control amplifiers, that is, up to two spindles.)

The serial spindle parameters largely correspond to each of the above-mentioned functions as follows.

① For the 1st spindle control amplifier: No. 4000 through no. 4351 "S1"

For the 2nd spindle control amplifier: No. 4000 through no. 4351 "S1"

② Parameter range for the main spindle in the spindle control unit when the spindle change function is not provided or provided: "S1"/"S2" of no. 4000 through no. 4175

Parameter range for the subspindle in the spindle control unit when the spindle change function is provided: "S1"/"S2" of no. 4176 through no. 4351

③ Low-speed range parameters when the output change function is provided

Main spindle when the spindle change function is not provided or provided: "S1"/"S2" of no. 4136 through no. 4175

Subspindle when the spindle change function is provided: "S1"/"S2" of no. 4284 through no. 4351

(Note 5) *The serial spindle parameters are stored in the CNC as parameters, transferred to the spindle control unit, and used by the spindle control unit.*

When setting them automatically, upload the parameter data onto the CNC according to the motor model.

The serial interface spindle amplifier parameters can be modified even after starting the system. By modifying the parameters (no. 4000 through no. 4351 "S1"/"S2") on the CNC, rewritten parameters are transferred as required to update the parameter data in the spindle control unit. (Note that it is dangerous to make unnecessary modification of the parameters)

4345	Serial Spindle Motor's Detected Rotating Speed

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set a rotating speed at which a serial spindle motor speed detection signal is output. The system monitors the rotating speed of the serial spindle motor for the 1st/2nd spindle and outputs motor speed detection signals corresponding to the respective spindles to the Y-address specified by the parameter no. 1891, as to the rotating speed is exceeding the rotating speed set in this parameter.

(Note 1) *When the servo/spindle motor speed detecting function is not provided or a value of 0 has been set, no motor speed detection signal is ouput.*

(Note 2) *Set a motor rotating speed, not a spindle rotating speed.*

	#7	#6	#5	#4	#3	#2	#1	#0
4800							ND2	ND1

Data format: Bit type

- ND1
  - 0: During synchronous control of the spindle, the 1st spindle motor runs in the direction indicated by a command's sign.
  - 1: During synchronous control of the spindle, the 1st spindle motor runs in the direction opposite to a command's sign.
- ND2
  - 0: During synchronous control of the spindle, the 2nd spindle motor runs in the direction indicated by a command's sign.
  - 1: During synchronous control of the spindle, the 1st spindle motor runs is the direction opposite to a command's sign.

4810	Error Pulses between Two Spindles at Phase Adjustment in Simultaneous Control Mode by Serial Spindle

Data format: Byte type

Unit of data: Pulses

Data range: 0 to 255

Set a difference in error pulses between two spindles at phase adjustment in the synchronous control mode by the serial spindle. When the difference in error pulses between two spindles becomes less than the value set in this parameter, a spindle phase synchronous finish signal FSPPH becomes high. This parameter is used to finish phase adjustment performed in the serial spindle synchronous control mode or to confirm a phase difference during synchronous control.

4811	Allowable Number of Error Pulses between Two Spindles in Synchronous Control Mode by Serial Spindle

Data format: Word type

Unit of data: Pulses

Data range: 0 to 32767

Set the allowable number of error pulses between the two spindles in the synchronous control motor by the serial spindle. This parameter is used to output an inter-spindle phase error detection signal SYCAL in the serial spindle synchronous control mode. When a phase error is detected, which is higher than the value set in this parameter, SYCAL is turned to High.

	#7	#6	#5	#4	#3	#2	#1	#0	
4900								FLR	L
									M

Data format: Bit type

• FLR In the spindle speed fluctuation detecting function, the least input increment for the tolerance(q) and fluctuation rate(r) is;

0: 1%

1: 0.1%

(Note) *For the M-system, it is always 1%.*

4911	Tolerance(q) of Rpm Assuming Arrival of Spindle at Specified Rpm

Data format: Word type

Unit of data, Data range:

Unit of data	1%	0.1%
Data range	1 ~ 100	1 ~ 1000

(Note) *The unit of the data differs depending on setting of the parameter no. 4900, #0 (FLR).*

Set a rate(q) of rpm at which it is assumed that the spindle has reached its specified rpm in the spindle speed fluctuation detecting function.

Let us say the specified rpm is Sc. When actual spindle rpm reaches a range of (Sc - Sq) to (Sc + Sq), it is started to detect spindle fluctuation, assuming that the spindle has reached its specified rpm.

where; $Sq = Sc \times \frac{q}{100}$

4912	Spindle Fluctuation Rate(r) Not Taken as Spindle Speed Fluctuation Detection Alarm

Data format: Word type

Unit of data, Data range:

Unit of data	1%	0.1%
Data range	1 ~ 100	1 ~ 1000

(Note) *The unit of data differs depending on setting of the parameter no. 4900, #0 (FLR).*

Set a spindle fluctuation rate(r) which is not taken as an alarm in the spindle speed fluctuation detection function.

4913	Spindle Fluctuation Rpm(d) Not Taken as Spindle Speed Fluctuation Detection Alarm

Data format: Word type

Unit of data: rpm

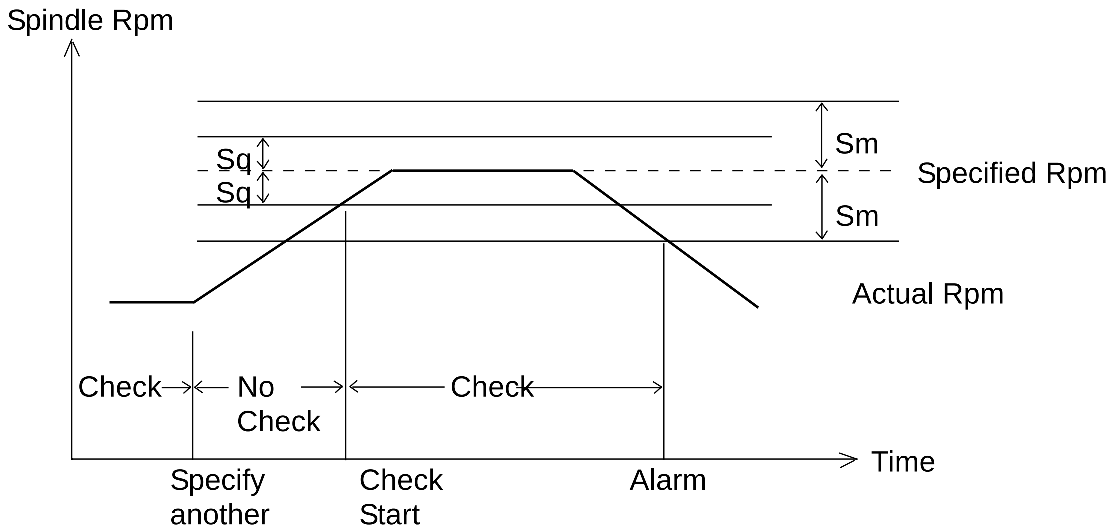
Data range: 0 to 32767

Set an allowable fluctuation rpm(Sd) which is not taken as an alarm in the spindle speed fluctuation detecting function. It is determined as follows whether actual spindle rpm is fluctuating more than an allowable range of the specified rpm. Of the two rpms Sd and Sr, a larger one is assumed to be allowable fluctuating rpm Sm. When the actual spindle rpm fluctuates more than Sm against the specified rpm Sc, it is taken as an alarm. Where;

Sd: Constant allowable fluctuation width not based on the specified rpm. Set in the parameter no. 4193.

Sr: Allowable fluctuation width obtained by multiplying the specified rpm Sc by a constant rate r. Set the parameter no. 4912.

Sm: Either Sd or Sr, whichever has larger rpm



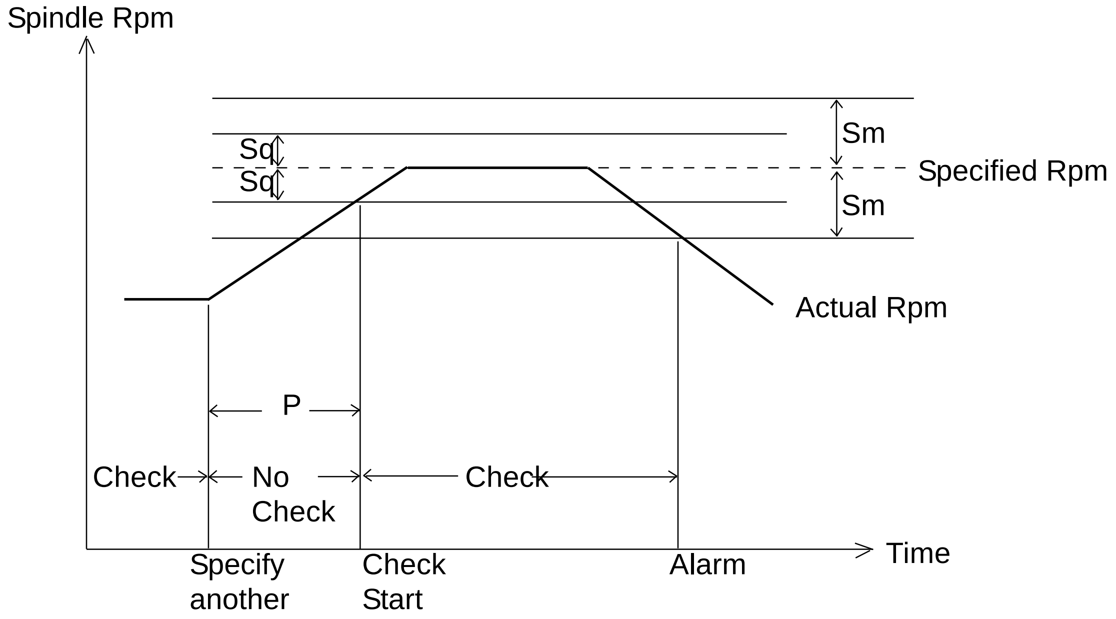
4914	Time Required to Start Spindle Speed Fluctuation Detection after Change of Specified Rpm (p)

Data format: Long type

Unit of data: msec

Data range: 0 to 999999

Set a time required to start spindle speed fluctuation detection after the specified rpm changed in the spindle speed fluctuation detecting function. In other words, spindle speed fluctuation is not detected until a set time elapses after a change of the specified rpm.



		#7	#6	#5	#4	#3	#2	#1	#0	
4950		IMB	ESI				ISZ	IDM	IOR	L
										M

Data format: Bit type

- IOR
  0: When a reset is applied during the spindle positioning mode, the mode is not canceled.
  1: When a reset is applied during the spindle positioning mode, the mode is canceled.
- IDM
  0: Positions the spindle in the positive (plus) direction by an M-code
  1: Positions the spindle in the negative (minus) direction by an M-code
- ISZ
  When a spindle orientation commanding M-code is given in positioning the spindle;

0: Performs spindle orientation after changing from the spindle rotation mode to the spindle positioning mode

1: Does not perform spindle orientation after changing from the spindle rotation mode to the spindle positioning mode

• ESI 0: Selects the conventional specification for spindle positioning

1: Selects the extended specification for spindle positioning

(Note) *When the extended specification is selected, the following two items are extended.*

(1) The number of X-codes to specify a spindle positioning angle is changed from 6 to any number within a range of 1 to 256. (See Parameter No. 4964)

(2) The upper limit of a feed rate set value (set value of the parameter no. 1420) for spindle positioning is extended from 240000 to 269000 (least input increment: 10 deg./min.).

• IMB 0: Specification-A is used for positioning at a semifixed angle by M-code in the spindle positioning function

1: Specification-B is used for positioning at a semifixed angle by M-code in the spindle positioning function

(Note) *When positioning at a semifixed angle by M-code, spindle positioning operation is classified into the following three kinds:*

(1) Cancels the spindle rotation mode to shift to the spindle positioning mode

(2) Positions the spindle in the spindle positioning mode

(3) Cancels the spindle positioning mode to shift to the spindle rotation mode

For the specification-A;

Specify the above-mentioned operations (1) to (3) by individual M-codes, respectively.

(1) Specify by an M-code which performs spindle orientation (See Parameter No. 4960)

(2) Specify by an M-code which specifies a spindle positioning angle (See Parameter No. 4962)

(2) Specify by an M-code which cancels spindle positioning (See Parameter No. 4961)

For the specification-B;

The above-mentioned operations (1) to (3) are continuously performed if a spindle positioning angle commanding M-code (see Parameter no. 4962) is given.

4960	Spindle Orientation Commanding M-code	L
		M

Data format: Word type

Unit of data: Integer

Data range: 6 to 97

Set an M-code for shifting from the spindle swivel mode to the spindle positioning mode. This M-code orients the spindle and allows spindle positioning commands in the subsequent blocks.

4961	Spindle Positioning Cancellation M-code	L
		M

Data format: Word type

Unit of data: Integer

Data range: 6 to 97

Set an M-code for canceling the spindle positioning mode to shift to the spindle swivel mode.

4962	Spindle Positioning Angle Commanding M-code	L
		M

Data format: Word type

Unit of data: Integer

Data range: 6 to 92

There are two kinds of spindle positioning ways; positioning at an optional angle by an address C and positioning at a semifixed angle by an M-code.

In this parameter, set the M-code used in the latter method.

(1) In case of the parameter no. 4950, #6 (ESI) = 0

Suppose a set value of this parameter is α, six M-codes, M α to M (α + 5), are used as M-codes for positioning at a semifixed angle.

(2) In case of the parameter no. 4950, #6 (ESI) = 1

Set a beginning M-code in this parameter and set quantity in the parameter no. 4964. Suppose a set value of the parameter no. 4962 is α and that of the parameter no. 4964 is β, β pieces of M-codes, M α to M (α + β - 1), are used as M-codes for positioning at a semifixed angle.

The following table shows relations between the M-codes and positioning angles.

M-code	Positioning Angle	(Example) Positioning Angle at θ = 30°
M α	θ	30NNN
M (α + 1)	2 θ	60°
M (α + 2)	3 θ	90°
M (α + 3)	4 θ	120°
M (α + 4)	5 θ	150°
M (α + 5)	6 θ	180°
⁀	⁀	
M (α + n)	(n + 1) θ	

(Note) *θ is a basic rotating angle set in the parameter no. 4963.*

4963	Basic Rotating Angle for Spindle Positioning	L M

Data format: Word type

Unit of data: degrees

Data range: 1 to 60

Set a basic rotating angle in positioning at a semifixed angle by an M-code.

4964	Number of M-codes Giving Spindle Positioning Angle	L M

Data format: Byte type

Unit of data: Integer

Data range: 0, 1 to 256

Set the number of M-codes used in positioning a semifixed angle by an M-code. The M-codes set in the parameter no. 4962 corresponding to the quantity set in this parameter are selected as M-codes used in positioning at a semifixed angle.

Suppose a set value of the parameter no. 4962 is α and that of the parameter no. 4964 is β , β pieces of M-codes, M α to M (α + β - 1), are used as M-codes for positioning at a semifixed angle.

(Note 1) *This parameter is valid when "1" is set in the parameter no. 4950, #6 (ESI).*

(Note 2) *Pay full attention to the set values so that the M-codes, M α to M (α + β - 1), will not be duplicate of other M-codes.*

(Note 3) *When "0" is set in this parameter, it is equivalent to setting "6". That is, M α to M (α + 5) will be the M-codes for positioning at a semifixed angle.*

4970	Spindle Servo Loop Gain	L
		M

Data format: Word type

Unit of data: 0.01 $sec.^{-1}$

Data range: 1 to 9999

Set a spindle servo loop gain in spindle positioning.

4971	Spindle Servo Loop Gain Multiplier For Gear 1	L
		M
4972	Spindle Servo Loop Gain Multiplier For Gear 2	L
		M
4973	Spindle Servo Loop Gain Multiplier For Gear 3	L
		M
4974	Spindle Servo Loop Gain Multiplier For Gear 4	L
		M

Data format: Word type

Unit of data:

Data range:

Set spindle servo loop gain multipliers for the gears 1-4 in spindle positioning. The loop gain multiplier is a conversion multiplier to convert a position deviation amount into a speed command voltage. Set a value obtained by the following formula.

Loop gain multiplier = 2048000 x E x A/L

where;

E: Speed command voltage (V) required to rotate at spindle rpm of 1,000 rpm

L: Spindle rotating angle (3600) per rotation of the spindle motor

A: Unit of detection (degrees)

<Example> When the spindle rotating angle per rotation of the motor is 360 degrees, the speed command voltage is 2.2 V, the spindle rpm is 1,000 rpm, and the unit of detection is 0.088 deg./pulse;

Loop gain multiplier = 2048000 x 2.2 x 0.088/360 = 1101

(Note) *Assuming that a 10 V spindle motor is used at spindle rpm of 4,500 rpm, it was calculated at 1,000 rpm and 2.2 V.*

(Note) *The above-mentioned parameters no. 4970 through no. 4974 are for the analog spindle.*

2.14 Parameters Related to Tool Offset

Data format: Bit type

		#7	#6	#5	#4	#3	#2	#1	#0	
5000										L
									SBK	M

• SBK 0: The program does not make a single-block stop in the block internally created for tool diameter compensation during the HPCC mode.

1: The program makes a single-block stop in the block internally created for tool diameter compensation during the HPCC mode.

Data format: Bit type

		#7	#6	#5	#4	#3	#2	#1	#0	
5001										L
					BCK	ICK				M

• ICK 0: Checks for an interference of tool diameter compensation during the HPCC mode

1: Does not check for an interference of tool diameter compensation during the HPCC mode

• BCK In a tool diameter compensation interference check during the HPCC mode, a programmed moving direction differs from an offset moving direction by 900 to 2700

0: It is taken as an alarm

1: It is not taken as an alarm

Data format: Bit type

		#7	#6	#5	#4	#3	#2	#1	#0	
5002										L
		NMOH	ROFD	LVK	HOFA	OFC	PCI	DHOF	EVO	M

• EVO 0: When an offset amount is changed during selection, the blocks starting at the one where the next D- or H-code is given become valid

1: When an offset amount is changed during selection, the blocks starting at the buffered next become valid

• DHOF 0: A tool offset (G45 to G48) number is specified with a D-code

1: A tool offset (G45 to G48) number is specified with an H-code

• PCI 0: Tool offset (G45 to G48) is invalid to an arc command

1: Tool offset (G45 to G48) is valid to an arc command

- OFC 0: Does not cancel tool offset by a G28/G30 command
  1: Cancels tool offset by a G28/G30 command
- HOFA 0: Tool length compensation (G43/G44) is always applied to the Z-axis
  1: Tool length compensation (G43/G44) is applied to the programmed axis
- LVK 0: Clears a tool length compensation vector by reset
  1: Does not clear a tool length compensation vector by reset (It is held)
- ROFD With Reset, the compensation volume of tool diameter compensation (D code) is:
  0: Cleared.
  1: Not cleared.
- NMOH When, during tool length compensation, H code has been command in a block without command of a tool length compensation axis.
  0: Tool length compensation axis is subject to shift.
  (A new compensation amount is reflected in this block.)
  1: Tool length compensation axis is not subject to shift.
  (A new compensation amount is reflected in the next block where a tool length compensation axis commanded is given.)

	#7	#6	#5	#4	#3	#2	#1	#0	
5003	RCPT				CNM	CNI	CNC	DOFB	L
			LGC	LGA	CNM	CNI	CNC	DOFB	M

Data format: Bit type

- DOFB 0: Tool diameter compensation start-up and cancellation methods are Type A
  1: Tool diameter compensation start-up and cancellation methods are Type B
- CNC In a tool diameter compensation/tool nose radius compensation interference check, a programmed moving direction differs from an offset moving direction by 900 to 2700
  0: It is taken as an alarm
  1: It is not taken as an alarm
- CNI 0: Checks for a tool diameter compensation/tool nose radius compensation interference
  1: Does not check for a tool diameter compensation/tool nose radius compensation interference
- CNM 0: Does not move by a compensation amount in the "G40;" block for tool diameter compensation

1: Moves by a compensation amount in the "G40;" block for tool diameter compensation (Offset cancellation movement)

- LGA 0: Does not limit tool length compensation axes to a single axis of G240 to G244
  1: Limits tool length compensation axes to a single axis of G240 to G244
- LGC 0: Does not set G49 automatically by G240 to G245, G248, or G249 command
  1: Sets G49 automatically by G240 to G245, G248, or G249 command
- RCPT 0: Tool diameter compensation is enabled at a tool nose point of T = 9 only
  1: Tool diameter compensation is enabled at a tool nose point of T = 1 to 9

	#7	#6	#5	#4	#3	#2	#1	#0	
5004									L
	TDI		PTNC	TAI			LHCP		M

Data format: Bit type

- LHCP 0: Does not cancel tool length compensation by a G28/G30 command
  1: Cancels tool length compensation by a G28/G30 command
- TAI 0: Automatically distinguishes by shape/wear an absolute value or incremental value at tool offset data input
  1: Automatically distinguishes by the function key an absolute value or incremental value at tool offset data input
- PTNC 0: In changing the tool offset amount (L10 to L13) by the G10 command, the P-data is the tool offset number.
  1: In changing the tool offset amount (L10 to L13) by the G10 command, the P-data is is the specified tool number.
- TDI 0: Decimal point programming for the tool offset data is conventional.
  1: Decimal point programming for the tool offset data is of electronic calculator type.

	#7	#6	#5	#4	#3	#2	#1	#0	
5005	TPCV	NROS					RG1U	RVCL	L
									M

Data format: Bit type

- RVCL When there are 3 or more continuous blocks without move during tool nose radius compensation (including when a preread stop command is used);

0: Creates an offset vector perpendicular to an end point of the current block

1: Clears an offset vector temporarily at an end block of the current block

(Note) *Tool diameter compensation creates the offset vector perpendicular to the end point.*

- RG1U 0: Automatic tool nose radius compensation starts up in a G00 block

  1: Automatic tool nose radius compensation starts up in a G00 or G01 block
- NROS When rotary tools (rotary X, rotary Z, Canned X, Canned Z) have been set by tool type:

  0: Tool compensation amount according to each tool type is automatically set. (As for details, see the description of Parameter No's. 5031/5032.)

  1: Tool compensation volume is not changed.
- TPCV Nose point changing in Rotary Tool Offset Auto Changeover (G159) in ATC type C is:

  0: Not performed.

  1: Performed.

	#7	#6	#5	#4	#3	#2	#1	#0	
5006								IDX5	L
									M

- IDX5 0: The minimum indexing angle of the turret head for the ATC type E is 45°.

  1: The minimum indexing angle of the turret head for the ATC type E is 5°.

5009	Maximum Number of Turret Faces	L
		M

Data format: Word type

Data range: 1 to 32767

In case of the lathe (L-system), set the maximum number of turret faces. When a T-code command is given and the specified number of turret faces exceeds the maximum number of turret faces, it results in an alarm (no. 182 T-command error).

5010	Maximum Number of Tool Pots	L
		M

Data format: Word type

Data range: 1 to 32767

In case of the lathe (L-system) with an ATC, set the maximum number of tool pots. Set the number of turret faces plus the number of pots of ATC magazines.

5018		
		L
	M-code for Tool Change (ATC)	M

Data format: Word type

Data range: 0 to 32767

Set an M-code used for tool change (ATC) in case of the machining center (M-system).

(Note) *When a value of 0 is set, it is considered M06.*

5025	Vector Neglection Limit Value When Moving Outside the Corner in Tool Diameter/Tool Nose Radius Compensation

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

When tool diameter/tool nose radius compensation is applied and a tool moves outside the corner, set a limit value which neglects a small stroke created by tool diameter/tool nose radius compensation.

5026		
		L
	Denominator Constant for Obtaining 3D Tool Offset Vector	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a denominator constant (P) for obtaining a three-dimensional tool offset vector. A value of P is used as follows when calculating the three-dimensional tool offset vector.

$Vx = i \times r/P$

$Vy = j \times r/P$

$Vz = k \times r/P$

where; Vx, Vy, Vz: Three-dimensional tool offset vectors for the X-, Y-, and Z-axes or their parallel axes

I, J, K: Values specified in the program r: Offset value

(Note) *When a value of 0 is set, P equals $i^2 + j^2 + k^2$.*

5027	Incremental Input Clamp Value at Tool Offset Input

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 1 to 99999999

Set an input data clamp value for inputting tool offset data incrementally. You cannot incrementally input the data exceeding the set value of this parameter.

5028	Difference (Z-axis direction) between the X-axis rotary tool center and the reference outer diameter tip for rotary tool offset auto changeover (G159) in ATC type C [Parameter B]	L
		M

5029	Difference (X-axis direction) between the inner diameter center and the Z-axis rotary tool center for rotary tool offset auto changeover (G159) in ATC type C [Parameter A]	L
		M

5030	Difference between the X-axis rotary tool offset and the Z-axis rotary tool offset for rotary tool offset auto changeover (G159) in ATC type C [Parameter C]	L
		M

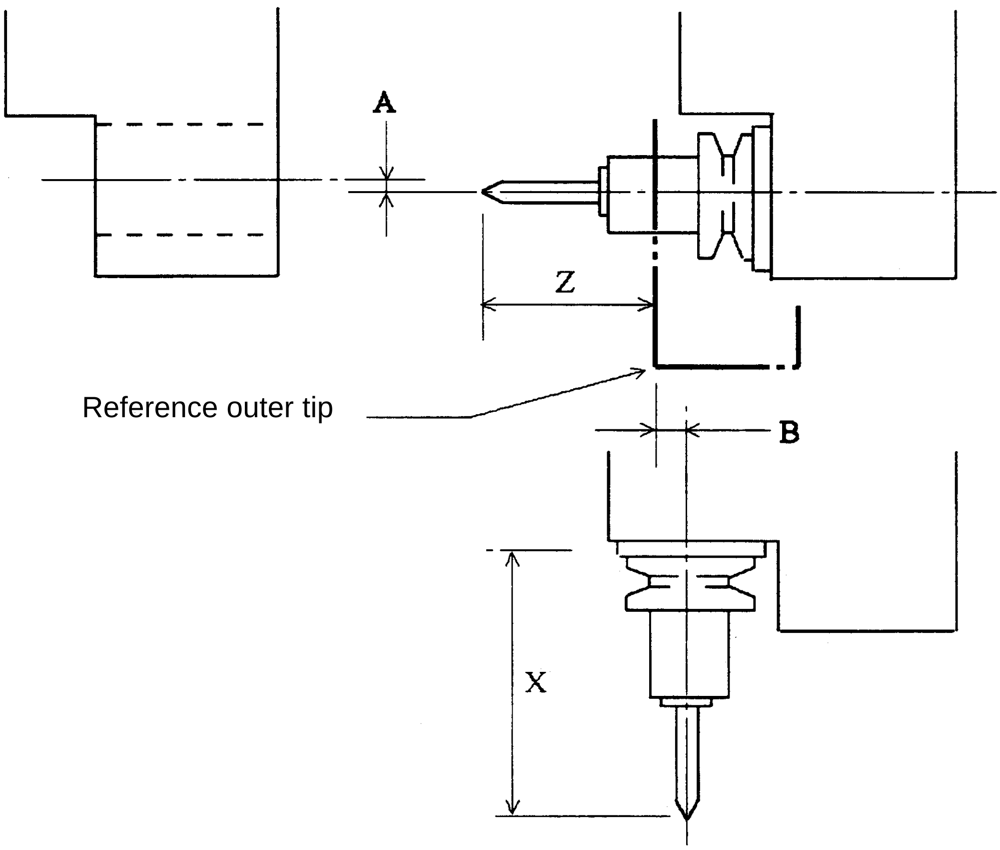
Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Constants (x 3) are set, which are used in rotary tool offset auto changeover (G159) of ATC type C. As for Parameter A, B, and C, see the drawing below:



C = (X/2) -Z

where, X and Z are tool offsets when the same rotary tool has been measured in Q setter.

X: X-axis tool offset when measured as the X-axis rotary tool

Z: Z-axis tool offset when measured as the Z-axis rotary tool

5031	Z-axis tool compensation amount (profile) for X-axis rotary tool	L
		M

5032	X-axis tool compensation amount (profile) for Z-axis rotary tool [standard value = 0]	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

When the tool type is changed in the TOOL OFFSET screen, set the tool offset amount for the rotary tool when automatically setting the tol offset amount peculiar to the tooltype (parameter No. 5005, #6(NROS) = 0).

Change od the tool type means that the tools are cllassified into the following four groups and their pre-setting group differ from the post-setting group.

① X-axis rotary tools (Rotary X/Canned X)

② Z-axis rotary tools (Rotary Z/Canned Z)

③ Other tools (Turning, etc.)

④ No type

[Description of Automatic Setting]

- When changing to the X-axis rotary tool (rotary X/cannec X)

  → Set the data of the parameter No. 5031 as the Z-axis offset amount (geometry). Set 9 for the tool nose point and 0 for other offset amounts (geometry/wear).

- When changing to the Z-axis rotary tool (rotary Z/cannec Z)

  → Set the data of the parameter No. 5032 as the Z-axis offset amount (geometry). Set 9 for the tool nose point and 0 for other offset amounts (geometry/wear).

- When changing to the tools other than the above-mentioned

  → Set 0 for the toolnose point and 0 for all the offset amount (geometry/wear).

(NOTE) *When the group does not change even if the tool type is set, or when the tool type is deleted, the tool offset amount is not automatically set.*

2.15 Parameters Related to Canned Cycle

	#7	#6	#5	#4	#3	#2	#1	#0	
5100	FDR	PDW	DHD	HSIM	MO5	SIJ	DTP		L
		PDW	DHD		MO5	SIJ	DTP	FCZ	M

Data format: Bit type

- FCZ 0: A drilling axis used in a canned cycle for drilling is always the Z-axis.
  1: A drilling axis used in a canned cycle for drilling is the axis specified in the program.
- DTP 0: A dwell command by P in a direct tap cycle (M-system: G741/G841, L-system: G842/G843) is invalid
  1: A dwell command by P in a direct tap cycle (M-system: G741/G841, L-system: G842/G843) is valid
- SIJ 0: In a canned cycle for drilling (M-system: G76/G87, L-system: G861/G87), the shift direction is specified by the parameter no. 5127 and the shift amount is specified by Q.
  1: In a canned cycle for drilling (M-system: G76/G87, L-system: G861/G87), the shift direction ad the shift amount are specified by I, J, and K.

(Note) *When SIJ = 0 is set, see Parameter No. 5127.*

- MO5 0: When reversing (M-system: M03/M04, L-system: M13/M14) the spindle (rotating tool) in the canned cycle for drilling, a stop M-code (M-system: M05, L-system: M15) is not output
  1: When reversing (M-system: M03/M04, L-system: M13/M14) the spindle (rotating tool) in the canned cycle for drilling, a stop M-code (M-system: M05, L-system: M15) is output
- HSIM 0: Does not use a spindle index M-code in a canned cycle for drilling.
  1: Uses a spindle index M-code in a canned cycle for drilling. (Necessary to set Parameters 5135 and 5136)
- DHD 0: In a peck drilling cycle (M-system: M73/G83, L-system: M831/G83), a dwell command by P is invalid
  1: In a peck drilling cycle (M-system: M73/M83, L-system: M831/G83), a dwell command by P is invalid
- PDW 0: In a tap cycle (M-system: G74/G84, L-system: M841/G84), a dwell command by P is invalid
  1: In a tap cycle (M-system: G74/G84, L-system: M841/G84), a dwell command by P is valid
- FDR 0: In a canned cycle for drilling, an address to specify an ",R" point is ",R"
  1: In a canned cycle for drilling, an address to specify an "D"

		#7	#6	#5	#4	#3	#2	#1	#0	
5101		KGL	KDH							L
				DTC2	DTC1		FEP	FTP	FXY	M

Data format: Bit type

- FXY 0: In the canned cycle for true circle plane machining (G302 to G305), square side/plane machining (G322 to G326), and pocket machining (G327 to G333), the X-Y plane (G7) is always assumed.
  1: In the canned cycle for true circle plane machining (G302 to G305), square side/plane machining (G322 to G326), and pocket machining (G327 to G333), the plane (abides by the program command.
- FTP 0: A special canned cycle (G322 to G333) is Type-A (conventional type)
  1: A special canned cycle (G322 to G333) is Type-B (unified type)
- FEP 0: When the special canned cycle (G322 to G333) is a unified type (parameter no. 5101, #1 (FTP) = 1), the X and Y end points for the special canned cycle are the last cutting end points
  1: When the special canned cycle (G322 to G333) is a unified type (parameter no. 5101, #1 (FTP) = 1), the X and Y end points for the special canned cycle are the X and Y specified positions
- DTC1, DTC2 Selection of the direct tap specifying method

DTC2	DTC1	Specifying Method	
0	0	S-MIII system: Specify by G741/G841	(Standard)
0	1	S-MII system: Specify by M21 + G74/G84	
1	0	S-LIII system: Specify by G842/G843	

- KDH 0: When a canned cycle for drilling is LII type (parameter no. 5101, #7 (KGL) = 1), G83 is high-speed peck drilling
  1: When a canned cycle for drilling is LII type (parameter no. 5101, #7 (KGL) = 1), G83 is high-speed peck drilling
- KGL 0: A canned cycle for drilling is LIII type
  1: A canned cycle for drilling is LII type

		#7	#6	#5	#4	#3	#2	#1	#0	
5102		APT	NSR	CDO	NRC		MF20	TPES	TPSS	L
								TPES	TPSS	M

Data format: Bit type

- TPSS 0: Always outputs an S-code in the first block of a tapping cycle (direct tap included)
  1: Outputs an S-code in the first block of a tapping cycle (direct tap included) if there is any S-command
- TPES 0: Always outputs an S-code in the last block of a tapping cycle (direct tap included)

1: Outputs an S-code in the first block of a tapping cycle (direct tap included) if there is any S-command

(Note) *TPSS and TPES are used for spindle gear speed change for tapping in the M-system.*

- *TPSS is used to select whether to perform gear speed change for tapping automatically (even without an S-command)*
- *TPES is used to select whether to put back the gear to the normal state automatically (even without an S-command)*

Although there is no gear for the L-system's rotary tools, this parameter is also valid for the L-system.

- MF20 Be sure to set 0.
- NRC 0: Performs finish roughing at the end of a multiple repetitive cycle (G71/G72)
  1: Does not perform finish roughing at the end of a multiple repetitive cycle (G71/G72)
- CDO 0: During a multiple repetitive cycle (G71/G72), a depth of cut override is invalid
  1: During a multiple repetitive cycle (G71/G72), a depth of cut override is valid
- NSR 0: Does not apply tool nose radius compensation to type-2 roughing of a multiple repetitive cycle (G71/G72).
  1: Applies tool nose radius compensation to type-2 roughing of a multiple repetitive cycle (G71/G72).
- APT 0: A command A for the multiple repetitive cycle (G77) has a decimal point
  1: A command A for the multiple repetitive cycle (G77) does not have a decimal point

	#7	#6	#5	#4	#3	#2	#1	#0	
5103				SBP					L
	M6MAS				M6CT	M6G			M

Data format: Bit type

- M6G 0: When a G-code is specified simultaneously with the ATC canned cycle (M06) of the M-system, it results in an alarm
  1: When a G-code is specified simultaneously with the ATC canned cycle (M06) of the M-system, it does not result in an alarm
- M6CT 0: When a spindle tool T-code is specified in the same block as M06 in the ATC canned cycle for the M-system, the "M06 T_;" step is skipped.

1: When a spindle tool T-code is specified in the same block as M06 in the ATC canned cycle for the M-system, an alarm results from the "M06 T_;" step.

(Note) *This parameter is valid only in case of ATC canned cycle type G or H (Model HK).*

- SBP In the ATC canned cycle of L-system, single block is:
  0: Invalid.
  1: Valid
- M6MAS 0: In the ATC canned cycle of the M-system, the Z-system moves to the ATC position, followed by the X- and Y-axis simulataneously. (Conventional)
  1: In the ATC canned cycle of the M-system, the X-, Y-, and Z-axis move to the ATC position simulataneously. (MAS)

(Note) *This parameter is valid only for the ATC Types I (Model HS500), J (Model VS50), and N (Model MS400H).*

	#7	#6	#5	#4	#3	#2	#1	#0	
5104	NMDR							G92K	L
									M

Data format: Bit type

- G92K 0: In straight thread cutting in the canned cycle for thread cutting (G92), the K-code command (thread angle cutting) is disabled.
  1: In straight thread cutting in the canned cycle for thread cutting (G92), the K-code command (thread angle cutting) is enabled.

(Note) *Incase of tapered thread cutting, the K-code command is disabled regardless of theis parameter.*

- NMDR 0: Does not check whether the door is closed upon starting soft jaw forming.
  1: Checks whether the door is closed upon starting soft jaw forming.

	#7	#6	#5	#4	#3	#2	#1	#0	
5105									L
				DTPG					M

Data format: Bit type

- DTPG In the direct tap pecking operation;
  0: The tool returns to the R-point after cutting to the Z-point.
  1: The tool returns by the distance set in the parameter (No.5177) after cutting to the Z-point.

	#7	#6	#5	#4	#3	#2	#1	#0	
5108	TKMO4x	TKMO2x	TKMO1x			TKMP2x	TKMP1x	TKMVx	L
									M

Data format: Bit axis type

TKMVx Move toward the ATC position is:

0: Not performed.

1: Performed.

TKMP1x, TKMP2x Selection of ATC Position

TKMP2x	TKMP1x	Return Position
0	0	1st zero point
0	1	3rd zero point
1	0	4th zero point

(Note) *In ATC type C, as X, Y, and Z axes move to the ATC position according to the signals from the PMC, the ATC position selecting parameters (TKMP1x, TKMP2x) have no meaning regarding X, Y, and Z axes. However, the parameter whether or not to move to the ATC position (TKMVx) stays valid regarding X, Y, and Z axes.*

TKM01x, TKM02x, TKM04x Order for Move to ATC Position (Two or more axis can move simultaneously.)

TKMO2x	TKMO2x	TKMO1x	Move Order
0	0	0	1st
0	0	1	2nd
0	1	0	3rd
0	1	1	4th
1	0	0	5th
1	0	1	6th
1	1	0	7th
1	1	1	8th

	#7	#6	#5	#4	#3	#2	#1	#0	
5109	TKRO4x	TKRO2x	TKRO1x			TKRP2x	TKRP1x	TKRTx	L
				ARTR2x	ARTR1x	ARTP2x	ARTP1x	ARTAx	M

Data format: Bit axis type

[For L-System] ..... For the M-system, see the next page.

TKRTx Return from the ATC position is:

0: Not performed.

1: Performed.

TKRP1x, TKRP2x Position to which the axis is returned from the ATC position is selected as follows:

TKMP2x	TKMP1x	ATC Position
0	0	1st zero point
0	1	3rd zero point
1	0	4th zero point

TKR01x, TKR02x, TKR04x Order in which the tool is returned from the ATC position (Two or more axis can be assigned simultaneously.)

TKMO4x	TKMO2x	TKRO1x	Move Order
0	0	0	1st
0	0	1	2nd
0	1	0	3rd
0	1	1	4th
1	0	0	5th
1	0	1	6th
1	1	0	7th
1	1	1	8th

	#7	#6	#5	#4	#3	#2	#1	#0	
5109	TKRO4x	TKRO2x	TKRO1x			TKRP2x	TKRP1x	TKRTx	L
				ARTR2x	ARTR1x	ARTP2x	ARTP1x	ARTAx	M

Data format: Bit axis type

[For M-System] ..... For the L-system, see the preceding page.

- ARTAx 0: Does not retract the tool in order to avoid an interference with the ATC in the ATC canned cycle (M06)
  1: Retracts the tool in order to avoid interference with the ATC in the ATC canned cycle (M06)
- ARTP1x, ARTP2x Selects a position to retract the tool to in the ATC canned cycle (M06).

ARTP2x	ARTP1x	Position to Retract to
0	0	Optional position (set in the parameter no. 5161)
0	1	1st reference point
1	0	2nd reference point

- ARTR1x, ARTR2x Selects how to retract the rotary axis (parameter no. 1010, #0 (ROTx) = 1) in the ATC canned cycle (M06).

ARTP2x	ARTP1x	How to Retract the Rotary Axis
0	0	Same as the linear axis
0	1	Takes a shortcut (returns within one rotation)
1	0	Moves in the positive direction (ditto)
1	1	Moves in the negative direction (ditto)

(Note) *When a rotary axis control function is provided, the retract method complies with the rotary axis control specification, regardless of ARTR1x and ARTR2x.*

(Note 1) *You do not have to set the parameter no. 5109 for the axes which move to an ATC position at ATC operation time. Which axes move to the ATC position are determined as follows depending on the type of the ATC canned cycle.*

ATC Type	Target Model	Axes Moving to ATC Position	
A	VK, VKC, VG	Y-axis, Z-axis	
(B)	VM40	Y-axis, Z-axis	Unusable
(C)	VM40II	X-axis, Z-axis	Unusable
D	VF	Y-axis, Z-axis	
E	VM40III, VM50	Y-axis, Z-axis	
F	HG	Y-axis, Z-axis	
G	HS630 (Chain)	X-axis, Y-axis, Z-axis	
H	HS630 (Matrix)	X-axis, Y-axis, Z-axis	
I	HS500	X-axis, Y-axis, Z-axis	
J	VS	Y-axis, Z-axis	

(Note 2) *When a retract axis position is specified in the same block as an M06 command, the axes move according to a programmed value, regardless of the parameter no. 5109*

5111	Chamfering Angle for Canned Cycle for Thread Cutting (G92/G76)	L
		M

Data format: Byte type

Least input increment: 0.1 pitch

Data range: 1 to 127

Set a chamfering amount for a canned cycle for thread cutting (G92/G76).

(Note) *if any data is set beyond the specified range, it will be regarded as 10 (1.0 pitch).*

5112	Chamfering Angle for Canned Cycle for Thread Cutting (G92/G76)	L
		M

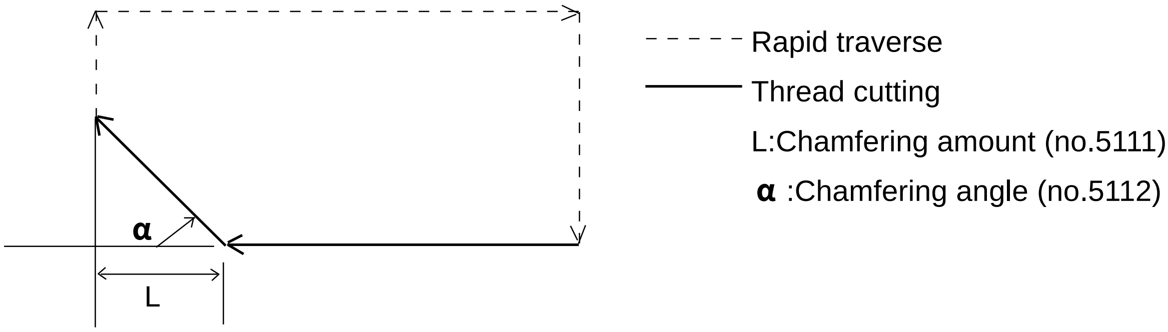
Data format: Byte type

Unit of data: degrees

Data range: 1 to 89

Set a chamfering angle for a canned cycle for thread cutting (G92/G76).

(Note) *if any data is set beyond the specified range, it will be regarded as 45 (45 degrees).*



5113	Depth of Cut Override for Multiple Repetitive Cycle (G71/G72)	L
		M

Data format: Byte type

Unit of data: %

Data range: 1 to 255

Set a depth of cut override for multiple repetitive cycle (G71/G72).

(Note) *When the data is 0 (zero), it is considered 100%.*

5114	X-axis Release Maximum Rapid Traverse Override for Canned Cycle for Thread Cutting (G92, G76)	L
	(G322 to G333)	M

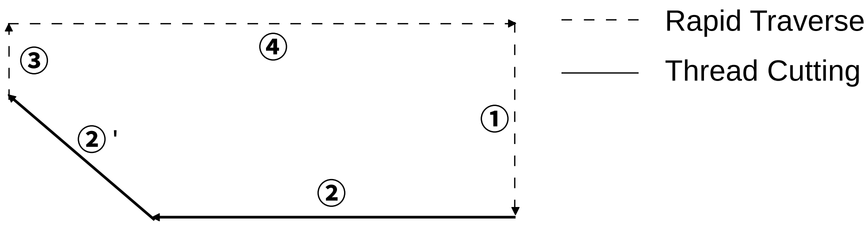
Data format: Byte type

Unit of data: %

Data range: 1 to 100

Set the maximum rapid traverse override for X-axis release operation in the thread cutting cycle (G92, G76). The rapid traverse override selected at the machine operation panel is clamped at this parameter's value only in the X-axis release operation (movement ③ in the figure below).

(Note) *If you set the data beyond a range, it will be considered to be 100 (100%).*



5115	Finish Speed Override Amount for Special Canned Cycle (G322 to G333)	L M

Data format: Byte type

Unit of data: %

Data range: 0 to 100

Set a finish speed override amount (SFF) for a special canned cycle (G322 to G333).

$$\text{Finish speed} = F \times \frac{SFF}{100}$$

(Note) *if any data is set beyond the specified range, it will be regarded as 100 (100%).*

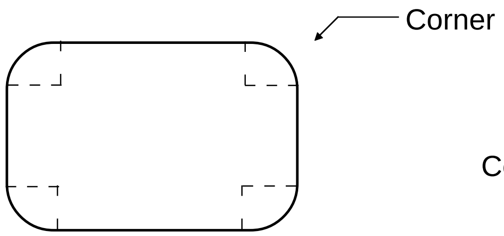
5116	Corner Speed Override Amount for Special Canned Cycle (G322 to G333)	L M

Data format: Byte type

Unit of data: %

Data range: 0 to 100

Set a corner speed override amount (SFC) for a special canned cycle (G322 to G333).



$$\text{Corner speed} = F \times \frac{SFC}{100}$$

(Note) *if any data is set beyond the specified range, it will be regarded as 100 (100%).*

5117	Divided Arc for Helical Drilling Cycle (G812/G813)	L M

Data format: Byte type

Unit of data: Degrees

Data range: 1 to 90

In the helical drilling cycle (G812/G813), set the angle by which the arc is to be divide d at the time of cutting a cone.

(Note) *The data set beyond the data range is regarded as 90°.*

5127	Tool Retract Direction after Orientation for Canned Cycle for Drilling (G861/G87)	L
	Tool Retract Direction after Orientation for Canned Cycle for Drilling (G76/G87)	M

Data format: Byte axis type

Data range: -Maximum number of controlled axes to -1, +1 to + Maximum number of controlled axes

Set for each drilling axis a tool retract axis and its direction after orientation for a canned cycle for drilling (M-system: G76/G87, L-system: G861/G87). Use a set value to specify the controlled axis number you want to retract, and use a plus (+) or minus (-) sign to specify the retract direction.

The following shows a setting example.

When there are three controlled axes and they are X-axis (1st axis), Y-axis (2nd axis), and Z-axis (3rd axis), the set values correspond to the retract directions as follows:

Set Value	Retract Direction
+1	+X
+2	+Y
+3	+Z

Set Value	Retract Direction
-1	-X
-2	-Y
-3	-Z

<Example 1> When the drilling axis is the Z-asis (3rd axis) and the retract direction is the -X-axis direction (-1);

Parameter no. 5127   X (1st axis) ----

Y (2nd axis) ----

Z (3rd axis) -1

<Example 2> When the drilling axis is the X-axis (1st axis) and the retract direction is the +Y-axis direction (+2);

Parameter no. 5127   X (1st axis) +2

Y (2nd axis) ----

Z (3rd axis) ----

(Note) This parameter has no meaning when the parameter no. 5100, #2 (SIJ) is set to "1".

5129	Number of Finish Cycle Repetition Times for Multiple Repetitive Cycle	L
		M

Data format: Word type

Unit of data: times

Data range: 1 to 255

Set the number of finish cycle repetition times for a multiple repetitive cycle (G76).

(Note) *If the data is set beyond the specified range, it will be regarded as 1 (one time).*

5130	Soft Jaw Forming: Feed Rate Magnification in Unload Cutting	L
		M

Data format: Word type

Unit of data: times

Data range: 1 to 100

A feed rate magnification in unloaded cutting is set for soft jaw forming function. As "cutting feed rate x magnification" speed is applied in unloaded cutting, work time can be shortened.

(NOTE) *Any data, if set beyond the range, is considered as data = 1 (x 1: same as cutting.)*

5131	M-code for Rotary Tool Forward Rotation in Canned Cycle for Drilling,	L
	M-code for Spindle Forward Rotation in Canned Cycle for Drilling	M
5132	M-code for Rotary Tool Reverse Rotation in Canned Cycle for Drilling	L
	M-code for Spindle Reverse Rotation in Canned Cycle for Drilling	M
5133	M-code for Rotary Tool Stop in Canned Cycle for Drilling	L
	M-code for Spindle Stop in Canned Cycle for Drilling	M
5134	M-code for Rotary Tool Orientation in Canned Cycle for Drilling	L
	M-code for Spindle Orientation in Canned Cycle for Drilling	M

Data format: Word type

Data range: 0 to 32767

Set M-codes for spindle (rotary tool) forward rotation, reverse rotation, stop, and orientation in the canned cycle for drilling.

(Note) *When "0" is set, it is regarded as follows, respectively.*

No.	Movement	Meaning of Set Value = 0	
		M-system	L-system
5131	Forward	M03	M13
5132	Reverse	M04	M14
5133	Stop	M05	M05
5134	Orientation	M19	M15

5135	Minimum Value for Spindle Index M-code in Canned Cycle for Drilling	L M

5136	Maximum Value for Spindle Index M-code in Canned Cycle for Drilling	L M

Data format: Word type

Data range: 0 to 32767

When using a spindle index M-code in a canned cycle for drilling (Parameter 5100, #4 (HSIM) = 1), set the minimum and maximum values for the spindle index M-code.

If the spindle index M-code is specified in the canned cycle for drilling, drilling will be performed like when an axis command is given. (This is used when the C-axis is not provided and you want to perform drilling every time the spindle is indexed.)

5145	Retract Amount for Multiple Repetitive Cycle (G71/G72)	L M

5146	Clearance Amount for Multiple Repetitive Cycle (G71/G72)	L M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a retract amount and clearance amount a multiple repetitive cycle (G71/G72). The clearance amount is used for the Type-2 profile.

5147	Return Amount for Multiple Repetitive Cycle (G74/G75)	L M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a return amount for a multiple repetitive cycle (G74/G75).

5148	Minimum Depth of Cut for Multiple Repetitive Cycle (G76)	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a minimum depth of cut for a multiple repetitive cycle (G76).

5149	Finish Allowance Amount for Multiple Repetitive Cycle (G76)	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a finish allowance amount for a multiple repetitive cycle (G76).

5150	Return Amount for Canned Cycle for Drilling (G831)	L
	Return Amount for Canned Cycle for Drilling (G73)	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a return amount for a canned cycle for drilling (M-system: G73, L-system: G831).

5151	Clearance Amount for Canned Cycle for Drilling (G83)

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a clearance amount for a canned cycle for drilling (G83).

5152	Finish Allowance at Side and Hole Bottom for Special Canned Cycle (G322 to G333)	L M
5153	Clearance Amount at Side and Hole Bottom for Special Canned Cycle (G322 to G333)	L M
5154	Corner Override Effective Distance for Special Canned Cycle (G322 to G333)	L M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set sequentially a finish allowance, clearance amount, and corner override effective distance at the side and hole bottom for a special canned cycle (G322 to G333). The following table shows relations between the G-functions and their related parameter numbers.

G-code	Function	Related Parameters		
		No. 5152	No. 5153	No. 5154
G322	Square side outside cutting CW	○	○	×
G323	Square side outside cutting CCW	○	○	×
G324	Square plane cutting	○	×	×
G325	Square plane cutting 1-directional	○	×	×
G326	Square plane cutting 2-directional	○	×	×
G327	Circle inside pocketing	○	○	×
G328	Square inside pocketing	○	○	○
G329	Track inside pocketing	○	○	×
G330	Circle outside pocketing	○	○	×
G331	Square outside pocketing	○	○	○
G332	Track outside pocketing	○	○	×
G333	Circle pocketing	○	○	×

○ : Uset

× : Unuset

5155	Approach Amount at Soft Jaw Forming	L
		M

5156	Retract Amount at Soft Jaw Forming	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set an approach amount and retract amount for forming the soft jaws.

5157		L
	Return Amount of Packing in Direct Tap	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a return amount of pecking in a direct tap cycle.

5158	Speed in High-speed Feed Section of High-speed Machining Cycle (G337 /G305)	L M

Data format: Long type

Unit of data:

	Effective Digits of Speed F for Feed per Minute					Unit
	F60	F60	F60	F60	F60	
Metric programming	1	0.1	0.01			mm/min
Inch orogramming				0.1	0.01	inch/min

Data range: 0 to 99999999

Set the speed moving in the high-speed feed section in the high-speed machining cycle (corner pocket machining cycle (G337/square pocket machining cycle (G338)).

5159	Speed in High-speed Feed Section of Circle Cutting (G302 to G305)	L M

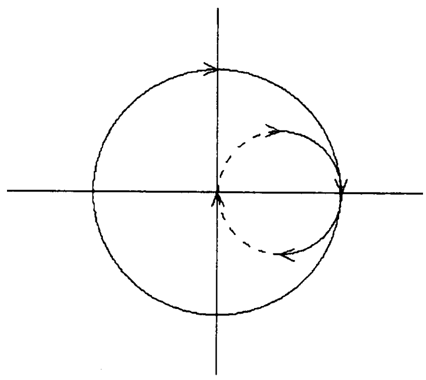
Data format: Long type

Unit of data:

	Effective Digits of Speed F for Feed per Minute					Unit
	F60	F61	F62	F51	F52	
Metric input	1	0.1	0.01			mm/min
Inch input				0.1	0.01	inch/min

Data range: 0 to 99999999

Set a speed for the high-speed feed section of circular interpolation in approach movement of circle cutting (G302 to G305).



- - - - High-speed Feed Section

5160		L
	Maximum Spindle Rpm at Soft Jaw Forming	M

Data format: Long type

Unit of data: rpm

Data range: 0 to 32767

Set a maximum spindle rpm at soft jaw forming time. A value set in this parameter is output as G50 (G92 for the G-code system B or C).

(Note 1) *G50 is not output when the set value is 0.*

(Note 2) *The maximum spindle rpm set for soft jaw forming remains valid even after completion on soft jaw forming. When it differs from a numerical value used in machining, re-set it in the machining program.*

5161		L
	Retract Axis Position for M-system ATC Canned Cycle	M

Data format: Long axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set in machine coordinate system the position of the axis which moves without interfering with the ATC in the M-system ATC canned cycle.

(Note 1) *This parameter is valid only for the axis (parameter no. 5109, #0 (ARTAx) = 1) which retracts without moving to the ATC position (determined by the ATC type) in the ATC canned cycle and whose retract position is optional (parameter no. 5109, #1 (ARTP1x) = 0, #2 (ARTP2) = 0).*

(Note 2) *It is not necessary to set this parameter for the axis which moves to the ATC position at ATC operation time. For which axis moves to the ATC position, see the description of the parameter no. 5109*

(Note 3) *When the retract axis position is specified in the same block as a M06 command, the axis moves according to a program command value, not this parameter.*

5163	Soft Jaw Forming: Jaw Bolt Hole Pitch	L
		M

5164	Soft Jaw Forming: Length from Top of Jaw to Center of Bolt Hole	L
		M

5165	Soft Jaw Forming: Spot Facing Diameter	L
		M

Data format: Long type

Least input increment:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set the "jaw bolt hole pitch," "length from the top of the jaw to the center of the bolt hole," and "spot-facing diameter" used in bolt barrier calculation for soft jaw forming.

5171		L
	X-axis 3rd Reference Point Distance "a" in ATC Canned Cycle for M-system (HS)	M

5172		L
	X-axis 3rd Reference Point Distance "b" in ATC Canned Cycle for M-system (HS)	M

Data format: Long type

Unit of data:

IS-A	IS-B	IS-C	Unit
0.01	0.001	0.0001	mm

Data range: -99999999 to 99999999

Set the X-axis 3rd reference point position used in the ATC canned cycle (G/H type: Model HS) for the M-system, taking the X-axis 2nd reference point as standard.

If the ATC canned cycle is executed, the CNC unit will change the X-axis 3rd reference point position (parameter no. 1227) to the X-axis 2nd reference point position (parameter no. 1226) plus the set value in this parameter, and then, axis move operation in the ATC canned cycle will be performed. (The X-axis moves to the changed 3rd reference point position (parameter no. 1227).) This is done in order to change the X-axis ATC position depending on the tool types to be automatically changed to prevent an interference at the time automatic tool change.

Whether the 3rd reference point distance "a" or "b" should be used is determined as follows depending on the tool types to be automatically changed.

Parameter Used	Spindle Tool Type	Tool Type Called
(a) 5171	Type A	Type A
(b) 5172	Type A	Type B
(c) 5172	Type B	Type A

(Note) *The tool types A and B are defined as follows:*

- *Type A: Standard tools, standard tools (heavy), oil holes, long tools*
- *Type B: Large-diameter tools, U-axis tools, angular tools, special boring bars*

The "no tool" condition is assumed that the "type-A tool" is attached.

5179		L
	M-system ATC Canned Cycle: Raoid Traverse Block Overlap Ratioat at Move to ATC Position	M

5180		L
	M-system ATC Canned Cycle: Raoid Traverse Block Overlap Ratioat at Return from ATC Position	M

Data format: Bit axis type

Unit of data: %

Data range: 0 to 100

Set for each axis a rapid traverse block overlap ratio for when moving and returning from the ATC position in the M-system ATC canned cycle (Model VS/HS).

2.16 Parameters Related to Direct Tap

		#7	#6	#5	#4	#3	#2	#1	#0	
5200		SRS	FHD		DOV	SIG	CRG	VGR	G84	L
			FHD		DOV	SIG	CRG	VGR	G84	M

Data format: Bit type

- G84 Be sure to set "1".
- VGR
  0: Does not use an optional gear ratio between the spindle and position coder in the direct tap mode (Set the gear ratio in the parameter no. 3706)
  1: Use an optional gear ratio between the spindle and position coder in the direct tap cycle (Set the gear ratio in the parameters no. 5221 to no. 5224, no. 5231 to 5234)
- CRG
  0: When a direct tap mode cancellation command (G80, G-code of Group 01, reset, etc.) is given, the direct mode is cancelled after a direct tap mode signal RGTAP is turned to Low
  1: When a direct tap mode cancellation command (G80, G-code of Group 01, reset, etc.) is given, the direct mode is cancelled before a direct tap mode signal RGTAP is turned to Low
- SIG
  0: Disable SIND (G0032/G0033) when changing the gear for the direct tap mode
  1: Enables SIND (G0032/G0033) when changing the gear for the direct tap mode
- DOV
  0: Disables an override at the time of drawing out in the direct tap mode
  1: Enables an override at the time of drawing out in the direct tap mode (Set an override value in the parameter no. 5211)
- FHD
  0: Disables the feed hole and single block functions in the direct tap mode
  1: Enables the feed hold and single block functions in the direct tap mode
- SRS
  0: Uses a spindle selection signal SWS1/SWS2 (G0027 #0/#1) to select the spindle for direct tapping in multispindle control (Used commonly for multispindle control)
  1: Uses a direct tap spindle selection signal RGTSP/RGTSP2 (G0061 #4/#5) to select the spindle for direct tapping in multispindle control (Special signal for direct tapping)

	#7	#6	#5	#4	#3	#2	#1	#0	
5201						TDR			L
						TDR		NIZ	M

Data format: Bit type

- NIZ 0: Does not smoothes direct tapping
  1: Smoothes direct tapping
- TDR 0: In the direct tap mode, the same parameter is used as a cutting time constant in both cutting and drawing out (Parameter no. 5261 to no. 5264)
  1: In the direct tap mode, the different parameters are used as cutting time constants in cutting and drawing out (Parameter no. 5261 to no. 5264 as the time constant for cutting, Parameter no. 5271 to no. 5274 as the time constant for drawing out)

	#7	#6	#5	#4	#3	#2	#1	#0	
5202									L
								ORI	M

Data format: Bit type

- ORI 0: Does not perform spindle orientation when starting direct tapping
  1: Performs spindle orientation when starting direct tapping

(Note) *This parameter is valid only for the serial spindle.*

	#7	#6	#5	#4	#3	#2	#1	#0	
5203									L
							HRM	HRG	M

Data format: Bit type

- HRG 0: Disables direct tapping by the manual handle.
  1: Enables direct tapping by the manual handle.
- HRM Whe the tapping axis moves in the minus direction in direct tapping by the manual handle;
  0: The spindle rotates in the forward direction in the G841 mode and in the reverse direction in the G741 mode, respectively.
  1: The spindle rotates in the reverse direction in the G841 mode and in the forward direction in the G741 mode, respectively.

	#7	#6	#5	#4	#3	#2	#1	#0	
5204								DGN	M

Data format: Bit type

- DGN 0: Displays a direct tap synchronous error in the DIAGNOSE screen

(No. 455 to no. 457)

1: Displays a difference in error amount between the spindle and tapping axis in the DIAGNOSE screen (No. 452 to no. 453)

5210	Direct Tap Mode Commanding M-code

Data format: Byte type

Data range: 0 to 255

Set a direct tap mode commanding M-code.

(Note 1) *In the M-system, a set value of 0 is regarded as 21 (M21). In the L-system, a set value is output as it is.*

(Note 2) *In case of the M-system, the direct tap mode commanding method can be selected by means of the parameter no. 3409, #0 (DTCP) or #2 (MDCP).*

When the S-M II system is selected, specify the direct tap mode by a G-code (G74/G84) after specifying the M-code set in this parameter.

(Note 3) *Even when no M-code is given as a direct tap command, the M-code set in this parameter is generated inside the NC unit and output to the machine.*

5211	Override Value for Drawing out Direct Tap

Data format: Byte type

Unit of data: %

Data range: 0 to 200

Set an override value for drawing out the direct tap.

(Note) *This parameter is valid when "1" is set in the parameter no. 5200, #4 (DOV).*

5214	Setting of Direct Tap Synchronous Error Width

Data format: Word type

Unit of data: Unit of detection

Data range: 0 to 32767

Set a synchronous error width allowable range in the direct tap mode. When the synchronous error width exceeds the set value of this parameter, it results in a servo alarm no. 411 for the tapping axis (error excessive in move).

5221	Number of Gear Teeth on Spindle Side in Direct Tap Mode (1st Gear)
5222	Number of Gear Teeth on Spindle Side in Direct Tap Mode (2nd Gear)
5223	Number of Gear Teeth on Spindle Side in Direct Tap Mode (3rd Gear)

5224	Number of Gear Teeth on Spindle Side in Direct Tap Mode (4th Gear)	L
		M

Data format: Word type

Data range: 1 to 32767

Set for each gear the number of gear teeth on the spindle side at optional gear ratio in the direct tap mode.

(Note) *These parameters are valid when "1" is set in the parameter no. 5200, #1 (VGR). When the position coder is attached to the spindle, set the same value in the parameters no. 5221 through no. 5224.*

5231	Number of Gear Teeth on Position Coder Side in Direct Tap Mode (1st Gear)	
5232	Number of Gear Teeth on Position Coder Side in Direct Tap Mode (2nd Gear)	
5233	Number of Gear Teeth on Position Coder Side in Direct Tap Mode (3rd Gear)	
5234	Number of Gear Teeth on Position Coder Side in Direct Tap Mode (4th Gear)	L
		M

Data format: Word type

Data range: 1 to 32767

Set for each gear the number of gear teeth on the position coder side at optional gear ratio in the direct tap mode.

(Note) *These parameters are valid when "1" is set in the parameter no. 5200, #1 (VGR). When the position coder is attached to the spindle, set the same value in the parameter no. 5231 through no. 5234.*

When it comes to the spindle motor with an incorporated position coder, there is the position coder of 2,048 pulses/rev. In this case, set a value doble the actual number of teeth. (In order to convert into 4,096 pulses/rev.)

5241	Maximum Spindle Rpm in Direct Tap Mode (1st Gar)	
5242	Maximum Spindle Rpm in Direct Tap Mode (2nd Gar)	
5243	Maximum Spindle Rpm in Direct Tap Mode (3rd Gar)	
5244	Maximum Spindle Rpm in Direct Tap Mode (3rd Gar)	L
		M

Data format: Long type

Unit of data: rpm

Data range: Spindle to position coder ratio

1 : 1 → 0 ~ 7400

1 : 2 → 0 ~ 9999

1 : 4 → 0 ~ 9999

1 : 8 → 0 ~ 9999

Set the maximum spindle rpm in the direct tap mode.

(Note) *In the system with the 1st gear, set the same value as the parameter no. 5241 in the parameter no. 5243. In the system with the 2nd gear, set the same value as the parameter no. 5242 in the parameter no. 5243. Otherwise, a P/S alarm no. 2000 will occur. These are applied to the M-system.*

5261	Acceleration/Deceleration Time Constant for Each Gear in Direct Tap (1st Gear)	
5262	Acceleration/Deceleration Time Constant for Each Gear in Direct Tap (2nd Gear)	
5263	Acceleration/Deceleration Time Constant for Each Gear in Direct Tap (3rd Gear)	
5264	Acceleration/Deceleration Time Constant for Each Gear in Direct Tap (4th Gear)	L
		M

Data format: Word type

Unit of data: msec.

Data range: 0 to 4000

Set the linear acceleration/deceleration time constant for the spindle and tapping axis for each gear in the direct tap mode. Set a time required to reach the maximum spindle rpm (parameter no. 5241 onward). An actual time constant is a proportional value of the maximum spindle rpm and specified S.

5271	Acceleration/Deceleration Time Constant for Drawing out Direct Tap (1st Gear)	
5272	Acceleration/Deceleration Time Constant for Drawing out Direct Tap (2nd Gear)	
5273	Acceleration/Deceleration Time Constant for Drawing out Direct Tap (3rd Gear)	
5274	Acceleration/Deceleration Time Constant for Drawing out Direct Tap (4th Gear)	L
		M

Data format: Word type

Unit of data: msec.

Data range: 0 to 4000

Set the linear acceleration/deceleration time constant for the spindle and tapping axis for each gear at the time of drawing out the direct tap.

(Note) *This parameter is valid when "1" is set in the parameter no. 5201, #2 (TDR).*

5280	Position Control Loop Gain for Spindle and Tapping Axis in Direct Tap Mode (Common to Each Gear)

Data format: Word type

Unit of data: 0.01 $sec.^{-1}$

Data range: 1 to 9999

Set the position control loop gain for the spindle and tapping axis in the direct tap mode. It has a great effect on thread accuracy. Adjusting it to a loop gain multiplier, carry out a cutting test to adjust to an optimum value.

(Note) *When you want to change the loop gain for each gear, set "0" in this parameter and set the loop gain for each gear in the parameter no. 5281 through no. 5284. Unless this parameter has "0", the loop gain for each becomes invalid and the value set in this parameter becomes the loop gain common to all the gears.*

5281	Position Control Loop Gain for Spindle and Tapping Axis in Direct Tap Mode (1st Gear)	
5282	Position Control Loop Gain for Spindle and Tapping Axis in Direct Tap Mode (2nd Gear)	
5283	Position Control Loop Gain for Spindle and Tapping Axis in Direct Tap Mode (3rd Gear)	
5284	Position Control Loop Gain for Spindle and Tapping Axis in Direct Tap Mode (4th Gear)	L
		M

Data format: Word type

Unit of data: 0.01 $sec.^{-1}$

Data range: 1 to 9999

Set for each gear the position control loop gain for the spindle and tapping axis in the direct tap.

(Note) *When setting the loop gain for each gear, set "0" in the parameter no. 5280.*

5291	Loop Gain Multiplier for Spindle in Direct Tap (1st Gear)	
5292	Loop Gain Multiplier for Spindle in Direct Tap (2nd Gear)	
5293	Loop Gain Multiplier for Spindle in Direct Tap (3rd Gear)	
5294	Loop Gain Multiplier for Spindle in Direct Tap (4th Gear)	L
		M

Data format: Word type

Data range: 0 to 32767

Set the loop gain multiplier for the spindle for each gear in the direct tap mode. It has a great effect on thread accuracy. Adjusting it to the loop gain, carry out a cutting test to finely adjust an optimum value.

(Note) *This is a parameter for the analog spindle.*

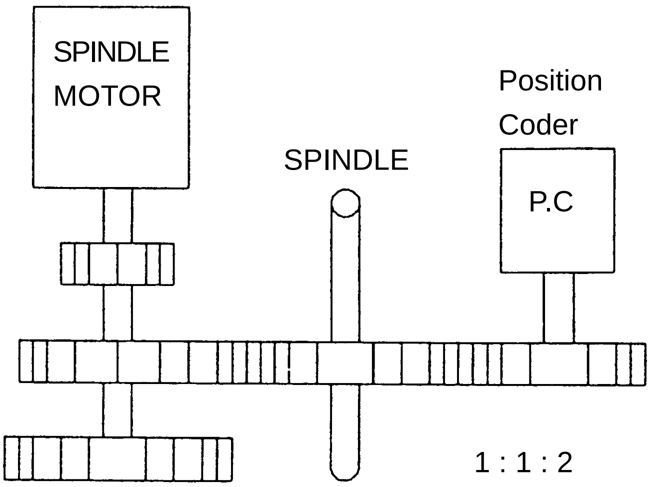
Loop gain multiplier = 2,048 x E/L x $\boldsymbol{\alpha}$ *x 1,000*

E: Speed command voltage at 1,000 rpm

L: Spindle rotating angle for each rotation of the spindle motor

$\boldsymbol{\alpha}$ *: Unit of detection*

(Calculation Formula)



In the configuration shown on the left;

E = 1.667 (V)
(6,000 rpm motor at 10 (V))

L = 360°
(As the spindle motor rotates once, the spindle rotates once)

α = La/4096
= 720°/4096
= 0.17578°

La = 720°
(For the position coder to rotate once, the spindle must rotate twice; 3600 x 2)

4096 = Detection pulses for each rotation of the position coder

◎ The following shows relations with a spindle to position coder gear ratio:

1 : 1 ---- 0.08789 deg
1 : 2 ---- 0.17578 deg
1 : 4 ---- 0.35156 deg
1 : 8 ---- 0.70313 deg

From the relations above, the loop gain multiplier will be as follows:

Loop gain multiplier = 2,048 x 1.667 x 360 x 0.17578 x 1,000

= 1,667

(Note) *When the spindle motor incorporates the position coder of 512 pulses/rev., the* *unit of detection is;*

α *= La/2,048*

5300	In-position Width for Tapping Axis in Direct Tap Mode

Data format: Word type

Unit of data: Unit of detection

Data range: 1 to 32767

Set the in-position width for the tapping axis in the direct tap mode.

5301	In-position Width for Spindle in Direct Tap Mode

Data format: Word type

Unit of data: Unit of detection

Data range: 1 to 32767

Set the in-position width for the spindle in the direct tap mode.

(Note) *Too large a value will worsen thread accuracy.*

5310	Tapping Axis Moving Position Deviation Amount Limit Value in Direct Tap Mode

Data format: Word type

Unit of data: Unit of detection

Data range: 1 to 32767

Set a tapping axis moving position deviation amount limit value in the direct tap mode. When setting the data beyond this data range, set it in the parameter no. 5314.

(Note) *When using a high-resolution detector, the unit of detection is 10 times higher.*

5311	Spindle Moving Position Deviation Amount Limit Value in Direct Tap Mode

Data format: Word type

Unit of data: Unit of detection

Data range: 1 to 32767

Set a spindle moving position deviation amount limit value in the direct tap mode.

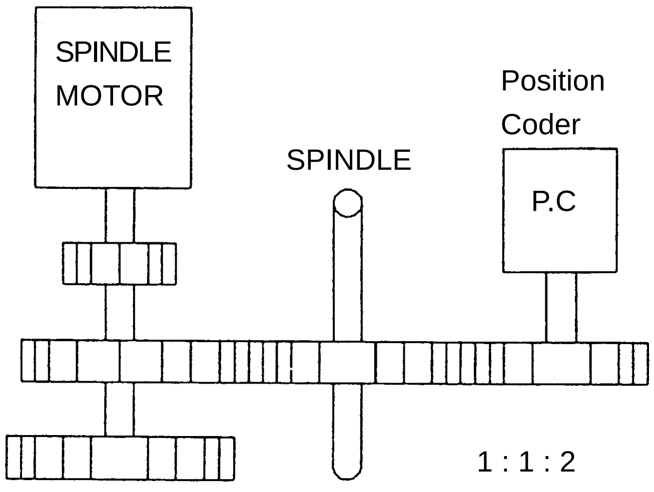
$$\text{Calculation formula} = \frac{S \times 360 \times 100 \times 1.5}{60 \times G \times \alpha}$$

S: Maximum spindle rpm for direct tapping (Set value in the parameter no. 5241 onward)

G: Loop gain for the direct tapping axis (Set value in the parameters no. 5280 onward)

α : Unit of detection

(Calculation Formula)



In the configuration shown on the left;

S = 3600

G = 3000

L = 360° (As the spindle motor rotates once, the spindle rotates once)

La = 7200 (For the position coder to rotate once, the spindle must rotate twice; 3600 x 2)

4096 = Detection pulses for each rotation of the position coder

$$\text{Set value } = \frac{3600 \times 360 \times 100 \times 1.5}{60 \times 3000 \times 0.17578}$$

$$= 6144$$

(Note) *When the spindle motor incorporates the position coder of 512 pulses/rev., the unit of detection is;*

α = La/2,048

5312	Tapping Axis Stopping Position Deviation Amount Limit Value in Direct Tap

Data format: Word type

Unit of data: Unit of detection

Data range: 1 to 32767

Set a tapping axis stopping position deviation amount limit value in the direct tap mode.

5313	Spindle Stopping Position Deviation Amount Limit Value in Direct Tap

Data format: Word type

Unit of data: Unit of detection

Data range: 1 to 32767

Set a spindle stopping position deviation amount limit value in the direct tap mode.

5314	Tapping Axis Moving Position Deviation Amount Limit Value in Direct Tap

Data format: Long type

Unit of data: Unit of detection

Data range: 0 to 99999999

A tapping axis moving position deviation amount limit value in the direct tap mode is normally set in the parameter no. 5310. When you want to set a value exceeding the setting range of the parameter no. 5310, set it in this parameter.

(Note) *When a value of 0 is set in this parameter, setting of the parameter no. 5310 becomes valid. When a value other than 0 is set in this parameter, the parameter no. 5310 becomes invalid and this parameter becomes valid.*

5321	Spindle Backlash Amount in Direct Tap Mode (1st Gear)	L
	Spindle Backlash Amount in Direct Tap Mode	M
5322	Spindle Backlash Amount in Direct Tap Mode (2nd Gear)	L
		M
5323	Spindle Backlash Amount in Direct Tap Mode (3rd Gear)	L
		M
5324	Spindle Backlash Amount in Direct Tap Mode (4th Gear)	L
		M

Data format: Byte type

Unit of data: Unit of detection

Data range: 0 to 127

Set a spindle backlash amount in the direct tap mode.

2.17 Parameters Related to Custom Macro

	#7	#6	#5	#4	#3	#2	#1	#0
6000	PRT	EMP	LVCON	CVA		BCS	SCS	TCS

Data format: Bit type

- TCS 0: Does not call a subprogram by a T-code
  1: Calls a subprogram by a T-code
- SCS 0: Does not call a subprogram by a S-code
  1: Calls a subprogram by a S-code
- BCS 0: Does not call a subprogram by a 2nd miscellaneous function code
  1: Calls a subprogram by a 2nd miscellaneous function code
- CVA 0: Activates an ADP function
  1: Does not activates an ADP function
- LVCON 0: Takes over a local variable by a macro modal call
  1: Does not take over a local variable by a macro modal call
- EMP 0: Does not add % to the beginning and end of the external output command data
  1: Adds % to the beginning and end of the external output command data
- PRT 0: Leading zero outputs a space by DPRNT or PRINT
  1: Leading zero outputs nothing by DPRNT or PRINT

	#7	#6	#5	#4	#3	#2	#1	#0	
6001									L
				MC12	MC11		TSE	MCSB	M

Data format: Bit type

- MCSC 0: The interrupt type custom macro calling method is subprogram call.
  1: The interrupt type custom macro calling method is macro call.
- TSE 0: The interrupt type custom macro interupt signal is detected by the status trigger method.
  1: The interrupt type custom macro interupt signal is detected by the edge trigger method (at the rise).

MCI1,MCI2 Selection of the interrupt type macro interrupt type

MC12	MC11	Interrupt type
0	0	Type 1
0	1	Type 2
1	0	Type 3
1	1	Type 3

	#7	#6	#5	#4	#3	#2	#1	#0	
6003							MTLF	YST	L
									M

Data format: Bit type

- YST
  - 0: When the Y-axis is not available, system variable (#2001 to #3199) number assignment for tool offset amount is Type-I.
  - 1: When the Y-axis is not available, system variable (#2001 to #3199) number assignment for tool offset amount is Type-II (same as when the Y-axis is available).
- MTLF
  - 0: Reflects a spare tool in the system variable #4120/4320.
  - 1: Does not reflect a spare tool in the system variable #4120/4320.

	#7	#6	#5	#4	#3	#2	#1	#0
6004								
6005								
6006								
6007								
6008								
6009								
6010								
6011								

Data format: Byte type

Set an EIA code representing a special character in the form of bit pattern.

No. 6004: Bit pattern for the EIA code representing "["

No. 6005: Bit pattern for the EIA code representing "]"

No. 6006: Bit pattern for the EIA code representing "#"

No. 6007: Bit pattern for the EIA code representing "*"

No. 6008: Bit pattern for the EIA code representing "="

No. 6009: Bit pattern for the EIA code representing "?"

No. 6010: Bit pattern for the EIA code representing "@"

No. 6011: Bit pattern for the EIA code representing "&"

	#7	#6	#5	#4	#3	#2	#1	#0
6012			UGB	UGS	UGT	UGM2	UGM1	UGG

Data format: Bit type

- UGG
  - 0: Allows another G-code macro call during a G-code macro call

1: Does not allow another G-code macro call during a G-code macro call

- UGM1 0: Allows a G-code macro call during an M-code macro call
  1: Does not allow a G-code macro call during an M-code macro call
- UGM2 0: Allows a G-code macro call during an M-code subprogram call
  1: Does not allow a G-code macro call during an M-code subprogram call
- UGT 0: Allows a G-code macro call during a T-code subprogram call
  1: Does not allow a G-code macro call during a T-code subprogram call
- UGS 0: Allows a G-code macro call during an S-code subprogram call
  1: Does not allow a G-code macro call during an S-code subprogram call
- UGB 0: Allows a G-code macro call during a 2nd miscellaneous function code subprogram call
  1: Does not allow a G-code macro call during a 2nd miscellaneous function code subprogram call

	#7	#6	#5	#4	#3	#2	#1	#0
6013			M1B	M1S	M1T	M1M2	M1M1	M1G

Data format: Bit type

- M1G 0: Allows an M-code macro call during a G-code macro call
  1: Does not allow an M-code macro call during a G-code macro call
- M1M1 0: Allows another M-code macro call during an M-code macro call
  1: Does not allow another M-code macro call during an M-code macro call
- M1M2 0: Allows an M-code macro call during an M-code subprogram call
  1: Does not allow an M-code macro call during an M-code subprogram call
- M1T 0: Allows an M-code macro call during a T-code subprogram call
  1: Does not allow an M-code macro call during a T-code subprogram call
- M1S 0: Allows an M-code macro call during an S-code subprogram call
  1: Does not allow an M-code macro call during an S-code subprogram call
- M1B 0: Allows an M-code macro call during a 2nd miscellaneous function code subprogram call
  1: Does not allow an M-code macro call during a 2nd miscellaneous function code subprogram call

	#7	#6	#5	#4	#3	#2	#1	#0
6014			M2B	M2S	M2T	M2M2	M2M1	M2G

Data format: Bit type

- M2G 0: Allows an M-code subprogram call during a G-code macro call
  1: Does not allow an M-code subprogram call during a G-code macro call

- M2M1 0: Allows an M-code subprogram call during an M-code macro call
  1: Does not allow an M-code subprogram call during an M-code macro call
- M2M2 0: Allows an M-code subprogram call during an M-code subprogram call
  1: Does not allow another M-code subprogram call during an M-code subprogram call
- M2T 0: Allows an M-code subprogram call during a T-code subprogram call
  1: Does not allow an M-code subprogram call during a T-code subprogram call
- M2S 0: Allows an M-code subprogram call during an S-code subprogram call
  1: Does not allow an M-code subprogram call during an S-code subprogram call
- M2B 0: Allows an M-code subprogram call during a 2nd miscellaneous function code subprogram call
  1: Does not allow an M-code subprogram call during a 2nd miscellaneous function code subprogram call

	#7	#6	#5	#4	#3	#2	#1	#0
6015			TSB	TSS	TST	TSM2	TSM1	TSG

Data format: Bit type

- TSG 0: Allows a T-code subprogram call during a G-code macro call
  1: Does not allow a T-code subprogram call during a G-code macro call
- TSM1 0: Allows a T-code subprogram call during an M-code macro call
  1: Does not allow a T-code subprogram call during an M-code macro call
- TSM2 0: Allows a T-code subprogram call during an M-code subprogram call
  1: Does not allow a T-code subprogram call during an M-code subprogram call
- TST 0: Allows another T-code subprogram call during a T-code subprogram call
  1: Does not allow another T-code subprogram call during a T-code subprogram call
- TSS 0: Allows a T-code subprogram call during an S-code subprogram call
  1: Does not allow a T-code subprogram call during an S-code subprogram call
- TSB 0: Allows a T-code subprogram call during a 2nd miscellaneous function code subprogram call

1: Does not allow a T-code subprogram call during a 2nd miscellaneous function code subprogram call

	#7	#6	#5	#4	#3	#2	#1	#0
6016			SSB	SSS	SST	SSM2	SSM1	SSG

Data format: Bit type

- SSG 0: Allows an S-code subprogram call during a G-code macro call
  1: Does not allow an S-code subprogram call during a G-code macro call
- SSM1 0: Allows an S-code subprogram call during an M-code macro call
  1: Does not allow an S-code subprogram call during an M-code macro call
- SSM2 0: Allows an S-code subprogram call during an M-code subprogram call
  1: Does not allow an S-code subprogram call during an M-code subprogram call
- SST 0: Allows an S-code subprogram call during a T-code subprogram call
  1: Does not allow an S-code subprogram call during a T-code subprogram call
- SSS 0: Allows another S-code subprogram call during an S-code subprogram call
  1: Does not allow another S-code subprogram call during an S-code subprogram call
- SSB 0: Allows an S-code subprogram call during a 2nd miscellaneous function code subprogram call
  1: Does not allow an S-code subprogram call during a 2nd miscellaneous function code subprogram call

	#7	#6	#5	#4	#3	#2	#1	#0
6017			BSB	BSS	BST	BSM2	BSM1	BSG

Data format: Bit type

- BSG 0: Allows a 2nd miscellaneous function code subprogram call during a G-code macro call
  1: Does not allow a 2nd miscellaneous function code subprogram call during a G-code macro call
- BSM1 0: Allows a 2nd miscellaneous function code subprogram call during an M-code macro call
  1: Does not allow a 2nd miscellaneous function code subprogram call during an M-code macro call
- BSM2 0: Allows a 2nd miscellaneous function code subprogram call during an M-code subprogram call

1: Does not allow a 2nd miscellaneous function code subprogram call during an M-code subprogram call

- BST 0: Allows a 2nd miscellaneous function code subprogram call during a T-code subprogram call

  1: Does not allow a 2nd miscellaneous function code subprogram call during a T-code subprogram call
- BSS 0: Allows a 2nd miscellaneous function code subprogram call during an S-code subprogram call

  1: Does not allow a 2nd miscellaneous function code subprogram call during an S-code subprogram call
- BSB 0: Allows another 2nd miscellaneous function code subprogram call during a 2nd miscellaneous function code subprogram call

  1: Does not allow another 2nd miscellaneous function code subprogram call during a 2nd miscellaneous function code subprogram call

6030	G-code Which Performs O9010 Macro Call
6031	G-code Which Performs O9011 Macro Call
6032	G-code Which Performs O9012 Macro Call
6033	G-code Which Performs O9013 Macro Call
6034	G-code Which Performs O9014 Macro Call
6035	G-code Which Performs O9015 Macro Call
6036	G-code Which Performs O9016 Macro Call
6037	G-code Which Performs O9017 Macro Call
6038	G-code Which Performs O9018 Macro Call
6039	G-code Which Performs O9019 Macro Call

Data format: Word type

Data range: -9999 to 9999

Set G-codes which perform a macro call on the programs numbered O9010 to O9019, respectively.

(Note 1) *Calling operation differs depending on the set data (value).*

- *Set data = 0 ----- Does not make a macro call*
- *Set data > 1 ----- Performs a macro simple call*
- *Set data < 0 ----- Performs a macro modal call*

(Note 2) *Do not set the G-codes used in the CNC unit. If they are set, they will make a macro call and will not work as normal G-functions.*

6041	M-code Which Performs O9001 Subprogram Call
6042	G-code Which Performs O9002 Subprogram Call
6043	G-code Which Performs O9003 Subprogram Call
6044	G-code Which Performs O9004 Subprogram Call
6045	G-code Which Performs O9005 Subprogram Call
6046	G-code Which Performs O9006 Subprogram Call
6047	G-code Which Performs O9007 Subprogram Call
6048	G-code Which Performs O9008 Subprogram Call
6049	G-code Which Performs O9009 Subprogram Call

Data format: Word type

Data range: 0 to 32767

Set M-codes which perform a subprogram call on the programs numbered O9001 to O9009

(Note) *A set value of 0 does not perform a subprogram call.*

6050	M-code Which Performs O9020 Macro Call
6051	M-code Which Performs O9021 Macro Call
6052	M-code Which Performs O9022 Macro Call
6053	M-code Which Performs O9023 Macro Call
6054	M-code Which Performs O9024 Macro Call
6055	M-code Which Performs O9025 Macro Call
6056	M-code Which Performs O9026 Macro Call
6057	M-code Which Performs O9027 Macro Call
6058	M-code Which Performs O9028 Macro Call
6059	M-code Which Performs O9029 Macro Call

Data format: Word type

Data range: 0 to 32767

Set M-codes which perform a macro call on the programs numbered O9020 to O9029.

(Note) *A set value of 0 does not perform a macro call.*

6070		L
	M-code Which Enables Custom Macro Interrupt	M

6071		L
	M-code Which Disables Custom Macro Interrupt	M

Data format: Word type

Data range: 0 to 32767

Set an M-code which enables/disables a custom macro interrupt.

(Note) *It is regarded as 96 (M96) when "0" is set in the parameter no. 6070, and as 97 (M97) when "0" is set in the parameter no. 6071.*

2.18 Parameters Related to Skip Function

	#7	#6	#5	#4	#3	#2	#1	#0	
6200	SKF	SRE		HSS			SKO		L
	SKF	SRE		HSS			SKO		M

Data format: Bit type

- SKO 0: Assumes that a signal is input (skip) when a skip signal SKIP (X008, #7) is "1"
  1: Assumes that a signal is input (skip) when a skip signal SKIP (X008, #7) is "0"
- HSS 0: Does not use a high-speed skip signal in the skip function
  1: Uses a high-speed skip signal in the skip function
- SRE 0: Assumes that a signal is input at a rise (0 → 1) when the high-speed skip signal is used
  1: Assumes that a signal is input at a fall (1 → 0) when the high-speed skip signal is used
- SKF 0: Disables automatic acceleration/deceleration to a G31 skip command
  1: Enables automatic acceleration/deceleration to a G31 skip command

	#7	#6	#5	#4	#3	#2	#1	#0	
6201				IGX	TSA	TSE	SEB	SEA	L
				IGX			SEB	SEA	M

Data format: Bit type

- SEA, SEB Setting of whether acceleration/deceleration and servo delay amount should be considered when the skip signal is turned on in the high-speed skip function

SEB	SEA	Whether to Consider Delay Amount
0	0	Does not consider it
0	1	Considers and compensates it (Type A)
1	0	Considers and compensates it (Type B)

(Note) *There are two ways to compensation; Type A and Type B. The skip function memories the then current position inside the NC unit by the skip signal. Since the current position in the NC contains a delay amount of the servo system, it is dislocated from the machine position by the delay amount of the servo system. This dislocation amount can be calculated by a position deviation amount on the part of the servo system and an* *accumulation amount by feed rate acceleration/deceleration performed in the NC unit. If this dislocation amount is taken into consideration, it will not be necessary to include the delay amount of the servo system in a measurement error.*

This dislocation amount can be compensated in the following two ways depending on parameter setting.

① Type A: A value calculated from a cutting time constant and servo time constant (loop gain) is assumed to be the dislocation amount.

② Type B: The accumulation amount and position deviations is assumed to be the dislocation amount, when the skip signal is turned on.

• TSE In the skip function by a torque limit reach signal, the skip position stored in a system variable is;

0: Position compensated considering the delay amount of the servo system (position deviation amount)

... A servo error amount is pulled back

1: Position not considering the delay amount of the servo system

... A servo error amount is not pulled back.

(Note) *In the skip function by the torque limit reach signal, the then current position is stored in the NC unit by the torque limit reach signal being turned on. Since the current position in the NC unit contains a delay amount of the servo system, it is dislocated from the machine position by the delay amount of the servo system. This dislocation amount can be calculated by the position deviation amount on the part of the servo system.*

When TSE is "0", the skip position is the current position subtracted by the position deviation amount. When TSE is "1", the current position (including a delay of the servo system) is assumed to be the skip position, without considering the dislocation amount corresponding to the position deviation amount.

• TSA 0: In the skip function by the torque limit reach signal, all the axes are monitored whether they have reached the torque limit

1: In the skip function by the torque limit reach signal, only the axes specified in the same block as G31 is monitored whether it has reached the torque limit

• IGX 0: Enables SKIP (X008, #7) as a skip signal when using the high-speed skip function

1: Disables SKIP (X008, #7) as a skip signal when using the high-speed skip function

	#7	#6	#5	#4	#3	#2	#1	#0
6202	1S8	1S7	1S6	1S5	1S4	1S3	1S2	1S1

Data format: Bit type

- 1S1 to 1S8 Set which high-speed skip signal is to be enabled to a G31 skip command.
  0: Disables a high-speed skip signal to the bits.
  1: Enables a high-speed skip signal to the bits.
  The following shows relations between each bit and signal.

Bit	1S8	1S7	1S6	1S5	1S4	1S3	1S2	1S1
Signal	HDI7	HDI6	HDI5	HDI4	HDI3	HDI2	HDI1	HDI0

	#7	#6	#5	#4	#3	#2	#1	#0
6207								IOC

Data format: Bit type [Valid for the **Σ** 10]

- IOC 0: A high-speed skip input signal HDIn uses the Option- 2 board
  1: A high-speed skip input signal HDIn uses the I/O card

2.19 Parameters Related to Measurement

		#7	#6	#5	#4	#3	#2	#1	#0	
6240		TSB	TPR	NGC	MNG	TSF	WMG	MS2	MS1	L
										M

Data format: Bit type

• MS1, MS2 Select machine external measurement data.

MS2	MS1	Measurement Data
0	0	Judgment value output
0	1	Error value output
1	0	Measured value output

• WMG 0: Disables wear management for machine external measurement
1: Enables wear management for machine external measurement

• TSF 0: Disables qualitative compensation for machine external measurement
1: Enables qualitative compensation for machine external measurement

• MNG 0: When judging machine external measurement work, a range of -OK to +OK is assumed good
1: When judging machine external measurement work, a range of --NG to ++NG is assumed no good

• NGC 0: Does not clear the current ++NG/--NG value at the time of tool offset for machine external measurement
1: Clears the current ++NG/--NG value at the time of tool offset for machine external measurement

• TPR 0: Disables an output when the machine external measurement special specification is valid (parameter no. 6241, #7 (TSB) = 1)
1: Enables an output when the machine external measurement special specification is valid (parameter no. 6241, #7 (TSB) = 1)

• TSB 0: The machine external measurement special specification is invalid
1: The machine external measurement special specification is valid

		#7	#6	#5	#4	#3	#2	#1	#0	
6241								NTC	PCL	L
										M

Data format: Bit type

• PCL 0: Does not clear the number of remaining pass times for machine external measurement by reset.
1: Clears the number of remaining pass times for machine external measurement by reset.

• NTC 0: Does not clear the counter when the tool specified by G194 is unused.
1: Clears the counter when the tool specified by G194 is unused.

		#7	#6	#5	#4	#3	#2	#1	#0	
6242										L
		5FWST	ESR2P	TSPRM	HDMD	THOP	NOJP	CSLMN	EXOF	M

Data format: Bit type

- EXOF 0: Does not consider an external work zero point offset amount at the time of work setter measurement or when selecting "F5: SET COORDINATE DATA" in the Work Coordinate screen.

  1: Considers an external work zero point offset amount at the time of work setter measurement or when selecting "F5: SET COORDINATE DATA" in the Work Coordinate screen.

  (Note) *Set this parameter to "1" when external work zero point offset is being used for thermal displacement compensation.*

- CSLMN 0: The cursor of the work checker moves automatically

  1: The cursor of the work checker is operated manually

- NOJP 0: When the tool setter is selected, the cursor moves automatically to the tool offset value of the spindle tool number

  1: When the tool setter is selected, the cursor does not move to the tool offset value of the spindle tool number

- THOF 0: Does not consider a thermal displacement work zero point offset amount at the time of work setter measurement or when selecting "F5: SET COORDINATE DATA" in the Work Coordinate screen.

  1: Considers a thermal displacement work zero point offset amount at the time of work setter measurement or when selecting "F5: SET COORDINATE DATA" in the Work Coordinate screen.

  (Note) *Set this parameter to "1" when thermal displacement work zero point offset is being used for thermal displacement compensation.*

- HDMD 0: Disables the tool length/tool diameter measurement mode for the tool setter

  1: Enables the tool length/tool diameter measurement mode for the tool setter

  (Note) *Setting "1" in this parameter determines whether the tool length or tool diameter is to be measured depending on the cursor position (tool length/ tool diameter) in the TOOL OFFSET screen. When operation does not comply with the cursor position, an alarm occurs.*

- TSPRM 0: When measuring a reference gauge position with the tool setter, the parameters no. 6252 to no. 6255 are used for a touch probe (reference tool) dimension

1: When measuring a reference gauge position with the tool setter, the parameters no. 6260 to no. 6263 are used for a touch probe (reference tool) dimension

(Note) *When the touch probe is not available for reasons of the machine, set "1" in this parameter and make measurement with a reference tool.*

- ESR2P 0: Does not rewrite a work offset in point-to-point measurement of the work setter (coordinate correction)
  1: Rewriters a work offset in point-to-point measurement of the work setter (coordinate correction)
- 5FWST 0: Disables the W-setter available for the 5-face machining system
  1: Enables the W-setter available for the 5-face machining system

	#7	#6	#5	#4	#3	#2	#1	#0	
6243									L
	TOFM				MOM1	SGCK	SPOS	SGROO	M

Data format: Bit type

- SGR00 The "G00 Z_;" block measured by safety guard (comparison) operation is;
  0: Only the first one after a tool change
  1: All
- SPOS The measurement position Z displayed on the CRT by safety guard operation is;
  0: Difference between a command value and measured value
  1: Measured value
- SGCK 0: Does not move the Z-axis to the 2nd reference point when starting safety guard (comparison) operation
  1: Moves the Z-axis to the 2nd reference point when starting safety guard (comparison) operation
- MOM1 0: Executed M00/M01 by safety guard (tool length) operation
  1: Ignores M00/M01 by safety guard (tool length) operation
- TOFM 0: When the measured result is a minus value in tool length measurement with the tool setter, it is set as a plus value. (Absolute Value)
  1: When the measured result is a minus value in tool length measurement with the tool setter, it is set as a minus value as it is.

	#7	#6	#5	#4	#3	#2	#1	#0	
6244	QDC	QNC	QTI	QRA	QDR	QTM	QBR	QTL	L
									M

Data format: Bit type

- QTL 0: Disables a Q-setter tool nose point interlock
  1: Enables a Q-setter tool nose point interlock
- QBR 0: Disables a Q-setter barrier check
  1: Enables a Q-setter barrier check
- QTM 0: Enables a touch signal check by Q-setter repeat operation.
  1: Disables a touch signal check by Q-setter repeat operation.
- QDR 0: Does not make sure of closing of the door in Q-setter repeat operation.
  1: Makes sure of closing of the door in Q-setter repeat operation.
- QRA In Q-setter repeat work, the nose R compensation amount is:
  0: Not taken into account.
  1: Taken into account
- QTI In Q-setter repeat, rotary tool:
  0: Cannot be measured. (Alarm No. 749)
  1: Can be measured.
- QNC 0: Does not check with the Q-setter whether the tool number matches the cursor position.
  1: Checks with the Q-setter whether the tool number matches the cursor position. (Alarm No. 719 when not matching)
- QDC 0: Does not check whether the difference between the offset amount measured with the Q-setter and that prior to measurement is within a certain range.
  1: Checks whether the difference between the offset amount measured with the Q-setter and that prior to measurement is within a certain range. (Set the tolerance in the parameter No. 6264. Alarm No. 709 when beyond the range)

	#7	#6	#5	#4	#3	#2	#1	#0	
6245								QOT2N	L
									M

Data format: Bit type

- Q0T2N 0: Does not use the function which overrides stored stroke limit-2 in the Q-setter mode.
  1: Uses the function which overrides wtored stroke limit-2 in the Q-setter mode.

6249		L
	W-setter: X-axis Reference Gauge Position	M

6250		L
	W-setter: Y-axis Reference Gauge Position	M

6251		L
	W-setter: Z-axis Reference Gauge Position	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set the position of the reference gauge used for the W-setter in the machine coordinate system.

6252		L
	W-setter: Diameter of Probe Sphere	M

6253		L
	W-setter: X-axis Deviation Amount of Probe Sphere	M

6254		L
	W-setter: Y-axis Deviation Amount of Probe Sphere	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999 (0 to 99999999 for the parameter no. 6252)

Set the diameter and X-axis/Y-axis deviation amount of the touch probe sphere used for the W-setter.

(Note) *When measuring with the reference gauge with the parameter no. 6242, #5 (TSPRM) = 1, the parameters no. 6260 to no. 6262 are used, instead of this parameter.*

6255	Z-setter Sensor Length	L
	W-setter: Probe Length	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set the sensor length used for the Z-setter (L-system) and the touch probe length used for the W-setter (M-system).

(Note) *In the M-system, when measuring with the reference gauge with the parameter no. 6242, #5 (TSPRM) = 1, the parameter no. 6263 is used, instead of this parameter.*

6256	Retouch Return Amount for Q-setter/Z-setter/B-setter	L
	W-setter: Retouch Return Amount	M

Data format: Long type

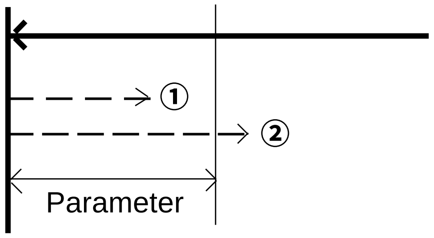
Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a retouch return amount for the Q-/Z-/B-setter (L-system) or W-setter (M-system). Unless the tool is moved by the amount set in this parameter in the opposite direction after touching, it cannot be moved in the touching direction.

Touching Position



Move in Measuring Direction

The tool cannot be moved in the measuring direction even if it is moved as far as ①. It can be moved in the measuring direction if moved as far as ②.

6257		L
	W-setter: Minimum Point-to-point Distance Value at 3-point Measurement	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a minimum point-to-point distance value for making 3-point measurement by the W-setter. When the point-to-point distance at measurement is shorter than the value set in this parameter, it is necessary to redo measurement at the 2nd (3rd) point.

6258		L
	Safety Guard: X-axis Measuring Position	M

6259		L
	Safety Guard: Y-axis Measuring Position	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set the X-axis/Y-axis measuring position used for safety guard (tool length) operation in the machine coordinate system. Before proceeding to measurement operation, the X-axis and Y-axis move to this position automatically.

6260		L
	W-setter: Diameter of Reference Tool for Reference Gauge Measurement	M

6261		L
	W-setter: X-axis Deviation Amount of Reference Tool for Reference gauge Measurement	M

6262		L
	W-setter: Y-axis Deviation Amount of Reference Tool for Reference Gauge Measurement	M

6263		L
	W-setter: Length of Reference Tool for Reference Gauge Measurement	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999 for the parameters no. 6261 and no. 6262 0 to 99999999 for the parameter no. 6260 and 6263

Set the dimension of the reference tool used for measuring the position of the reference gauge by the W-setter (tool setter).

(Note) *This parameter is valid only when "1" is set in the parameter no. 6242, #5 (TSPRM). When TSPRM is "0", the parameter no. 6252 to no. 6255 are used instead of this one.*

6264	Q-setter: Allowable Differnce between New and Old Offset Amounts	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set the allowable differnce between the new and old offset amounts forwhen checking the difference between the new and old offset amounts at measurement with the Q-setter (parameter No. 6244, #7 (QDC) = 1).

When the difference between the offset amounts exceeds this parameter, analarm (No. 709) takes place after rewriting to the new offset amount.

6265	Q-setter Repeat: Push Amount from Contact Position	L
		M

6266	Q-setter Repeat: Clearance Amount at Approach	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a push amount from the contact position (no. 6265) and a clearance amount at approach (no. 6266) in terms of radius value, which are required for Q-setter repeat operation. In Q-setter repeat operation, the tool is moved at a rapid traverse rate to a position away from the contact position set in the parameter (no. 6015/no. 6016) by the clearance amount at approach, and then, moved by jog feed by the "clearance amount at approach plus the push amount from the contact position" to make measurement. (See the description of the parameter no. 6267/no. 6268)

6267	Q-setter Repeat: Clearance Amount of Right-handed Tool	L
		M

6268	Q-setter Repeat: Clearance Amount of Left-handed Tool	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

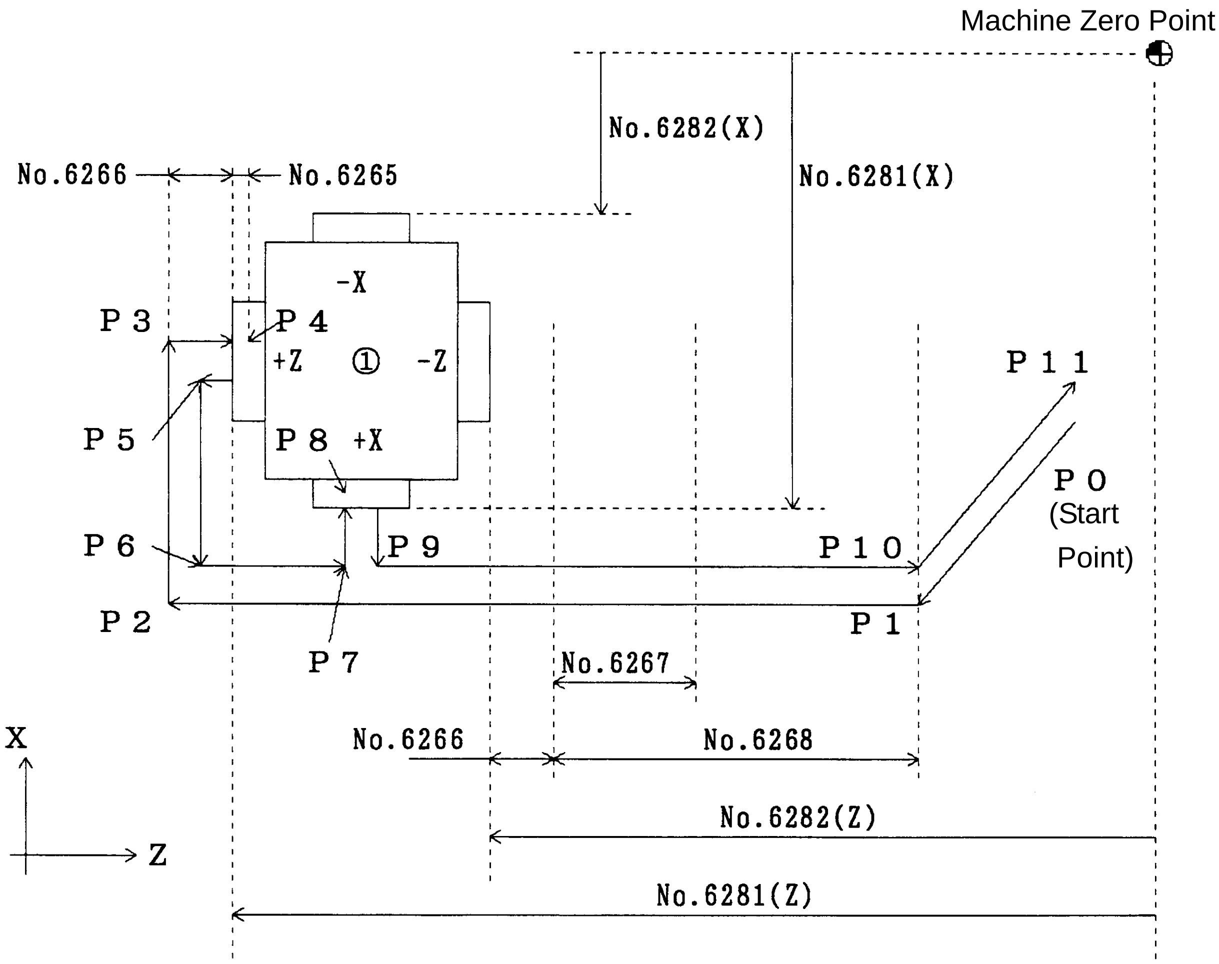
Data range: 0 to 99999999

Set the clearance amounts of the right-handed and left-handed tools in terms of radius value, which are required for Q-setter repeat operation.

The right-handed tool is brought into contact from right (+Z) to left (-Z) and refers to those with a tool nose point of other than 1, 4, and 5. The left-handed tool is brought into contact from left (-Z) to right (+Z) and refers to those with a tool nose point of 1, 4, and 5.

<Movement for Virtual Tool Nose Point-1 (Left-handed Tool)>

No. : Denotes a parameter number



6276		L
	Measurement Feed Rate for Automatic Tool Length Measurement (G37)	M

Data format: Long type

Unit of data:

	Valid Digits of Speed F for Feed per Minute					Unit
	F60	F61	F62	F51	F52	
Metric input	1	0.1	0.001			mm/min
Inch input				0.1	0.01	inch/min

Data range: 0 to 99999999

Set a measurement feed rate for automatic tool length measurement (G37). (See the description of the parameter no. 6279)

6277		L
	Measurement Length for Automatic Tool Length Measurement (G37)	M

6279	Measurement Speed Length for Automatic Tool Length Measurement (G37)	L M

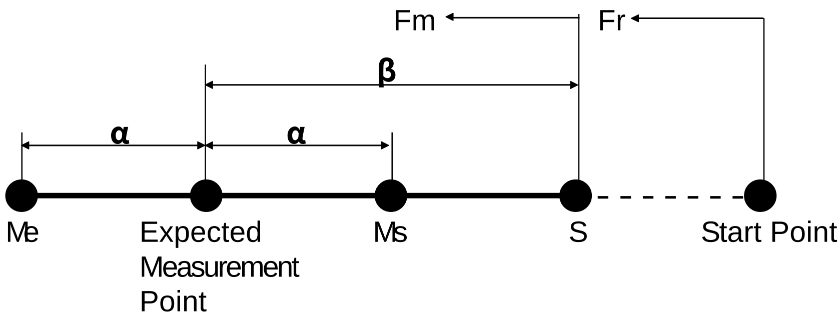
Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a measurement length and measurement speed length for automatic tool length measurement



Fr: Rapid traverse rate

Fm: Measurement feed rate (parameter no. 6276)

S: Measurement speed move start point

Ms: Measurement start point

α : Measurement length (parameter no. 6277)

β : Measurement speed length (parameter no. 6279)

6281	Q-setter Contact Surface Positive Coordinate Value	L M

6282	Q-setter Contact Surface Negative Coordinate Value	L M

Data format: Long axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

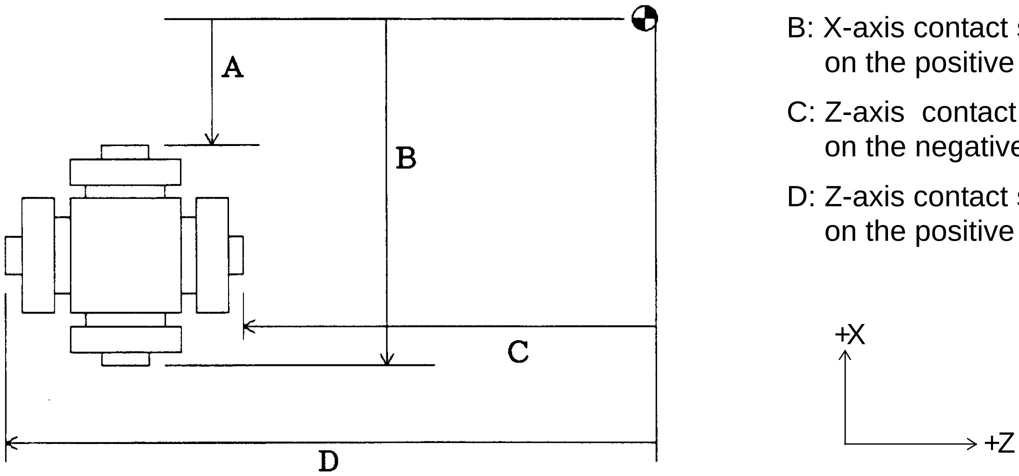
Data range: -99999999 to 99999999

Set Q-setter's positive (plus) and negative (minus) contact surface positions (sensor positions) for each axis in the machine coordinate system.

(Note 1) *Normally, set only for the X-axis and Z-axis.*

(Note 2) *The contact surface positive (negative) side is the position for the tool to come* *into contact, moving in the positive (minus) direction.*

It does not refer to the position mechanically located on the positive (negative) side.



A: X-axis contact surface on the negative side

B: X-axis contact surface on the positive side

C: Z-axis contact surface on the negative side

D: Z-axis contact surface on the positive side

6283	Q-setter Barrier Coordinate Value	L M

Data format: Long axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set Q-setter barrier coordinate values for each axis in the machine coordinate system. If the tool enters inside the barrier when operating the Q-setter, a signal is output to the machine.

(Note 1) *When "0" is set in the parameter no. 6244, #1 (QBR), the Q-setter barrier is not checked.*

(Note 2) *Normally, set only for the X-axis and Z-axis.*

6307	W-setter for 5-face Machining System: X Shift Amount When Horizontal Spindle Is in +Y Direction	L M
6308	W-setter for 5-face Machining System: Y Shift Amount When Horizontal Spindle Is in +Y Direction	L M
6309	W-setter for 5-face Machining System: Z Shift Amount When Horizontal Spindle Is in +Y Direction	L M
6310	W-setter for 5-face Machining System: X Shift Amount When Horizontal Spindle Is in -X Direction	L M
6311	W-setter for 5-face Machining System: Y Shift Amount When Horizontal Spindle Is in -X Direction	L M
6312	W-setter for 5-face Machining System: Z Shift Amount When Horizontal Spindle Is in -X Direction	L M
6313	W-setter for 5-face Machining System: X Shift Amount When Horizontal Spindle Is in -Y Direction	L M
6314	W-setter for 5-face Machining System: Y Shift Amount When Horizontal Spindle Is in -Y Direction	L M
6315	W-setter for 5-face Machining System: Z Shift Amount When Horizontal Spindle Is in -Y Direction	L M
6316	W-setter for 5-face Machining System: X Shift Amount When Horizontal Spindle Is in +X Direction	L M
6317	W-setter for 5-face Machining System: Y Shift Amount When Horizontal Spindle Is in +Y Direction	L M

6318		L
	W-setter for 5-face Machining System: Z Shift Amount When Horizontal Spindle Is in +X Direction	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set X-,Y-,and Zaxis shift amounts for each direction (+Y, -X, -Y, +X) of the horizontal spindle used by the W-setter for the 5-face machining system.

6319		L
	W-setter for 5-face Machining System: Horizontal Deviation Amount from Center of Horizontal Spindle to Center of Probe Sphere	M

6320		L
	W-setter for 5-face Machining System: Vertical Deviation Amount from Center of Horizontal Spindle to Center of Probe Sphere	M

6321		L
	W-setter for 5-face Machining System: Distance from Gauge Line of Horizontal Spindle to Nose of Sensor	M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999 (0 to 99999999 for the parameter no. 6321)

Set each dimension of the touch probe used by the W-setter for the 5-face machining system.

6323		L
	ATC Canned Cycle for 5-face Machining System/Safety Guard: Y-axis Standby Position	M

6324		L
	ATC Canned Cycle for 5-face Machining System/Safety Guard: Y-axis Return Position	M

6325	ATC Canned Cycle for 5-face Machining System/Safety Guard: Y-axis Tool Change Position	L M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set ATC-related positions used in the ATC canned cycle/safety guard operation for the 5-face machining system in the machine coordinate system.

2.20 Parameters Related to Graphic Display

(Note) *Most parameters related to graphic display are normally set through the Graphic Display Parameter Setting screen.*

Data format: Bit type

	#7	#6	#5	#4	#3	#2	#1	#0
6500							TED	

- TED 0: Enables graphic display for each tool
  1: Disables graphic display for each tool

Data format: Bit type

	#7	#6	#5	#4	#3	#2	#1	#0
6501				PGRD				PGOF

- PGOF 0: In premachining graphic display, an offset amount by cutter compensation/ tool nose radius compensation is included in graphic display. (Offset route)
- PGRD 0: In premachining graphic display, dry run for a rapid traverse command complies with the parameter no. 1401, #6 (RDR).
  1: In premachining graphic display, dry run for a rapid traverse command is certainly enabled.

6509	Line Type for Cutting Feed
6510	Line Type for Rapid Traverse

Data format: Byte type

Data range: 0, 1, 2

Set lines types for cutting feed and rapid traverse in graphic display.

0: Full line 1: Broken line 2: No display

6511	Graphic Display Color Data 1 for Each Tool
6512	Graphic Display Color Data 2 for Each Tool
6513	Graphic Display Color Data 3 for Each Tool
6514	Graphic Display Color Data 4 for Each Tool
6515	Graphic Display Color Data 5 for Each Tool
6516	Graphic Display Color Data 6 for Each Tool
6517	Graphic Display Point Color Data

Data format: Byte type

Data range: 0 to 7

Set the color data for graphic display and graphic display points for each tool.

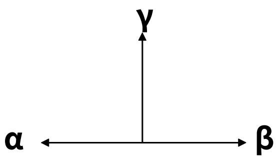
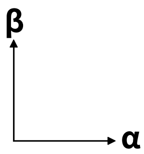
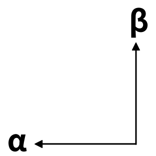
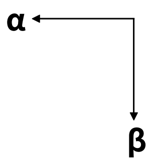
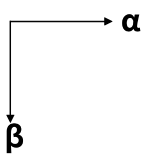
0: Black 1: Blue 2: Green 3: Light blue 4: Red 5: Purple 6: Yellow 7: White

6518	Setting of Coordinate System for 1st Graphic Display

Data format: Byte type

Data range: -1, 0 to 4

Set the coordinate system for 1st graphic display in terms of ID number. The following shows relations between the ID numbers and coordinate system.

ID No.	Coordinate System	
-1	No coordinate system selected (No graphic display)	
0		**α** : 1st axis **β** : 2nd axis **γ** : 3rd axis
1		**α** : 1st axis **β** : 2nd axis
2		**α** : 1st axis **β** : 2nd axis
3		**α** : 1st axis **β** : 2nd axis
4		**α** : 1st axis **β** : 2nd axis

(Note) *Optional controlled axes can be specified for each coordinate system by setting relevant parameters. Use the parameters no. 6527 through no. 6537 to specify the axes.*

6519	Horizontal Rotating Angle for 1st Graphic Display

6520	Vertical Rotating Angle for 1st Graphic Display

Data format: Word type

Unit of data: degrees

Data range: -180 to 180

Set horizontal and vertical angles for 1st graphic display.

(Note) *This parameter is valid only when the coordinate system for 1st graphic display is three-dimensional (coordinate system ID no. = 0).*

6522	Setting of Coordinate System for 2nd Graphic Display

Data format: Byte type

Data range: -1, 0 to 4

Set the coordinate system for 1st graphic display in terms of ID number.

(Note 1) *The relations between the ID numbers and coordinate system are the same as those for 1st graphic display. See the description of the parameter no. 6518.*

(Note 2) *Optional controlled axes can be specified for each coordinate system by setting relevant parameters. Use the parameters no. 6543 through no. 6553 to specify the axes.*

6523	Horizontal Rotating Angle for 2nd Graphic Display
6524	Vertical Rotating Angle for 2nd Graphic Display

Data format: Word type

Unit of data: degrees

Data range: -180 to 180

Set horizontal and vertical angles for 2nd graphic display.

(Note) *This parameter is valid only when the coordinate system for 2nd graphic display is three-dimensional (coordinate system ID no. = 0).*

6525	Maximum Coordinate Value of Graphic Display Range for Each Axis (Positive Side)
6526	Maximum Coordinate Value of Graphic Display Range for Each Axis (Negative Side)

Data format: Long axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Linear axis (metric input)	0.01	0.001	0.0001	mm
Linear axis (inch input)	0.001	0.0001	0.00001	inch
Rotary axis	0.01	0.001	0.0001	deg

Data range: -99999999 to 99999999

Set the maximum and minimum coordinate values (graphic display range) of the Graphic screen.

(Note) *When the work coordinate system is used for graphic display (parameter no. 6500, #7 (MPD) = 0), set the coordinate values in the work coordinate system, and when the machine coordinate system is used for graphic display (parameter no. 6500, #7 (MPD) = 1), set the coordinate values in the machine coordinate system.*

6527	Axis Setting for 1st Graphic Display: 1st Axis of Coordinate System ID No. 0 (Three-dimensional)
6528	Axis Setting for 1st Graphic Display: 2nd Axis of Coordinate System ID No. 0 (Three-dimensional)
6529	Axis Setting for 1st Graphic Display: 3rd Axis of Coordinate System ID No. 0 (Three-dimensional)
6530	Axis Setting for 1st Graphic Display: 1st Axis of Coordinate System ID No. 1 (Two-dimensional)
6531	Axis Setting for 1st Graphic Display: 2nd Axis of Coordinate System ID No. 1 (Two-dimensional)
6532	Axis Setting for 1st Graphic Display: 1st Axis of Coordinate System ID No. 2 (Two-dimensional)
6533	Axis Setting for 1st Graphic Display: 2nd Axis of Coordinate System ID No. 2 (Two-dimensional)
6534	Axis Setting for 1st Graphic Display: 1st Axis of Coordinate System ID No. 3 (Two-dimensional)
6535	Axis Setting for 1st Graphic Display: 2nd Axis of Coordinate System ID No. 3 (Two-dimensional)
6536	Axis Setting for 1st Graphic Display: 1st Axis of Coordinate System ID No. 4 (Two-dimensional)
6537	Axis Setting for 1st Graphic Display: 2nd Axis of Coordinate System ID No. 4 (Two-dimensional)

Data format: Byte type

Data range: 0 to maximum number of controlled axes -1, except Bit 7 Set with an axis number which axis should be selected for each axis of the coordinate system (ID no. 0 to ID no. 4) for 1st graphic display.

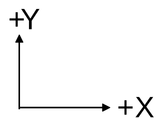
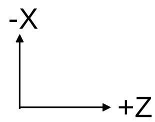
#7	#6		#0
	Axis No. -1		

0: Plus (+) Axis Name 1: Minus (-) Axis Name

When Bit 7 is "0", the axes of the coordinate system assume a "plus (+) axis name," and when "1", they assume a "minus (-) axis name."

Set Value	Meaning	Set Value	Meaning
0	+1st axis	-128	-1st axis
1	+2nd axis	-127	-2nd axis
2	+3rd axis	-126	-3rd axis
~	~	~	~
7	+8th axis	-121	-8th axis

<Setting Example> When the number of controlled axes is 3 and the axis names are X, Y, and Z in order of axis numbers, and the coordinate system ID number is 1;

Parameter	Meaning	Coordinate System
No. 6530 = 0 No. 6531 = 1	1st axis: +X 2nd axis: +Y	
No. 6530 = 2 No. 6531 = -128	1st axis: +Z 2nd axis: -X	

6543	Axis Setting for 2nd Graphic Display: 1st Axis of Coordinate System ID No. 0 (Three-dimensional)

6544	Axis Setting for 2nd Graphic Display: 2nd Axis of Coordinate System ID No. 0 (Three-dimensional)

6545	Axis Setting for 2nd Graphic Display: 3rd Axis of Coordinate System ID No. 0 (Three-dimensional)

6546	Axis Setting for 2nd Graphic Display: 1st Axis of Coordinate System ID No. 1 (Two-dimensional)

6547	Axis Setting for 2nd Graphic Display: 2nd Axis of Coordinate System ID No. 1 (Two-dimensional)

6548	Axis Setting for 2nd Graphic Display: 1st Axis of Coordinate System ID No. 2 (Two-dimensional)

6549	Axis Setting for 2nd Graphic Display: 2nd Axis of Coordinate System ID No. 2 (Two-dimensional)

6550	Axis Setting for 2nd Graphic Display: 1st Axis of Coordinate System ID No. 3 (Two-dimensional)

6551	Axis Setting for 2nd Graphic Display: 2nd Axis of Coordinate System ID No. 3 (Two-dimensional)

6552	Axis Setting for 2nd Graphic Display: 1st Axis of Coordinate System ID No. 4 (Two-dimensional)

6553	Axis Setting for 2nd Graphic Display: 2nd Axis of Coordinate System ID No. 4 (Two-dimensional)

Data format: Byte type

Data range: 0 to maximum number of controlled axes -1, except Bit 7

Set with an axis number which axis should be selected for each axis of the coordinate system (ID no. 0 to ID no. 4) for 2nd graphic display.

(Note) *Meanings of set values are the same as those for 1st graphic display. See the description of the parameter no. 6527 through no. 6537.*

6559	Spacing of Scale Graduations

Data format: Long type

Least input increment:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set the spacing for one graduation, when displaying the scale in the Graphic Display screen.

6563	M-code Execution Time in Premachining Plotting

6564	S-code Execution Time in Premachining Plotting

6565	T-code Execution Time in Premachining Plotting

6566	B-code Execution Time in Premachining Plotting

Data format: Word type

Unit of data: 0.01 sec.

Data range: 0 to 32767

Set the M-, S-, T-, and B-code execution time in premachining plotting. Set an execution time average value for each code.

The set values in these parameters are added to a machining time when premachining plotting is performed.

2.21 Parameters Related to Manual Handle Feed, Manual Handle Interrupt, and Tool Axis Direction Handle Feed

	#7	#6	#5	#4	#3	#2	#1	#0
7001								MIN

Data format: Bit type

- MIN 0: Disables manual intervention and reset functions
  1: Enables manual intervention and reset functions

	#7	#6	#5	#4	#3	#2	#1	#0	
7100				HPF				JHD	L
				HPF				JHD	M

Data format: Bit type

- JHD 0: Disables the manual pulse generator in the JOG mode
  1: Enables the manual pulse generator in the JOG mode
- HPF When a manual handle feed rate exceeding a rapid traverse rate is specified;
  0: The feed rate is clamped to the rapid traverse rate and handle pulses exceeding the rapid traverse rate are ignored (The graduation of the manual pulse generator may not conform to a stroke)
  1: The feed rate is clamped to the rapid traverse rate and handle pulses exceeding the rapid traverse rate are accumulated in the CNC unit; they are not ignored (Even if you stop rotating the manual pulse generator, the tool will stop after moving by accumulated pulses)

	#7	#6	#5	#4	#3	#2	#1	#0
7101								IOL

Data format: Bit type [Valid only for **Σ 10]**

- IOL In manual handle feed;
  0: Uses the manual pulse generator interface on the main CPU board
  1: Uses the manual pulse generator interface provided in the machine operation panel interface for I/O link

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

Data format: Bit axis type

- HNGx 0: Each axis moves in the same direction as the rotating direction of the manual pulse generator

1: Each axis moves in the reverse direction of the rotating direction of the manual pulse generator

	#7	#6	#5	#4	#3	#2	#1	#0	
7104									L
						CXC		TLX	M

Data format: Bit type

- TLX In the tool axis direction handle feed function, when the rotary axes corresponding to the basic 3 axes of the basic coordinate system are on the machine zero point;
  0: Selects the Z-axis direction as the tool axis direction
  1: Selects the X-axis direction as the tool axis direction
- CXC 0: Performs tool axis direction handle feed with the 5-axis machine
  1: Performs tool axis direction handle feed with the 4-axis machine

7110	Number of manual pulse generators used

Data format: Byte type

Data range: 1, 2, or 3

Set the number of manual pulse generators.

7113	Manual Handle Feed Magnification m
7114	Manual Handle Feed Magnification n

Data format: Word type

Least input increment: 1

Data range: 1 to 127 for no. 7113,

0 to 1000 for no. 7114

Set magnifications m and n selected by manual handle feed stroke selection signals MP1 and MP2.

Stroke Selection Signal		Stroke (Manual Handle Feed)
MP2	MP1	
0	0	Least input increment x 1
0	1	Least input increment x 10
1	0	Least input increment x m
1	1	Least input increment x n

7120		L
	Axis Configuration in Tool Axis Direction Handle Feed Function	M

Data format: Byte type

Data range: 1 to 4

In the tool axis direction handle feed function, suppose the rotary axes corresponding to the basic 3 axes X, Y, and Z of the basic coordinate system are A, B, and C, respectively. When the rotary axes are on the machine zero point and the tool axis direction is the Z-axis, consider the following 4 types depending on the axis configuration of the machine. Two types, (1) and (2) are applied to the 4-axis machine.

(1) A-C axes type

(2) B-C axes type

(3) A-B axes (A-axis master) type

(4) A-B axes (B-axis master) type

Set either one of those types in this parameter. Their set values are 1, 2, 3, and 4 from the top, respectively. When the tool axis direction is the X-axis, those types will be changed to B-A axes, C-A axes, B-C axes (B-axis master), and B-C axes (C-axis master) from the top, respectively.

7121		L
	Axis Selection for Tool Axis Direction Handle Feed Mode	M

Data format: Byte type

Data range: 1 to maximum number of controlled axes

Select the axis number for the manual handle feed axis selection signal of the 1st manual pulse generator which enables the tool axis direction handle feed mode. When the set value of this parameter matches a value of the manual handle feed axis selection signal, the tool axis direction handle feed mode is enabled.

2.22 Parameters Related to Polygon Machining (L-system Only)

	#7	#6	#5	#4	#3	#2	#1	#0	
7600	PLZ								L
									M

Data format: Bit type

- PLZ 0: In polygon machining by the servo motor, A G28 command returns a synchronous axis to the reference point in the same sequence as manual reference point return

  1: In polygon machining by the servo motor, A G28 command returns a synchronous axis to the positioning reference point by a rapid traverse rate.

  When no reference point return has been performed after turning on the power, it is returned to the reference point in the same sequence as

	#7	#6	#5	#4	#3	#2	#1	#0	
7602			COF	HST	HSL		SNG	MNG	L
									M

manual reference point return.

Data format: Bit type

- MNG 0: Does not reverse the rotating direction of the master axis (1st spindle) in the inter-spindle polygon machining mode

  1: Reverse the rotating direction of the master axis (1st spindle) in the inter-spindle polygon machining mode
- SNG 0: Does not reverse the rotating direction of the polygon synchronous axis (2nd spindle) in the inter-spindle polygon machining mode

  1: Reverse the rotating direction of the polygon synchronous axis (2nd spindle) in the inter-spindle polygon machining mode
- HSL When the inter-spindle polygon machining mode phase control is provided (#5, (COF) = 0);

  0: Shifts the polygon synchronous axis (2nd spindle) for phase adjustment

  1: Shifts the master axis (1st spindle) for phase adjustment
- HST When the inter-spindle polygon machining mode phase control is provided (#5 (COF) = 0) and the inter-spindle polygon machining mode is specified;

  0: Control enters the inter-spindle polygon machining mode at the current spindle speed

  1: Control enters the inter-spindle polygon machining mode after stopping the spindle automatically

(Note) *Since another detector is attached to detect a spindle one-rotation signal when a built-in spindle is used, this parameter is used in cases such as when detection of the one-rotation signal is not established at an optional speed, and so on. (If "1" is set in the parameter no. 4016, #7 on the part of the serial spindle, together with this parameter, a one-rotation signal detecting position can be assured in the inter-spindle polygon machining mode.)*

- COF 0: Provides phase control in the inter-spindle polygon machining mode
  1: Does not provide phase control in the inter-spindle polygon machining mode

(Note) *When phase control is not provided, the machine reaches its steady state earlier by a time otherwise spent for phase adjustment control. To perform polygon machining, however, it is necessary to finish machining after reaching steady rotation once. (If a spindle rpm is changed, including a stop, machining will not be effected because the phase will be shifted.) With this parameter being set to 1, an alarm is created if phase position has been commanded in a program.*

	#7	#6	#5	#4	#3	#2	#1	#0	
7603	PST		RDG				QDR	RPL	L
									M

Data format: Bit type

- RPL 0: Cancels the inter-spindle polygon machining mode at reset time
  1: Does not cancel the inter-spindle polygon machining mode at reset time
- QDR 0: The rotating direction of the polygon synchronous axis depends on the sign (+/-) of a command value, Q
  1: The rotating direction of the polygon synchronous axis complies with that of the 1st spindle
- RDG 0: No. 476 Spindle Polygon Phase Command Value (R) in the DIAGNOSE screen indicates a command value (unit of setting for the rotary axis applies here)
  1: No. 476 Spindle Polygon Phase Command Value (R) in the DIAGNOSE screen indicates the actual number of shift pulses here

(Note) *A phase command is given by an address R in the unit of "degrees," but an actual shift amount is controlled, being converted into pulses at a rate of 3600 = 4,096 pulses. This parameter is to switch a command value display into this converted value display.*

• PST 0: Does not use a polygon spindle stop signal *PLSST (G0038, #0)
1: Uses a polygon spindle stop signal *PLSST (G0038, #0)

7610	Controlled Axis Number of Rotary Tool Axis for Polygon Machining	L M

Data format: Byte type

Data range: 1 to maximum number of controlled axes

Set the control number of the rotary tool axis used for polygon machining by the servo motor.

7620	Stroke of Rotary Tool Axis per Rotation	L M

Data format: Long type

Unit of data:

IS-A	IS-B	IS-C	Unit
0.01	0.001	0.0001	deg

Data range: 1 to 99999999

Set the stroke of the rotary tool axis per rotation in polygon machining by the servo motor.

7621	Upper-limit Rpm of Rotary Tool Axis (Polygon Synchronous Axis)	L M

Data format: Word type

Unit of data: rpm

Data range: ① For polygon machining by the servo motor
0 to 1.2 x 108/setting of the parameter no. 7620

② For inter-spindle polygon machining
Taking as an upper limit the allowable rpm based on performance of the 2nd spindle or mechanical factor, set within a range of 0 to 32767.

Set the upper-limit rpm of the rotary tool axis (polygon synchronous axis). When the rotating speed of the rotary tool axis (polygon synchronous axis) exceeds the set upper-limit rpm during polygon machining, it is clamped to the upper-limit rpm. When it is clamped to the upper-limit rpm, the spindle and rotary tool axis (polygon synchronous axis) become asynchronous. When clamped, an alarm no. 5018 occurs.

7631	Spindle Rotation Deviation Allowable Level in Inter-spindle Polygon Machining	L M

Data format: Byte type

Unit of data: rpm

Data range: 0 to 255

Standard set value: 1 to 10

At the time of inter-spindle polygon machining, set the deviation allowable levels for respective actual spindle speeds and specified speeds. (Specify commonly to the master axis and polygon synchronous axis)

7632	Steady State Confirmation Time in Inter-spindle Polygon Machining	L M

Data format: Word type

Unit of data: msec.

Data range: 0 to 32767

Set a time required to determine that both spindles have reached their specified speeds in inter-spindle polygon machining.

When the respective spindles have reached the speed within the allowable level set in the parameter no. 7631 and that state continues longer than the time set in the parameter no. 7632, a spindle polygon speed reach signal PSAR (F0063, #2) is turned to "1".

8678	M code to start Polygon turning	L M

8679	M code to end Polygon turning	L M

Data format: Word type

Data range: 1 to 32767

An M codes to start and end Polygon turning (Polygon Synchronous mode) are set here.

In Polygon turning, after a Polygon turning ratio [as well as phase] being set with "G10 L110 P Q [R];], working starts by the M code having been set in Parameter No. 8678 and is ended with the M code having been set in Parameter No. 8679.

(Note 1) *With data outside the range being set, it is taken as:*

- *Starting M code (Parameter No. 8678): M156*
- *Ending M code (Parameter No. 8679): M157*

(Note 2) *The M codes for starting/ending Polygon turning are processed inside CNC alone, which are not output in Machine.*

2.23 Parameters Related to Cutting Monitoring

	#7	#6	#5	#4	#3	#2	#1	#0	
8000	SLDIF			MNDT	MNDZ	MNDY	MNDX	MNDS	L
	SLDIF	LFFCS			MNDZ	MNDY	MNDX	MNDS	M

Data format: Bit type

- MNDS 0: The spindle load data system is the absolute value data system
  1: The spindle load data system is the reference data system
- MNDX 0: The X-axis load data system is the absolute value data system
  1: The X-axis load data system is the reference data system
- MNDY 0: The Y-axis load data system is the absolute value data system
  1: The Y-axis load data system is the reference data system
- MNDZ 0: The Z-axis load data system is the absolute value data system
  1: The Z-axis load data system is the reference data system
- MNDT 0: The rotary tool load data system is the absolute value data system
  1: The rotary tool load data system is the reference data system

(Note) *The absolute data system uses a load value as it is. The reference data system takes as 0 a load value after a cancellation time at start of monitoring. (This is used for the axes to which a load is always applied)*

- LFFCS 0: Disables tool life forecast signal output.
  1: Enables tool life forecast signal output.
- SLDIF Selection of how to capture the spindle load data
  0: Captures inside the CNC. (Serial spindle)
  1: Captures the 12-bit data from the external A/D converter via the PMC ladder. (Other than the serial spindle)

(Note)When this parameter is set to “1”, it is necessary to set the parameter No. 8076.

	#7	#6	#5	#4	#3	#2	#1	#0
8001	LIMNT	LICNT	MSWE	MSOL		MNAD	MNWE	MNOL

Data format: Bit type

- MNOL 0: Disables main monitoring overload setting when all the data are cleared by screen operation
  1: Enables main monitoring overload setting when all the data are cleared by screen operation
- MNWE 0: Disables main monitoring wear setting when all the data are cleared by screen operation
  1: Enables main monitoring wear setting when all the data are cleared by

screen operation

- MNAD 0: Disables main monitoring adaptive setting when all the data are cleared by screen operation
  1: Enables main monitoring adaptive setting when all the data are cleared by screen operation
- MSOL 0: Disables submonitoring overload setting when all the data are cleared by screen operation
  1: Enables submonitoring overload setting when all the data are cleared by screen operation
- MSWE 0: Disables submonitoring wear setting when all the data are cleared by screen operation
  1: Enables submonitoring wear setting when all the data are cleared by screen operation
- LICNT, LICNT Select the tool life management count mode when all the data are cleared by screen operation

LIMNT	LICNT	Tool Life Management Count Mode
0	0	Does not initialize
0	1	Initializes to the times mode
1	0	Initializes to the time mode

(Note) *This setting is valid only when the unit of life is set to either "times" or "minutes" (parameter no. 8003, #6 (LMREM) = 0).*

	#7	#6	#5	#4	#3	#2	#1	#0
8002								EREV

Data format: Bit type

- EREV 0: Disables spindle reverse rotation monitoring
  1: Disables spindle reverse rotation monitoring

	#7	#6	#5	#4	#3	#2	#1	#0	
8003						PCCLR	TLSTA		L
	LFREM	LMREM				PCCLR	TLSTA	SPOSNM	M

Data format: Bit type

- SPOSNW 0: Outputs 0 to 9 to spare positions
  1: Outputs 0 to 9 to spare positions
- TLSTA 0: Does not output the status of the tool no. 1 to no. 40
  1: Outputs the status of the tool no. 1 to no. 40
- PCCLR 0: Clears a selected tool by tool reset
  1: Clears the tool specified by TL01 to TL256

- LMREM 0: Selects "times" or "minutes" as the unit of life
  1: Does not select "times" or "minutes" as the unit of life
- LFREM 0: Clears the tool status and use value by M57
  1: Does not clear the tool status and use value by M57

	#7	#6	#5	#4	#3	#2	#1	#0	
8004		ADIM							L
	FTSEL	ADIM							M

Data format: Bit type

- ADIM 0: The load data is displayed in terms of ratio (%)
  1: The load data is displayed in terms of current value (A).

  (Note) *When the load data is to be displayed in terms of current value, it is necessary to set a current value corresponding to 100% load (parameter no. 8070 to no. 8074).*
- FTSEL 0: A T-command for a tool specific number is of the specific number system.
  1: A T-command for a tool specific number is of the number by functions system.

8006		L
	Automatic Calculation Parameter for Spindle Ovberload Monitoring Data	M
8007		L
	Automatic Calculation Parameter for Spindle Wear Monitoring Data	M
8008		L
	Automatic Calculation Parameter for Spindle Adaptive Monitoring Data	M
8009		L
	Automatic Calculation Parameter for Spindle No-load Monitoring Data	M

Data format: Byte type

Unit of data: %

Data range: 0

Set the data used for automatic calculation of each monitoring data of the spindle.

Monitoring data = Reference load value x Parameter set value/100

(The reference load value can be input by the keys or obtained by averaging an actual load value, using the set values of the parameters no. 8010 and no. 8011 (automatic setting))

8010	Upper-limit value for AV_HIG Spindle Load Calculation
8011	Lower-limit value for AV_LOW Spindle Load Calculation

Data format: Byte type

Unit of data: %

Data range: 0 to 100

Set the upper-limit and lower-limit load values used for calculating actual spindle cutting load value by averaging in the reference load value automatic setting mode.

(Note) *The upper-limit value (parameter no. 8010) must be higher than the lower-limit value (parameter no. 8011).*

8012	Automatic Calculation Parameter for X-axis Overload Monitoring Data
8013	Automatic Calculation Parameter for X-axis Wear Monitoring Data
8014	Automatic Calculation Parameter for X-axis Adaptive Monitoring Data
8015	Automatic Calculation Parameter for X-axis No-load Monitoring Data
8016	Upper-limit value for X-axis AV_HIG Load Calculation
8017	Lower-limit value for X-axis AV_LOW Load Calculation
8018	Automatic Calculation Parameter for Y-axis Overload Monitoring Data
8019	Automatic Calculation Parameter for Y-axis Wear Monitoring Data
8020	Automatic Calculation Parameter for Y-axis Adaptive Monitoring Data
8021	Automatic Calculation Parameter for Y-axis No-load Monitoring Data
8022	Upper-limit value for Y-axis AV_HIG Load Calculation
8023	Lower-limit value for X-axis AV_LOW Load Calculation
8024	Automatic Calculation Parameter for Z-axis Overload Monitoring Data
8025	Automatic Calculation Parameter for Z-axis Wear Monitoring Data
8026	Automatic Calculation Parameter for Z-axis Adaptive Monitoring Data
8027	Automatic Calculation Parameter for Z-axis No-load Monitoring Data

8028	Upper-limit value for Y-axis AV_HIG Load Calculation

8029	Lower-limit value for X-axis AV_LOW Load Calculation

The parameter no. 8012 through no. 8017 are for the X-axis, those no. 8018 through no. 8023 are for the Y-axis, and those no. 8024 through no. 8029 are for the Z-axis, respectively. Set them like you do the spindle parameters (no. 8006 through no. 8011).

8030	Spindle Monitoring Cancellation Time

8031	Spindle Monitoring Overload Detection Time

8032	Spindle Monitoring Sear Detection Time

8033	Spindle Monitoring No-load Detection Time

Data format: Byte type

Least input increment: 0.1 sec.

Data range 0 to 255

Set each time used for spindle monitoring.

- Cancellation time: This is a time to make the data invalid upon starting the spindle, changing a spindle speed, or starting a cutting feed.
- Overload detection time: This is a time required to judge it overloaded when a cutting load exceeds an overload value.
- Wear detection time: This is a time required to judge it worn out when a cutting load exceeds a wear value.
- No-load detection time: This is a time required to judge it no-load when a cutting load is smaller than a no-load value.

8034	X-axis Monitoring Cancellation Time

8035	X-axis Monitoring Overload Detection Time

8036	X-axis Monitoring Wear Detection Time

8037	X-axis Monitoring No-load Detection Time

8038	Y-axis Monitoring Cancellation Time

8039	Y-axis Monitoring Overload Detection Time

8040	Y-axis Monitoring Wear Detection Time

8041	Y-axis Monitoring No-load Detection Time

8042	Z-axis Monitoring Cancellation Time

8043	Z-axis Monitoring Overload Detection Time

8044	Z-axis Monitoring Wear Detection Time

8045	Z-axis Monitoring No-load Detection Time

The parameter no. 8034 through no. 8037 are for the X-axis, those no. 8038 through no. 8041 are for the Y-axis, and those no. 8042 through no. 8045 are for the Z-axis, respectively. Set them like you do the spindle parameters (no. 8030 through no. 8033).

8050	Parameter to Determine Adaptive Control Upper-limit Value

8051	Parameter to Determine Adaptive Control Lower-limit Value

Data format: Byte type

Unit of data: %

Data range: 0 to 255

Set the values which determine the target load upper-limit and lower-limit values for adaptive control.

Adaptive control upper-limit value = Adaptive value x Parameter no. 8050/100

Adaptive control lower-limit value = Adaptive value x Parameter no. 8051/100

8052	Maximum Feed Rate Override for Adaptive Control

8053	Minimum Feed Rate Override for Adaptive Control

8054	Feed Rate Override Step for Adaptive Control Data format: Byte type

Data format: Byte type

Unit of data: %

Data range: Parameter no. 8052: 110 to 200

Parameter no. 8053: 10 to 90

Parameter no. 8054: 10 to 50

Set the parameters to control a feed rate override in adaptive control. In feed rate override control, change a feed rate override in an increment of feed override step (parameter) no. 8054) within a range of maximum feed rate override (parameter no. 8052) to minimum feed rate override (parameter no. 8053).

8055	Feed Rate Override Decrease Judgment Time for Adaptive Control

8056	Feed Rate Override Increase Judgment Time for Adaptive Control

Data format: Byte type

Unit of data: 0.1 sec.

Data range: 0 to 255

Set a time required to judge it necessary to change a feed rate override when a cutting load goes beyond a range of adaptive control upper-limit value to lower-limit value in adaptive control.

- Decrease judgment time: A time required to decrease a feed rate override when the cutting load exceeds the upper-limit value
- Increase judgment time: A time required to increase a feed rate override when the cutting load becomes smaller than the lower-limit value

8058	Spindle Data Averaging Times

8059	Feed Axis Data Averaging Times

Data format: Byte type

Unit of data: times

Data range: 2 to 40

Set the number of times to average the load data obtained from the spindle and feed axis.

<When a set value is n>

The n times worth of load data totalized and divided by n is the average load data.

(Note) *When a set value is beyond the specified range, averaging is not performed. (The set value is assumed to be "1")*

8060		L
	Boundary Value of Life State	M

Data format: Byte type

Unit of data: %

Data range: 0 to 100

When the tool life state is displayed with △ (running out of life) or ✕ (out of life), set a boundary value of △ .

<Example> When the tool life is managed in the time mode and the life value is set to 100 minutes and this parameter is set to 80;

Tool Used Time	Life State Display
0 to 79 minutes	Blank
80 to 99 minutes	△ (running out of life)
100 minutes or more	✕ (out of life)

8063		L
	Spindle Cancellation Time 2 (For Low Gear)	M

8064		L
	Spindle Cancellation Time 3 (For Low Gear)	M

8065		L
	Spindle Cancellation Time 4 (For Low Gear)	M

8066		L
	Spindle Cancellation Time 5 (For High Gear)	M

8067		L
	Spindle Cancellation Time 6 (For High Gear)	M

8068		L
	Spindle Cancellation Time 7 (For High Gear)	M

8069		L
	Spindle Cancellation Time 8 (For High Gear)	M

Data format: Byte type

Least input increment: 0.1 sec.

Data range: 0 to 255

Set a spindle cancellation time for each rpm range.

(Note) *Set a boundary value of rpm range in the parameter no. 8080 to no. 8085.*

8070	Current Value at 100% Spindle Load
8071	Current Value at 100% X-axis Load
8072	Current Value at 100% Y-axis Load
8073	Current Value at 100% Z-axis Load

8074	Current Value at 100% Rotary Tool Load	L
		M

Data format: Word type

Unit of data: 0.1 A

Data range: 1 to 9999

When the load data is to be displayed in terms of current value (parameter no. 8004, #6 (AIDM) = 1), set a current value corresponding to 100% load.

(Note) *When the load data is to be displayed in terms of ratio (%) (parameter no. 8004, #6 (AIDM) = 0), it is not necessary to set this parameter.*

8076	A/D Converted 12-bit Data Corresponding to 100% Spindle Load

Data format: Word type

Data range: 2049 to 4095

Set the A/D converted 12-bit data corresponding to the 100 % spindle load for when capturing the spindle load data (parameter No.8000, #7 (SLDIF) = 1).

Make sure that the 0 % load is 2048 (800H), maximum load in the minus direction is 0, and that in the plus direction is 4095 (FFFH). (In the standard setting, the set value is XXXX because the 120 % load is 4095.)

(Note) *The data beyond the lomits is regarded as 4095.*

8078		L
	Tool Call Number Offset Value	M

Data format: Word type

Data range: 0 to 32767 (Standard set value: 1000)

Set a boundary value to distinguish whether a T-code command value is a tool number or spare tool group number.

T-code < Set value: The T-code is assumed to be a tool number.

T-code ≧ Set value: The T-code is assumed to be a spare tool group number.

8080		L
	Spindle Rpm at Spindle Cancellation Time 1-2 (Low Gear) Change Point	M

8081		L
	Spindle Rpm at Spindle Cancellation Time 2-3 (Low Gear) Change Point	M

8082		L
	Spindle Rpm at Spindle Cancellation Time 3-4 (Low Gear) Change Point	M

8083		L
	Spindle Rpm at Spindle Cancellation Time 5-6 (High Gear) Change Point	M

8084		L
	Spindle Rpm at Spindle Cancellation Time 6-7 (High Gear) Change Point	M

8085		L
	Spindle Rpm at Spindle Cancellation Time 7-8 (High Gear) Change Point	M

Data format: Word type

Unit of data: rpm

Data range: 0 to 32767

Set the spindle rpm used as a boundary value of each spindle rpm range when sorting the spindle cancellation time for each spindle rpm range.

(Note) *Set the cancellation time for each spindle rpm range in the parameters no. 8063 to no. 8069.*

2.24 Parameters Related to High-speed, High-accuracy Contour Control by RISC

(1) Parameters related to pre-interpolation acceleration/deceleration

8400	Parameter-1 to Set Pre-interpolation Linear Acceleration/ Deceleration	L M

Data format: Long type

Unit of data:

Data range:

	Unit	Data range	
		IS-B	IS-C
Linear axis	1 mm/min	10 ~ 60000	1 ~ 6000
Rotary axis	1 deg/min	10 ~ 60000	1 ~ 6000

Set a parameter to set a pre-interpolation acceleration.

Normally, set the maximum cutting speed (parameter no. 1422).

8401	Parameter-2 to Set Pre-interpolation Linear Acceleration/ Deceleration	L M

Data format: Word type

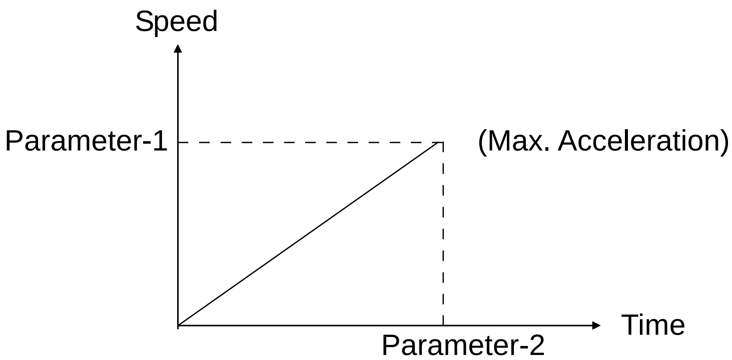
Unit of data: msec.

Data range: 0 to 4000

Set a time required to reach the speed set by the parameter-1.

In case of pre-interpolation bell type acceleration/deceleration, the data set by the parameter-1 and parameter-2 becomes the maximum pre-interpolation bell type acceleration.

(Note) *If either parameter no. 8400 or 8401 is set "0", the pre-interpolation linear acceleration/deceleration function will be lost.*



	#7	#6	#5	#4	#3	#2	#1	#0	
8402									L
	BADO		DST	BLK			NWBL		M

Data format: Bit type

- NWBL, BADO   Select a type of pre-interpolation acceleration/deceleration.

BADO	NWBL	Description
0	0	Selects a linear type pre-read pre-interpolation acceleration/deceleration
1	1	Selects a bell type pre-read pre-interpolation acceleration/ deceleration

- BLK   Be sure to set 0.
- DST   Be sure to set 1

		#7	#6	#5	#4	#3	#2	#1	#0	
8403										L
		SGO				PLC2	PLC1	MSU		M

Data format: Bit type

- MSU   0: If a G00, M-code, S-code, T-code, or B-code command is specified in the HPCC mode, it will result in an alarm.
  1: If a G00, M-code, S-code, T-code, or B-code command is specified in the HPCC mode, it will be executed on the part of the CNC.
- PLC1   0: Does not make a stroke check before move to the stored stroke limit-1 in the HPCC mode
  1: Makes a stroke check before move to the stored stroke limit-1 in the HPCC mode
- PLC2   0: Does not make a stroke check before move to the stored stroke limit-2 in the HPCC mode
  1: Makes a stroke check before move to the stored stroke limit-2 in the HPCC mode
- SGO   0: If G00 is specified in the HPCC mode, the system will comply with setting of the parameter 8403, #1 (MSU)
  1: If G00 is specified in the HPCC mode, the system will replace a G00 command by a G01 command and move an axis at the speed set in the parameter no. 8481.

(2) Parameters related to automatic speed control

8410		L
	Allowable Speed Difference in Speed Determination by Corner Speed Difference	M

Data format: Long axis type

Unit of data:

Data range:

	Unit	Data range	
		IS-B	IS-C
Linear axis	1 mm/min	10 ~ 60000	1 ~ 6000
Rotary axis	1 deg/min	10 ~ 60000	1 ~ 6000

When "0" is set for all the axes, deceleration at corner is not done.

When using a speed determining function by corner speed difference and a change of speed component for each axis at a block joint exceeds the set value of this parameter, obtain a feed rate which will not exceed this limit, and decelerate using pre-interpolation acceleration/deceleration.

8416		L
	Pre-read Bell Type Pre-interpolation Acceleration/Deceleration	M

Data format: Long type

Unit of data: msec

Data range: 0 to 99999999

At the time of pre-read bell type pre-interpolation acceleration/deceleration, set a time required to reach acceleration set in the parameters no. 8400 and no. 8401.

	#7	#6	#5	#4	#3	#2	#1	#0	
8451									L
	NOF			ZAG				USE	M

Data format: Bit type

- USE 0: Does not provide automatic speed control
  1: Provides automatic speed control
- ZAG 0: Does not determine a speed based on a Z-axis descending angle
  1: Determines a speed based on a Z-axis descending angle
- NOF 0: Makes an F-command valid in the block where automatic speed control is enabled
  1: Neglects an F-command valid in the block where automatic speed control is enabled

8452		L
	Speed Fluctuation Neglection Width	M

Data format: Byte type

Unit of data: %

Data range: 0 to 100 (<u>Standard set value 10</u>)

8456		L
	Range-2 Override	M

Data format: Word type

Unit of data: %

Data range: 1 to 100 (Standard set value 80)

Set an override value in the speed determination range-2 by cutting load.

8457		L
	Range-3 Override	M

Data format: Word type

Unit of data: %

Data range: 1 to 100 (Standard set value 70)

Set an override value in the speed determination range-3 by cutting load.

8458		L
	Range-4 Override	M

Data format: Word type

Unit of data: %

Data range: 1 to 100 (Standard set value 60)

Set an override value in the speed determination range-4 by cutting load.

	#7	#6	#5	#4	#3	#2	#1	#0	
8459									L
							CTV	CDC	M

Data format: Bit type

- CDC Be sure to set "0".
- CTY Be sure to set "1".

8464		L
	Automatic Speed Control Initial Speed	M

Data format: Long type

Unit of data:

Data range:

	Unit	Data range	
		IS-B	IS-C
Linear axis	1 mm/min	0 ~ 600000	0 ~ 60000
Rotary axis	1 deg/min	0 ~ 600000	0 ~ 60000

Set an initial speed for automatic speed control. When the program has no F-command during automatic speed control, automatic speed control starts at this initial speed. Normally, set a maximum feed rate (parameter no. 1422).

8465		L
	Automatic Speed Control Upper-limit Speed	M

Data format: Long type

Unit of data:

Data range:

	Unit	Data range	
		IS-B	IS-C
Linear axis	1 mm/min	0 ~ 600000	0 ~ 60000
Rotary axis	1 deg/min	0 ~ 600000	0 ~ 60000

Set an upper-limit speed for automatic speed control. Normally, set a maximum feed rate (parameter no. 1422).

8470		L
	Parameter to Determine Allowable Acceleration in Speed Determination by Acceleration	M

Data format: Word axis type

Unit of data: msec.

Data range: 0 to 32767

Set a time required to reach the maximum cutting speed (parameter no. 1422) in order to determine allowable acceleration/deceleration when using a speed determining function by acceleration during automatic speed control.

A machining error and machine shock are reduced more as you set a value higher than this parameter value.

	#7	#6	#5	#4	#3	#2	#1	#0	
8475									L
					CIR	BIP			M

Data format: Bit type

- CIR 0: Does not use the automatic speed control function by acceleration/deceleration during circular interpolation
  1: Uses the automatic speed control function by acceleration/deceleration during circular interpolation
  (Note) *When "1" is set, set the parameter no. 8470 designed to set allowable acceleration/deceleration.*
- BIP 0: Does not use a corner deceleration function
  1: Does not use a corner deceleration function (Be sure to set "1")

	#7	#6	#5	#4	#3	#2	#1	#0	
8480									L
		RI2	RI1	RI0					M

Data format: Bit type

• RI2, RI1, RI0 Be sure to set the following values.

	RI2	RI1	RI0
Set value	0	1	0

8481		L
	Rapid Traverse Rate in HPCC Mode	M

Data format: Long type

Unit of data:

Data range:

	Unit	Data range	
		IS-B	IS-C
Linear axis	1 mm/min	0 ~ 600000	0 ~ 60000
Rotary axis	1 deg/min	0 ~ 600000	0 ~ 60000

When the parameter no. 8403, #7 (SGO) is "1", set a rapid traverse rate in the HPCC mode.

(Note) *A G00 command is replaced by a G01 command and executed. Therefore, even if two axes are specified, they are sure to move at this rapid traverse rate.*

<Example> If the following command is given with a rapid traverse rate = 1,000 mm/min.;

G00 X100. Y100. ;

It will result in F1000, not F1414.

(3) Parameters related to controlled axes

8680		L
	Maximum Number of Controlled Axes by RISC	M

Data format: Word type

Data range: 1 to maximum number of controlled axes

Set the maximum number of axes controlled by RISC.

<Example> When the axes are X-axis, Y-axis, Z-axis, A-axis, B-axis, and C-axis, respectively, starting at the 1st axis, and you want to control the 4th axis by RISC, set "4". At this time, the X-, Y-, and Z-axis are also controlled by RISC.

X-axis, Y-axis, Z-axis, A-axis ----- Axes controlled by RISC

B-axis, C-axis -------------------- Axes not controlled by RISC

(Note) *Function-wise, this parameter is included in the category, "Other Parameters."*

(4) Parameters related to smoothing interpolation

		#7	#6	#5	#4	#3	#2	#1	#0	
8485										L
				CDS						M

Data format: Bit type

- CDS 0: Disables smoothing interpolation in the HPCC mode.
  1: Enables smoothing interpolation in the HPCC mode.

		#7	#6	#5	#4	#3	#2	#1	#0	
8686										L
		Maximum Move Distance of Smoothing Interpolation Block								M

Data format: Long type

Unit of data: Least input increment

Data range: 0 to 99999999

Set the block length to determine whether to perform smoothing interpolation. Smooting interpolation is not performed by the block having a segment length longer than this set value. Set in this parameter the maximum segment length of a polygonal line for when approximating the work of metal mold part to the polygonal line at constant tolerance.

2.25 Other Parameters

	#7	#6	#5	#4	#3	#2	#1	#0	
8650				THF			RSP1	RSP0	L
									M

Data format: Bit type

- RSP0, RAP1 Select the tool life management resetting/skipping method.

RSP1	RSP0	Resetting/Skipping Method
0	0	Resets or skips the tool selected inside the NC unit
0	1	Resets or skips the tool specified on the part of the machine (PMC)
1	0	Resets the reference tool group specified on the part of the machine (PMC)
1	1	Resets all the tools

(Note) *In the M-system, the tool specified on the part of the machine (PMC) is reset or skipped.*

- THF
  - 0: In tool life management with ATC, a spare tool is stored in an empty turret face.
  - 1: In tool life management with ATC, a spare tool is stored in the same turret face as an out-of-life tool.

	#7	#6	#5	#4	#3	#2	#1	#0
8651	SKE	AUX	NCC		RDE	OVE		MLE

Data format: Bit type

- MLE
  - 0: In the axis control by the PMC, enables machine lock operation (machine lock signal MLK) to the PMC controlled axis.
  - 1: In the axis control by the PMC, disables machine lock operation (machine lock signal MLK) for the PMC controlled axis.

  (Note) *Machine lock operation for each axis is always enabled regardless of this parameter.*

- OVE In axis control by the PMC, the signals used for dry run or override operation include;
  - 0: Same signals as the CNC
    - ① Cutting feed override signals *FV0 to *FV7
    - ② Override cancel signal OVC
    - ③ Rapid override signals ROV1, ROV2
    - ④ Dry run signal DRN
    - ⑤ Rapid traverse select signal RT

1: Signals unique to axis control by the PMC
① Cutting feed override signals *FV0E to *FV7E
② Override cancel signal OVCE
③ Rapid override signals ROV1E, ROV2E
④ Dry run signal DRNE
⑤ Rapid traverse select signal RTE

• RDE 0: Disables dry run for a rapid traverse command in axis control by the PMC.
1: Enables dry run for a rapid traverse command in axis control by the PMC.

• NCC When an axis move command is given by the program to axis control by the PMC (axis selected by a controlled axis select signal);
0: An alarm results when the PMC is controlling that axis by an axis control command.
1: An alarm results.

• AUX 0: Assumes one byte for a code output of an auxiliary function (12H) command.
1: Assumes two bytes for a code output of an auxiliary function (12H) command.

• SKE 0: In axis control by the PMC, a skip signal uses a signal, SKIP (X008, #7), same as the CNC.
1: In axis control by the PMC, a skip signal uses a signal, ESKIP (X004, #6), unique to axis control by the PMC.

	#7	#6	#5	#4	#3	#2	#1	#0
8652	FR2	FR1	PF2	PF1	F10	SUE	DWE	RPD

Data format: Bit type

• RPD 0: In axis control by PMC, a PMC controlled axis rapid traverse rate assumes the feed rate set in the parameter no. 1420.
1: In axis control by PMC, a PMC controlled axis rapid traverse rate assumes the feed rate specified by the feed rate data of the axis control command.

• DWE 0: In axis control by the PMC, the least input increment for the dwell command is 1 msec. when the increment system is IS-C.
1: In axis control by the PMC, the least input increment for the dwell command is 0.1 msec. when the increment system is IS-C.

• SUE 0: In case of external pulse synchronous command in axis control by the PMC, acceleration/deceleration control is provided for the axis synchronizing with external pulses. (Exponential functional acceleration/ deceleration)

1: In case of external pulse synchronous command in axis control by the PMC, acceleration/deceleration control is not provided for the axis synchronizing with external pulses. (Exponential functional acceleration/deceleration)

• F10 Sets the least input increment for the feed rate data, in case of cutting feed command (feed per minute) in axis control by the PMC.

F10	Metric system	Inch system
0	1 mm/min	0.01 inch/min
1	10 mm/min	0.1 inch/min

• PF1, PF2 Sets the unit of the cutting feed rate (feed per revolution) in axis control by the PMC.

PF2	PF1	
0	0	1/1
0	1	1/10
1	0	1/100
1	1	1/1000

• FR1, FR2 Sets the least input increment for the feed rate data, in case of cutting feed command (feed per revolution) in axis control by the PMC.

FR2	FR1	Metric system	2. Inch system
0	0	0.0001 mm/rev	0.000001 inch/rev
1	1		
0	1	0.001 mm/rev	0.00001 inch/rev
1	0	0.01 mm/rev	0.0001 inch/rev

	#7	#6	#5	#4	#3	#2	#1	#0
8653								PIM

Data format: Bit type

• PIM 0: In case of linear axis at PMC axis independent mode in axis control by the PMC, it is affected by the inch/metric system.

1: In case of linear axis at PMC axis independent mode in axis control by the PMC, it is not affected by the inch/metric system.

	#7	#6	#5	#4	#3	#2	#1	#0	
8654	NDI	NCI	DSL			JFM	NMT		L
		NCI	DSL	G8R	G8C	JFM	NMT		M

Data format: Bit type

• MMT 0: When a command is given from the CNC side to the same axis while the axis is moving by an axis control command from the PMC side, it is assumed to be an alarm.

1: When a command is given from the CNC side to the same axis while the axis is moving by an axis control command from the PMC side, any command not accompanied by axis move is executed without assuming it to be an alarm.

• JFM Sets the least input increment for the feed rate data, in case of continuous feed command in axis control by the PMC.

Increment System	JFM	Metric System	Inch System	Rotary Axis
IS-B	0	1 mm/min	0.01 inch/min	0.00023 rpm
	1	200 mm/min	2.00 inch/min	0.046 rpm
IS-C	0	0.1 mm/min	0.001 inch/min	0.000023 rpm
	1	20 mm/min	0.200 inch/min	0.0046 rpm

• G8C 0: Disables precontrol with respect to axis control by the PMC.

1: Enables precontrol with respect to axis control by the PMC.

(Note) *Valid only for the axis where the parameter no. 1819, #7 (NAHx) is set to 0.*

• G8R 0: Precontrol with respect to axis control by the PMC is enabled for cutting feed. (Disabled for rapid traverse)

1: Precontrol with respect to axis control by the PMC is enabled for cutting feed and for rapid traverse

(Note) *Valid only for the axis where the parameter no. 1819, #7 (NAHx) is set to 0.*

• DSL 0: When axis selection is prohibited in axis control by the PMC, switching of the axis results in an alarm.

1: When axis selection is prohibited in axis control by the PMC, switching of the axis is made valid for the system having no command, without assuming it to be an alarm.

• NCI 0: In axis control by the PMC, an in-position check is made at the time of deceleration.

1: In axis control by the PMC, an in-position check is not made at the time of deceleration.

• NDI 0: When the PMC controlled axis is of diameter designation in axis control by the PMC, the command data is doubled.

1: When the PMC controlled axis is of diameter designation in axis control by the PMC, the command data is given as it is.

(Note) *Valid only for the axis where the parameter no. 1010, #3 (DIAx) is set to 1.*

	#7	#6	#5	#4	#3	#2	#1	#0	
8655									L
	TI4	TI3	TI2	TI1	BR4	BR3	BR2	BR1	M

Data format: Bit type

- BR1 0: Enables 5-face machining system's tool nose interference check 1
  1: Disables 5-face machining system's tool nose interference check 1
- BR2 0: Enables 5-face machining system's tool nose interference check 2
  1: Disables 5-face machining system's tool nose interference check 2
- BR3 0: Enables 5-face machining system's tool nose interference check 3
  1: Disables 5-face machining system's tool nose interference check 3
- BR4 0: Enables 5-face machining system's tool nose interference check 4
  1: Disables 5-face machining system's tool nose interference check 4
- TI1 0: A prohibit6ed area for 5-face machining system's tool nose interference check 1 is the inside
  1: A prohibited area for 5-face machining system's tool nose interference check 1 is the outside.
- TI2 0: A prohibit6ed area for 5-face machining system's tool nose interference check 2 is the inside
  1: A prohibited area for 5-face machining system's tool nose interference check 2 is the outside.
- TI3 0: A prohibit6ed area for 5-face machining system's tool nose interference check 3 is the inside
  1: A prohibited area for 5-face machining system's tool nose interference check 3 is the outside.
- TI4 0: A prohibit6ed area for 5-face machining system's tool nose interference check 4 is the inside
  1: A prohibited area for 5-face machining system's tool nose interference check 4 is the outside.

	#7	#6	#5	#4	#3	#2	#1	#0	
8656									L
	RTMS							V113	M

Data format: bit type

- V113 0: The 2nd movement of an oscillation axis is;
  0: Returns by an absolute value of a V-command
  1: Moves in the direction indicated by the sign of a V-command (Compatible with MII)

- RTMS 0: When an M-, S-, T-, or B-code contained block is encountered while moving backward by a retracing function, that code is executed to continue moving backward
  1: When an M-, S-, T-, or B-code contained block is encountered while moving backward by a retrace function, a warning is issued without executing that code.

	#7	#6	#5	#4	#3	#2	#1	#0	
8657	TCPN						PRHLN	PRON	L
	TCPN		STLC	MMGS			PRHLN	PRON	M

Data format: Bit type

- PRON 0: When an O-number is specified upon restarting the program, an N-number is searched for after calling the program relevant to the specified O-number. (A search is completed when the specified N-number matches)
  1: When an O-number is specified upon restarting the program, an N-number is searched for using the program relevant to the currently called O-number and the specified O-number is added to the search conditions. (A search is completed when the specified N-number matches in the specified program)
- PRHLN 0: When searching for a block in the canned cycle for drilling after restarting the program, use the number of holes to specify the number of repeat times (L)
  1: When searching for a block in the canned cycle for drilling after restarting the program, use the number of command blocks to specify the number of repeat times (L)
- MMGS 0: The specification of the matrix magazine is standard.
  1: The specification of the matrix magazine is special.
- STLS 0: Does not use a T-type boring bar as a special tool (chain type).
  1: Use a T-type boring bar as a special tool (chain type).
- TCPN 0: Uses thrmal displacement compensation.
  1: Does not use thrmal displacement compensation.

	#7	#6	#5	#4	#3	#2	#1	#0	
8658	SLG2				SOT	DSW	DSPO	PTSM	L

Data format: Bit type

- PTSM 0: The machining time for each machining time display program is set at the time of all resets
  1: The machining time for each machining time display program is set at the

time of executing M02/M30

- SLG2 In command G22 to set boundary values for the stored stroke limits 2/3;
  - 0: Limit 3 boundary value is changed.
  - 1: Limit 2 boundary value is changed.
- DSPO
  - 0: Does not turn off the “discharge signal (DSP0:RF46, #0)” by reset in the L-system scheduler.
  - 1: Turns off the “discharge signal (DSP0:RF46, #0)” by reset in the L-system scheduler.
- DSW
  - 0: Does not turn off the “different work signal (DSDW:RF46, #1)” and “last work signal (DSFW:RF46, #2)” by reset in the L-system scheduler.
  - 1: Turns off the “different work signal (DSDW:RF46, #1)” and “last work signal (DSFW:RF46, #2)” by reset in the L-system scheduler.
- SOT
  - 0: Enables the discharge counter in the L-system scheduler. (Loader specification)
  - 1: Disables the discharge counter in the L-system scheduler. (Bar feeder specification)

	#7	#6	#5	#4	#3	#2	#1	#0	
8659									L
						SBBG	SBOH	SBLT	M

Data format: Bit type

- SBLT
  - 0: Disables a light-weight tool as the special tool Type B.
  - 1: Enables a light-weight tool as the special tool Type B.
- SBOH
  - 0: Disables an oil hole tool as the special tool Type B.
  - 1: Enables an oil hole tool as the special tool Type B.
- SBLT
  - 0: Disables a large-diameter tool as the special tool Type B.
  - 1: Enables a large-diameter tool as the special tool Type B.

	#7	#6	#5	#4	#3	#2	#1	#0	
8660									L
		NI1	MI0						M

Data format: Bit type [Valid for **Σ 16M/18M**]

- NI0 Be sure to set 1.
- NI1 Be sure to set 0.

	#7	#6	#5	#4	#3	#2	#1	#0	
8663	NWLY		PDWW	PDLN	TOWR2	NTWR1	TLCL2	TLCL2	L
									M

Data format: Bit type

- TLCL1, TLCL2 Setting as to whether the "type" and "name" of the tool unused at the time of tool layout creation in the operation guide function

TLCL2	TLCL1	Description
0	0	Clears the "type" and "name
0	1	Clears only the "name"
1	0	Clears only the "type"
1	1	Clears neither of them

- NTWR1 In the operation guide function, data of the tool nose point, tool nose radius, and knife-edge width of the auto programming tool file are:
  0: Set, in the NC tool offset amount, at the time of tool layout creation. (where, the wear compensation amounts for the tool nose R and knife-edge width become 0.)
  1: Not set, in the NC tool offset amount, at the time of tool layout creation.

  (Note) *Which of the data among those of the tool nose point, tool nose radius, and knife-edge width are made valid is decided beforehand for each tool file number.*

- TOWR2 In the operation guide function, the tool offset profile data (X/Z) of the auto programming tool file are:
  0: Not set, in the NC tool offset amount, at the time of tool layout creation.
  1: Set, in the NC tool offset amount, at the time of tool layout creation. (Wear compensation amount for each becomes 0. The Y-axis compensation volume is not set.)
- PDLN In the operation guide function, the setup information L data (work reference point shift volume Z) in ( ) are:
  0: Set, in the NC parameter, at the time of tool layout creation. (Not set, however, for No L/L = 0.)
  1: Not set, in the NC parameter, at the time of tool layout creation.
- PDWW In the operation guide function, the setup information W data (work length) in ( ) are:
  0: Not set, in the NC parameter, at the time of tool layout creation. (Always work length = 0)
  1: Set, in the NC parameter, at the time of tool layout creation.

  (Note) *When Z setter is provided, this parameter = 1.*

- NWLY In the operation guide function, with the setup information in ( ):

0: '$' character is not identified at the time of tool layout creation.

1: '$' character is identified, where characters of and after '$' alone are made valid at the time of tool layout creation.

(Note) *In S- **Σ** 10L Multi type, the number of drilling tool files on the auto programming side is 200 sets, while it is equal to 100 for the format Multi type. Note, therefore, tool layout cannot be correctly created on the S- **Σ** 10L through use of a program (setup information) created by the conventional Multi. In order to solve this program, a new specification has been added in which '$' is output at the beginning of the setup information of the **Σ** 10L auto programming side. In other words, this parameter serves to recognize that a program without '$' is 100-sets specification, thus preventing creation of an erroneous tool layout. When using a program created in the conventional Multi type, register the program in the NC equipment with this parameter = 1 and, then, change it into the setup information in 200-set spec. on the auto programming side.*

Further, with this parameter = 1, setup information without '$' is taken as "Without setup information" in operation guide processing.

	#7	#6	#5	#4	#3	#2	#1	#0	
8664	ATLY	NINF	WTLFL2	WTLFL1		MTP2	MTP1	MTP0	L
									M

Data format: Bit type

• MTP0, MTP1, MTP2 Select the machine model for the operation guide function.

MTP2	MTP1	MTP0	Model
0	0	0	NRIII/TF25
0	0	1	TG
0	1	0	CA20/23II
0	1	1	CA30/40II

• WTLFL1 In the operation guide function, the NC tool offset data (tool nose point, tool nose radius knife-edge width) are:

0: Not set, in a tool file on the auto programming side, at the time of tool layout creation.

1: Set, in a tool file on the auto programming side, at the time of tool layout creation. (For the tool nose radius and knife-edge width, profile data alone are set).

- WTLFL2 In the operation guide function, the NC tool offset data (profile X/Z) are:
  - 0: Not set, in a tool file on the auto programming side, at the time of tool layout creation.
  - 1: Set, in a tool file on the auto programming side, at the time of tool layout creation. (Neither wear data not Y-axis compensation amount is set.)
- NINF
  - 0: Displays the explanatory screen and moves to the "Dimension Adjustment/ Tool Layout" screen with a function key, when "Dimension Adjustment/Tool Layout" is selected in the menu in the operation guide function.
  - 1: Displays the "Dimension Adjustment/Tool Layout" screen directly without the explanatory screen, when "Dimension Adjustment/Tool Layout" is selected in the menu in the operation guide function.
- ATLY
  - 0: Tool layout in the operation guide function is created with the function keys after calling the program.
  - 1: Tool layout in the operation guide function is created automatically when the program is called.

	#7	#6	#5	#4	#3	#2	#1	#0	
8665	BKSP	ROTL	TTP2	TTP1		TLS2	TLS1	TLS0	L
									M

Data format: Bit type

- TLS0, TLS1, TLS2 Sets the type of the tail stock for the operation guide function.

TLS2	TLS1	TLS0	Type of Tail Stock	Applicable Model
0	0	0	No tail stock	
0	0	1	Standard	NR **III** , TF25, TG, CA20/23 **II**
0	1	0	With timer (M code control)	NR **III** , TF25, CA20/23 **II**
0	1	1	Programmable (B axis control)	NR **III** , TF25, TG, CA20/23 **II**
1	0	0	Mobile	TG, CA30/40 **II**

- TTP1, TTP2, ROTL Type of the turret head and use/nonuse of a rotary tool for the operation guide function are set here.

ROTL	TTP2	TTP1	Tool Rest Type	Use/Nonuse of Rotary Tool
0	0	0	BH (base holder) type	Not used
0	0	1	VDI type	Not used
1	0	1	VDI type	Used
0	1	0	QCT type	Not used
1	1	0	QCT type	Used

• BKSP Whether the back spindle should be set for the operation guide function

0: Does not set the back spindle

1: Sets the back spindle

		#7	#6	#5	#4	#3	#2	#1	#0	
8666						NZPEx	NZPDx	NZPCx	NZPBx	L
		PRSCx				NZPEx	NZPDx	NZPCx	NZPBx	M

Data format: Bit axis type

• NZPBx, NZPCx, NZPDx, NZPEx
0: Starts checking the position area B, C, D, and E for each axis, respectively, after completing zero point return.
0: Starts checking the position area B, C, D, and E for each axis, respectively, immediately after power-on.

• PRSCx In program restarting function, the rotary axis, when approaching to the restarting position,:

0: Does not take a shortcut.

1: Takes a shortcut.

		#7	#6	#5	#4	#3	#2	#1	#0	
8667										L
									NMIx	M

Data format: Byte axis type [Only for Σ 16M/18M]

• NMXIx 0: Enables a batch delivery in the AI contout control mode for the respective axes.

1: Disables a batch delivery in the AI contout control mode for the respective axes.

(Note) *Set "1" for the controlled axis by the PMC or the Cs axis.*

8668	Manual Rapid Traverse Clamp Override before Zero Point Return
8669	Manual Rapid Traverse Clamp Override after Zero Point Return
8670	Automatic Rapid Traverse Clamp Override before Zero Point Return
8671	Rapid Traverse Clamp Override at Full Automatic Zero Point Return before Zero Point Return

Data format: Byte type

Unit of data: %

Data range: 1 to 100

Set rapid override clamp values in the respective states. When a rapid traverse override value selected at the machine operation panel exceeds the set value, rapid traverse override is clamped at the set value.

(Note 1) *When the data is beyond the specified range, it is assumed to be 100%. (It is not clamped)*

(Note 2) *Rapid traverse override is not clamped in automatic operation after zero point return and full automatic zero point return after zero point return.*

8673		L
	Oscillation Compensation Coefficient	M

Data format: Byte type

Unit of data: %

Data range: 0 to 100 (Standard value: 100)

Set a coefficient to multiply a servo delay amount offset value during oscillation and a delay amount offset amount at the time of acceleration/deceleration (calculation values inside the NC unit) by it.

(Note 1) *When the set value of this parameter is 0, a servo delay is not compensated.*

(Note 2) *For the details of servo delay compensation, see the description of the parameter no. 8677.*

8676		L
	Selection of DI/DO Group for Each Axis in Axis Control by PMC	M

Data format: Byte axis type

Data range: 1 to 4

Set Value	Meaning
1	Used the DI/DO group-A (G142 to G153).
2	Used the DI/DO group-B (G154 to G165).
3	Used the DI/DO group-C (G166 to G177).
4	Used the DI/DO group-D (G178 to G189).

8677		L
	Oscillation Compensation Start Allowable Error Amount	M

Data format: Word type

Unit of data:

IS-A	IS-B	IS-C	Unit
0.01	0.001	0.0001	mm

Data range: 0 to 32767

In servo delay compensation during oscillating operation, apply compensation when the difference between the shortage at the upper dead point and that at the lower dead point is smaller than this parameter.

In short, this parameter is to apply compensation after oscillation is stabilized.

(Note) *When the set value of this parameter is 0, servo delay compensation is not applied.*

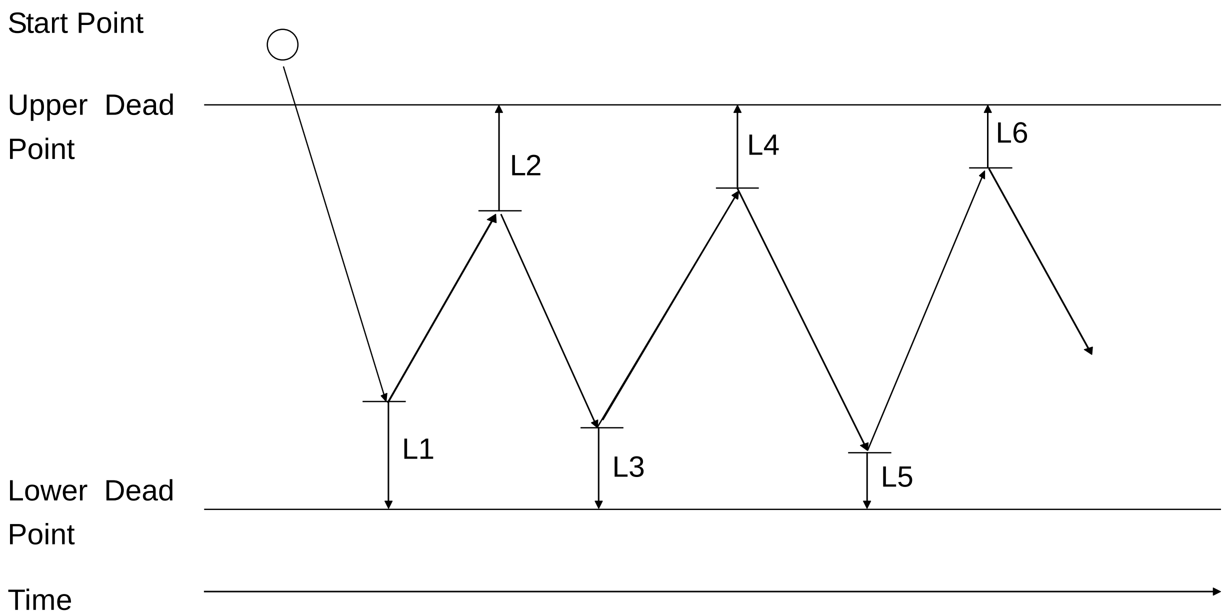
<Servo delay Compensating Function during Oscillations>

When a grinding axis is oscillated at a high speed, an actual tool does not reach a specified position due to a servo delay and a delay at acceleration/deceleration. The control unit measures the difference between the specified position and an actual tool position and compensates for this shortage automatically.

In order to compensate for shortage, a specified stroke is increased by a compensation amount corresponding to the shortage than the distance between the upper and lower dead points, and an oscillation command is executed at a speed which ensures that the number of oscillating operation per unit time will equal the specified number of times. That is, after starting oscillating operation, when the difference between the shortage to the upper dead point and that to the lower dead point is smaller than the set value of the parameter no. 8677, compensation is applied.

Once compensation is initiated, the oscillation axis goes beyond the specified upper/lower dead point and an oscillation speed also increases gradually. Then, when the difference between the actual machine position and specified position becomes less than in-position (parameter no. 1826), further compensation is cancelled, and thereafter, the tool keeps moving at the then feed rate.

You can also set the parameter no. 8673 designed for setting a coefficient used to multiply a servo delay compensation amount during oscillating operation or a shortage compensation amount due to a delay at the time of acceleration/deceleration.



Shortage at the upper dead point: L2, L4, L6

Shortage at the lower dead point: L1, L3, L5

Compensation is initiated in case of;

| L3 - L2 | < Compensation start allowable error amount (parameter no. 8677)

Compensation is cancelled and the tool keeps moving at the then feed rate in case of;

| L6 | < In-position (parameter no. 1826)

8678	M code to start Polygon turning.	L
		M

8679	M code to end Polygon turning.	L
		M

Data format: Word type

Data range: 1 to 32767

M codes to start and end Polygon turning (Polygon Synch. mode) are set.

(Note) *As for details, see description of the parameters of "2.22 Parameters Related to Polygon Turning".*

8680		L
	Maximum Number of Controlled Axes by RISC	M

Data format: Word type

Data range: 1 to maximum number of controlled axes

Set the maximum number of axes controlled by RISC.

(Note) *For the details, see the description of the parameter in 2.24 Parameters Related to High-speed, High-accuracy Contour Control by RISC.*

8684		L
	M-code for Switching toAI Countour Control Mode	M

Data format: Word type   [Valid for **Σ** 16M/18M]

Data range: 1 to 32767

Set the M-code to be generated inside the NC unit in order to switch to the AI contour control mode.

(Note) *The M-code is regarded as M22 when the data is beyond the above-mentioned range.*

8685	Upper-limit Feed Rate per Revolution in Axis Control by PMC

Data format: Word axis type

Least input increment:

Data range:

	Least Input Increment	Data range	
		IS-B	IS-C
Linear axis	1 mm/min	6 ~ 15000	6 ~ 12000
Rotary axis	1 deg/min	6 ~ 15000	6 ~ 12000

Set the upper-limit feed rate per revolution in axis control by the PMC.

(Note) *The rate set for the 1st axis will be applied to all the axes. Setting for the 2nd axis onward is meaningless.*

8686		L
	Backward Feed Rate	M

Data format: Long type

Unit of data:

	Effective Digits of Speed F for Feed per Minute					Unit
	F60	F61	F62	F51	F52	
Metric input	1	0.1	0.01			mm/min
Inch input				0.1	0.01	inch/min

Data range: 0 to 99999999

Set a backward feed rate in the retracing function.

(1) For rapid traverse

With G00 replaced by G01, the tool moves backward at the feed rate set in this parameter.

(Note) *When the set value of this parameter is 0, the tool moves backward at a rapid traverse rate (parameter no. 1420) without replacing G00 by G01.*

(2) For cutting feed

The tool moves backward at the feed rate set in this parameter.

(Note) *When the set value of this parameter is 0, the tool moves backward at the feed rate (F) specified by the program. Without replacing G00 by G01.*

8690	Back Spindle Work Transfer: Work Drawing M-code	L
		M

Data format: Long type

Data range: 0 to 99999999

Set an M-code which draws the work with torque limit applied to the B-axis, in the work transfer function for the back spindle.

It this M-code is specified in the work transfer mode (signal from the machine), the B-axis will move over the amount set in the parameter no. 8691 at the speed set in the parameter no. 8692, after the M-code is completed.

G98 G01 D_(PRM8691) F_(PRM8692)

Normally, set the M-code which specifies chucking of the back spindle.

When a set value is "0", M118 is assumed.

8691	Back Spindle Work Transfer: B-axis Move Amount at Work Drawing Time	L
		M

Data format: Long type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set a B-axis move amount applied when the work is drawn with torque limit applied to the B-axis, in the work transfer function for the back spindle. When a set value is "0", the work is not drawn.

For details, see a description for the parameter no. 8690.

8692	Back Spindle Work Transfer: B-axis Move Speed at Work Drawing Time	L
		M

Data format: Long type

Unit of data:

	Speed-F Significant Digits for Feed per Minute				Unit
	F60	F61	F51	F52	
Metric input	1	0.1			mm/min
Inch input			0.1	0.01	inch/min

Data range: 0 to 99999999

Set a B-axis speed applied when the work is drawn with torque limit applied to the B-axis, in the work transfer function for the back spindle.

When a set value is "0", the work is not drawn.

For details, see a description for the parameter no. 8690.

8693		L
	5-face Machining System: Angle Offset Amount for Tool Nose Interference Check	M

Data format: Long type

Unit of data: degrees

Data range: 0 to 359 (Standard set value = 0)

Set an angle offset value used when making a tool nose interference check in the 5-face machining system. In a tool nose interference check, the X-axis is used as the reference (00) to determine a spindle indexing angle. A reference angle (00 position) can be shifted by setting this parameter.

8694		L
	Maximum Feed Rate of Oscillation Axis	M

Data format: Long axis type

Unit of data: mm/min.

Data range:

IS-A, IS-B	IS-C
30 ~ 240000	30 ~ 100000

Set a maximum feed rate in oscillating operation for each axis. An oscillation speed is clamped at the set value of this parameter.

(Note 1) *Normally, set only for the Z-axis (axis to be oscillated).*

(Note 2) *When the set value of this parameter is 0, oscillating operation is not performed.*

8695		L
	5-face Machining System: Positive (Plus) Directional Coordinate Value for Tool Nose Interference Check 1	M

8696		L
	5-face Machining System: Negative (Minus) Directional Coordinate Value for Tool Nose Interference Check 1	M

8697		L
	5-face Machining System: Positive (Plus) Directional Coordinate Value for Tool Nose Interference Check 2	M

8698		L
	5-face Machining System: Negative (Minus) Directional Coordinate Value for Tool Nose Interference Check 2	M

8699		L
	5-face Machining System: Positive (Plus) Directional Coordinate Value for Tool Nose Interference Check 3	M

8700		L
	5-face Machining System: Negative (Minus) Directional Coordinate Value for Tool Nose Interference Check 3	M

8701		L
	5-face Machining System: Positive (Plus) Directional Coordinate Value for Tool Nose Interference Check 4	M

8702		L
	5-face Machining System: Negative (Minus) Directional Coordinate Value for Tool Nose Interference Check 4	M

Data format: Long axis type

Unit of data:

	IS-A	IS-B	IS-C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

Data range: -99999999 to 99999999

Set values in the machining coordinate system, which are used as boundaries or prohibited areas for tool nose interference checks 1 through 4 of the 5-face machining system.

(Note 1) *Use the parameter no. 8655, #0 (BR1) through #3 (BR4) to enable or disable tool nose interference checks 1 through 4, respectively, and use the parameter no. 8655, #4 (TI1) through #7 (TI4) to select the inside or outside as the prohibited area, respectively.*

(Note 2) *Tool nose interference check is applied to only the three axes, X, Y, and Z. It is not necessary to set the data of the other axes.*

8703	Approach Order to Program Restart Position at Program Restart

Data format: Byte axis type

Data range: 1 to maximum number of controlled axes

Set an order of axes which approach a program restart position at a dry run speed after searching for a program restarted block at the time of program restart.

Set "1" for the axis moving first, "2" for the axis moving next, in that order. Finally, set the maximum number of controlled axes for the axis moving last.

(Note) *Since only one axis is allowed to move at the same time, you cannot set the same value for multiple axes.*

<Example> When there are four controlled axes, the axis names are X, Y, Z, and B, respectively, and you want to move them in order of B, X, Y, and Z;

Parameter no. 8703	X	2
	Y	3
	Z	4
	B	1

8705	Linear Acceleration/Deceleration Time Constant for Speed Command Continuous Feed for Each Axis in Axis Control by PMC

Data format: Word axis type

Unit of data: msec./1,000 rpm

Data range: 0 to 32767

As a linear acceleration/deceleration time constant for speed command continuous feed in axis control by the PMC, set for each axis the time required to increase/decrease a servo motor speed by 1,000 rpm.

(Note) *When this parameter is set to 0,acceleration/deceleration control is not provided.*

8707	Operation Guide: Number of Shift Faces between Cutting Face and Tool Setting Face to Turret	L M

Data format: Byte type

Data range: 0 to 127

Set the number of shift faces between the cutting face and tool setting face of the turret used in the operation guide.

8711	Operation Guide: Maximum Clamping Force of Chuck	L M

8712	Operation Guide: Maximum Center Pressure	L M

Data format: Word type

Unit of data: kgf/cm^2

Data range: 0 to 32767

Set the maximum clamping force of the chuck and maximum center pressure display in the operation guide.

8715	Operation Guide: Maximum Projection Length of Outer Diameter Tool (Front)	L M

8716	Operation Guide: Maximum Projection Length of Inner Diameter Tool (Front)	L M

8717	Operation Guide: Maximum Projection Length of Outer Diameter Tool (Back)	L M

8718	Operation Guide: Maximum Projection Length of Inner Diameter Tool (Back)	L M

8719	Operation Guide: Maximum Projection Length of X-axis Rotary Tool (Front)	L
		M

8720	Operation Guide: Maximum Projection Length of Z-axis Rotary Tool (Front)	L
		M

8721	Operation Guide: Maximum Projection Length of X-axis Rotary Tool (Back)	L
		M

8722	Operation Guide: Maximum Projection Length of Z-axis Rotary Tool (Back)	L
		M

Data format: Long type

Least input increment:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set the maximum projection length of each tool displayed in the operation guide.

8723	Operation Guide: Tail Stock Moving Speed (Timer Type)	L
		M

Data format: Long type

Unit of data: mm/sec.

Data range: 0 to 99999999

Set the moving speed of the timer type tail stock displayed in the operation guide.

8724	Operation Guide: Quill Minimum Projection Length	L
		M

8725	Operation Guide: Quill Minimum Projection Length	L
		M

Data format: Long type

Unit of data: 0.01 mm for metric input, 0.01 inch for inch input

Data range: 0 to 99999999

Set the minimum and maximum values for quill projection length to be displayed in the operation guide function.

8727	Repair/Correction: Width of Outer Diameter Reference Tool Used for Z-axis Zero Point Correction	L
		M

Data format: Long type

Least input increment:

	IS-A	IS-B	IS-C	Unit
Metric system	0.01	0.001	0.0001	mm
Inch system	0.001	0.0001	0.00001	inch

Data range: 0 to 99999999

Set the width of the outer diameter reference tool used for Z-axis zero point correction by the repair/correction function.

8728	Repair/Correction: Minimum Allowable Zero Point Shift Amount for Each Axis in Zero Point Correction	L
		M

8729	Repair/Correction: Minimum Allowable Zero Point Shift Amount for Each Axis in Zero Point Correction	L
		M

Data format: Long axis type

Least input increment: Detection increment

Data range: 0 to 99999999

Set for each axis the minimum and maximum allowable zero point shift amounts used for zero point correction by the repair/correction function.

The following lists the relations between the zero point shift amounts calculated in zero point correction and these parameters, and their corresponding zero point corrections.

Zero Point Shift Amount vs. Parameter	Zero Point Correction
Shift amount ≦ Min. allowable amount	Do not correct because this is a normal range.
Min. allowable value < Shift amount ≦ Max. allowable value	Correct the shift amount.
Max. allowable value < Shift amount	The shift amount is too large to correct.

2.26 Parameters Related to Maintenance

	#7	#6	#5	#4	#3	#2	#1	#0
8900						PPA	NPA	PWE

Data format: Bit type

- PWE 0: Disables parameter rewriting
  1: Enables parameter rewriting
- NPA 0: Switches automatically to the ALARM screen when a CNC alarm occurs
  1: Does not switch the screen when a CNC alarm occurs
- PPA 0: Does not switch the screen when a PMC alarm occurs
  1: Switches automatically to the ALARM screen when a PMC alarm occurs

	#7	#6	#5	#4	#3	#2	#1	#0
8901	FPNC							ALST

Data format: Bit type

- ALST 0: Does not list the NC alarm messages in the ALARM screen
  1: Lists the NC alarm messages in the ALARM screen
- FPNC 0: Makes an F parameter function (C language executor) error check.
  1: Does not make an F parameter function (C language executor) error check.

	#7	#6	#5	#4	#3	#2	#1	#0
8902	DNDC							PPBT

Data format: Bit type

- PPBT 0: If the Bit No. Q is omitted when inputting a bit type parameter in programmable parameter input (G10 L50), the data R is considered a decimal number.
  1: If the Bit No. Q is omitted when inputting a bit type parameter in programmable parameter input (G10 L50), the data R is considered a bit pattern.
- DNDC 0: When operation data is short at the time of buffering in other than memory operation (tape, DNC, etc.), the warning No. 582 is not displayed.
  1: When operation data is short at the time of buffering in other than memory operation (tape, DNC, etc.), the warning No. 582 is displayed.

	#7	#6	#5	#4	#3	#2	#1	#0
8907	MCDN							SNDP

Data format: Bit type

- SNDP 0: Does not display the screen maintenance information at the upper right of the screen (L and N display area).
  1: Displays the screen maintenance information at the upper right of the screen (L and N display area).
- MCDN [Only for Σ 16/18/21]
  0: Enables automatic recognition of the memory card.
  1: Disablesautomatic recognition of the memory card.

	#7	#6	#5	#4	#3	#2	#1	#0	
8908								QOT2Px	L
									M

Data format: Bit axis type

- Q0T2Px 0: When disabling stored stroke limit-2 in the Q-setter mode (PRM6245, #0 = 1), stored stroke limit-2 prior to the Q-setter mode is disabled.
  1: When disabling stored stroke limit-2 in the Q-setter mode (PRM6245, #0 = 1), stored stroke limit-2 prior to the Q-setter mode is enabled.

(Note) When disabling stored stroke limit-2 in the Q-setter mode, store the previous state (PRM1310, #0) in this parameter.

IV. DIAGNOSE

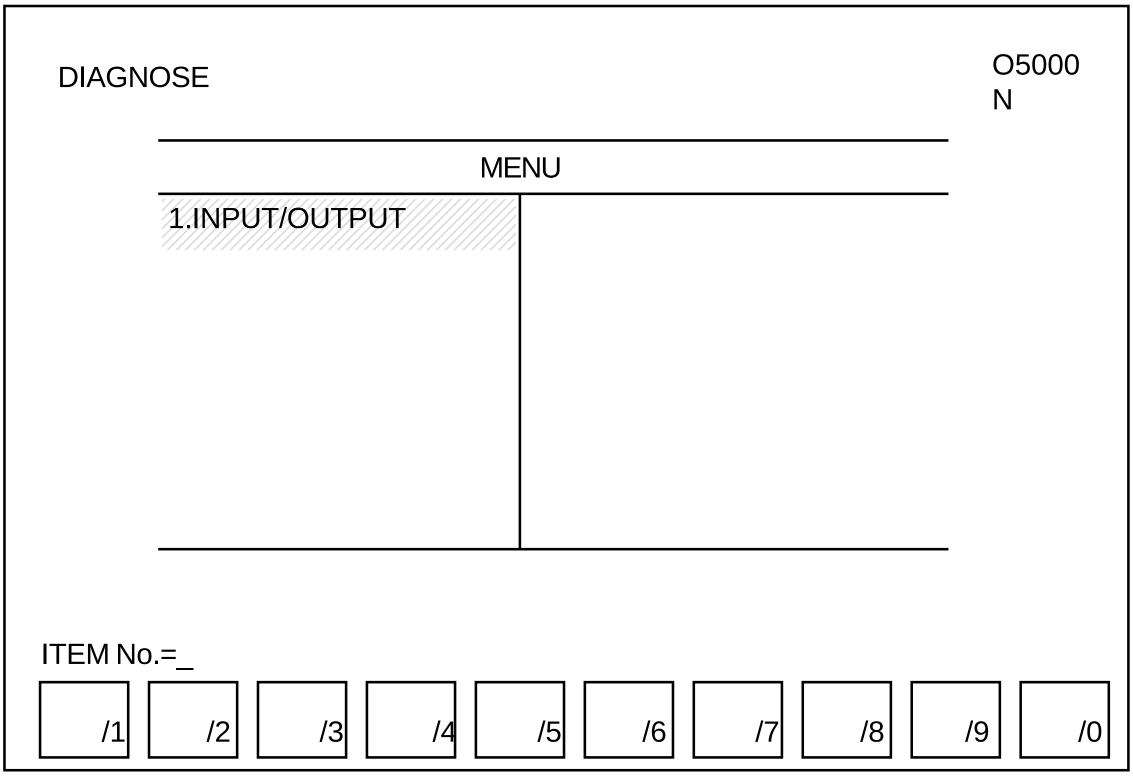
1. DIAGNOSE DISPLAY

    1.1 Input/Output Signals

1. DIAGNOSE DISPLAY

① Press the FRONT/BACK key, soft key F4/SYSTEM , and then, press 2 and INPUT in the menu to display the DIAGNOSE screen.

② Select the item you want to display and press a relevant numerical key.



1.1 Input/Output Signals

DIAGNOSE O5000 N

OUTPUT SIGNAL TO NC 1 (PMC-->CNC) 1/8

No	7 6 5 4 3 2 1 0	HEX	No	7 6 5 4 3 2 1 0	HEX
G000	0 0 0 0 0 0 0 0	00	G016	0 0 0 0 0 0 0 0	00
G001	0 0 0 0 0 0 0 0	00	G017	0 0 0 0 0 0 0 0	00
G002	0 0 0 0 0 0 0 0	00	G018	0 0 0 0 0 0 0 0	00
G003	0 0 0 0 0 0 0 0	00	G019	0 0 0 0 0 0 0 0	00
G004	0 0 0 0 0 0 0 0	00	G020	0 0 0 0 0 0 0 0	00
G005	0 0 0 0 0 0 0 0	00	G021	0 0 0 0 0 0 0 0	00
G006	0 0 0 0 0 0 0 0	00	G022	0 0 0 0 0 0 0 0	00
G007	0 0 0 0 0 0 0 0	00	G023	0 0 0 0 0 0 0 0	00
G008	0 0 0 0 0 0 0 0	00	G024	0 0 0 0 0 0 0 0	00
G009	0 0 0 0 0 0 0 0	00	G025	0 0 0 0 0 0 0 0	00
G010	0 0 0 0 0 0 0 0	00	G026	0 0 0 0 0 0 0 0	00
G011	0 0 0 0 0 0 0 0	00	G027	0 0 0 0 0 0 0 0	00
G012	0 0 0 0 0 0 0 0	00	G028	0 0 0 0 0 0 0 0	00
G013	0 0 0 0 0 0 0 0	00	G029	0 0 0 0 0 0 0 0	00
G014	0 0 0 0 0 0 0 0	00	G030	0 0 0 0 0 0 0 0	00
G015	0 0 0 0 0 0 0 0	00	G031	0 0 0 0 0 0 0 0	00

G	RG	F	RF		X	Y			
RELAY /1	RELAY /2	RELAY /3	RELAY /4	/5	RELAY /6	RELAY /7	/8	/9	/0

The input/output signals of the PMC are displayed in the form of byte bit.

Use the function keys to change over a G-contact, RG-contact, F-contact, RF-contact, X-contact, and Y-contact.

The G-contact represents an output signal-1 to the NC unit (PMC → CNC), RG contact an output signal-2 to the NC unit (PMC → CNC), F-contact an input signal-1 from the NC unit (CNC → PMC), RF-contact an input signal-2 from the NC unit (CNC → PMC), X-contact an input signal from the machine (machine → PMC), and Y-contact an output signal to the machine (PMC → machine) respectively.

In the list, the signals marked "M" to their left are exclusive for the M-system (machining centers), those marked "L" are exclusive for the L-system (lathes), and those with no mark are common to both.

Output Signals-1 to NC Unit (G-contact) 1/18

No.	7	6	5	4	3	2	1	0
G000								
G001								
G002								
G003								
G004		MFIN3 3rd M-function finish	MFIN2 2nd M-function finish	FIN Miscella-neous function finish				
G005	[M] BFIN High-speed B-function finish	AFL Miscella-neous function lock		[L] BFIN High-speed B-function finish	TFIN High-speed T-function finish	SFIN High-speed S-function finish		MFIN High-speed M-function finish
G006		[L] SKIPP		OVC Override cancel		*ABSM Manual absolute		
G007	[M] RLSOT Soft limit cancel	EXLM Stored stroke limit changeover	*FLWP Follow up			ST Automatic operation start	[L] STLK Start lock	
G008	ERS External reset	RRW Reset & rewind	*SP Automatic operation pause	*ESP Emergency stop				*IT All axes interlock
G009								
G010	*JV7 Manual feed rate override	*JV6	*JV5	*JV4	*JV3	*JV2	*JV1	*JV0

Output Signals-1 to NC Unit (G-contact) 2/18

No.	7	6	5	4	3	2	1	0
G011	*JV15 Manual feed rate override	*JV14	*JV13	*JV12	*JV11	*JV10	*JV9	*JV8
G012	*FV7 Feed rate override	*FV6	*FV5	*FV4	*FV3	*FV2	*FV1	*FV0
G013								
G014								
G015								
G016	M FID F 1-digit select							
G017								
G018	HS2D Manual handle feed axis select	HS2C	HS2B	HS2A	HS1D	HS1C	HS1B	HS1A
G019	RT Rapid traverse		MP2 Manual handle feed stroke select	MP1	HS3D Manual handle feed axis select	HS3C	HS3B	HS3A
G020								
G021								

Output Signals-1 to NC Unit (G-contact) 3/18

No.	7	6	5	4	3	2	1	0
G022								
G023	M ALNGH							
G024								
G025								
G026								
G027	CON Cs-axis contour control		L *SSTP3 3rd spindle stop	L *SSTP2 2nd spindle stop	L *SSTP1 1st spindle stop	L SW3 Spindle changeover	L SW2	L SW1
G028	L PC2SLC Position coder select	L SPSTP Spindle stop check	L *SCPF Spindle clamp check	L *SUCPF Spindle unclamp check		GR2 Gear select	GR1	
G029		*SSTP Spindle stop	SOR Spindle orientation	SAR Spindle speed arrival		L GR31		L GR21
G030	SOV7 Spindle override	SOV6	SOV5	SOV4	SOV3	SOV2	SOV1	SOV0
G031								
G032	RO8I Spindle rpm command input	RO7I	RO6I	RO5I	RO4I	RO3I	RO2I	RO1I

Output Signals-1 to NC Unit (G-contact) 4/18

No.	7	6	5	4	3	2	1	0
G033	SIND Spindle control select	SSIN Spindle polarity control select	SGN Spindle polarity select		R12I Spindle rpm command input	R11I	R10I	R19I
G034	RO8I2 2nd spin-dle rpm command input	RO7I2	RO6I2	RO5I2	RO4I2	RO3I2	RO2I2	RO1I2
G035	SIND2 2nd spindle control select	SSIN2 2nd spin-dle polarity control select	SGN2 2nd spindle polarity select		R12I2 2nd spin-dle rpm command input	R11I2	R10I2	R09I2
G036	RO8I3 3rd spindle rpm command input	RO7I3	RO6I3	RO5I3	RO4I3	RO3I3	RO2I3	RO1I3
G037	SIND3 3rd spindle control select	SSIN3 3rd spindle polarity control select	SGN3 3rd spindle polarity select		R12I3 3rd spindle rpm command input	R11I3	R10I3	R09I3
G038					SPPHS Spindle in-phase control	SPSYC Spindle synchronize		L *PLSST Polygon spindle stop signal
G039								
G040								
G041	HS2ID Manual handle interrupt	HS2IC	HS2IB	HS2IA	HS1ID	HS1IC	HS1IB	HS1IA
G042					M HS3ID Manual handle interrupt	M HS3IC	M HS3IB	M HS3IA
G043	ZRN Reference point return mode		DNCI DNC operation			MD4 Mode select	MD2	MD1

Output Signals-1 to NC Unit (G-contact) 5/18

No.	7	6	5	4	3	2	1	0
G044							MLK Machine lock	BDT1 Block skip signal
G045	BDT9 Optional block skip signal	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
G046	DRN Dry run	KEY4 Memory protect	KEY3	KEY2	KEY1		SBK Single block	
G047								
G048								
G049								
G050								
G051	[M]*C HLD Oscillation suspend				[M]*CHP8 Oscillation feed override	[M]*CHP4	[M]*CHP2	[M]*CHP1
G052								
G053	[L]CDZ Chamfering				UNIT Custom macro interrupt			
G054								

Output Signals-1 to NC Unit (G-contact) 6/18

No.	7	6	5	4	3	2	1	0
G055								
G056								
G057								
G058								
G059							TRRTN Tool return	TRESC Tool retract
G060	└*TSB Tail stock barrier select signal							
G061			└RGTSP2 Direct tap spindle select signal	└RGTSP1 →				RGTAP Direct tap mode
G062								
G063								
G064								
G065								

Output Signals-1 to NC Unit (G-contact) 7/18

No.	7	6	5	4	3	2	1	0
G066								IGNVRY All axes VRDY OFF alarm neg-lect signal
G067								
G068								
G069								
G070	MRDYA 1st serial spindle ready	ORCMA (Serial) Orientation command	SFRA (Serial) Spindle forward command	SRVA (Serial) Spindle reverse command	CTH1A (Serial) Clutch/ gear select 1	CTH2A (Serial) Clutch/ gear select 2	TLMHA (Serial) Torque limit (High)	TLMLA (Serial) Torque limit (Low)
G071	RCHA (Serial) Power line status check	RSLA (Serial) Output changeover request	INTGA (Serial) Speed inte-gral control signal	SOCNA (Serial) Start/stop cancel	MCFNA (Serial) Power line changeover	SPSLA (Serial) Spind select	*ESPA (Serial) Emergency stop	ARSTA (Serial) Alarm reset
G072								
G073								
G074	MRDYB 2nd serial spindle ready	ORCMB (Serial) Orientation command	SFRB (Serial) Spindle forward command	SRVB (Serial) Spindle reverse command	CTH1B (Serial) Clutch/ gear select 1	CTH2B (Serial) Clutch/ gear select 2	TLMHB (Serial) Torque limit (High)	TLMLB (Serial) Torque limit (Low)
G075	RCHB (Serial) Power line status check	RSLB (Serial) Output changeover request	INTGB (Serial) Speed inte-gral control signal	SOCNB (Serial) Start/stop cancel	MCFNB (Serial) Power line changeover	SPSLB (Serial) Spind select	*ESPB (Serial) Emergency stop	ARSTB (Serial) Alarm reset
G076								

Output Signals-1 to NC Unit (G-contact) 8/18

No.	7	6	5	4	3	2	1	0
G077								
G078	SHA07 Spindle ORT external stop position command	SHA06	SHA05	SHA04	SHA03	SHA02	SHA01	SHA00
G079					SHA11 Spindle ORT external stop position command	SHA10	SHA09	SHA08
G080	SHB07 Spindle ORT external stop position command	SHB06	SHB05	SHB04	SHB03	SHB02	SHB01	SHB00
G081					SHB11 Spindle ORT external stop position command	SHB10	SHB09	SHB08
G082								
G083								
G084								
G085								
G086								
G087								

Output Signals-1 to NC Unit (G-contact) 9/18

No.	7	6	5	4	3	2	1	0
G088								
G089								
G090								
G091								
G092								
G093								
G094								
G095								
G096	HROV Rapid traverse OVER selection in 1% step	*HROV6 Rapid traverse override in 1% step	*HROV5	*HROV4	*HROV3	*HROV2	*HROV1	*HROV0
G097								
G098								

Output Signals-1 to NC Unit (G-contact) 10/18

No.	7	6	5	4	3	2	1	0
G099								
G100	+J8 Manual feed axis plus direction	+J7	+J6	+J5	+J4	+J3	+J2	+J1
G101								
G102	-J8 Manual feed axis minus direction	-J7	-J6	-J5	-J4	-J3	-J2	-J1
G103								
G104								
G105								
G106								
G107								
G108	MLK8 Each axis machine lock	MLK7	MLK6	MLK5	MLK4	MLK3	MLK2	MLK1
G109								

Output Signals-1 to NC Unit (G-contact) 11/18

No.	7	6	5	4	3	2	1	0
G110	M +LM8 Soft limit external setting plus direction	M +LM7	M +LM6	M +LM5	M +LM4	M +LM3	M +LM2	M +LM1
G111								
G112	M -LM8 Soft limit external setting minus direction	M -LM7	M -LM6	M -LM5	M -LM4	M -LM3	M -LM2	M -LM1
G113								
G114	*+L8 Overtravel limit plus direction	*+L7	*+L6	*+L5	*+L4	*+L3	*+L2	*+L1
G115								
G116	*-L8 Overtravel limit minus direction	*-L7	*-L6	*-L5	*-L4	*-L3	*-L2	*-L1
G117								
G118	*+ED8 External deceleration plus direction	*+ED7	*+ED6	*+ED5	*+ED4	*+ED3	*+ED2	*+ED1
G119								
G120	*-ED8 External deceleration minus direction	*-ED7	*-ED6	*-ED5	*-ED4	*-ED3	*-ED2	*-ED1

Output Signals-1 to NC Unit (G-contact) 12/18

No.	7	6	5	4	3	2	1	0
G121								
G122								
G123								
G124	DTCH8 Control axis detach	DTCH7	DTCH6	DTCH5	DTCH4	DTCH3	DTCH2	DTCH1
G125								
G126	SVF8 Servo off	SVF7	SVF6	SVF5	SVF4	SVF3	SVF2	SVF1
G127								
G128								
G129								
G130	*IT8 Each axis interlock	*IT7	*IT6	*IT5	*IT4	*IT3	*IT2	*IT1
G131								

Output Signals-1 to NC Unit (G-contact) 13/18

No.	7	6	5	4	3	2	1	0
G132	+MIT8 Positive interlock direction by axis direction	+MIT7	+MIT6	+MIT5	+MIT4	+MIT3	+MIT2	+MIT1
G133								
G134	-MIT8 Negative interlock direction by axis direction	-MIT7	-MIT6	-MIT5	-MIT4	-MIT3	-MIT2	-MIT1
G135								
G136	EAX8 (PMC) Controlled axis	EAX7	EAX6	EAX5	EAX4	EAX3	EAX2	EAX1
G137								
G138								
G139								
G140								
G141								
G142	EBUFA Axis control command given	ECLRA Reset	ESTPA Axis control suspend	ESOFA Servo off	ESBKA Block stop	EMBUFA Buffering prohibit signal		

Output Signals-1 to NC Unit (G-contact) 14/18

No.	7	6	5	4	3	2	1	0
G143	EMSBKA Block stop disable	EC6A Axis control command	EC5A	EC4A	EC3A	EC2A	EC1A	EC0A
G144	EIF7A Feed rate	EIF6A	EIF5A	EIF4A	EIF3A	EIF2A	EIF1A	EIF0A
G145	EIF15A Feed rate	EIF14A	EIF13A	EIF12A	EIF11A	EIF10A	EIF9A	EIF8A
G146	EID7A Stroke	EID6A	EID5A	EID4A	EID3A	EID2A	EID1A	EID0A
G147	EID15A Stroke	EID14A	EID13A	EID12A	EID11A	EID10A	EID9A	EID8A
G148	EID23A Stroke	EID22A	EID21A	EID20A	EID19A	EID18A	EID17A	EID16A
G149	EID31A Stroke	EID30A	EID29A	EID28A	EID27A	EID26A	EID25A	EID24A
G150	DRNE Dry run							
G151								
G152								
G153								

Output Signals-1 to NC Unit (G-contact) 15/18

No.	7	6	5	4	3	2	1	0
G154	EBUFB Axis control command given	ECLRB Reset	ESTPB Axis control suspend	ESOFB Servo off	ESBKB Block stop	EMBUFB Buffering prohibit signal		
G155	EMSBKB Block stop disable	EC6B Axis control command	EC5B	EC4B	EC3B	EC2B	EC1B	EC0B
G156	EIF7B Feed rate	EIF6B	EIF5B	EIF4B	EIF3B	EIF2B	EIF1B	EIF0B
G157	EIF15B Feed rate	EIF14B	EIF13B	EIF12B	EIF11B	EIF10B	EIF9B	EIF8B
G158	EID7B Stroke	EID6B	EID5B	EID4B	EID3B	EID2B	EID1B	EID0B
G159	EID15B Stroke	EID14B	EID13B	EID12B	EID11B	EID10B	EID9B	EID8B
G160	EID23B Stroke	EID22B	EID21B	EID20B	EID19B	EID18B	EID17B	EID16B
G161	EID31B Stroke	EID30B	EID29B	EID28B	EID27B	EID26B	EID25B	EID24B
G162								
G163								
G164								

Output Signals-1 to NC Unit (G-contact) 16/18

No.	7	6	5	4	3	2	1	0
G165								
G166	EBUFC Axis control command given	ECLRC Reset	ESTPC Axis control suspend	ESOFC Servo off	ESBKC Block stop	EMBUFC Buffering prohibit signal		
G167	EMSBKC Block stop disable	EC6C Axis control command	EC5C	EC4C	EC3C	EC2C	EC1C	EC0C
G168	EIF7C Feed rate	EIF6C	EIF5C	EIF4C	EIF3C	EIF2C	EIF1C	EIF0C
G169	EIF15C Feed rate	EIF14C	EIF13C	EIF12C	EIF11C	EIF10C	EIF9C	EIF8C
G170	EID7C Stroke	EID6C	EID5C	EID4C	EID3C	EID2C	EID1C	EID0C
G171	EID15C Stroke	EID14C	EID13C	EID12C	EID11C	EID10C	EID9C	EID8C
G172	EID23C Stroke	EID22C	EID21C	EID20C	EID19C	EID18C	EID17C	EID16C
G173	EID31C Stroke	EID30C	EID29C	EID28C	EID27C	EID26C	EID25C	EID24C
G174								
G175								

Output Signals-1 to NC Unit (G-contact) 17/18

No.	7	6	5	4	3	2	1	0
G176								
G177								
G178	EBUFD Axis control command given	ECLRD Reset	ESTPD Axis control suspend	ESOFD Servo off	ESBKD Block stop	EMBUFD Buffering prohibit signal		
G179	EMSBKD Block stop disable	EC6D Axis control command	EC5D	EC4D	EC3D	EC2D	EC1D	EC0D
G180	EIF7D Feed rate	EIF6D	EIF5D	EIF4D	EIF3D	EIF2D	EIF1D	EIF0D
G181	EIF15D Feed rate	EIF14D	EIF13D	EIF12D	EIF11D	EIF10D	EIF9D	EIF8D
G182	EID7D Stroke	EID6D	EID5D	EID4D	EID3D	EID2D	EID1D	EID0D
G183	EID15D Stroke	EID13D	EID13D	EID12D	EID11D	EID10D	EID9D	EID8D
G184	EID23D Stroke	EID22D	EID21D	EID20D	EID19D	EID18D	EID17D	EID16D
G185	EID31D Stroke	EID30D	EID29D	EID28D	EID27D	EID26D	EID25D	EID24D
G186								

Output Signals-1 to NC Unit (G-contact) 18/18

No.	7	6	5	4	3	2	1	0
G187								
G188								
G189								
G190								
G191								
G192	IGVRY8 Each axis VRDY OFF alarm negl-ect signal	IGVRY7	IGVRY6	IGVRY5	IGVRY4	IGVRY3	IGVRY2	IGVRY1
G193								
G194								
G195								
G196	*DEC8 Reference point return deceleration	*DEC7	*DEC6	*DEC5	*DEC4	*DEC3	*DEC2	*DEC1
G197								

Output Signals-2 to NC Unit (RG-contact) 1/9

No.	7	6	5	4	3	2	1	0
RG000	UI007 Input for custom macro	UI006	UI005	UI004	UI003	UI002	UI001	UI000
RG001	UI015	UI014	UI013	UI012	UI011	UI010	UI009	UI008
RG002	UI023	UI022	UI021	UI020	UI019	UI018	UI017	UI016
RG003	UI031	UI0303	UI029	UI028	UI027	UI026	UI025	UI024
RG004	UI107	UI106	UI105	UI104	UI103	UI102	UI101	UI100
RG005	UI115	UI114	UI113	UI112	UI111	UI110	UI109	UI108
RG006	UI123	UI122	UI121	UI120	UI119	UI118	UI117	UI116
RG007	UI131	UI130	UI129	UI128	UI127	UI126	UI125	UI124
RG008	UI207	UI206	UI205	UI204	UI203	UI202	UI201	UI200
RG009	UI215	UI214	UI213	UI212	UI211	UI210	UI209	UI208
RG010	UI223	UI222	UI221	UI220	UI219	UI218	UI217	UI216

Output Signals-2 to NC Unit (RG-contact) 2/9

No.	7	6	5	4	3	2	1	0
RG011	UI231 Input for custom macro	UI230	UI229	UI228	UI227	UI226	UI225	UI224
RG012	UI307	UI306	UI305	UI304	UI303	UI302	UI301	UI300
RG013	UI315	UI314	UI313	UI312	UI311	UI310	UI309	UI308
RG014	UI323	UI322	UI321	UI320	UI319	UI318	UI317	UI316
RG015	UI331	UI330	UI329	UI328	UI327	UI326	UI325	UI324
RG016	EISTB External data input strobe	ERDRQ (External) Data output request	EOREND (External) Read finish			EXSTP External tape I/O stop	EXRD External tape input request	EXPUN External tape output request
RG017	EIA7 External data input address	EIA6	EIA5	EIA4	EIA3	EIA2	EIA1	EIA0
RG018	EID7 External data input data	EID6	EID5	EID4	EID3	EID2	EID1	EID0
RG019	EID15 External data input data	EID14	EID13	EID12	EID11	EID10	EID9	EID8
RG020	EID23 External data input data	EID22	EID21	EID20	EID19	EID18	EID17	EID16
RG021	EID31 External data input data	EID30	EID29	EID28	EID27	EID26	EID25	EID24

Output Signals-2 to NC Unit (RG-contact) 3/9

No.	7	6	5	4	3	2	1	0
RG022	EID39 External data input data	EID38	EID37	EID36	EID35	EID34	EID33	EID32
RG023	EID47 External data input data	EID46	EID45	EID44	EID43	EID42	EID41	EID40
RG024	^{M}SGCMP Comparison select	^{M}SGTLS Tool length measurement select	^{M}WKCK Work checker		^{M}OFH Tool setter	^{M}WSH Work setter master hole select	^{M}WSS Work setter datum level select	^{M}WSC Work setter coordinate correction select
RG025	EWRQ Thermal displacement offset data take-in	EWCZ Thermal displacement offset Z-axis select	EWCY Thermal displacement offset Y-axis select	EWCX Thermal displacement offset X-axis select		^{L}BSET B-setter mode select	^{L}ZSET Z-setter mode select	^{L}QSET Q-setter mode select
RG026	^{M}SPNT2 Set point position 1	^{M}SPNT1 Set point position 2	^{M}SPNTS Set point		^{M}RVS Backward		^{M}OVMEM Automatic override memory	^{M}ATOV Automatic override
RG027	^{L}TPCP Turret head machining position face no.							
RG028	^{M}SPTL (LOW) Spindle tool no.							
RG029	^{M}SPTL (HIGH) Spindle tool no.							
RG030	^{M}WTTL (LOW) Standby tool no.							
RG031	^{M}WTTL (HIGH) Standby tool no.							

Output Signals-2 to NC Unit (RG-contact) 4/9

No.	7	6	5	4	3	2	1	0
RG032	LM_MF Life monitoring M-signal	LM_SF Life monitoring M-signal	LM_TF Life monitoring M-signal	LM_BF Life monitoring M-signal	ᴹTSET_STB Spindle tool no. setting	LM_RST Life monitoring reset	SPDL_FWD Spindle forward starting	SPDL_REV Spindle reverse starting
RG033	ᴹMSTB_MNG For high-speed processing							
RG034	EXT_BRK External broken tool notice for life	TLSKP Tool skip for life	TLRST Tool reset life					TL256 Specified tool no. for life
RG035	TL128 Specified tool no. for life	TL64	TL32	TL16	TL08	TL04	TL02	TL01
RG036	MONI_ON Load monitoring enable	TEACH_ON Teach cutting mode	ᴹSPDL_SAR Spindle speed arrival	ᴹS_CHG S-data change notice	ᴹS_SP_STB Spindle stop request	SV_TST Load error tool registration		
RG037								
RG038	ᴸWTRQR Wheel cut data trans-fer request R → L	ᴸWTRQL Wheel cut data trans-fer request L → R			ᴸWRNC Wheel cut right-side NC selection		ᴸWPRST Wheel cut work return start	ᴸWRTSP Wheel cut work interrupt
RG039								
RG040								
RG041	ᴸTCLUMP Turret clamp							

Output Signals-2 to NC Unit (RG-contact) 5/9

No.	7	6	5	4	3	2	1	0
RG042	└TPAP Turret head ATC position face no.							
RG043	└MGAP Magazine ATC position pot no.							
RG044	└MGSP Magazine setup pot no.							
RG045	└MATCT Independent tool call tool no.							
RG046	└ATCPOS2 ATC origin return request 2	└ATCPOS2 ATC origin return request 1	└MCATC Machine in ATC cycle	└MATCR Independent tool call data request	└TSMD In setup mode	└MSHG3 Memory change 3	└MSHG2 Memory change 2	└MSHG1 Memory change 1
RG047	ᴹTWAIT ATC canned cycle wait							└LTATPS ATC position final move
RG048	└MD07 Measurement data	└MD06	└MD05	└MD04	└MD03	└MD02	└MD01	└MD00
RG049	└MD15 Measurement data	└MD14	└MD13	└MD12	└MD11	└MD10	└MD09	└MD08
RG050	└MEGPS Measured value pass	└MREAD Measured value read	└MOVR Measured value over	└MSGM Measured value sign	└RD3 Measuring position	└RD2	└RD1	└RD0
RG051							└MEG02 Measuring points	└MEG01

Output Signals-2 to NC Unit (RG-contact) 6/9

No.	7	6	5	4	3	2	1	0
RG052	M SP07 Spindle head index angle	M SP06	M SP05	M SP04	M SP03	M SP02	M SP01	M SP00
RG053	M SP15 Spindle head index angle	M SP14	M SP13	M SP12	M SP11	M SP10	M SP09	M SP08
RG054						M SPPV Spindle head index vertical	M SPAT Attachment set	M SPRSH Spindle index detour
RG055	L WKTRM Back spindle work transfer mode					L CPFN Machine break point return	M BRN Block restart	SRN Program restart
RG056		SKPD Skip check			L DCLS Door close check	TAPE Tape		ALZRN All axes zero point return
RG057	MI8 Mirror image	MI7	MI6	MI5	MI4	MI3	MI2	MI1
RG058	L TSUFN Turret face number initialize complete	L MSUFN ATC pot number initialize complete		L INTCHB Chuck internal clamp (back) switch check	L DDRN Dry run switch check	L OPSTP Optional stop switch check	L TPCK Tape check switch check	L INTCHK Chuck internal clamp switch check
RG059						L ASHCL ATC shutter close confirm	L DBAOK ATC double arm zero point	L MPSOK ATC magazine pot position normal
RG060	L CM25T (LOW) M25 timer set value							
RG061	L CM25T (HIGH) M25 timer set value							
RG062	L CM26T (LOW) M26 timer set value							

Output Signals-2 to NC Unit (RG-contact) 7/9

No.	7	6	5	4	3	2	1	0
RG063	ᴸCM26T (HIGH) M26 timer set value							
RG064						ᴸSSDRQ Subspindle speed display request	ᴸTSDRQ Rotary tool speed display request	ᴸMSDRQ Spindle speed display data
RG065	ᴸMSDDT Spindle speed display data							
RG066	ᴸTSDDT Rotary tool speed display data							
RG067	ᴸSSDDT Subspindle speed display data							
RG068	ᴸCN27T (LOW) M27 timer set value							
RG069	ᴸCN27T (HIGH) M27 timer set value							
RG070	ᴹMGPTN (LOW) Number of magazine pots							
RG071	ᴹMGPTN (HIGH) Number of magazine pots							
RG072	ᴹTLPTN (LOW) Tool pot number							
RG073	ᴹTLPTN (HIGH) Tool pot number							
RG074	ᴹSTPTN (LOW) Set pot number							

Output Signals-2 to NC Unit (RG-contact) 8/9

No.	7	6	5	4	3	2	1	0
RG075	M STPTN (HIGH) Set pot number							
RG076	M TPSBR Special boring bar	M TPANG Angular cutter	M TPUAX U-axis tool	M TPLNG Long tool	M TPBIG Large-diameter tool	M TPOLH Oil hole	M TPATH Standard tool (Heavy)	M TPSTD Standard tool
RG077	M TPDEL Pot information clear						M TPFDS Fixed setting disallowed pot	M TPDSA Setting disallowed pot
RG078	M MGTP2 Magazine selection signal	M MGTP1			M CHKSTB Setup data check request	M WRSTB Pot information write request	M RDSTB Pot information read request	M INISET Initial setting
RG079								
RG080								
RG081								
RG082								
RG083								
RG084								
RG085								
RG086								
RG087								

Output Signals-2 to NC Unit (RG-contact) 9/9

No.	7	6	5	4	3	2	1	0
RG088								
RG089								
RG090								
RG091								
RG092								
RG093								
RG094								
RG095								
RG096								
RG097								
RG098								
RG099								

Input Signals-1 from NC Unit (F-contact) 1/18

No.	7	6	5	4	3	2	1	0
F000	OP In auto-matic operation	SA Servo ready	STL Automatic operation starting	SPL Automatic operation pausing				
F001	MA Control unit ready		TAP In Tapping	ENB Spindle enable	DEN Distribution finish	BAL Battery alarm	RST Resetting	AL In alarm
F002	MDRN Dry run check	CUT In cutting			THRD In thread cutting	CSS In constant surface speed control	RPDO In rapid traverse	INCH Inch input
F003	MTCHING TCHIN mode check	MEDT EDT mode check	MMEM MEM mode check	MRMT RMT mode check	MMDI MDI mode check	MJ JOG mode check	MH Handle mode check	MINC Incremental mode check
F004			MREF Manual reference point return check	MAFL Miscella-neous function lock check	MSBK Single block check	MABSM Absolute change-over check	MMLK Machine lock check	MBDT Optional block skip check
F005	MBDT9 Optional block skip-9 check	MBDT8 Optional block skip-8 check	MBDT7 Optional block skip-7 check	MBDT6 Optional block skip-6 check	MBDT5 Optional block skip-5 check	MBDT4 Optional block skip-4 check	MBDT3 Optional block skip-3 check	MBDT2 Optional block skip-2 check
F006								
F007	^{M}BF 2nd misc-ellaneous function strobe			^{L}BF 2nd misc-ellaneous function strobe	TF Tool function strobe	SF Spindle function strobe		MF Miscella-neous function strobe
F008			MF3 Miscella-neous function 3rd strobe	MF2 Miscella-neous function 2nd strobe				
F009								
F010	M28 Miscella-neous function code	M24	M22	M21	M18	M14	M12	M11

Input Signals-1 from NC Unit (F-contact) 2/18

No.	7	6	5	4	3	2	1	0
F011	M48 Miscellaneous function code	M44	M42	M41	M38	M34	M32	M31
F012	M68 Miscellaneous function code	M64	M62	M61	M58	M54	M52	M51
F013	M88 Miscellaneous function code	M84	M82	M81	M78	M74	M72	M71
F014	M228 2nd M-function code	M224	M222	M221	M218	M214	M212	M211
F015	M248 2nd M-function code	M244	M242	M241	M238	M234	M232	M231
F016	M328 3rd M-function code	M324	M322	M321	M318	M314	M312	M311
F017	M348 3rd M-function code	M344	M342	M341	M338	M334	M332	M331
F018								
F019								
F020								
F021								

Input Signals-1 from NC Unit (F-contact) 3/18

No.	7	6	5	4	3	2	1	0
F022	S7 Spindle function code	S6	S5	S4	S3	S2	S1	S0
F023	S15 Spindle function code	S14	S13	S12	S11	S10	S9	S8
F024	S23 Spindle function code	S22	S21	S20	S19	S18	S17	S16
F025	S31 Spindle function code	S30	S29	S28	S27	S26	S25	S241
F026	T28 Tool function code	T24	T22	T21	T18	T14	T23	T11
F027	T48 Tool function code	T44	T42	T41	T38	T34	T33	T31
F028	T68 Tool function code	T64	T62	T61	T58	T54	T53	T51
F029	T88 Tool function code	T84	T82	T81	T78	T74	T73	T71
F030	B28 2nd miscellaneous function code	B24	B22	B21	B18	B14	B13	B11
F031	B48 2nd miscellaneous function code	B44	B42	B41	B38	B34	B33	B31
F032	B68 2nd miscellaneous function code	B64	B62	B61	B58	B54	B53	B51

Input Signals-1 from NC Unit (F-contact) 4/18

No.	7	6	5	4	3	2	1	0
F033	B88 2nd miscellaneous function code	B84	B82	B81	B78	B74	B72	B71
F034						MGR30 Gear selection output	MGR20	MGR10
F035								SPAL Spindle alarm
F036	RO80 Spindle rotation binary output	RO70	RO60	RO50	RO40	RO30	RO20	RO10
F037					R120 Spindle rotation binary output	R110	R100	R090
F038					LENB3 3rd spindle enable	LENB2 2nd spindle enable	LSUCLP Spindle unclamp	LSCLP Spindle clamp
F039					MCHPCYL Oscillation cycle on-going	MCHPMOD Oscillation mode on-going		
F040								
F041								
F042								
F043								

Input Signals-1 from NC Unit (F-contact) 5/18

No.	7	6	5	4	3	2	1	0
F044				SYCAL Spindle synchronous control alarm signal	FSPPH Spindle phase synchronous control comp-lete signal	FSPSY Spindle synch-ronous speed control comp-lete signal	FSCSL Cs-axis contour control changeover finish	
F045	ORARA 1st orientation finish	TLMA Torque limiting	LDT2A Load detection 2	LDT1A Load detection 1	SARA Speed arrival	SDTA Speed detection	SSTA Speed zero	ALMA Alarm
F046					RCFNA Output changeover finish	RCHPA Output changeover request	CFINA Spindle changeover finish	CHPA Power line changeover
F047								
F048								
F049	ORARB 2nd spindle orientation finish	TLMB Torque limiting	LDT2B Load detection 2	LDT1B Load detection 1	SARB Speed arrival	SDTB Speed detection	SSTB Speed zero	ALMB Alarm
F050					RCFNB Output changeover finish	RCHPB Output changeover request	CFINB Spindle changeover finish	CHPB Power line changeover
F051								
F052								
F053								
F054								

Input Signals-1 from NC Unit (F-contact) 6/18

No.	7	6	5	4	3	2	1	0
F055								
F056								
F057								
F058								
F059								
F060								
F061								
F062								
F063	L PSYN Polygon synchronizing signal					L PSAR Spindle polygon speed reach signal	L PSE2 Polygon synchronous axis unreached signal	L PSE1 Polygon master axis unreached signal
F064								
F065							M RGSPM Direct tap spindle reverse reversing	M RGSPP Direct tap spindle forwarding

Input Signals-1 from NC Unit (F-contact) 7/18

No.	7	6	5	4	3	2	1	0
F066	M EXHPCC HPCC running signal	M MHPCC HPCC mode on-going signal						M G08MD Precontrol mode on-going signal
F067								
F068								
F069								
F070								
F071								
F072								
F073								
F074								
F075								
F076					RTAP Direct tap mode on-going signal			

Input Signals-1 from NC Unit (F-contact) 8/18

No.	7	6	5	4	3	2	1	0
F077								
F078								
F079								
F080								
F081								
F082								
F083								
F084								
F085								
F086								
F087								

Input Signals-1 from NC Unit (F-contact) 9/18

No.	7	6	5	4	3	2	1	0
F088								
F089								
F090								
F091								
F092			TRSPS Tool return finish		TRACT In tool retract mode			
F093								
F094	ZP8 Reference point position	ZP7	ZP6	ZP5	ZP4	ZP3	ZP2	ZP1
F095								
F096	ZP28 2nd reference point position	ZP27	ZP26	ZP25	ZP24	ZP23	ZP22	ZP21
F097								
F098	ZP38 3rd reference point position	ZP37	ZP36	ZP35	ZP34	ZP33	ZP32	ZP31

Input Signals-1 from NC Unit (F-contact) 10/18

No.	7	6	5	4	3	2	1	0
F099								
F100	ZP48 4th reference point position	ZP47	ZP46	ZP45	ZP44	ZP43	ZP42	ZP41
F101								
F102	MV8 Axis moving	MV7	MV6	MV5	MV4	MV3	MV2	MV1
F103								
F104	INP8 In-position	INP7	INP6	INP5	INP4	INP3	INP2	INP1
F105								
F106	MVD8 Axis moving direction	MVD7	MVD6	MVD5	MVD4	MVD3	MVD2	MVD1
F107								
F108								
F109								

Input Signals-1 from NC Unit (F-contact) 11/18

No.	7	6	5	4	3	2	1	0
F110	MDTCH8 Controlled axis detaching	MDTCH7	MDTCH6	MDTCH5	MDTCH4	MDTCH3	MDTCH2	MDTCH1
F111								
F112	EADEN8 PMC axis control/distribution complete signal	EADEN7	EADEN6	EADEN5	EADEN4	EADEN3	EADEN2	EADEN1
F113								
F114	└TRQL8 Torque limit reach signal	└TRQL7	└TRQL6	└TRQL5	└TRQL4	└TRQL3	└TRQL2	└TRQL1
F115								
F116	FRP8 Floating reference point return finish	FRP7	FRP6	FRP5	FRP4	FRP3	FRP2	FRP1
F117								
F118								
F119								
F120	ZRF8 Reference point establish	ZRF7	ZRF6	ZRF5	ZRF4	ZRF3	ZRF2	ZRF1

Input Signals-1 from NC Unit (F-contact) 12/18

No.	7	6	5	4	3	2	1	0
F121								
F122	HD07 High-speed skip status signal	HD06	HD05	HD04	HD03	HD02	HD01	HD00
F123								
F124								
F125								
F126								
F127								
F128								
F129	*EAXSL Controlled axis select state		EOVO Override 0%					
F130	EBSYA Axis control command read	EOTNA Overtravel negative direction	EOTPA Overtravel positive direction	EGENA Axis moving	EDENA Miscellaneous function running	EIALA Alarm	ECKZA Accumulation zero checking	EINPA Imposition signal
F131							EABUFA Buffer full signal	EMFA Aux. function strobe

Input Signals-1 from NC Unit (F-contact) 13/18

No.	7	6	5	4	3	2	1	0
F132	EM28A Aux. function code signal (1, 2 digits)	EM24A	EM22A	EM21A	EM18A	EM14A	EM12A	EM11A
F133	EBSYB Axis control command read	EOTNB Overtravel negative direction	EOTPB Overtravel positive direction	EGENB Axis moving	EDENB Miscellaneous function funning	EIALB Alarm	ECKZB Accumulation zero checking	EINPB Imposition
F134							EABUFB Buffer full signal	ENFB Aux. function strobe
F135	EM28B Aux. function code signal (1, 2 digits)	EM24B	EM22B	EM21B	EM18B	EM14B	EM12B	EM11B
F136	EBSYC Axis control command read	EOTNC Overtravel negative direction	EOTPC Overtravel positive direction	EGENC Axis moving	EDENC Miscellaneous function running	EIALC Alarm	ECKZC Accumulation zero checking	EINPC Imposition
F137							EABUFC Buffer full signal	ENFC Aux. function strobe
F138	EM28C Aux. function code signal (1, 2 digits)	EM24C	EM22C	EM21C	EM18C	EM14C	EM12C	EM11C
F139	EBSYD Axis control command read	EOTND Overtravel negative direction	EOTPD Overtravel positive direction	EGEND Axis moving	EDEND Miscellaneous function running	EIALD Alarm	ECKZD Accumulation zero checking	EINPD Imposition
F140							EABUFD Buffer full signal	ENFD Aux. function strobe
F141	EM28D Aux. function code signal (1, 2 digits)	EM24D	EM22D	EM21D	EM18D	EM14D	EM12D	EM11D
F142	EM48A Aux. function code signal (3, 4 digits)	EM44A	EM42A	EM41A	EM38A	EM34A	EM32A	EM31A

Input Signals-1 from NC Unit (F-contact) 14/18

No.	7	6	5	4	3	2	1	0
F143								
F144								
F145	EM48B Aux. function code signal (3, 4 digits)	EM44B	EM42B	EM41B	EM38B	EM34B	EM32B	EM31B
F146								
F147								
F148	EM48C Aux. function code signal (3, 4 digits)	EM44C	EM42C	EM41C	EM38C	EM34C	EM32C	EM31C
F149								
F150								
F151	EM48D Aux. function code signal (3, 4 digits)	EM44D	EM42D	EM41D	EM38D	EM34D	EM32D	EM31D
F152								
F153								

Input Signals-1 from NC Unit (F-contact) 15/18

No.	7	6	5	4	3	2	1	0
F154								
F155								
F156								
F157								
F158								
F159								
F160								
F161								
F162								
F163								
F164								

Input Signals-1 from NC Unit (F-contact) 16/18

No.	7	6	5	4	3	2	1	0
F165								
F166								
F167								
F168								
F169								
F170								
F171								
F172								
F173								
F174								
F175								

Input Signals-1 from NC Unit (F-contact) 17/18

No.	7	6	5	4	3	2	1	0
F176								
F177								
F178								
F179								
F180								
F181								
F182	EACNT8 PMC axis control/ controlling signal	EACNT7	EACNT6	EACNT5	EACNT4	EACNT3	EACNT2	EACNT1
F183								
F184								
F185								
F186								

Input Signals-1 from NC Unit (F-contact) 18/18

No.	7	6	5	4	3	2	1	0
F187								
F188								
F189								
F190								
F191								
F192								
F193								
F194								
F195								
F196								
F197								

Input Signals-2 from NC Unit (RF-contact) 1/10

No.	7	6	5	4	3	2	1	0
RF000	U0007 Output for custom macro	U0006	U0005	U0004	U0003	U0002	U0001	U0000
RF001	U0015	U0014	U0013	U0012	U0011	U0010	U0009	U0008
RF002	U0023	U0022	U0021	U0020	U0019	U0018	U0017	U0016
RF003	U0031	U0030	U0029	U0028	U0027	U0026	U0025	U0024
RF004	U0107	U0106	U0105	U0104	U0103	U0102	U0101	U0100
RF005	U0115	U0114	U0113	U0112	U0111	U0110	U0109	U0108
RF006	U0123	U0122	U0121	U0120	U0119	U0118	U0117	U0116
RF007	U0131	U0130	U0129	U0128	U0127	U0126	U0125	U0124
RF008	U0207	U0206	U0205	U0204	U0203	U0202	U0201	U0200
RF009	U0215	U0214	U0213	U0212	U0211	U0210	U0209	U0208
RF010	U0223	U0222	U0221	U0220	U0219	U0218	U0217	U0216

Input Signals-2 from NC Unit (RF-contact) 2/10

No.	7	6	5	4	3	2	1	0
RF011	U0231 Output for custom macro	U0230	U0229	U0228	U0227	U0226	U0225	U0224
RF012	U0307	U0306	U0305	U0304	U0303	U0302	U0301	U0300
RF013	U0315	U0314	U0313	U0312	U0311	U0310	U0309	U0308
RF014	U0323	U0322	U0321	U0320	U0319	U0318	U0817	U0316
RF015	U0331	U0330	U0329	U0328	U0327	U0326	U0325	U0324
RF016	EOSTB External data out-up strobe		EIREND (External) Read finish	U0228 (External) Search finish			RPALM External tape read/ punch alarm	RPBSY External tape reading/ punching
RF017	EOA7 External data output address	EOA6	EOA5	EOA4	EOA3	EOA2	EOA1	EOA0
RF018	EOD7 External data output data	EOD6	EOD5	EOD4	EOD3	EOD2	EOD1	EOD0
RF019	EOD15 External data output data	EOD14	EOD13	EOD12	EOD11	EOD10	EOD9	EOD8
RF020	EOD23 External data output data	EOD22	EOD21	EOD20	EOD19	EOD18	EOD17	EOD16
RF021	EOD31 External data output data	EOD30	EOD29	EOD28	EOD27	EOD26	EOD25	EOD24

Input Signals-2 from NC Unit (RF-contact) 3/10

No.	7	6	5	4	3	2	1	0
RF022	EOD39 External data output data	EOD38	EOD37	EOD36	EOD35	EOD34	EOD33	EOD32
RF023	EOD47 External data output data	EOD46	EOD45	EOD44	EOD43	EOD42	EOD41	EOD40
RF024	EWFN Thermal displacement data take-in finish						^{L}QBRI In Q-setter barrier area	TOUCH Skip touching
RF025	^{M}MPNT2 Set point memory position 2	^{M}MPNT1 Set point memory position 1			^{M}RVSL Reversing			
RF026	FINA Life monitoring finish				^{M}TSET_ACK Spindle tool setting finish		^{M}FMT_ALM Format alarm	^{M}MST_USE MST code monopoly
RF027	^{M}MFA High-speed processing M finish	^{M}SFA High-speed processing S finish	^{M}TFA High-speed processing T finish					
RF028	EXT_ACK External breakage registration finish	SKP_ACK Tool skip finish	RST_ACK Tool reset finish		^{M}TSEL_ALM Specified tool regist-ration alarm	^{M}M51_ALM Pre-machining tool alarm	BREK_SEL Broken tool select	LIFE_SEL Out-of-life tool select
RF029	TLCHB New tool	TLCHA Tool change	^{M}PCHG_EXT With status tool		^{M}SPOS_8 Pre-registration order	^{M}SPOS_4	^{M}SPOS_2	^{M}SPOS_1
RF030	OV_LOAD Overload alarm	NO_LOAD No-load alarm		^{M}SCHG_ACK S-data change finish	^{M}S_SP ACK Spindle stop request finish			ACT_OVR Monitoring override enable

Input Signals-2 from NC Unit (RF-contact) 4/10

No.	7	6	5	4	3	2	1	0
RF031	MFV_128 Monitoring override data	MFV_64	MFV_32	MFV_16	MFV_8	MFV_4	MFV_2	MFV_1
RF032	└WTFNR Wheel cut data transfer complete R → L	└WTFNL Wheel cut data transfer complete L → R	└WTALM Wheel cut data transfer alarm				└WPRNC Wheel cut work return N in search	└WRTOK Wheel cut work interrupt accept
RF033								
RF034								
RF035								
RF036	└TPCT Turret head machining position tool no.							
RF037	└MGST Magazine setup position tool no.							
RF038	└TCMGP Tool called magazine pot no.							
RF039	└TRMGP Tool return magazine pot number							

Input Signals-2 from NC Unit (RF-contact) 5/10

No.	7	6	5	4	3	2	1	0
RF040	└TCTPP Tool called turret head face number							
RF041	└TSTPP Tool mounten turret head face no.							
RF042	└TRRQ Pre-call tool magazind return request	└ATMTT ATC MG-TP-TP request	└ATCTT ATC TP-TP request	└ATCMT ATC-MG-TP request	└TPIDX TP index request	└ALM3 Program error	└ALM2 Tool search error	└ALM1 ATC condition unfinished
RF043		└TFW Machine ATC processing		└FMCHG Memory change check	└CTMT Machining position rotary tool	└TSMDW Setup mode processing wait	└MTCRQ Indepen-dent tool call request	└TCRQ Magazine toll call request
RF044								
RF045	└LJCM Soft jaw forming mode signal	└BKCD Back machining mode signal	└LJGR Soft jaw forming trace check signal	└PCGR Pre-work plot signal		└NGSTP Measure-ment NG stop	└MSTB Measure-ment judgment strobe	└NG Measure-ment NG judgment
RF046						└DSFW Scheduler last work	└DSDW Scheduler different kind of work	└DSPO Scheduler delivery
RF047	MPEDM Finish notice		MWCUP Work count match			RMTSL Remote select		AZRNC All axes zero point returning
RF048	MMI8 Mirror image check	MMI7	MMI6	MMI5	MMI4	MMI3	MMI2	MMI1

Input Signals-2 from NC Unit (RF-contact) 6/10

No.	7	6	5	4	3	2	1	0
RF049	└TSURQ Turret face number initialize request	└MSURQ ATC pot number initialize request						└M25FW M25 forward end move
RF050	└SM25T (LOW) M25 timer change value							
RF051	└SM25T (HIGH) M25 timer change value							
RF052	└SM26T (LOW) M26 timer change value							
RF053	└SM26T (HIGH) M26 timer change value							
RF054	PSA_E Position area E	PSA_D Position area D	PSA_C Position area C	PSA_B Position area B				
RF055	+PSAB8 Position area B prohibit direction	+PSAB7	+PSAB6	+PSAB5	+PSAB4	+PSAB3	+PSAB2	+PSAB1
RF056	-PSAB8 Position area B prohibit direction	-PSAB7	-PSAB6	-PSAB5	-PSAB4	-PSAB3	-PSAB2	-PSAB1
RF057	+PSAC8 Position area C prohibit direction	+PSAC7	+PSAC6	+PSAC5	+PSAC4	+PSAC3	+PSAC2	+PSAC1

Input Signals-2 from NC Unit (RF-contact) 7/10

No.	7	6	5	4	3	2	1	0
RF058	-PSAC8 Position area C prohibit direction	-PSAC7	-PSAC6	-PSAC5	-PSAC4	-PSAC3	-PSAC2	-PSAC1
RF059	+PSAD8 Position area D prohibit direction	+PSAD7	+PSAD6	+PSAD5	+PSAD4	+PSAD3	+PSAD2	+PSAD1
RF060	-PSAD8 Position area D prohibit direction	-PSAD7	-PSAD6	-PSAD5	-PSAD4	-PSAD3	-PSAD2	-PSAD1
RF061	+PSAE8 Position area E prohibit direction	+PSAE7	+PSAE6	+PSAE5	+PSAE4	+PSAE3	+PSAE2	+PSAE1
RF062	-PSAE8 Position area E prohibit direction	-PSAE7	-PSAE6	-PSAE5	-PSAE4	-PSAE3	-PSAE2	-PSAE1
RF063	^{M}ATPSBR Special boring bar	^{M}ATPALM Angular cutter	^{M}ATPUAX U-axis tool	^{M}ATPLNG Long tool	^{M}ATPBIG Large-diameter tool	^{M}ATPOLH Oil hole	^{M}ATPATH Standard tool (Heavy)	^{M}ATPSTD Standard tool
RF064	^{M}CHKOK Setup data check OK							^{M}ATPDSA Setting disallowed pot
RF065	^{M}CHKALM Setup data check alarm	^{M}WRALM Pot information write alarm	^{M}RDALM Pot information read alarm	^{M}INIALM Initialization alarm	^{M}CHKACK Setup data check complete	^{M}WRACK Pot information write complete	^{M}RDACK Pot information read complete	^{M}INIACK Initialization complete
RF066								
RF067								
RF068								

Input Signals-2 from NC Unit (RF-contact) 8/10

No.	7	6	5	4	3	2	1	0
RF069								
RF070								
RF071								
RF072								
RF073								
RF074								
RF075								
RF076								
RF077								
RF078								
RF079								

Input Signals-2 from NC Unit (RF-contact) 9/10

No.	7	6	5	4	3	2	1	0
RF080								
RF081								
RF082								
RF083								
RF084								
RF085								
RF086	└ASO80 S12 bit auxiliary signal	└ASO70	└ASO60	└ASO50	└ASO40	└ASO30	└ASO20	└ASO10
RF087	└SSLG2 S select G code identify signal	└SSLG1	└ASOOT1 S12 bit auxiliary signal in output	└ASOOT1	└AS120 S12 bit auxiliary signal	└AS110	└AS100	└AS090
RF088	└SM27T (LOW) M27 timer changed value							
RF089	└SM27T (HIGH) M27 timer changed value							
RF090	PSW8 Position switch	PSW7	PSW6	PSW5	PSW4	PSW3	PSW2	PSW1

Input Signals-2 from NC Unit (RF-contact) 10/10

No.	7	6	5	4	3	2	1	0
RF091	PSW16 Position switch	PSW15	PSW14	PSW13	PSW12	PSW11	PSW10	PSW9
RF092	└MSUNO ATC pot initialize number							
RF093	└TSUNO Turret initialized face number							
RF094	└AR7 Actual spindle speed	└AR6	└AR5	└AR4	└AR3	└AR2	└AR1	└AR0
RF095	└AR15 Actual spindle speed	└AR14	└AR13	└AR12	└AR11	└AR10	└AR9	└AR8
RF096	R_OVC Override cancel turn-back	R_IT All axes interlock turn-back			ᴹR_ZCN Z-axis cancel turnback	R_DRN Dry run turn-back	R_SBK Single block turn-back	R_MLK Machine lock turn-back
RF097							R_RT Manual rapid traverse select turn-back	SJOG Special jog operation request turn-back
RF098	R_PJ8 Feed axis direction "+" select turn-back	R_PJ7	R_PJ6	R_PJ5	R_PJ4	R_PJ3	R_PJ2	R_PJ1
RF099	R_MJ8 Feed axis direction "-" select turn-back	R_MJ7	R_MJ6	R_MJ5	R_MJ4	R_MJ3	R_MJ2	R_MJ1

Since the following signals are directly referred to by CNC processing, they cannot be intervened by ladder processing. However, X009 can use G196 (notified by ladder processing) by parameter setting. (PRM3004, #0 = 1)

Form the X- and Y-contacts other than the following signals, see the electrical diagram of the machine.

Input Signals (X-contact) from Machine 1/1

No.	7	6	5	4	3	2	1	0
X008	SKIP Skip			*ESP Emergency stop				
X009	*DEC8 Reference point return deceleration	*DEC7	*DEC6	*DEC5	*DEC4	*DEC3	*DEC2	*DEC1

APPENDIX: BOOT SYSTEM

1. OVERVIEW

Prior to execution of the CNC software, the "BOOT SYSTEM " has the following functions related to loading of the CNC system software (Flash ROM to DRAM) and system maintenance of the CNC.

(1) Registering a file into the Flash ROM

Reads a file from the MS-DOS formatted memory card complying with JEIDA V4.1 into the Flash ROM

(2) Checking a file in the Flash ROM (Series, version number)

(3) Deleting a file in the Flash ROM

(4) Saving a file in the Flash ROM into the memory card

(5) Saving/restoring collectively a battery backup file (SRAM area) such as parameters, programs, etc. into/from the memory card

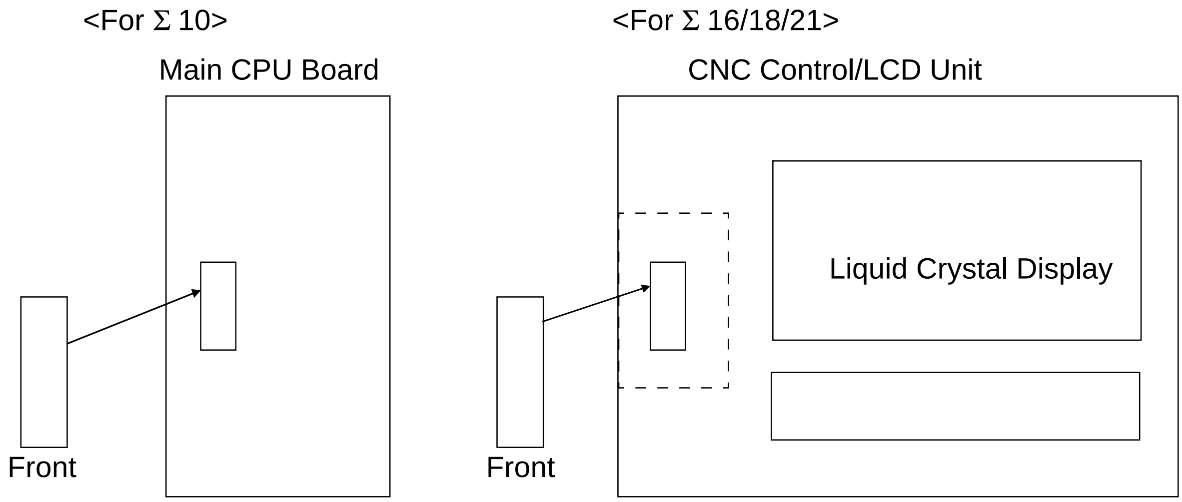
(6) Deleting a file in the memory card

(7) Formatting the memory card

The following describes how to start up the "BOOT SYSTEM," display those functions on the screen, and operate them.

[Memory Card Insertion Slot]

A memory card insertion slot varies from the Σ 10 to the other models (Σ 16/18/21) as follows.



(Note 1) *For the Σ 10, the insertion slot is located on the main CPU board of the CNC unit inside the control panel. For the Σ 16/18/21, the covered insertion slot is located by the display.*

(Note 2) *Inset the memory card in the direction shown in the figure above. (Its inserting direction is diametrically opposite between the Σ 10 and the other models.) It cannot be inserted in the other direction. Do not force it in.*

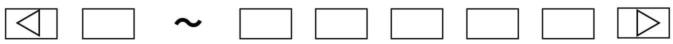
1.1 Starting up the BOOT SYSTEM

When the system is started up normally the "BOOT SYSTEM" automatically transfers files from the Flash ROM to the DRAM. Therefore, the user will not be aware of existence of the "BOOT SYSTEM."

When you carry out maintenance work or when there is no file existing in the Flash ROM, turn on the menu screen and operate the BOOT SYSTEM.

① At the time of system maintenance such as replacing the files in the Flash ROM

Operation: Turn on the power, pressing the rightmost soft key and its left one simultaneously.



Keep pressing these two soft keys until the "BOOT SYSTEM" screen appears.

② When the Flash ROM does not contain the files required to start up the CNC
Immediately after the CNC is turned on, the "BOOT SYSTEM" starts transferring the files from the Flash ROM to the DRAM. When the Flash ROM does not contain a file (NC BASIC) which is minimumly required to start up the CNC, or when that file is corrupt, however, the "BOOT SYSTEM" will start automatically.

1.2 System Files and User Files

The "BOOT SYSTEM" largely sorts out the files used in the Flash ROM into the "system files" and "user files" to manage them. Their difference follows.

- System files

  Files minimumly required such as CNC software and servo control software

- User files

  Files such as PMC sequence program (ladder) created by a machine manufacture

2. SCREEN CONFIGURATION AND OPERATING METHODS

Once the "BOOT SYSTEM" is started up, the MAIN MENU screen appears first.

The following describes this screen.

①	SYSTEM MONITOR MAIN MENU 60M1 - 10
②	1.SYSTEM DATA LOADING
③	2.SYSEM 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 : Displays a title.
Displayed at the right end is the series and version number of the BOOT SYSTEM.

② : Loads into the Flash ROM

③ : Checks the version number of the ROM file

④ : Deletes the file from the Flash ROM

⑤ : Saves into the memory card

⑥ : Backs up the SRAM area

⑦ : Deletes the file from the memory card

⑧ : Formats the memory card

⑨ : Terminates the BOOT SYSTEM to start the CNC

⑩ : Displays a brief operating method or error message

(1) Operating method

Use the [UP] and [DOWN] soft keys to select desired processing. Bring the cursor to the function you want to select and press the [SELECT] soft key. In order to check prior to executing the function, it may be necessary to press [YES] or [NO] soft key.

(2) Basic operation flow

Move the cursor [UP] [DOWN]	→	Select a menu item [SELECT]	→	Is this O.K.? [YES] [NO]	→	Execute

→ [SELECT] → Select END

→ Returns you to the previous screen

(Note) *One screen can display up to 8 files. When there are 9 or more files, press the soft key* ▷ *to switch to the next screen to display the remaining files. [END] is displayed on the last page.*

2.1 SYSTEM DATA LOADING Screen

(1) Description of the function

This function reads the system files and user files from the memory card into the Flash ROM.

(2) Screen configuration

①	SYSTEM DATA LOADING	①: Displays a title. Displayed at the right end is a "page number/total number of pages."
	FILE DIRECTORY	
②	BOE1E10.MEM	②: Displays the files existing in the memory card.
	BOE1E11.MEM	
③	END	③: Returns you to the previous menu.
	*** MESSAGE ***	
④	SELECT FILE AND HIT SELECT KEY.	④: Displays a message.
	[SELECT] [YES] [NO] [UP] [DOWN]	

(3) Operating method

‡@Bring the cursor to the file you want to read from the memory card into the Flash ROM, and press the [SELECT] soft key.

② After you select a file, you will be asked if your choice is correct.

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

③ Press the [YES] soft key to start reading the file or [NO] to cancel it.

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

④ When processing ends successfully, the following message appears.

Press the [SELECT] soft key. When there is an error, see "3. ERROR MESSAGES AND REMEDIES."

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

(4) Others

① Counter display while reading the file

An address for access data is displayed while reading the file.

```
*** MESSAGE ***
LOADING FROM MEMORY CARD.
ADDRESS 001:     ←  Displayed at this position of the screen
      [A]
```

[A]: 128 KB Unit of management number in the Flash ROM

② File names in the Flash ROM The "BOOT SYSTEM" distinguishes the files in the Flash ROM by the first 4 characters of their in-header IDs. When the Flash ROM already contains the same kind of file as the one which is to be read from the memory card, the file in the Flash ROM will be deleted first before reading from the memory card. The following table lists in-header IDs and their types. These in-header IDs are subject to change without prior notice.

In-header ID	Type	File Category
NC BASIC	CNC system	System file
DG SERVO	Servo	System file
GRAPHIC	Graphic	System file
NO□ OPTN	CNC option	System file
PMC □ ***	PMC control software, etc.	System file
SCOS□.□M	CNC software	System file
CEX □ .□M	Human interface software (C language executor)	User file
PMC-RB	Ladder software (PMC-RB)	User file
PMC-RC	Ladder software, PMC-RC C software (PMC-RC)	User file
CEX1DROM	FROM file	User file

□ : Denotes one numeral *: Denotes one alphabet

2.2 SYSTEM DATA CHECK Screen

(1) Description of the function

This function lists the files existing in the Flash ROM and displays the number of 128 KB units of management of each file, and software series and version number.

(2) Screen configuration

```
①  SYSTEM DATA CHECK                    1/2
②  [BOARD : MAIN]
    FILE DIRECTORY(FLASH ROM:8MB)
③  1 NC BASIC   (10)
    2 DG SERVO ( 1)
    3 NC1 OPTN  ( 8)
    4 PMC0BSC   ( 2)
    5 PMC1OPT1 ( 4)
    6 PMC2BSC   ( 2)
    7 PMC3OPT1 ( 4)
    8 GRAPHIC    ( 2)
④  END

    *** MESSAGE ***
⑤  SELECT FILE AND HIT SELECT KEY.

    [SELECT] [ YES ] [  NO  ] [  UP  ] [ DOWN ]
```

① : Displays a title.

② : Displays a board name being accessed.

③ : Lists the file names existing in the Flash ROM. A parenthesized number to the right of the file name indicates the number of units of management used.

④ : Returns you to the previous menu

⑤ : Displays a message

(3) Operating method

① Select a file whose detailed information you want to know, for example, select "1 NC BASIC (10)."

② Unit of management numbers, and the series and version number per unit of management are displayed as to the selected file. After checking them, press the [SELECT] soft key to return to the file selection screen.

```
      ROM FILE CHECK
      NC BASIC
      0     B0E1   801B    000
      1     B0E1   802B    001
      2     B0E1   841B    002
      3     B0E1   842B    003
      4     B0E1   881B    004
      5     B0E1   882B    005
      6     B0E1   8C1B    006
      7     B0E1   8C2B    007


*** MESSAGE ***
HIT SELECT KEY.
```

0 B0E1 801B 000

Internal Unit of Management No.

ROM No. and Version No.

Series

(3) Others

① About the file parity information

Parity information is embedded per unit of management in the system files whose file names in the Flash ROM are NC BASIC, DG SERVO, and so on.

When they are displayed in the check screen and their names are displayed in the parity field with any character other than the ASCII code or "@", it is likely that the Flash ROM is corrupt or a corrupt file has been read. Read from the memory card again. Since the files such as SCOS1. 0M, CEX 2.0M, PMC-RC do not have the parity information per unit of management, a character other than the ASCII code or "@" may be displayed in the series/version number information, but this does not mean that those files are corrupt.

2.3 SYSTEM DATA DELETE Screen

(1) Description of the function

This function deletes the user files existing in the Flash ROM.

(2) Screen configuration

```
①   SYSTEM DATA CHECK                              1/2
②   [BOARD : MAIN]
    FILE DIRECTORY(FLASH ROM:8MB)
③   1 NC BASIC   (10)
    2 DG SERVO ( 1)
    3 NC1 OPTN  ( 8)
    4 PMC0BSC   ( 2)
    5 PMC1OPT1 ( 4)
    6 PMC2BSC   ( 2)
    7 PMC3OPT1 ( 4)
    8 GRAPHIC    ( 2)
④   END

    *** MESSAGE ***
⑤   SELECT FILE AND HIT SELECT KEY.

    [SELECT] [ YES ] [  NO  ] [  UP  ] [ DOWN ]
```

①: Displays a title.

②: Displays a board name being accessed.

③: Lists the file names existing in the Flash ROM. A parenthesized number to the right of the file name indicates the number of units of management used.

④: Returns you to the previous menu

⑤: Displays a message

(3) Operating method

① Bring the cursor onto the file name you want to delete, and press the [SELECT] soft key.

② The following message appears for your confirmation.

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

③ Press [YES] to start deletion or press [NO] to cancel deletion.

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

④ When deletion is terminated successfully, the following message appears. Press [SELECT].

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

(4) Others

① Difference between the system files and user files in the SYSTEM DATA DELETE function

The system files are protected against erroneous deletion, but the user files are not. Although the system files are protected, they can be overwritten by the SYSTEM DATA LOADING function.

2.4 SYSTEM DATA SAVE Screen

(1) Description of the function

This function saves the user files existing in the Flash ROM into the memory card. Only the user files can be saved from the Flash ROM into the memory card. The system files cannot be saved.

(2) Screen configuration

```
①  SYSTEM DATA SAVE                    1/2
②  [BOARD : MAIN]
    FILE DIRECTORY(FLASH ROM:8MB)
③  1 NC BASIC   (10)
    2 DG SERVO ( 1)
    3 NC1 OPTN  ( 8)
    4 PMC0BSC   ( 2)
    5 PMC1OPT1 ( 4)
    6 PMC2BSC   ( 2)
    7 PMC3OPT1 ( 4)
    8 GRAPHIC    ( 2)
④  END

    *** MESSAGE ***
⑤  SELECT FILE AND HIT SELECT KEY.

    [SELECT] [ YES ] [  NO  ] [  UP  ] [ DOWN ]
```

① : displays a title.

② : Displays a board name being accessed.

③ : Lists the file names existing in the Flash ROM. A parenthesized number to the right of the file name indicates the number of units of management used.

④ : Returns you to the previous menu

⑤ : Displays a message

(3) Operating method

① Bring the cursor onto the file name you want to save, and press the [SELECT] soft key.

② For your confirmation, the following message is displayed.

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

③ Press [YES] to start save operation or press [NO] to cancel save operation.

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

④ When save operation is terminated successfully, the following message is displayed. Press the [SELECT] soft key. Since the saved file mane is displayed, take notes of it for your confirmation.

```
*** MESSAGE **
FILE SAVE COMPLETE.  HIT SELECT KEY.
SAVE FILE NAME : PMC_RC.000
```

(4) Others

① Difference between the system files and user files in the SYSTEM DATA SAVE function

The SYSTEM DATA SAVE function cannot save the system files; it can save only the user files.

② About the names of the saved files

The files saved from the Flash ROM into the memory card are named as follows.

Flash ROM In-header ID		Memory Card File Name
PMC-RC	→	PMC-RC.XXX
CEX 1.0M	→	CEX 1.0M.XXX
CEX 2.0M	→	CEX 2.0M.XXX

"XXX" is an MS-DOS extension and is replaced by 32 numbers ranging from "000" to "031." For example, when saving the "PMC-RC" file from the Flash ROM into the memory card, the first 6 characters of its file name are saved in the memory card. When "PMC-RC" already exists, its extension number is incremented by 1 to "PMC-RC.001."

Thus, the file name can be created up to "PMC-RC.031," incrementing the extension number one by one. When there is a missing number halfway, the file name is created in the ascending order of the extension number.

Therefore, when saving multiple files in the same memory card, whose extensions alone are different, confirm the file names which are displayed when save operation is terminated successfully.

2.5 SRAM DATA BACKUP Screen

(1) Description of the function

With this function, the data (parameters, programs, etc.) in the SRAM, which are held even if the CNC is turned off, can be collectively saved/restored from the memory card.

(2) Screen configuration

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 : 0.5MB(BASIC)
⑥	FILE NAME : SRAM0_5A.FDB
	*** MESSAGE ***
⑦	SELECT MENU AND HIT SELECT KEY.
	[SELECT] [YES] [NO] [UP] [DOWN]

①: Displays a title.

②: Displays a board name being accessed.

③: Displays a menu

④: Returns you to the previous menu

⑤: Displays the size of the SRAM attached to the CNC

⑥: Displays a file name

⑦: Displays a message

(3) Operating method

[When backing up the data]

① When you select "1. SRAM BACKUP," a confirmation message appears.

② A backup filename is displayed depending on the SRAM's capacity.

Press [YES] to start backing up the data.

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

③ If there is already a backup file existing in the memory card, a confirmation message is displayed to ask you whether it is all right to overwrite it.

④ The file name currently saved in the memory card is displayed in the FILE NAME: field.

```
SRAM SIZE  :  0.5MB( BASIC )
FILE NAME : SRAM0_5.FDB -> MEMORY

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

Indicates that the data are being backed up

⑤ When terminated successfully, the following message is displayed.

Press the [SELECT] soft key.

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

[When restoring the data]

① When you select "2. RESTORE SRAM," the following message is displayed.

Press the [YES] key.

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

② While the data are being restored, the following message is displayed.

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

③ When terminated successfully, the following message is displayed.

Press the [SELECT] soft key.

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

(4) Others

① About the name of the backup file

The name of the SRAM backup file in the memory card is determined depending on the size of the SRAM installed in the CNC. When the size of the SRAM is 1 MB or more, the backup file is divided by 512 KB.

SRAM Size \ No. of Files	1 File	2 Files	3 Files	4 Files	5 Files
256KB	SRAM256A.FDB				
0.5MB	SRAM0_5A.FDB				
1.0MB	SRAM1_0A.FDB	SRAM1_0B.FDB			
1.5MB	SRAM1_5A.FDB	SRAM1_5B.FDB	SRAM1_5C.FDB		
2.0MB	SRAM2_0A.FDB	SRAM2_0B.FDB	SRAM2_0C.FDB	SRAM2_0D.FDB	
2.5MB	SRAM2_5A.FDB	SRAM2_5B.FDB	SRAM2_5C.FDB	SRAM2_5D.FDB	SRAM2_5E.FDB

[Caution]

When the SRAM data, etc. are restored from the memory card in the system where an absolute pulse coder is used, set "0" in the parameter no. 1815, #4 (APZ) and re-set the reference point.

2.6 MEMORY CARD FILE DELETE Screen

(1) Description of the function

This function deletes the files existing in the memory card.

(2) Screen configuration

①	SYSTEM DATA LOADING 1/1
	FILE DIRECTORY
②	D101E10.ROM
	D101E11.ROM
③	END
	*** MESSAGE ***
④	SELECT FILE AND HIT SELECT KEY.
	[SELECT] [YES] [NO] [UP] [DOWN]

①: Displays a title.
Displayed at the right end is a "page number/total number of pages."

②: Displays the files existing in the memory card.

③: Returns you to the previous menu.

④: Displays a message.

(3) Operating method

① Use the [SELECT] key to select the file name you want to delete from the memory card.

② The following confirmation message is displayed. Press the [YES] key.

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

③ After the file was deleted successfully, the following message is displayed. Press the [SELECT] key.

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

2.7 MEMORY CARD FORMAT Function

(1) Description of the function

This function can format the memory card. When using the memory card for the first time or when its content is corrupted because of running out of the battery , and so on, it is necessary to format it.

(2) Operating method

① Select "7. MEMORY CARD FORMAT" IN THE SYSTEM MONITOR MAIN MENU screen.

② The following confirmation message is displayed. Press the [YES] key.

```
*** MESSAGE ***
MEMORY CARD FORMAT OK?  HIT YES OR NO.
```

③ The following message is displayed while formatting the memory card.

```
*** MESSAGE ***
FORMATTING MEMORY CARD.
```

④ After the memory card was formatted successfully, the following message is displayed. Press the [SELECT] key.

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

2.8 LOAD BASIC SYSTEM

(1) Description of the function

This function terminates the "BOOT SYSTEM" and starts the CNC.

(2) Operating method

Select "9. END" in the MAIN MENU screen. A message, "ARE YOU SURE ? HIT YES OR NO," is displayed. When you want to terminate the "BOOT SYSTEM" and start the CNC, press the [YES] soft key. Pressing the [NO] soft key returns you to the MAIN MENU screen.

```
*** MESSAGE ***
ARE YOU SURE?  HIT YES OR NO.


[SELECT]   [ YES ]   [  NO  ]  [  UP  ]   [ DOWN ]
```

① When the [YES] soft key is pressed, NC BASIC SYSTEM in the Flash ROM is examined. While it is examined, the following message is displayed.

```
*** MESSAGE ***
CHECK CNC BASIC SYSTEM.


[SELECT]   [ YES ]   [  NO  ]  [  UP  ]   [ DOWN ]
```

If "NC BASIC" is properly held, it will be loaded into the DRAM to start the NC BASIC SYSTEM. While it is loaded, the following display blinks.

```
*** MESSAGE ***
            LOADING BASIC TO DRAM


[SELECT]   [ YES ]   [  NO  ]  [  UP  ]   [ DOWN ]
```

If the contents of the NC BASIC SYSTEM are corrupt, you will be returned to the processing selection screen like when you press the [NO] key.

```
SYSTEM MONITOR MAIN MENU    60M1 - 10

1.  SYSTEM DATA LOADING
2.  SYSTEM DATA CHECK
3.  SYSTEM DATA DELETE
4.  SYTEM DATA SAVE
5.  SYSTEM 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 ]
```

3. ERROR MESSAGES AND REMEDIES

The following describes the error messages and their remedies. The error messages are listed in an alphabetic order.

3.1 In Case of Σ 10

	Message	Description and Remedy
D	DELETE ERROR. HIT SELECT KEY.	You failed to delete the files in the Flash ROM. If you try again and have the same result, the Flash ROM may be corrupted. Replace the Flash ROM module.
	DEVICE ERROR (CNC x)	You failed to save a file into the Flash ROM. If the same message is displayed again, the Flash ROM may be corrupted. Replace the Flash ROM module.
	D-RAM OR S-RAM PARITY	Illegal data was found in the RAM area. If you try to back up the RAM which has not been cleared yet, this message will be displayed and the BOOT SYSTEM may stop.
F	FILE SAVE ERROR. HIT SELECT KEY.	You failed to save a file into the memory card. Check whether the memory card is normal. *(Note) Normal means that the memory card is not running out of the battery or not electrically destroyed, and is properly inserted into a slot.*
	FLASH MEMORY NO SPACE	The Flash ROM does not have enough space to read in a selected file. Delete unnecessary files from the Flash ROM.
	FLASH ROM MODULE NOT EXIST. HIT SELECT KEY.	The target printed circuit board does not have the Flash ROM module. Install it.
I	ILLEGAL FORMAT FILE	You selected the file which cannot be read into the Flash ROM. That file is corrupt or the header information for the Flash ROM is corrupt.
L	LOADING ERROR. HIT SELECT KEY.	An error occurred while loading into the Flash ROM. Do not touch the memory card in the course of loading.
M	MAX EXTENSION OVER. HIT SELECT KEY.	There are more than 31 file name extensions. Delete unnecessary backup files from the memory card.
	MEMORY CARD BATTERY ALARM. HIT SELECT KEY.	The battery in the memory card has run out. Replace the battery by a new one.

	Message	Description and Remedy
M	MEMORY CARD FULL. HIT SELECT KEY.	The memory card has no available space. Delete unnecessary files from the memory card or replace it by the one having an available capacity.
	MEMORY CARD MOUNT ERROR. HIT SELECT KEY.	You failed to access the memory card. Is the memory card properly formatted ?
	MEMORY CARD NOT EXIST. HIT SELECT KEY.	The memory card is not inserted into its slot or it may not be inserted deeply enough.
	MEMORY CARD PROTECTED. HIT SELECT KEY.	Although you chose to save a file into the memory card, the write protect switch is turned on. Turn off the write protect switch.
	MEMORY CARD RESET ERROR. HIT SELECT KEY.	You failed to access the memory card. Check whether the memory card is normal. *(Note) Normal means that the memory card is not running out of the battery or not electrically destroyed, and is properly inserted into a slot.*
	MEMORY CARD TYPE IS NOT AVAILABLE.	You tried to save a file into an unusable Flash ROM card. Use a properly formatted Flash ROM card.
	MEMORY CARD WRITE ERROR. HIT SELECT KEY.	You failed to access the memory card. Check whether the memory card is normal. *(Note) Normal means that the memory card is not running out of the battery or not electrically destroyed, and is properly inserted into a slot.*
P	PLEASE FORMAT FLASH TYPE CARD. HIT SELECT KEY.	Because of the characteristics of the memory used, the Flash ROM card does not allow you to delete optional files from it. When you want to delete the files, delete all the files by using the FORMAT function.
R	ROM PARITY ERROR: NC BASIC. HIT SELECT KEY.	NC BASIC has a parity error. Use the SYSTEM DATA CHECK function to see whether the Flash ROM contains NC BASIC.
S	SRAM DATA BACKUP ERROR. HIT SELECT KEY.	You failed to save the backup data into the memory card. Check whether the memory card is normal. *(Note) Normal means that the memory card is not running out of the battery or not electrically destroyed, and is properly inserted into a slot.*

3.2 In Case of Σ 16/18/21

	Message	Description and Remedy
B	BOOT ROM PARITY. PLEASE POWER OFF.	The contents of the flash memory where BOOT software has been saved were corrupted. Replace the CPU card.
C	CHANGE MEMORY CARD. AND HIT YES OR NO.	The memory card became full while backing up the SRAM. Replace it with the memory card with available capacity.
D	DELETE ERROR. HIT SELECT KEY.	You attempted to delete a file in the Flash ROM, but failed. If the same message appears no matter how many times you attempt, the Flash ROM module may have been broken. Replace the module.
	DEVICE ERROR (CNC x)	You failed to delete a certain area in the Flash ROM. Turn off the power and restart again. If the same message appears in every attempt, the Flash ROM module may be broken. Replace the module.
F	FILE SAVE ERROR. HIT SELECT KEY.	You failed to save a file in the memory card. Check whether the memory card is normal. *(Note) The normal condition refers to the condition where the memory card is neither running out of battery nor electrically destroyed and is properly inserted into the slot.*
	FLASH MEMORY NO SPACE.	The Flash ROM module does not have enough space to save a selected file. Delete unnecessary files from the Flash ROM or replace with a larger-size Flash ROM module.
	FLASH ROM MODULE NOT EXIST.	The target PCB has no Flash ROM module. Install the module.
I	ILLEGAL FORMAT FILE.	You selected a file that could not be read into the Flash ROM. The file you attempted to read is corrupted or the header information for the Flash ROM is corrupted.
	ILLEGAL FROM MODULE. HIT SELECT KEY.	A Flash ROM module ID is illegal. Check a Flash ROM module type.
	ILLEGAL SRAM MODULE. HIT SELECT KEY.	An SRAM module ID is illegal. Check an SRAM module type.

	Message	Description and Remedy
L	LOADING ERROR. HIT SELECT KEY.	An error occurred halfway loading to the Flash ROM module. Do not touch the memory card when loading is under way.
M	MAX EXTENSION OVER. HIT SELECT KEY.	The number of file name extensions has exceeded 31. Delete unnecessary backup files in the memory card.
	MEMORY CARD BATTERY ALARM. HIT SELECT KEY.	The battery in the memory card has run out. Replace the battery with a new one.
	MEMORY CARD FULL. HIT SELECT KEY.	The memory card has no available capacity. Delete unnecessary files from the memory card or replace with another card with available capacity.
	MEMORY CARD IS NOT AVAILABLE. HIT SELECT KEY.	This memory card is not supported.
	MEMORY CARD MOUNT ERROR. HIT SELECT KEY.	You failed to access the memory card. Check whether the memory card is FAT-formatted.
	MEMORY CARD NOT EXIST. HIT SELECT KEY.	The memory card is not inserted into the slot. Check whether it is inserted deeply enough.
	MEMORY CARD PROTECTED. HIT SELECT KEY.	The protect switch of the memory card has been turned on. When you want to save, turn off the protect switch.
	MEMORY CARD RESET ERROR. HIT SELECT KEY.	You failed to access the memory card. It is likely that the memory is out of the battery, electrically destroyed, or not properly inserted into the slot.
	MEMORY CARD WRITE ERROR. HIT SELECT KEY.	You failed to save in the memory card. It is likely that the memory is out of the battery, electrically destroyed, or not properly inserted into the slot.
N	NMI OCCURRED. PLEASE POWER OFF.	There is a hardware or software failure.
P	PLEASE FORMAT FLASH TYPE CARD. HIT SELECT KEY.	You attempted to delete a file from the flash memory card or create a file with the same name as an already existing file name. Delete all the files once with the FORMAT function.

	Message	Description and Remedy
R	ROM PARITY ERROR: NC BASIC. HIT SELECT KEY.	The NC BASIC has a parity error. Using the SYSTEM DATA CHECK function, check whether the CNC's Flash ROM module has the NC BASIC.
S	SRAM DATA BACKUP ERROR. HIT SELECT KEY.	You failed to save the backup data in the memory card. It is likely that the memory is out of the battery, electrically destroyed, or not properly inserted into the slot.
	SRAM PARITY OCCURRED. PLEASE POWER OFF.	A parity error was detected when the SRAM was being backed up.

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MAINTENANCE

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