FANUC

GE Fanuc Automation

Computer Numerical Control Products

Series 21i / 210i – Model A

Parameter Manual

*Warnings, Cautions, and Notes
as Used in this Publication*

$$\boxed{\text{Warning}}$$

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

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

$$\boxed{\text{Caution}}$$

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

Note

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

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

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

PREFACE

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

Product Name	Abbreviations	
FANUC Series 21*i*–TA	21*i*–TA	Series 21*i*
FANUC Series 210*i*–TA	210*i*–TA	Series 210*i*
FANUC Series 21*i*–MA	21*i*–MA	Series 21*i*
FANUC Series 210*i*–MA	210*i*–MA	Series 210*i*

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

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

Table 1 Related manuals

Manual name	Specification Number	
DESCRIPTIONS	B–63002EN	
CONNECTION MANUAL (Hardware)	B–63083EN	
CONNECTION MANUAL (Function)	B–63003EN–1	
OPERATOR'S MANUAL FOR LATHE	B–63084EN	
OPERATOR'S MANUAL FOR MACHINING CENTER	B–63094EN	
MAINTENANCE MANUAL	B–63085EN	
PARAMETER MANUAL	B–63090EN	*
PROGRAMMING MANUAL (Macro Compiler/Macro Executor)	B–61803E–1	
FAPT MACRO COMPILER PROGRAMMING MANUAL	B–66102E	
FANUC Symbolic CAP T Basic module V1 OPERATOR'S MANUAL	B–62824EN	
FANUC Symbolic CAP T C/Y axis module V1 OPERATOR'S MANUAL	B–62824EN–1	
FANUC Super CAP M Basic module V1 OPERATOR'S MANUAL	B–62984EN	

Table of Contents

APPENDIX

1 DISPLAYING PARAMETERS

Follow the procedure below to display parameters.

(1) Press the SYSTEM function key on the MDI as many times as required, or alternatively, press the SYSTEM function key once, then the PARAM section display soft key. The parameter screen is then selected.

```
PARAMETER (FEEDRATE)                O0001 N12345


 1401    RDR   JZR   RF0                 LRP   RPD
         0    0     0     0     0     0    0     0
 1402                                    DLF   HFC
         0    0     0     0     0     0    0     0
 1410  DRY RUN FEEDRATE                    10000
 1411  INIT.CUTTING F                          0
 1420  RAPID FEEDRATE        X            15000
                             Y            15000
                             Z            15000


 >
 MEM STRT MTN FIN *** 10:02:35
 [PARAM] [DGNOS] [ PMC ] [SYSTEM] [(OPRT)]
```

| POS | PROG | OFFSET SETTING | CUSTOM |

| SYSTEM | MESSAGE | GRAPH |

Function key

Cursor

Soft key display (section select)

◁ Return menu key   Soft key   ▷ Continuous menu key

(2) The parameter screen consists of multiple pages. Use step (a) or (b) to display the page that contains the parameter you want to display.

  (a) Use the page select key or the cursor move keys to display the desired page.

  (b) Enter the data number of the parameter you want to display from the keyboard, then press the [**NO.SRH**] soft key. The parameter page containing the specified data number appears with the cursor positioned at the data number. (The data is displayed in reverse video.)

> **NOTE**
> If key entry is started with the section select soft keys displayed, they are replaced automatically by operation select soft keys including [**NO.SRH**]. Pressing the **[(OPRT)]** soft key can also cause the operation select keys to be displayed.

```
 >
 MEM STRT MTN FIN *** 10:02:34
 [NO.SRH] [ ON:1 ] [ OFF:0 ] [+INPUT] [INPUT ]
```

← Data entered from the keyboard
← Soft key display (section select)
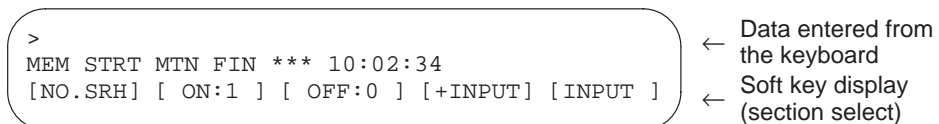
2 SETTING PARAMETERS FROM MDI

Follow the procedure below to set parameters.

(1) Place the NC in the MDI mode or the emergency stop state.

(2) Follow the substeps below to enable writing of parameters.

    1. To display the setting screen, press the SETTING function key as many times as required, or alternatively press the SETTING function key once, then the SETTING section select soft key. The first page of the setting screen appears.

    2. Position the cursor on "PARAMETER WRITE" using the cursor move keys.

```
SETTING (HANDY)                    O0001  N00010

 PARAMETER WRITE =  0   (0:DISABLE 1:ENABLE)
 TV CHECK        =  0   (0:OFF      1:ON)
 PUNCH CODE      =  0   (0:EIA      1:ISO)
 INPUT UNIT      =  0   (0:MM       1:INCH)
 I/O CHANNEL     =  0   (0-3:CHANNEL NO.)
```

    3. Press the [**(OPRT)**] soft key to display operation select soft keys.

```
 >
 MDI STOP *** *** *** 10:03:02
 [NO.SRH] [ ON:1 ] [ OFF:0 ] [+INPUT] [INPUT]
```
← Soft key display (section select)

    4. To set "PARAMETER WRITE=" to 1, press the ON:1 soft key, or alternatively enter 1 and press the INPUT soft key. From now on, the parameters can be set. At the same time an alarm condition (P/S100 PARAMETER WRITE ENABLE) occurs in the CNC.

(3) To display the parameter screen, press the SYSTEM function key as many times as required, or alternatively press the SYSTEM function key once, then the PARAM section select soft key.
(See "1. Displaying Parameters.")

(4) Display the page containing the parameter you want to set, and position the cursor on the parameter. (See "1. Displaying Parameters.")

(5) Enter data, then press the [**INPUT**] soft key. The parameter indicated by the cursor is set to the entered data.

[Example] 12000 [**INPUT**]

```
PARAMETER (FEEDRATE)                    O0001 N00010


 1401       RDR                   JZR      RPD        Cursor
        0    0    0    0    0    0    0    0
 1402              JRV
        0    0    0    0    0    0    0    0
 1410   DRY RUN FEEDRATE                 12000
 1412                                         0
 1420   RAPID FEEDRATEX                   15000
                          Y               15000
                          Z               15000


 >
 MDI STOP *** *** ALM 10:03:10
 [NO.SRH] [ ON:1 ] [ OFF:0 ] [+INPUT] [INPUT]
```

Data can be entered continuously for parameters, starting at the selected parameter, by separating each data item with a semicolon (;).

[Example] Entering 10;20;30;40 and pressing the INPUT key assigns values 10, 20, 30, and 40 to parameters in order starting at the parameter indicatedby the cursor.

(6) Repeat steps (4) and (5) as required.

(7) If parameter setting is complete, set "PARAMETER WRITE=" to 0 on the setting screen to disable further parameter setting.

(8) Reset the NC to release the alarm condition (P/S100).
If an alarm condition (P/S000 PLEASE TURN OFF POWER) occurs in the NC, turn it off before continuing operation.

3 INPUTTING AND OUTPUTTING PARAMETERS THROUGH THE READER/PUNCHER INTERFACE

This section explains the parameter input/output procedures for input/output devices connected to the reader/puncher interface.
The following description assumes the input/output devices are ready for input/output. It also assumes parameters peculiar to the input/output devices, such as the baud rate and the number of stop bits, have been set in advance.

3.1
OUTPUTTING PARAMETERS THROUGH THE READER/PUNCHER INTERFACE

(1) Select the EDIT mode or set to Emergency stop.

(2) To select the parameter screen, press the SYSTEM function key as many times as required, or alternatively press the SYSTEM function key once, then the PARAM section select soft key.

(3) Press the [**(OPRT)**] soft key to display operation select soft keys, then press the forward menu key located at the right–hand side of the soft keys to display another set of operation select keys including PUNCH.

```
  PARAMETER (FEEDRATE)              O0001  N00010


   1401      RDR                   JZR        RPD
         0     0     0     0     0     0     0     0          Cursor
   1404                               DLF HFC
         0     0     0     0     0     0     0     0
   1410   DRY RUN FEEDRATE                 12000
   1411   INIT. CUTTING F                      0
   1420   RAPID FEEDRATEX                 15000
                              Y           15000
                              Z           15000

  >
  MDI STOP *** *** ALM 10:03:10                     ← State display
  [      ] [ READ ] [PUNCH] [      ] [       ]      ← Soft key display
                                                      (operation select)
```

(4) Pressing the [**PUNCH**] soft key changes the soft key display as shown below:

```
  >
  EDIT STOP *** *** *** 10:35:03
  [      ] [       ] [       ] [CANCEL] [ EXEC ]
```

(5) Press the [**EXEC**] soft key to start parameter output. When parameters are being output, "OUTPUT" blinks in the state display field on the lower part of the screen.

```
  >
  EDIT STOP *** *** *** 10:35:04    OUTPUT          ← OUTPUT blinking
  [      ] [       ] [       ] [CANCEL] [ EXEC ]
```

(6) When parameter output terminates, "OUTPUT" stops blinking. Press the RESET key to interrupt parameter output.

3.2
INPUTTING
PARAMETERS
THROUGH THE
READER/PUNCHER
INTERFACE

(1) Place the NC in the emergency stop state.

(2) Enable parameter writing.

1. To display the setting screen, press the SETTING function key as many times as required, or alternatively press the SETTING function key once, then the SETTING section select soft key. The first page of the setting screen appears.
2. Position the cursor on "PARAMETER WRITE" using the cursor move keys.
3. Press the [**(OPRT)**] soft key to display operation select soft keys.
4. To set "PARAMETER WRITE=" to 1, press the ON:1 soft key, or alternatively enter 1, then press the [**INPUT**] soft key. From now on, parameters can be set. At the same time an alarm condition (P/S100 PARAMETER WRITE ENABLE) occurs in the NC.

(3) To select the parameter screen, press the SYSTEM function key as many times as required, or alternatively press the SYSTEM key once, then [**PARAM**] soft key.

(4) Press the [**(OPRT)**] soft key to display operation select keys, then press the forward menu key located at the right–hand side of the soft keys to display another set of operation select soft keys including [**READ**].

```
>
EDIT STOP  -EMS- ALM 10:37:30                ← State display
[        ] [ READ ] [PUNCH] [        ] [        ]   ← Soft key display
```

(5) Pressing the [**READ**] soft key changes the soft key display as shown below:

```
>
EDIT STOP  -EMS- ALM 10:37:30
[        ] [        ] [        ] [CANCEL] [ EXEC ]
```

(6) Press the [**EXEC**] soft key to start inputting parameters from the input/output device. When parameters are being input, "INPUT" blinks in the state display field on the lower part of the screen.

```
>
EDIT STOP  -EMS- ALM 10:37:30   INPUT         ← INPUT blinking
[        ] [        ] [        ] [CANCEL] [ EXEC ]
```

(7) When parameter input terminates, "INPUT" stops blinking. Press the RESET key to interrupt parameter input.

(8) When parameter read terminates, "INPUT" stops blinking, and an alarm condition (P/S000) occurs in the NC. Turn it off before continuing operation.

4 DESCRIPTION OF PARAMETERS

Parameters are classified by data type as follows:

Table 4 Data Types and Valid Data Ranges of Parameters

Data type	Valid data range	Remarks
Bit	0 or 1	
Bit axis		
Byte	−128 to 127	In some parameters, signs are ignored.
Byte axis	0 to 255	
Word	−32768 to 32767	In some parameters, signs are ignored.
Word axis	0 to 65535	
2–word	−99999999 to 99999999	
2–word axis		

> **NOTE**
> 1 For the bit type and bit axis type parameters, a single data number is assigned to 8 bits. Each bit has a different meaning.
> 2 The axis type allows data to be set separately for each control axis.
> 3 The valid data range for each data type indicates a general range. The range varies according to the parameters. For the valid data range of a specific parameter, see the explanation of the parameter.

(1) Notation of bit type and bit axis type parameters

[Example]

	#7	#6	#5	#4	#3	#2	#1	#0
0000			SEQ			INI	ISO	TVC

Data No.   Data #0 to #7 are bit positions.
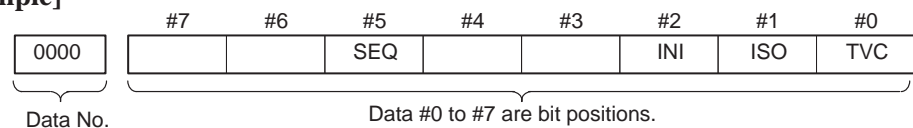
(2) Notation of parameters other than bit type and bit axis type

1023	Servo axis number of a specific axis

Data No.   Data.
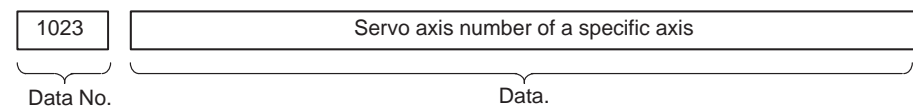
NOTE
1 The bits left blank in 4. DESCRIPTION OF PARAMETERS and parameter numbers that appear on the display but are not found in the parameter list are reserved for future expansion. They must always be 0.
2 Parameters having different meanings between the T series and M series and parameters that are valid only for the T or M series are indicated in two levels as shown below. Parameters left blank are unavailable.

Example1
   Parameter 5010 has different meanings for the T series and M series.

| 5010 | Tool nose radius compensation ... | T series |
| | Tool compensation C ... | M series |

Example2
   DPI is a parameter common to the M and T series, but GSB and GSC are parameters valid only for the T series.

	#7	#6		#0	
3401	GSC	GSB		DPI	T series
				DPI	M series

Example3
   The following parameter is provided only for the M series.

| 1451 | | T series |
| | F1 digit feed ... | M series |

4.1
PARAMETERS OF SETTING

	#7	#6	#5	#4	#3	#2	#1	#0
0000			SEQ			INI	ISO	TVC

Setting entry is acceptable.

[Data type] Bit

TVC TV check

　　0 : Not performed
　　1 : Performed

ISO Code used for data output

　　0 : EIA code
　　1 : ISO code

INI Unit of input

　　0 : In mm
　　1 : In inches

SEQ Automatic insertion of sequence numbers

　　0 : Not performed
　　1 : Performed

> **NOTE**
> When a program is prepared by using MDI keys in the part program storage and edit mode, a sequence number can automatically be assigned to each block in set increments. Set the increment to parameter 3216.

	#7	#6	#5	#4	#3	#2	#1	#0
0001							FCV	

Setting entry is acceptable.

[Data type] Bit

FCV Tape format

　　0 : Series 16 standard format
　　1 : Series 15 format

> **NOTE**
> Programs created in the Series 10/11 tape format can be used for operation on the following functions:
> 1　Subprogram call M98
> 2　Thread cutting with equal leads G32 (T series)
> 3　Canned cycle G90, G92, G94 (T series)
> 4　Multiple repetitive canned cycle G71 to G76 (T series)
> 5　Drilling canned cycle G73, G74, G76, G80 to G89 (M series)
> 6　Cutter compensation C (M series)
> When the tape format used in the Series 10/11 is used for this CNC, some limits may add. Refer to the Series 21*i*/210*i*–MODEL A OPERATOR'S MANUAL .

	#7	#6	#5	#4	#3	#2	#1	#0
0002	SJZ							

Setting entry is acceptable.

[Data type] Bit

SJZ Manual reference position si performed as follows:

0 : When no reference position has been set, reference position return is performed using deceleration dogs. When a reference position is already set, reference position return is performed using rapid traverse and deceleration dogs are ignored.

1 : Reference position return is performed using deceleration dogs at all times.

> **NOTE**
> SJZ is enabled when bit 3 (HJZ) of parameter No.1005 is set to 1. When a reference position is set without a dog, (i.e. when bit 1 (DLZ) of parameter No.1002 is set to 1 or bit 1 (DLZx) of parameter No.1005 is set to 1) reference position return after reference position setting is performed using rapid traverse at all times, regardless of the setting of SJZ.

	#7	#6	#5	#4	#3	#2	#1	#0
0012	RMVx							MIRx

Setting entry is acceptable.

[Data type] Bit axis

MIRx Mirror image for each axis

0 : Mirror image is off.
1 : Mirror image is on.

RMVx Releasing the assignment of the control axis for each axis

0 : Not released
1 : Released

> **NOTE**
> RMVx is valid when RMBx in parameter 1005#7 is 1.

(1) Parameters related to setting

0020	I/O CHANNEL: Selection of an input/output device

Setting entry is acceptable.

[Data type] Byte

[Valid data range] 0 to 35

The CNC provides the following interfaces for data transfer to and from the host computer and external input/output devices:

● Input/output device interface (RS–232C serial port)
● Remote buffer interface (RS–232C/RS–422)
● DNC1/DNC2 interface

In addition, data can be transferred to and from the Power Mate via the FANUC I/O Link.

This parameter selects the interface used to transfer data to and from an input/output device.

Setting	Description
0, 1	RS–232C serial port 1
2	RS–232C serial port 2
3	Remote buffer interface
4	Memory card interface
5	Data server interface
10	DNC1/DNC2 interface, OSI–Ethernet
20 21 22 | 34 35	Group 0 Group 1 Group 2 | Group 14 Group 15 Data is transferred between the CNC and a Power Mate in group n (n: 0 to 15) via the FANUC I/O Link.

NOTE
1 An input/output device can also be selected using the setting screen. Usually, the setting screen is used.
2 The specifications (such as the baud rate and the number of stop bits) of the input/output devices to be connected must be set in the corresponding parameters for each interface beforehand. (See Section 4.2.) I/O CHANNEL = 0 and I/O CHANNEL = 1 represent input/output devices connected to RS–232C serial port 1. Separate parameters for the baud rate, stop bits, and other specifications are provided for each channel.

```
┌─────────────────────────────┐
│ Mother board                │
│                             │   I/O CHANNEL=0, 1
│  RS–232–C serial port 1     ├──    (Channel 1)    ── RS–232–C I/O device
│     R232–1(JD36A)           │
│                             │   I/O CHANNEL=2
│  RS–232–C serial port 2     ├──    (Channel 2)    ── RS–232–C I/O device
│     R232–2(JD36B)           │
├─────────────────────────────┤
│ Serial communication board  │
│   Remote buffer board       │
│   DNC1 board                │
│   DNC2 board                │   I/O CHANNEL=3
│     R232–3(JD28A)           ├──    (Channel 3)    ── RS–232–C I/O device
│                             │                        (when a remote buffer or DNC2 board is used)
│                             │   I/O CHANNEL=3
│     R422–1(JD6A)            ├──    (Channel 3)    ── RS–422 I/O device
│                             │                        (when a remote buffer or DNC1 board is used)
└─────────────────────────────┘
```

3 The input/output unit interface may be referred to as the reader/punch interface.
   RS–232C serial port 1 and RS–232C serial port 2 are also referred to as channel 1 and channel 2, respectively. The remote buffer interface is also referred to as channel 3.

4.2
PARAMETERS OF READER/PUNCHER INTERFACE, REMOTE BUFFER INTERFACE

This CNC has three channels of input/output device interfaces. The input/output device to be used is specified by setting the channel connected to that device in setting parameter I/O CHANNEL.

The specified data, such as a baud rate and the number of stop bits, of an input/output device connected to a specific channel must be set in parameters for that channel in advance.

For channel 1, two combinations of parameters to specify the input/output device data are provided.

The following shows the interrelation between the input/output device interface parameters for the channels.

Input/output channel number (parameter No.0020)

↓

| 0020 | I/O CHANNEL |

Specify a channel for an input/output device.

I/ O CHANNEL
=0 : Channel1
=1 : Channel1
=2 : Channel2
=3 : Channel3

I/O CHANNEL=0
(channel 1)

0101	Stop bit and other data
0102	Number specified for the input/output device
0103	Baud rate

I/O CHANNEL=1
(channel 1)

0111	Stop bit and other data
0112	Number specified for the input/output device
0113	Baud rate

I/O CHANNEL=2
(channel 2)

0121	Stop bit and other data
0122	Number specified for the input/output device
0123	Baud rate

I/O CHANNEL=3
(channel 3)

0131	Stop bit and other data
0132	Number specified for the input/output device
0133	Baud rate
0134	Selection of protocol
0135	Selection of RS–422 or RS–232C, and other data

Fig. 4.2 I/O device interface settings

4.2.1
Parameters Common
to All Channels

0024	Port for communication with the PMC ladder development tool (FAPT LADDER–II)

[Data type] Byte

This parameter sets the port to be used for communication with the PMC ladder development tool (FAPT LADDER–II).

0 : HSSB (COP7)

1 : RS–232C serial port 1 (JD36A)

2 : RS–232C serial port 2 (JD36B)

3 : Remote buffer interface (RS–232C) (JD28A)

	#7	#6	#5	#4	#3	#2	#1	#0
0100	ENS	IOP	ND3		NCR		CTV	

Setting entry is acceptable.

[Data type] Bit

CTV: Character counting for TV check in the comment section of a program.

0 : Performed

1 : Not performed

NCR Output of the end of block (EOB) in ISO code

0 : LF, CR, CR are output.

1 : Only LF is output.

ND3 In DNC operation, a program is:

0 : Read block by block. (A DC3 code is output for each block.)

1 : Read continuously until the buffer becomes full. (A DC3 code is output when the buffer becomes full.)

> **NOTE**
> In general, reading is performed more efficiently when ND3 set to 1. This specification reduces the number of buffering interruptions caused by reading of a series of blocks specifying short movements. This in turn reduces the effective cycle time.

IOP Specifies how to stop program input/output operations.

0 : An NC reset can stop program input/output operations.

1 : Only the [**STOP**] soft key can stop program input/output operations. (An reset cannot stop program input/output operations.)

ENS Action taken when a NULL code is found during read of EIA code

0 : An alarm is generated.

1 : The NULL code is ignored.

4.2.2
Parameters of
Channel 1
(I/O CHANNEL=0)

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

[Data type] Bit type

SB2 The number of stop bits

0 : 1
1 : 2

ASI Code used at data input

0 : EIA or ISO code (automatically distinguished)
1 : ASCII code

NFD Feed before and after the data at data output

0 : Output
1 : Not output

> **NOTE**
> When input/output devices other than the FANUC PPR are
> used, set NFD to 1.

0102	Number specified for the input/output device (when the I/O CHANNEL is set to 0)

[Data type] Byte

Set the number specified for the input/output device used when the I/O CHANNEL is set to 0, with one of the set values listed in Table 4.2 (a).

Table 4.2.2 (a) Set value and input/output device

Set value	Input/output device
0	RS–232–C (Used control codes DC1 to DC4)
1	FANUC CASSETTE ADAPTOR 1 (FANUC CASSETTE B1/ B2)
2	FANUC CASSETTE ADAPTOR 3 (FANUC CASSETTE F1)
3	FANUC PROGRAM FILE Mate, FANUC FA Card Adaptor FANUC FLOPPY CASSETTE ADAPTOR, FANUC Handy File FANUC SYSTEM P-MODEL H
4	RS–232–C (Not used control codes DC1 to DC4)
5	Portable tape reader
6	FANUC PPR FANUC SYSTEM P-MODEL G, FANUC SYSTEM P-MODEL H

0103	Baud rate (when the I/O CHANNEL is set to 0)

[Data type] Byte

Set baud rate of the input/output device used when the I/O CHANNEL is set to 0, with a set value in Table 4.2 (b).

— 14 —

Table 4.2.2 (b)

Set value	Baud rate (bps)	Set value	Baud rate (bps)
1	50	7	600
2	100	8	1200
3	110	9	2400
4	150	10	4800
5	200	11	9600
6	300	12	19200

4.2.3
Parameters of Channel 1 (I/O CHANNEL=1)

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

[Data type] Bit

These parameters are used when I/O CHANNEL is set to 1. The meanings of the bits are the same as for parameter 0101.

0112	Number specified for the input/output device (when I/O CHANNEL is set to 1)

[Data type] Byte

Set the number specified for the input/output device used when the I/O CHANNEL is set to 1, with one of the set values listed in Table 4.2 (a).

0113	Baud rate (when I/O CHNNEL is set to 1)

[Data type] Byte

Set the baud rate of the input/output device used when I/O CHANNEL is set to 1, with a value in Table 4.2 (b).

4.2.4
Parameters of Channel 2 (I/O CHANNEL=2)

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

[Data type] Bit

These parameters are used when I/O CHANNEL is set to 2. The meanings of the bits are the same as for parameter 0101.

0122	Number specified for the input/output device (when I/O CHANNEL is set to 2)

[Data type] Byte

Set the number specified for the input/output device used when I/O CHANNEL is set to 2, with a value in Table 4.2 (a).

0123	Baud rate (when the I/O CHANNEL is set to 2)

[Data type] Byte

Set the baud rate of the input/output device used when I/O CHANNEL is set to 2, with a value in Table 4.2 (b).

4.2.5
Parameters of
Channel 3
(I/O CHANNEL=3)

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

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

These parameters are used when I/O CHANNEL is set to 3. The meanings of the bits are the same as for parameter 0101.

0132	Number specified for the input/output device (when I/O CHANNEL is set to 3)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

Set the number specified for the input/output device used when I/O CHANNEL is set to 3, with a number in Table 4.2 (a).

0133	Baud rate (when the I/O CHANNEL is set to 3)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

Set the baud rate of the input/output device used when the I/O CHANNEL is set to 3 according to the table 4.2 (c).

> **NOTE**
> Valid data range: 1 to 15 (up to a baud rate of 86400 bps) for the RS–422 interface or 1 to 12 (up to a baud rate of 19200 bps) for the RS–232C interface.

Table 4.2.5 Baud rate settings

Set value	Baud rate (bps)	Set value	Baud rate (bps)
1	50	9	2400
2	100	10	4800
3	110	11	9600
4	150	12	19200
5	200	13	38400
6	300	14	76800
7	600	14	86400
8	1200		

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

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

PRY Parity bit
0: Not used
1: Used

SYN Reset/alarm in protocol B
0: Not reported to the host
1: Reported to the host with SYN and NAK codes

NCD CD (signal quality detection) of the RS–232C interface
0: Checked
1: Not checked

CLK Baud rate clock when the RS–422 interface is used
0: Internal clock
1: External clock

> **NOTE**
> When the RS–232C interface is used, set this bit to 0.

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

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

ASC Communication code except NC data
0: ISO code
1: ASCII code

ETX End code for protocol A or extended protocol A
0: CR code in ASCII/ISO
1: ETX code in ASCII/ISO

> **NOTE**
> Use of ASCII/ISO is specified by ASC.

PRA Communication protocol
0: Protocol B
1: Protocol A

R42 Interface
0: RS–232C interface
1: RS–422 interface

RMS State of remote/tape operation when protocol A is used
0: Always 0 is returned.
1: Contents of the change request of the remote/tape operation in the SET command from the host is returned.

4.3
PARAMETERS OF DNC1/DNC2 INTERFACE

0140	#7	#6	#5	#4	#3	#2	#1	#0
								BCC

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

BCC The BCC value (block check characters) for the DNC2 interface is:

0: Checked.
1: Not checked.

0141	System for connection between the CNC and host (DNC1 interface)
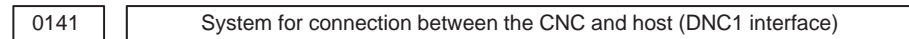
[Data type] Byte

[Valid data range] 1 or 2

This parameter specifies the system for connection (DNC1 interface) between the CNC and host.

Set value

1 : Point–to–point connection

2 : Multipoint connection

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

0142	Station address of the CNC (DNC1 interface)
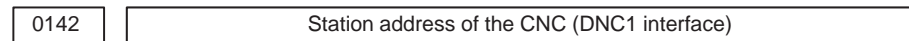
[Data type] Byte

[Valid data range] 2 to 52

This parameter specifies the station address of the CNC when the CNC is connected via the DNC1 interface using multipoint connection.

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

0143	Time limit specified for the timer monitoring a response (DNC2 interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

[Unit of data] Seconds

[Valid data range] 1 to 60 (The standard setting is 3.)

0144	Time limit specified for the timer monitoring the EOT signal (DNC2 interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.
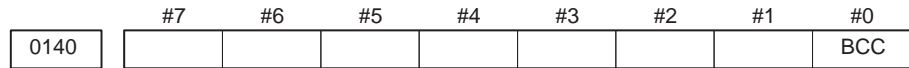
[Data type] Byte

[Unit of data] Seconds

[Valid data range] 1 to 60 (The standard setting is 5.)

0145	Time required for switching RECV and SEND (DNC2 interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

[Unit of data] Seconds

[Valid data range] 1 to 60 (The standard setting is 1.)

0146	Number of times the system retries holding communication (DNC2 interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

[Unit of data] Seconds

[Valid data range] 1 to 10 (The standard setting is 3.)

Set the maximum number of times the system retries holding communication with the remote device if the remote device uses an invalid protocol in the data–link layer or the remote device does not respond to the request.

0147	Number of times the system sends the message in response to the NAK signal (DNC2 interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

[Unit of data] Number of times

[Valid data range] 1 to 10 (The standard setting is 2.)

Set the maximum number of times the system retries sending the message in response to the NAK signal.

0148	Number of characters in overrun (DNC2) interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

[Valid data range] 10 to 225 (The standard setting is 10.)

Set the number of characters the system can receive after transmission is stopped (CS off).

0149	Number of characters in the data section of the communication packet (DNC2 interface)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Word

[Valid range] 80 to 256

The standard setting is 256. If the specified value is out of range, a value of 80 or 256 is used.
This parameter determines the maximum length of the packet used in transmission over the DNC2 interface. Including the two characters at the start of the packet, the four characters used for a command, and the three characters at the end, the maximum number of characters in the packet is nine plus the number specified in parameter No.0149.

|←――――――――――― Length of the packet ――――――――――→|

DLE	STX	Command	Data section	DEL	ETX	BCC
2 bytes		4 bytes	80 to 256 bytes	3 bytes		

4.4 PARAMETERS OF ONLINE CUSTOM SCREEN

	#7	#6	#5	#4	#3	#2	#1	#0
0801								SB2

[Data type] Bit

SB2 The number of stop bits is:

0 : 1 bit.
1 : 2 bits.

0802	Communication channel for the online custom screen

[Data type] Byte

0803	Communication baud rate for the online custom screen

[Data type] Byte

	#7	#6	#5	#4	#3	#2	#1	#0
0810								BGS
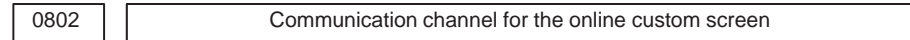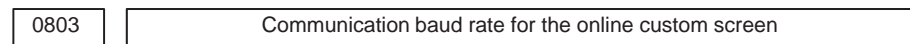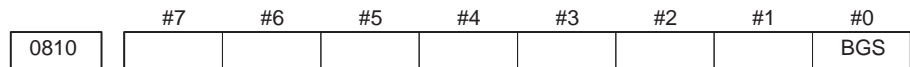
[Data type] Bit

BGS When the online custom screen is not displayed, online custom screen alarm task communication is:

0 : Not activated.
1 : Activated.

0811	Logging type for the online custom screen

[Data type] Byte

0812	PMC address of logging data for the online custom screen

[Data type] Word

0813	Logging data length for the online custom screen

[Data type] Word

0814	Logging wait address for the online custom screen
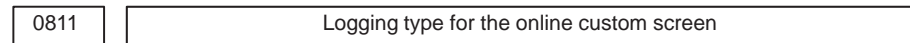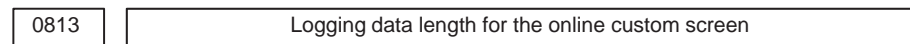
[Data type] Word

0820	Online custom screen device address (1)
0821	Online custom screen device address (2)
0822	Online custom screen device address (3)
0823	Online custom screen device address (4)
0824	Online custom screen device address (5)
0825	Online custom screen device address (6)
0826	Online custom screen device address (7)
0827	Online custom screen device address (8)
0828	Online custom screen device address (9)

[Data type] Byte

4.5
PARAMETERS OF
POWER MOTION
MANAGER

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

[Data type] Bit

SLV When the power motion manager is selected, the screen displays:

0 : One slave.
1 : Up to four slaves with the screen divided into four.

MD1,MD2 These parameters set a slave parameter input/output destination.

MD2	MD1	Input/output destination
0	0	Part program storage
0	1	Memory card

In either case, slave parameters are output in program format.

PMN The power motion manager function is:

0 : Enabled.
1 : Disabled. (Communication with slaves is not performed.)

4.6
PARAMETERS OF AXIS CONTROL/ INCREMENT SYSTEM

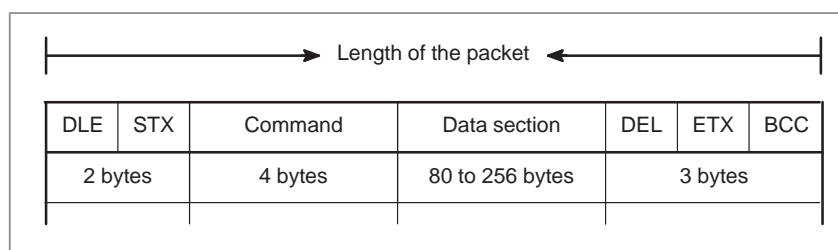| 1001	#7	#6	#5	#4	#3	#2	#1	#0
								INM

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

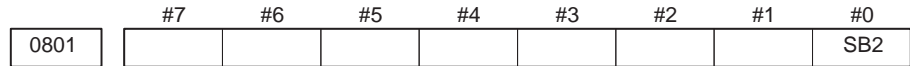**INM** Least command increment on the linear axis

0 : In mm (metric system machine)
1 : In inches (inch system machine)

1002	#7	#6	#5	#4	#3	#2	#1	#0
	IDG			XIK			DLZ	JAX
	IDG			XIK	AZR		DLZ	JAX

[Data type] Bit

JAX Number of axes controlled simultaneously in manual continuous feed, manual rapid traverse and manual reference position return

0 : 1 axis
1 : 3 axes

DLZ Function setting the reference position without dog

0 : Disabled
1 : Enabled

> **NOTE**
> This function can be specified for each axis by DLZx, bit 1 of parameter No.1005.

AZR When no reference position is set, the G28 command causes:

0: Reference position return using deceleration dogs (as during manual reference position return) to be exected.
1: P/S alarm No.090 to be issued.

> **NOTE**
> When reference position return without dogs is specified, (when bit 1 (DLZ) of parameter No.1002 is set to 1 or bit 1 (DLZx) of parameter No.1005 is set to 1) the G28 command specified before a reference position is set causes P/S alarm No.090 to be issued, regardless of the setting of AZR.

XIK   When LRP, bit 1 of parameter No.1401, is set to 0, namely, when positioning is performed using non–linear type positioning, if an interlock is applied to the machine along one of axes in positioning,

0:   The machine stops moving along the axis for which the interlock is applied and continues to move along the other axes.

1:   The machine stops moving along all the axes.

IDG   When the reference position is set without dogs, automatic setting of the IDGx parameter (bit 0 of parameter No.1012) to prevent the reference position from being set again is:

0 :   Not performed.

1 :   Performed.

	#7	#6	#5	#4	#3	#2	#1	#0
1004	IPR						ISC	
	IPR						ISC	ISA

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type]   Bit

ISA, ISC   The least input increment and least command increment are set.

ISC	ISA	Least input increment and least command increment	Symbol
0	0	0.001 mm, 0.001 deg, or 0.0001 inch	IS–B
0	1	0.01 mm, 0.01 deg, or 0.001 inch	IS–A
1	0	0.0001 mm, 0.0001 deg, or 0.00001 inch	IS–C

> **NOTE**
> IS–A cannot be used at present.

IPR   Whether the least input increment for each axis is set to a value 10 times as large as the least command increment is specified, in increment systems of IS–B or IS–C at setting mm.

0:   The least input increment is not set to a value 10 times as larg as the least command increment.

1:   The least input increment is set to a value 10 times as large as the least command increment.

If IPR is set to 1, the least input increment is set as follows:

Input increment	Least input increment
IS–B	0.01 mm, 0.01 deg, or 0.0001 inch
IS–C	0.001 mm, 0.001 deg, or 0.00001 inch

> **NOTE**
> For IS–A, the least input increment cannot be set to a value 10 times as large as the least command increment.

		#7	#6	#5	#4	#3	#2	#1	#0
1005		RMBx	MCCx	EDMx	EDPx			DLZx	ZRNx
		RMBx	MCCx	EDMx	EDPx	HJZx		DLZx	ZRNx

[Data type] Bit axis

ZRNx   When a command specifying the movement except for G28 is issued in automatic operation (MEM, RMT, or MDI) and when a return to the reference position has not been performed since the power was turned on
0 : An alarm is generated (P/S alarm 224).
1 : An alarm is not generated.

> **NOTE**
> The state in which the reference position has not been established refers to that state in which reference position return has not been performed after power–on when an absolute position detector is not being used, or that state in which the association of the machine position with the position detected with the absolute position detector has not been completed (see the description of bit 4 (APZx) of parameter No. 1815) when an absolute position detector is being used.

DLZx   Function for setting the reference position without dogs
0 : Disabled
1 : Enabled

> **NOTE**
> When DLZ of parameter No.1002 is 0, DLZx is enabled. When DLZ of parameter No.1002 is 1, DLZx is disabled, and the function for setting the reference position without dogs is enabled for all axes.

HJZx   When a reference position is already set:
0 : Manual reference position return is performed with deceleration sogs.
1 : Manual reference position return is performed using rapid traverse without deceleration dogs, or manual reference position return is performed with deceleration dogs, depending on the setting of bit 7 (SJZ) of parameter No.0002.

> **NOTE**
> When reference position return without dogs is specified, (when bit 1 (DLZ) of parameter No.1002 is set to 1 or bit (DLZx) of parameter No.1005 is set to 1) reference position return after a reference position is set is performed using rapid traverse, regardless of the setting of HJZ.

EDPx   External deceleration signal in the positive direction for each axis
0 : Valid only for rapid traverse
1 : Valid for rapid traverse and cutting feed

EDMx   External deceleration signal in the negative direction for each axis
0 : Valid only for rapid traverse
1 : Valid for rapid traverse and cutting feed

MCCx   When an axis become the removal state using the controlled axis removal signal or setting:
0: MCC is turned off
1: MCC is not turned off. (Servo motor excitation is turned off, but the MCC signal of the servo amplifier is not turned off.)

— 25 —

NOTE
This parameter is used to remove only one axis, for example, when a two–axis or three–axis amplifier is used. When two–a axis or three–axis amplifier is used and only one axis is removed, servo alarm No.401 (V–READY OFF) is usually issued. However, this parameter, when set to 1, prevents servo alarm No.401 from being issued.
Note, however, that disconnecting a servo amplifier from the CNC will cause the servo amplifier to enter the V–READY OFF status. This is a characteristic of all multiaxis amplifiers.

RMBx Releasing the assignment of the control axis for each axis (signal input and setting input)

0 : Invalid
1 : Valid

	#7	#6	#5	#4	#3	#2	#1	#0
1006			ZMIx		DIAx		ROSx	ROTx
			ZMIx				ROSx	ROTx

NOTE
When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit axis

ROTx, ROSx Setting linear or rotation axis.

ROSx	ROTx	Meaning
0	0	Linear axis (1) Inch/metric conversion is done. (2) All coordinate values are linear axis type. (3) Stored pitch error compensation is linear axis type (Refer to parameter No.3624)
0	1	Rotation axis (A type) (1) Inch/metric conversion is not done. (2) Machine coordinate values are rounded in 0 to 360°. Absolute coordinate values are rounded or not rounded by parameter No.1008#0(ROAx) and #2(RRLx). (3) Stored pitch error compensation is the rotation type. (Refer to parameter No.3624) (4) Automatic reference position return (G28, G30) is done in the reference position return direction and the move amount does not exceed one rotation.
1	0	Setting is invalid (unused)
1	1	Rotation axis (B type) (1) Inch/metric conversion, absolute coordinate values and relative coordinate values are not done. (2) Machine coordinate values, absolute coordinate values and relative coordinate values are linear axis type. (Is not rounded in 0 to 360°). (3) Stored pitch error compensation is linear axis type (Refer to parameter No.3624) (4) Cannot be used with the ratation axis roll over function and the index table indexing fanction (M series)

DIAx Either a diameter or radius is set to be used for specifying the amount of travel on each axis.

0 : Radius

1 : Diameter

ZMIx The direction of reference position return.

0 : Positive direction

1 : Negative direction

> **NOTE**
> The direction of the initial backlash, which occurs when power is switched on, is opposite to the direction of a reference position return.

	#7	#6	#5	#4	#3	#2	#1	#0
1008						RRLx	RABx	ROAx

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit axis

ROAx The roll–over function of a rotation axis is

0 : Invalid

1 : Valid

> **NOTE**
> ROAx specifies the function only for a rotation axis (for which ROTx, #0 of parameter No.1006, is set to 1)

RABx In the absolute commands, the axis rotates in the direction

0 : In which the distance to the target is shorter.

1 : Specified by the sign of command value.

> **NOTE**
> RABx is valid only when ROAx is 1.

RRLx Relative coordinates are

0 : Not rounded by the amount of the shift per one rotation

1 : Rounded by the amount of the shift per one rotation

> **NOTE**
> 1 RRLx is valid only when ROAx is 1.
> 2 Assign the amount of the shift per one rotation in parameter No.1260.

1010	Number of CNC–controlled axes

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte

[Valid data range] 1, 2, 3, ..., the number of controlled axes

Set the maximum number of axes that can be controlled by the CNC.

Examples

Suppose that the first axis is the X axis, and the second and subsequent axes are the Y, Z, A, B, and C axes in that order, and that they are controlled as follows:

X, Y, Z, and A axes: Controlled by the CNC and PMC
B and C axes: Controlled by the PMC

Then set this parameter to 4 (total 4: X, Y, Z, and A)

	#7	#6	#5	#4	#3	#2	#1	#0
1012								IDGx

[Data type] Bit axis

IDGx The function for setting the reference position again, without dogs, is:

0 : Not inhibited.
1 : Inhibited.

> **NOTE**
> 1 IDGx is enabled when the IDG parameter (bit 7 of parameter No.1002) is 1.
> 2 When the function for setting the reference position, without dogs, is used, and the reference position is lost for some reason, an alarm requesting reference position return (No.300) is generated when the power is next turned on. If the operator performs reference position return, as a result of mistakenly identifying the alarm as that requesting the operator to perform a normal reference position return, an invalid reference position may be set. To prevent such an operator error, the IDGx parameter is provided to prevent the reference position from being set again without dogs.
> (1) If the IDG parameter (bit 7 of parameter No.1002) is set to 1, the IDGx parameter (bit 0 of parameter No.1012) is automatically set to 1 when the reference position is set using the function for setting the reference position without dogs. This prevents the reference position from being set again without dogs.
> (2) Once the reference position is prevented from being set for an axis again, without dogs, any attempt to set the reference position for the axis without dogs results in the output of an alarm (No.090).
> (3) When the reference position must be set again without dogs, set IDGx to 0 before setting the reference position.

1020	Program axis name for each axis

[Data type] Byte axis

Set the program axis name for each controlled axis, using one of the values listed in the following table:

Axis name	Setting	Axis name	Setting	Axis name	Setting	Axis name	Setting
X	88	U	85	A	65	E	69
Y	89	V	86	B	66		
Z	90	W	87	C	67		

NOTE
1. With the T series, when G code system A is used, neither U, V, nor W can be used as an axis name. Only when G code system B or C is used, U, V, and W can be used as axis names.
2. The same axis name cannot be assigned to more than one axis.
3. When the secondary auxiliary function (option) is provided, the address used by the secondary auxiliary function (address B with the T series or, with the M series, the address specified in parameter No.3460) cannot be used as an axis name.
4. With the T series, when address C or A is used for chamfering, corner rounding, or direct drawing dimension programming (when the CCR parameter (bit 4 of parameter No.3405) is set to 1), addresses C or A cannot be used as an axis name.
5. Only with the T series, address E can be used as an axis name. Address E cannot be used with the M series. When address E is used as an axis name, note the following:
   – When G code system A is used, address E is always assigned to an absolute command.
   – When an equal–lead threading command (G32) is issued in the Series 15 command format, address E cannot be used to specify the thread lead. Use address F to specify the thread lead.

1022	Setting of each axis in the basic coordinate system

NOTE
When this parameter is set, power must be turned off before operation is continued.

[Data type] Byte axis

To determine the following planes used for circular interpolation, cutter compensation C (for the M series), tool nose radius compensation (for the T series), etc., each control axis is set to one of the basic three axes X, Y, and Z, or an axis parallel to the X, Y, or Z axis.

G17: Plane Xp–Yp

G18: Plane Zp–Xp

G19: Plane Yp–Zp

Only one axis can be set for each of the three basic axes X, Y, and Z, but two or more parallel axes can be set.

Set value	Meaning
0	Neither the basic three axes nor a parallel axis
1	X axis of the basic three axes
2	Y axis of the basic three axes
3	Z axis of the basic three axes
5	Axis parallel to the X axis
6	Axis parallel to the Y axis
7	Axis parallel to the Z axis

1023	Number of the servo axis for each axis

> **NOTE**
> When this parameter is set, power must be turned off before operation is continued.

[Data type] Byte axis

[Valid data range] 1, 2, 3, ..., number of control axes

Set the servo axis for each control axis.

Usually set to same number as the control axis number.
The control axis number is the order number that is used for setting the axis–type parameters or axis–type machine signals

Refer to FSSB section of CONNECTION MANUAL (Function) B–63003EN–1.

4.7
PARAMETERS OF COORDINATES

	#7	#6	#5	#4	#3	#2	#1	#0
1201	WZR		AWK			ZCL	ZPI	ZPR
			AWK			ZCL	ZPI	ZPR

[Data type] Bit

ZPR Automatic setting of a coordinate system when the manual reference position return is performed
0 : Not set automatically
1 : Set automatically

This bit is ineffective, when a workpiece coordinate system option is provided, however.

> **NOTE**
> ZPR is valid when the workpiece coordinate system option is not used. When this option is used, however, manual reference position return always results in a workpiece coordinate system being established based on the workpiece origin offsets (parameters No. 1220 to 1226), regardless of the setting of this parameter.

ZPI Coordinates at the reference position when a coordinate system is set automatically
0 : Value set in parameter No.1250 is used.
1 : For input in mm, the value set in parameter 1250 is used, or for input in inches, the value set in parameter No.1251 is used.

This bit is ineffective, when a workpiece coordinate system option is provided, however.

ZCL Local coordinate system when the manual reference position return is performed
0 : The local coordinate system is not canceled.
1 : The local coordinate system is canceled.

AWK When the workpiece zero point offset value is changed
0 : The absolute position display changed when the next buffaring block is performed.
1 : The absolute position display is changed immediately.
Changed value is valid ofter baffering the next block.

WZR Upon reset, the workpiece coordinate system is:
0 : Not returned to that specified with G54
1 : Returned to that specified with G54

	#7	#6	#5	#4	#3	#2	#1	#0
1202					RLC	G50	EWS	EWD
				G52	RLC			

[Data type] Bit

EWD The shift direction of the workpiece coordinate system is:
0 : The direction specified by the external workpiece zero point offset value
1 : In the opposite direction to that specified by the external workpiece zero point offset value

EXOFS : External workpiece zero point offset value
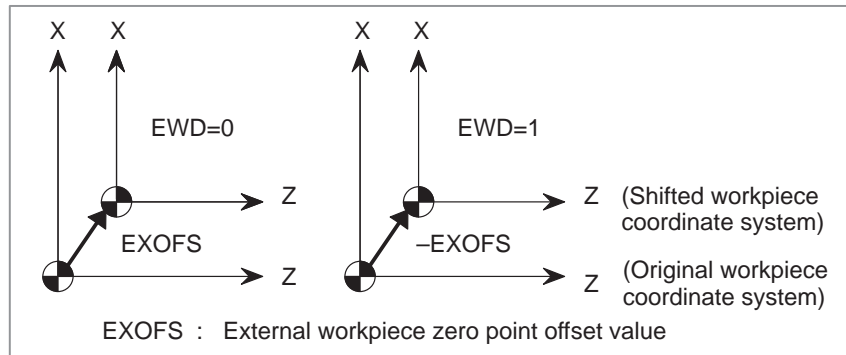
EWS Shift value of the workpiece coordinate system and external workpiece zero point offset value are

0 : Stored in the separate memory areas.

1 : Stored in the same memory area, that is, the shift and the offset values are the same.

G50 When the CNC has commands G54 to G59 specifying workpiece coordinate systems (optional function), if the G50 command for setting a coordinate system (or the G92 command in G command system B or C) is specified,

0 : G50 is executed and no alarm is issued.

1 : G50 is not executed and a P/S alarm (No. 010) is issued.

RLC Local coordinate system is

0 : Not cancelled by reset

1 : Cancelled by reset

G52 In local coordinate system setting (G52), a cutter compensation vector is:

0 : Not considered.

1 : Considered.

> **NOTE**
> Select a local coordinate system setting operation when cutter compensation is applied, and when two or more blocks specifying no movement exist prior to the specification of G52, or when G52 is specified after cutter compensation mode is canceled without eliminating the offset vector.

1220	External workpiece zero point offset value

[Data type] 2–word axis

[Unit of data]

Input increment	IS–A	IS–B	IS–C	Unit
Linear axis (input in mm)	0.01	0.001	0.0001	mm
Linear axis (input in inches)	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

This is one of the parameters that give the position of the origin of workpiece coordinate system (G54 to G59). It gives an offset of the workpiece origin common to all workpiece coordinate systems. In general, the offset varies depending on the workpiece coordinate systems. The value can be set from the PMC using the external data input function.

1221	Workpiece zero point offset value in workpiece coordinate system 1 (G54)

1222	Workpiece zero point offset value in workpiece coordinate system 2(G55)

1223	Workpiece zero point offset value in workpiece coordinate system 3(G56)

1224	Workpiece zero point offset value in workpiece coordinate system 4 (G57)

1225	Workpiece zero point offset value in workpiece coordinate system 5 (G58)

1226	Workpiece zero point offset value in workpiece coordinate system 6 (G59)

[Data type] 2–word axis

[Unit of data]

Input increment	IS–A	IS–B	IS–C	Unit
Linear axis (input in mm)	0.01	0.001	0.0001	mm
Linear axis (input in inches)	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

The workpiece zero point offset values in workpiece coordinate systems 1 to 6 (G54 to G59) are set.

Workpiece coordinate system 1 (G54)

Workpiece coordinate system 2 (G55)

Workpiece zero point offset

Origin of machine coordinate system
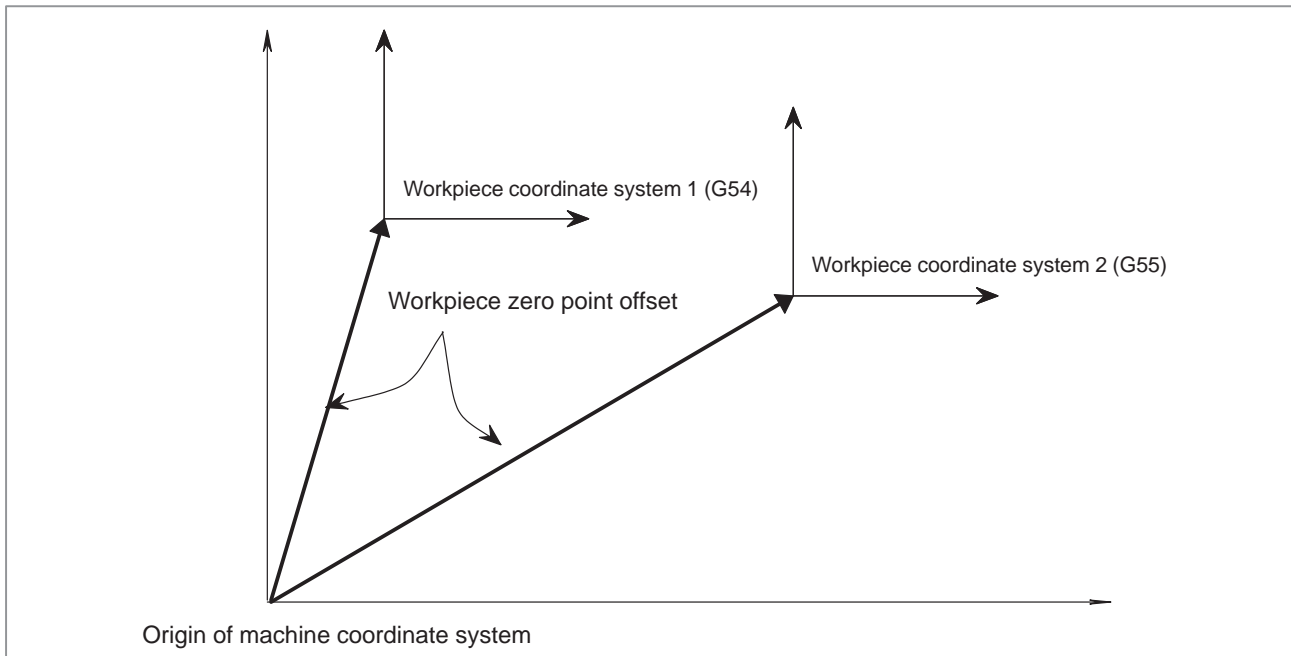
NOTE
The workpiece origin offset can also be set using the workpiece coordinate system screen.

1240	Coordinate value of the reference position on each axis in the machine coordinate system

NOTE
When this parameter is set, power must be turned off before operation is continued.

1241	Coordinate value of the second reference position on each axis in the machine coordinate system

1242	Coordinate value of the third reference position on each axis in the machine coordinate system

1243	Coordinate value of the fourth reference position on each axis in the machine coordinate system

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

Set the coordinate values of the reference positions in the machine coordinate system.

1250	Coordinate value of the reference position used when automatic coordinate system setting is performed

[Data type] 2–word axis

[Unit of data]

Input increment	IS–A	IS–B	IS–C	Unit
Linear axis (input in mm)	0.01	0.001	0.0001	mm
Linear axis (input in inches)	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

Set the coordinate value of the reference position on each axis to be used for setting a coordinate system automatically.

1251	Coordinate value of the reference position on each axis used for setting a coordinate system automatically when input is performed in inches

[Data type] 2–word axis

[Unit of data]

Incerment system	IS–A	IS–B	IS–C	Unit
Linear axis (input in inches)	0.001	0.0001	0.00001	inch

[Valid data range] –99999999 to 99999999

Set the coordinate value of the reference position on each axis to be used for setting a coordinate system automatically when input is performed in inches.

NOTE
This parameter is valid when ZPI in parameter 1201 is set to 1.

1260	Amount of a shift per one rotation of a rotation axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] 2–word axis

[Unit of data]

Increment system	Unit of data	Standard value
IS–A	0.01 deg	36000
IS–B	0.001 deg	360000
IS–C	0.0001 deg	3600000

[Valid data range] 1000 to 9999999

Set the amount of a shift per one rotaion of a rotaion axis.

1290	Distance between two opposite tool posts in mirror image

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch

[Valid data range] 0 to 99999999

Set the distance between two opposite tool posts in mirror image.

4.8
PARAMETERS OF STROKE CHECK

	#7	#6	#5	#4	#3	#2	#1	#0
1300	BFA	LZR	RL3			LMS		OUT
	BFA	LZR				LMS		OUT

[Data type] Bit

OUT The area inside or outside of the stored stroke check 2 is set as an inhibition area.

0 : Inside
1 : Outside

LMS The EXLM signal for switching stored stroke check 1

0 : Disabled
1 : Enabled

> **NOTE**
> Stored stroke check 1 supports two pairs of parameters for setting the prohibited area. The stored stroke limit switching signal is used to enable either of the prohibited areas set with these parameter pairs.
> (1) Prohibited area I: Parameters No.1320 and No.1321
> (2) Prohibited area II: Parameters No.1326 and No.1327

RL3 Stored stroke check 3 release signal RLSOT3 is

0 : Disabled
1 : Enabled

LZR Checking of stored stroke check 1 during the time from power–on to the manual position reference return

0 : The stroke check 1 is checked.
1 : The stroke check 1 is not checked

> **NOTE**
> When an absolute position detector is used and a reference position is already set upon power–up, stored stroke limit check 1 is started immediately after power–up, regardless of the setting.

BFA When a command that exceeds a stored stroke check is issued

0 : An alarm is generated after the stroke check is exceeded.
1 : An alarm is generated before the stroke check is exceeded.

> **NOTE**
> The tool stops at a point up to F/7500 mm short of or ahead of the boundary.
> (F: Feedrate when the tool reaches the boundary (mm/min))

	#7	#6	#5	#4	#3	#2	#1	#0
1310							OT3x	OT2x
							OT3x	OT2x

[Data type] Bit axis

OT2x Whether stored stroke check 2 is checked for each axis is set.

0 : Stored stroke check 2 is not checked.
1 : Stored stroke check 2 is checked.

OT3x Whether stored stroke check 3 is checked for each axis is set.

0 : Stored stroke check 3 is not checked.
1 : Stored stroke check 3 is checked.

1320	Coordinate value I of stored stroke check 1 in the positive direction on each axis
1321	Coordinate value I of stored stroke check 1 in the negative direction on each axis

[Data type] 2–word axis

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

The coordinate values of stored stroke check 1 in the positive and negative directions are set for each axis in the machine coordinate system. The outside area of the two checks set in the parameters is inhibited.

Set the machine coordinates of the boundaries in the positive direction (Xp, Yp, and Zp) using parameter No. 1320, and those of the boundaries in the negative direction (Xm, Ym, and Zm) using parameter No. 1321. The prohibited area thus becomes the hatched area in the figure on the left.

NOTE
1 For axes with diameter specification, a diameter value must be set.
2 When the parameters are set as follows, the stroke becomes infinite:

parameter 1320 < parameter 1321

For movement along the axis for which infinite stroke is set, only increment commands are available. If an absolute command is issued for this axis, the absolute register may overflow, and normal movement will not result.
3 The prohibited area specified with these parameters is invalid if bit 2 (LMS) of parameter No. 1300 is set to 1 and stored stroke limit switching signal EXLM is set to 1. In such a case, the settings of parameters No. 1326 and 1327 are used, instead.

1322	Coordinate value of stored stroke check 2 in the positive direction on each axis

1323	Coordinate value of stored stroke check 2 in the negative direction on each axis

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

Set the coordinate values of stored stroke check 2 in the positive and negative directions foreach axis in the machine coordinate system. OUT, #0 of parameter 1300, sets either the area outside of the area inside specified by two checks are the inhibition area.

(1) When the prohibited area is inside the boundaries (OUT = 0)

(Xp,Yp,Zp)

(Xm,Ym,Zm)

(2) When the prohibited area is outside the boundaries (OUT = 1)

(Xp,Yp,Zp)

(Xm,Ym,Zm)

Set the machine coordinates of the boundaries in the positive direction (Xp, Yp, and Zp) using parameter No. 1322, and those of the boundaries in the negative direction (Xm, Ym, and Zm) using parameter No. 1323. The prohibited area thus becomes the hatched area in the figure on the left.

NOTE
For axes with diameter specification, a diameter value must be set.
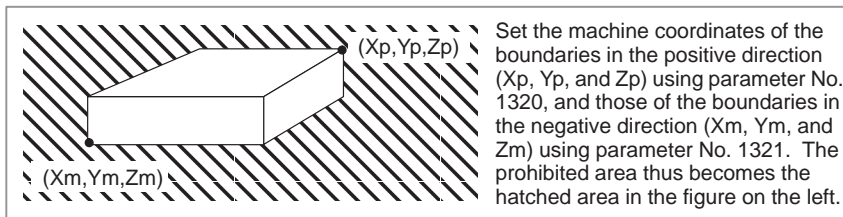
1324	Coordinate value of stored stroke checke 3 in the positive direction on each axis

1325	Coordinate value of stored stroke checke 3 in the negative direction on each axis

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

Set the coordinate values of stored stroke check 3 in the positive and negative directions foreach axis in the machine coordinate system. The area inside the checks set in the parameter is inhibited.

NOTE
Specify diameters for any axis for which diameter programming is specified.

1326	Coordinate value II of stored stroke check 1 in the positive direction on each axis

1327	Coordinate value II of stored stroke check 1 in the negative direction on each axis

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

Set the coordinate values of stored stroke check 1 in the positive and negative directions foreach axis in the machine coordinate system.

When stroke check switching signal EXLM is ON, stroke check are checked with parameters 1326 and 1327, not with parameters 1320 and 1321. The area outside that set by parameters 1326 and 1327 is inhibited.

NOTE
1 Specify diameter values for any axes for which diameter programming is specified.
2 These parameters are invalid if bit 2 (LMS) of parameter No. 1300 is set to 0, or if stored stroke limit switching signal EXLM is set to 0. In such a case, the settings of parameters No. 1320 and 1321 are used, instead.
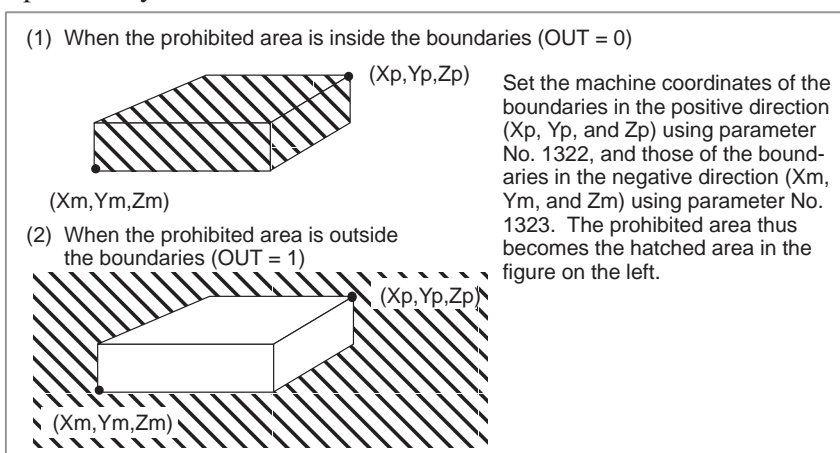

4.9
PARAMETERS OF THE CHUCK AND TAILSTOCK BARRIER (T SERIES)

1330	Profile of a chuck

[Data type] Byte

[Valid data range] 0 or 1

        0 : Chuck which holds a workpiece on the inner surface
        1 : Chuck which holds a workpiece on the outer surface

1331	Dimensions of the claw of a chuck (L)

1332	Dimensions of the claw of a chuck (W)

1333	Dimensions of the part of a claw at which a workpiece is held (L1)

1334	Dimensions of the part of a claw at which a workpiece is held (W1)

1335	X coordinate of a chuck (CX)

1336	ZX coordinate of a chuck (CZ)

[Data type] 2–word

[Unit of data]

Increment system	IS–B	IS–C	Unit
Millimeter input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

[Valid range] No.1331 to No.1334: 0 to 99999999

No.1335 to No.1336: –99999999 to 99999999
Specify the profile of a chuck.

Chuck which holds a workpiece on the outer surface (TY= 1)

Chuck which holds a workpiece on the inner surface (TY= 0)

Zero point of the workpiece coodinate system

Zero point of the workpiece coodinate system
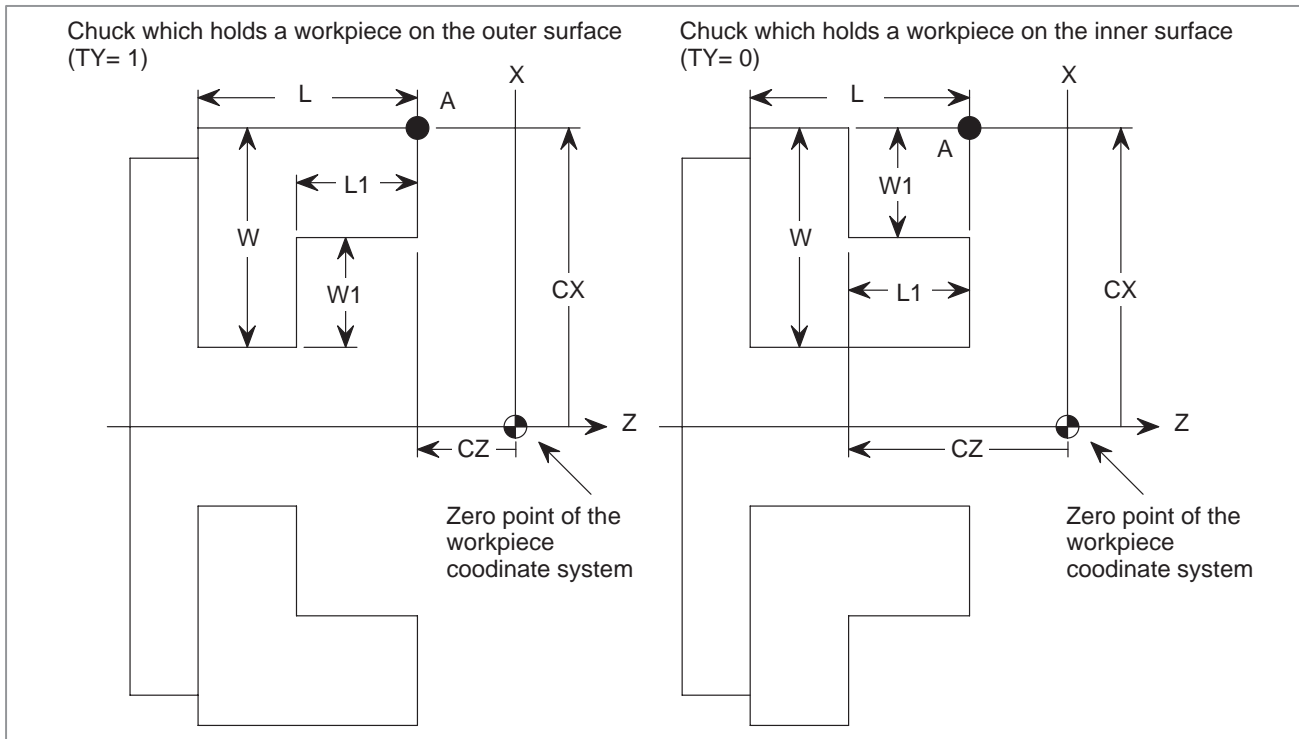
Symbol	Decription
Ty	Profile of a chuck (0: Chuck which holds a workpiece on the inner surface, 1: Chuck which holdsa workpiece on the outer surface)
CX	X coordinate of a chuck
CZ	Z coordinate of a chuck
L	Dimensions of the claw of a chuck
W	Dimensions of the claw of a chuck (radius input)
L_1	Dimensions of the part of a claw at which a workpiece is held
W_1	Dimensions of the part of a claw at which a workpiece is held (radius input)

TY Specifies the profile of a chuck. When TY is set to 0, the chuck holding a workpiece on theinner surface is specified. When TY is set to 1, the chuck holding a workpiece on the outer surface is specified. The profile of the chuck is assumed to be symmetrical with respect to the z–axis.

CX, and CZ Specify the position (point A) of a chuck with the coordinates of the workpiece coordinate system. In this case, do not use the coordinates of the machine coordinate system.

> **NOTE**
> Specifying the coordinates with a diameter or radius depends on whether the correspondingaxis conforms to diameter or radius specification. When the axis conforms to diameter specification, spcify the coordinates with a diameter.

L, L1, W and W1 Define the profile of a chuck.

> **NOTE**
> Always specify W and W1 with radiuses. Specify L and L1 with radiuses when the Z–axis conforms to radius specification.

1341	Length of a tailstock (L)

1342	Diameter of a tailstock (D)

1343	Length of a tailstock (L1)

1344	Diameter of a tailstock (D1)

1345	Length of a tailstock (D1)

1346	Diameter of a tailstock (D2)

1347	Diameter of the hole of a tailstock (D3)

1348	Z coordinate of a tailstock (TZ)

[Data type] 2–words

[Unit of data]

Increment system	IS–B	IS–C	Unit
Millimeter input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

[Valid range] No.1341 to No.1347: 0 to 99999999
No.1348: –99999999 to 99999999

Specify the profile of a tailstock.
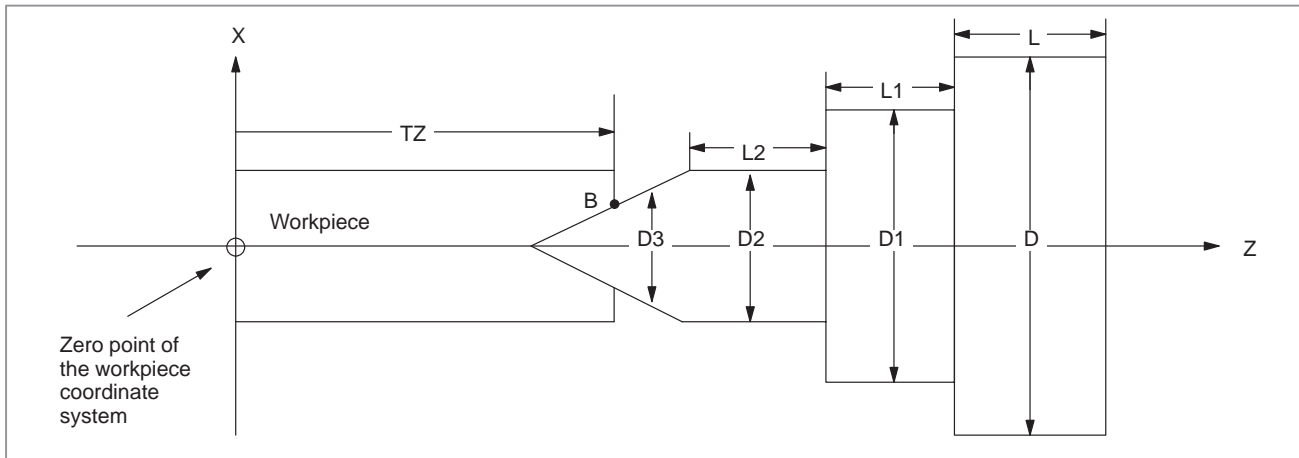
Symbol	Description
TZ	Z–axis coordinate of a tailstock
L	Length of a tailstock
D	Diameter of a tailstock (diameter input)
L1	Length of a tailstock (1)
D1	Diameter of a tailstock (1) (diameter input)
L2	Length of a tailstock (2)
D2	Diameter of a tailstock (2) (diameter input)
D3	Diameter of the hole of a tailstock (diameter input)

TZ Specifies the position (point B) of a tailstock with the Z–axis coordinate of the workpiece coordinate system. In this case, do not use the coordinate of the machine coordinate system. The profile of a tailstock is assumed to be symmetrical with respect to the Z–axis.

> **NOTE**
> Specifying the position of a tailstock with a radius or diameter depends on whether the Z–axis conforms to radius or diameter specification.

L, L1, L2, D, D1, D2, and D3
Define the profile of a tailstock.

> **NOTE**
> Always specify D, D1, D2, and D3 with diameters. Specify L, L1, and L2 with radiuses if the Z–axis conforms to radius specification.

4.10
PARAMETERS OF
FEEDRATE

	#7	#6	#5	#4	#3	#2	#1	#0
1401		RDR	TDR	RF0		JZR	LRP	RPD
		RDR	TDR	RF0			LRP	RPD

[Data type] Bit

RPD Manual rapid traverse during the period from power–on time to the completion of the reference position return.

0 : Disabled (Jog feed is performed.)
1 : Enabled

LRP Positioning (G00)

0 : Positioning is performed with non–linear type positioning so that the tool moves along each axis independently at rapid traverse.
1 : Positioning is performed with linear interpolation so that the tool moves in a straight line.

JZR The manual reference position return at JOG feedrate

0 : Not performed
1 : Performed

RF0 When cutting feedrate override is 0% during rapid traverse,

0 : The machine tool does not stop moving.
1 : The machine tool stops moving.

TDR Dry run during threading or tapping (tapping cycle G74 or G84, rigid tapping)

0 : Enabled
1 : Disabled

RDR Dry run for rapid traverse command

0 : Disabled
1 : Enabled

	#7	#6	#5	#4	#3	#2	#1	#0
1402				JRV				NPC
								NPC

[Data type] Bit

NPC The feed per rotation command is:

0 : Ineffective when a position coder is not provided.
1 : Effective even when a position coder is not provided (because the CNC converts it to the feed per minute command from F command S command).

JRV Manual continuous feed (jog feed)

0 : Jog feed is performed at feed per minute.
1 : Jog feed is performed at feed per rotation.

> **NOTE**
> Specify a feedrate in parameter No.1423.

	#7	#6	#5	#4	#3	#2	#1	#0
1403	RTV							MIF

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

MIF Cutting feedrates at feed per minute is specified by F commands

0 : In units of 1 mm/min for millimeter machines or 0.01 inches/min for inch machines.

1 : In unit of 0.001 mm/min for millimeter machines or 0.00001 inches/min for inch machines.

> **NOTE**
> M series are not equipped with this parameter. Cutting feedrates are specified by F commands in units of 0.001 mm/min for millimeter machines or 0.00001 inches/min for inch machines.

RTV Override while the tool is retracting in threading

0 : Override is effective.

1 : Override is not effective.

	#7	#6	#5	#4	#3	#2	#1	#0
1404					FRV	F8A	DLF	
						F8A	DLF	HFC

[Data type] Bit

HFC The feedrate for helical interpolation is:

0: Clamped so that the feedrates along an arc and linear axis do not exceed the maximum cutting feedrate specified by parameter.

1: Clamped so that the composite feedrate along an arc and linear axis does not exceed the maximum cutting feedrate specified by parameter.

DLF After a reference potition is set, manual reference position return performed at:

0 : Rapid traverse rate (parameter No.1420)

1 : Manual rapid traverse rate (parameter No.1424)

> **NOTE**
> This parameter selects a feedrate for reference position return performed without dogs. This parameter also selects a feedrate when manual reference position return is performed according to bit 7 (SJZ) of parameter No.0002 using rapid traverse without deceleration dogs after a reference position is set.

\<For T series\>

F8A Valid data range for an F command in feed–per–minute mode

0 : Range specified with bit 0 (MIF) of parameter No.1403

1 :

Increment system	Units	IS–A, IS–B	IS–C
Millimeter input	mm/min	0.001 to 240000.	0.001 to 100000.
Inch input	inch/min	0.00001 to 9600.	0.00001 to 4000.
Rotation axis	deg/min	1 to 240000.	1 to 100000.

\<For M series\>

F8A Valid data range for an F command with a decimal point in feed–per minute mode

0 :

Increment system	Units	IS–A, IS–B	IS–C
Millimeter input	mm/min	0.001 to 99999.999.	
Inch input	inch/min	0.00001 to 999.99999.	
Rotation axis (mm)	deg/min	1 to 240000.	1 to 100000.
Rotation axis (inch)	deg/min	1 to 9600.	1 to 4000.

1 :

Increment system	Units	IS–A, IS–B	IS–C
Millimeter input	mm/min	0.001 to 240000.	0.001 to 100000.
Inch input	inch/min	0.00001 to 9600.	0.00001 to 4000.
Rotation axis	deg/min	1 to 240000.	1 to 100000.

FRV For inch input, the valid range of the feedrate specified for feed per revolution is:

0 : Standard range. (F0.000001 to 9.999999 inches per revolution)

1 : Extended to F50.0 inches per revolution. (F0.000001 to 50.000000 inches per revolution)

	#7	#6	#5	#4	#3	#2	#1	#0
1405							FD3	F1U

[Data type] Bit

F1U Specifies the units of the data for the parameters that set the feedrates of the F1–digit feed commands (parameter Nos. 1451 to 1459).

Increment system	Units of data	
	When F1U is 0	When F1U is 1
Millimeter machine	0.1 mm/min	1 mm/min
Inch machine	0.001 inch/min	0.1 inch/min
Rotation axis	0.1 deg/min	1 deg/min

FD3 The number of significant digits of the fractional part in the feedrate command (F command) for feed per revolution is:

0 : Up to two decimal positions (three decimal positions for inch input).

1 : Up to three decimal positions (four decimal positions for inch input).

1410	Dry run rate

[Data type] Word

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800

Set the dry run rate when the manual feedrate is overridden by 100%.

Specify the jog feedrate when the override is 100% for manual linear or circular interpolation.

1411	Cutting feedrate in the automatic mode at power–on

Setting entry is acceptable.

[Data type] Word

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 32767	6 to 32767
Inch machine	0.1 inch/min	6 to 32767	6 to 32767

When the machine requires little change in cutting feedrate during cutting, a cutting feedrate can be specified in the parameter. This eliminates the need to specify a cutting feedrate in the NC program.
The feedrate set in this parameter is effective between the CNC being cleared by a power–on or reset and a feedrate being specified using a program command (F command). A feedrate becomes effective as soon as it has been specified by an F command.

1420	Rapid traverse rate for each axis

[Data type] 2–word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	30 to 240000	6 to 100000
Inch machine	0.1 inch/min	30 to 96000	6 to 48000
Rotation axis	1 deg/min	30 to 240000	6 to 100000

Set the rapid traverse rate when the rapid traverse override is 100% for each axis.

1421	F0 rate of rapid traverse override for each axis

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	30 to 15000	30 to 12000
Inch machine	0.1 inch/min	30 to 6000	30 to 4800
Rotaion axis	1 deg/min	30 to 15000	30 to 12000

Set the F0 rate of the rapid traverse override for each axis.

Rapid traverse override signal		Override value
ROV2	ROV1	
0	0	100%
0	1	50%
1	0	25%
1	1	F0

F0: Parameter 1421

1422	Maximum cutting feedrate for all axes

[Data type] 2–word

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 240000	6 to 100000
Inch machine	0.1 inch/min	6 to 96000	6 to 48000

Specify the maximum cutting feedrate.

A feedrate in the tangential direction is clamped in cutting feed so that it does not exceed the feedrate specified in this parameter.

> **NOTE**
> To specify the maximum cutting feedrate for each axis, use parameter No.1430 instead.

1423	Feedrate in manual continuous feed (jog feed) for each axis

[Data type] Word axis

(1) In M series, or in T series when JRV, bit 4 of parameter No.1402, is set to 0 (feed per minute), specify a jog feedrate at feed per minute with an override of 100%.

[Unit of data, valid range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min		
Inch machine	0.1 inch/min	6 to 32767	
Rotaiton axis	1 deg/min		

(2) When JRV, bit 4 of parameter No.1402, is set to 1 (feed per revolution) in T series, specify a jog feedarate (feed per revolution) under an override of 100%.

[Unit of data, valid range]

Increment system	Unit of data	Valid data range
Millimeter machine	0.01 mm/rev	
Inch machine	0.001 mm/rev	0 to 32767
Rotation axis	0.01 deg/rev	

1424	Manual rapid traverse rate for each axis

[Data type] 2–word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	30 to 240000	30 to 100000
Inch machine	0.1 inch/min	30 to 96000	30 to 48000
Rotation axis	1 deg/min	30 to 240000	30 to 100000

Set the rate of manual rapid traverse when the rapid traverse override is 100% for each axis.

> **NOTE**
> If 0 is set, the rate set in parameter 1420 is assumed.

1425	FL rate of the reference position return for each axis

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotaion axis	1 deg/min	6 to 15000	6 to 12000

Set feedrate (FL rate) after deceleration when the reference position return is performed for each axis.

1426	External deceleration rate of cutting feed

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800

Set the external deceleration rate of cutting feed.

1427	External deceleration rate of rapid traverse for each axis

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotaion axis	1 deg/min	6 to 15000	6 to 12000

Set the external deceleration rate of rapid traverse for each axis.

1430	Maximum cutting feedrate for each axis

[Data type] 2–word axis

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 240000	6 to 100000
Inch machine	0.1 inch/min	6 to 96000	6 to 48000
Rotaion axis	1 deg/min	6 to 240000	6 to 100000

Specify the maximum cutting feedrate for each axis.
A feedrate for each axis is clamped in cutting feed so that it does not exceed the maximum feedrate specified for each axis.

NOTE
1 This parameter is effective only in linear and circular interpolation. In polar coordinate, cylindrical, and involute interpolation, the maximum feedrate for all axes specified in parameter No.1422 is effective.
2 If the setting for each axis is 0, the maximum feedrate specified in parameter No.1422 is applied to all axes and the feedrate is clamped at the maximum feedrate.

1431	Maximum cutting feedrate for all axes in the look–ahead control mode

[Data type] 2–words

[Unit of data, valid range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	0 to 240000	0 to 100000
Inch machine	0.1 inch/min	0 to 96000	0 to 48000
Rotaion axis	1 deg/min	0 to 240000	0 to 100000

Specify the maximum cutting feedrate for all axes in the look–ahead control mode.
A feedrate in the tangential direction is clamped in cutting feed so that it does not exceed the feedrate specified in this parameter.

NOTE
1 To specify the maximum cutting feedrate for each axis, use parameter No.1432 instead.
2 In a mode other than the look–ahead mode, the maximum cutting feedrate specified in parameter No.1422 or No.1430 is applied and the feedrate is clamped at the maximum feedrate.

| 1432 | Maximum cutting feedrate for each axis in the look–ahead control mode |

[Data type] 2–word axis

[Unit of data, valid range]

Increment system	Unit of data	Valid data range IS–A, IS–B	Valid data range IS–C
Millimeter machine	1 mm/min	0 to 240000	0 to 100000
Inch machine	0.1 inch/min	0 to 96000	0 to 48000
Rotaion axis	1 deg/min	0 to 240000	0 to 100000

Specify the maximum cutting feedrate for each axis in the look–ahead control mode.

A feedrate for each axis is clamped during cutting feed so that it does not exceed the maximum cutting feedrate specified for each axis.

NOTE
1 This parameter is effective only in linear and circular interpolation. In polar coordinate, cylindrical, and involute interpolation, the maximum feedrate for all axes specified in parameter No.1431 is effective.
2 If a setting for each axis is 0, the maximum feedrate specified in parameter No.1431 is applied to all axes and the feedrate is clamped at the maximum feedrate.
3 In a mode other than the look–ahead mode, the maximum cutting feedrate specified in parameter No.1422 or No.1430 is applied and the feedrate is clamped at the maximum feedrate.

| 1450 | Change of feedrate for one graduation on the manual pulse generator during F1 digit feed |

[Data type] Byte

[Valid data range] 1 to 127

Set the constant that determines the change in feedrate as the manual pulse generator is rotated one graduation during F1-digit feed.

$$\Delta F = \frac{Fmaxi}{100n} \quad \text{(where, i=1 or 2)}$$

In the above equation, set n. That is, the number of revolutions of the manual pulse generator, required to reach feedrate Fmaxi is obtained. Fmaxi refers to the upper limit of the feedrate for an F1-digit feed command, and set it in parameter 1460 or 1461.

Fmax1: Upper limit of the feedrate for F1 to F4 (parameter 1460)

Fmax2: Upper limit of the feedrate for F5 to F9 (parameter 1461)

1451	Feedrate for F1 digit command F1

1452	Feedrate for F1 digit command F2

1453	Feedrate for F1 digit command F3

1454	Feedrate for F1 digit command F4

1455	Feedrate for F1 digit command F5

1456	Feedrate for F1 digit command F6

1457	Feedrate for F1 digit command F7

1458	Feedrate for F1 digit command F8

1459	Feedrate for F1 digit command F9

Setting entry is acceptable.

[Data type] 2–word

[Unit of data, valid range]

(1) When the F1U parameter (bit 0 of parameter No.1405) is 0

Increment system	Units of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	0.1 mm/min	6 to 150000	6 to 120000
Inch machine	0.01 inch/min	6 to 60000	6 to 48000
Rotation axis	0.1 deg/min	6 to 150000	6 to 120000

(2) When the F1U parameter (bit 0 of parameter No.1405) is 1

Increment system	Units of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotation axis	1 deg/min	6 to 15000	6 to 12000

These parameters set the feedrates for 1–digit feed commands F1 to F9.

When an 1–digit feed command is specified, and the feedrate is changed by turning the manual pulse generator, the parameter–set value also changes accordingly.

1460	
	Upper limit of feedrate for the one–digit F code command (F1 to F4)

1461	
	Upper limit of feedrate for the one–digit F code command (F5 to F9)

[Data type] 2–word

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotaion axis	1 deg/min	6 to 15000	6 to 12000

Set the upper limit of feedrate for the F1-digit feed command.

As the feedrate increases by turning the manual pulse generator, the feedrate is clamped when it reaches the upper limit set. If an F1-digit feed command F1 to F4 is executed, the upper limit is that set in parameter 1460. If an F1-digit command F5 to F9 is executed, the upper limit is that set in parameter 1461.

4.11
PARAMETERS OF
ACCELERATION/
DECELERATION
CONTROL

	#7	#6	#5	#4	#3	#2	#1	#0
1601			NCI	RTO				
			NCI	RTO		OVB		

[Data type] Bit

OVB Block overlap in cutting feed

0 : Blocks are not overlapped in cutting feed.
1 : Blocks are overlapped in cutting feed.

Block overlap outputs the pulses remaining at the end of pulse distribution in a block together with distribution pulses in the next block. This eliminates changes in feedrates between blocks.

Block overlap is enabled when blocks containing G01, G02, or G03 are consecutively specified in G64 mode. If minute blocks, however, are specified consecutively, overlap may not be performed.

The following pulses in block F2 are added to the pulses remaining at the end of pulse distribution in block F1.

$$\text{(Number of pulses to be added)} = F2 \times \frac{\textbf{(Number of pulses required at the end of block F1)}}{\textbf{F1}}$$

When F1 = F2
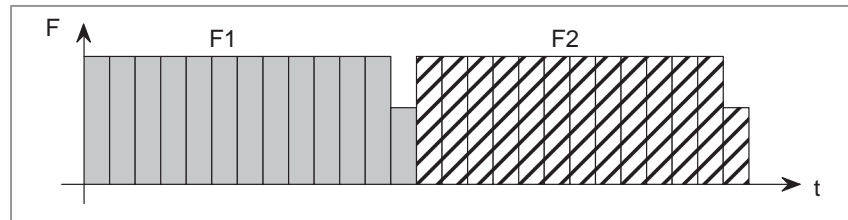
When block overlap is disabled
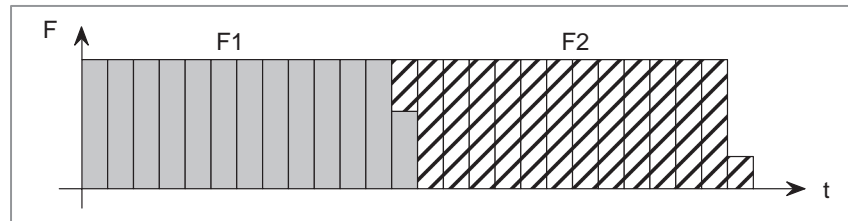
When block overlap is enabled

RTO Block overlap in rapid traverse

0 : Blocks are not overlapped in rapid traverse.
1 : Blocks are overlapped in rapid traverse.

> **NOTE**
> See the description of parameter No.1722.

NCI Inposition check at deceleration

0 : Performed
1 : Not performed

	#7	#6	#5	#4	#3	#2	#1	#0
1602		LS2		CSD	BS2	COV		FWB

[Data type] Bit

FWB Cutting feed acceleration/deceleration before interpolation

0 : Type A of acceleration/deceleration before interpolation is used.

1 : Type B of acceleration/deceleration before interpolation is used.

Type A: When a feedrate is to be changed by a command, acceleration/deceleration starts after the program enters the block in which the command is specified.

Type B: When a feedrate is to be changed by a command, deceleration starts and terminates at the block before the blcock in which the command is specified.
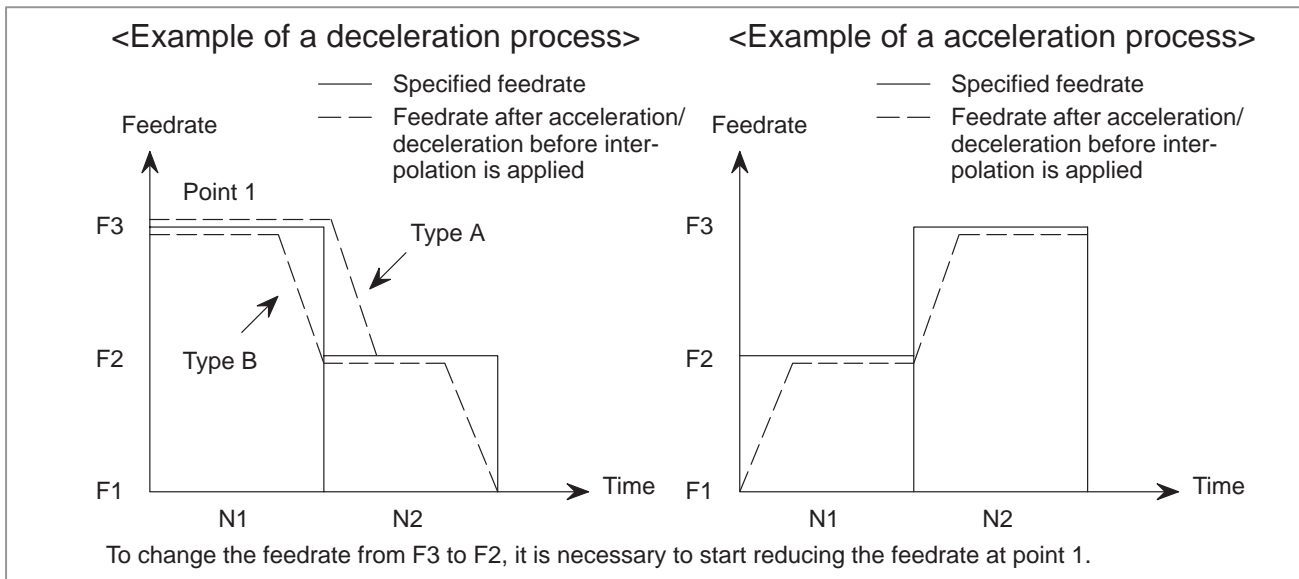When a feedrate is to be changed by a command, acceleration starts after the program enters theblock in which the command is specified.

<Example of a deceleration process>   <Example of a acceleration process>

To change the feedrate from F3 to F2, it is necessary to start reducing the feedrate at point 1.

COV The outer arc cutting feedrate change function of the automatic corner override function is:

0 : Not used.

1 : Used.

BS2 Acceleration/deceleration after interpolation for cutting feed in look–ahead control mode/high–precision contour control mode is:

0 : Exponential acceleration/deceleration or linear acceleration/deceleration (one of which is selected by the LS2 parameter (bit 6 of parameter No.1602)).

1 : Bell–shaped acceleration/deceleration.

BS2	LS2	Acceleration/deceleration
0	0	Exponential acceleration/deceleration after interpolation
0	1	Linear acceleration/deceleration after interpolation. (The option for linear acceleration/deceleration after interpolation for cutting feed is required.)
1	0	Bell–shaped acceleration/deceleration after interpolation. (The option for bell–shaped acceleration/deceleration after interpolation for cutting feed is required.)

CSD In the function for automatically reducing a feedrate at corners,

0 : Angles are used for controlling the feedrate.

1 : Differences in feedrates are used for controlling the feedrate.

LS2 Acceleration/deceleration after interpolation for cutting feed in look–ahead control mode/high–precision contour control mode is:

0 : Exponential acceleration/deceleration.

1 : Linear acceleration/deceleration. (The function for linear acceleration/ deceleration after interpolation for cutting feed is required.)

	#7	#6	#5	#4	#3	#2	#1	#0
1610				JGLx			CTBx	CTLx

[Data type] Bit axis

CTLx Acceleration/deceleration in cutting feed including feed in dry run

0 : Exponential acceleration/deceleration is applied.

1 : Linear acceleration/deceleration after interpolation is applied.

> **NOTE**
> If the optional function of linear acceleration/deceleration after interpolation in cutting feed is not provided, exponential acceleration/deceleration is used irrespective of this setting. To use bell–shaped acceleration/deceleration after interpolation, set this parameter to 0 and select the acceleration/deceleration using CTBx, bit 1 of parameter No.1610.
>
> | Parameter | | Acceleration/deceleration |
> |---|---|---|
> | **CTBx** | **CTLx** | |
> | 0 | 0 | Exponential acceleration/deceleration |
> | 0 | 1 | Linear acceleration/deceleration after interpolation |
> | 1 | 0 | Bell–shaped acceleration/deceleration after interpolation |

CTBx Acceleration/deceleration in cutting feed including feed in dry run

0 : Exponential acceleration/deceleration or linear acceleration/ deceleration after interpolation is applied (depending on the setting in CTLx, bit 0 of parameter No.1610).

1 : Bell–shaped acceleration/deceleration after interpolation is applied.

> **NOTE**
> This parameter is effective only when the function of bell–shaped acceleration/deceleration after interpolation in cutting feed is provided. If the function is not provided, the setting in CTLx, bit 0 of parameter No.1610, determines the type of acceleration/deceleration irrespective of the setting in this parameter.

JGLx Acceleration/deceleration in jog feed

0 : Exponential acceleration/deceleration is applied.

1 : Linear acceleration/deceleration after interpolation or bell–shaped acceleration/deceleration after interpolation is applied (depending on which is used for cutting feed).

1620	Time constant used for linear acceleration/deceleration or bell–shaped acceleration/deceleration in rapid traverse for each axis

[Data type] Word axis

[Unit of data] ms

[Valid data range] 0 to 4000

Specify a time constant used for acceleration/deceleration in rapid traverse. When the optional function of bell–shaped acceleration/deceleration in rapid traverse is provided, bell–shaped acceleration/deceleration is applied in rapid traverse. If the function is not provided, linear acceleration/deceleration is applied.

(1) When the function is provided, set this parameter to time constant T1 used in bell–shaped acceleration/deceleration in rapid traverse, and set parameter No.1621 to time constant T2.

(2) When the function is not provided, specify a time constant used in linear acceleration/deceleration.

NOTE

When parameter No.1621 (time constant T2 used for bell–shaped acceleration/deceleration in rapid traverse) is set to 0, linear acceleration/deceleration is applied in rapid traverse even if the function is provided. In this case, this parameter stands for a time constant used in linear acceleration/deceleration in rapid traverse.

<Rapid traverese linear acceleration/deceleration>

Speed

Rapid traverse feed rate
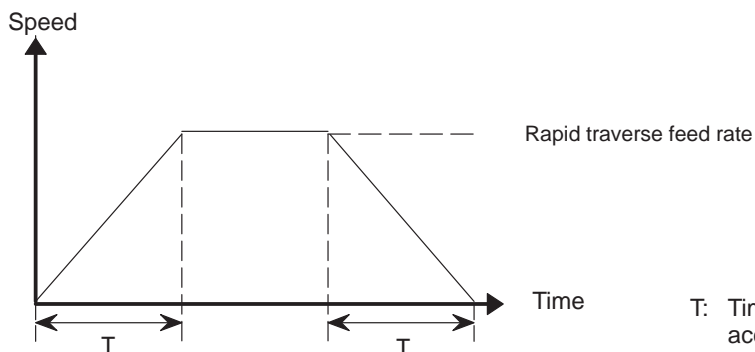
Time

T: Time constant for linear acceleration/deceleration

<Rapid traverse bell shaped acceleration/deceleration>

Speed

Rapid traverse rate
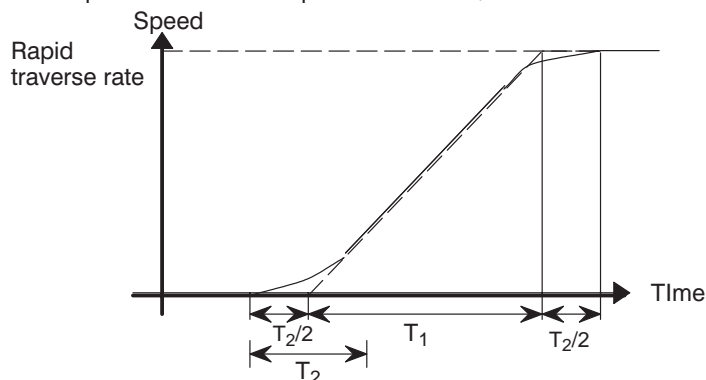
TIme

T_1: Set a time constant used for linear acceleration/deceleration

T_2: Set a time for rounding.

Total time=$T_1 + T_2$
Time for linear=$T_1 - T_2$
Time for rounding part=T_2

$T_2/2$ T_1 $T_2/2$

T_2

Set the value when the rapid traverse rate is 100%. If it is under 100%, the total time is reduced. (Constant acceleration method)

The value of T1 is determined from the torque of motor. Usually set the value of T2 to 24 ms ir 32 ms.

1621	Time constant t T2 used for bell–shaped acceleration/deceleration in rapid traverse for each axis

[Data type] Word axis

[Unit of data] ms

[Valid data range] 0 to 512

Specify time constant T2 used for bell–shaped acceleration/deceleration in rapid traverse for each axis.

NOTE
1 This parameter is effective when the function of bell–shaped acceleration/deceleration in rapid traverse is provided. Set parameter No.1620 to time constant T1 used for bell–shaped acceleration/deceleration in rapid traverse, and set this parameter to time constant T2.
For details of time constants T1 and T2, see the description of parameter No.1620.
2 When this parameter is set to 0, linear acceleration/ deceleration is applied in rapid traverse. The setting in parameter No.1620 is used as a time constant in linear acceleration/deceleration.

1622	Time constant of exponential acceleration/deceleration or bell–shaped acceleration/deceleration after interpolation, or linear aceeleration/deceleration after interpolation in cutting feed for each axis

[Data type] Word axis

[Unit of data] ms

[Valid data range] 0 to 4000 (exponential acceleration/deceleration in cutting feed)
0 to 512 (linear or bell–shaped acceleration/deceleration after
interpolation in cutting feed)

Set the time constant used for exponential acceleration/deceleration in cutting feed, bell–shaped acceleration/deceleration after interpolation or linear acceleration/deceleration after interpolation in cutting feed for each axis. Except for special applications, the same time constant must be set for all axes in this parameter. If the time constants set for the axes differ from each other, proper straight lines and arcs cannot be obtained.

Bell–shaped acceleraton/deceleration after cutting feed interpolation

Speed

T : Total time. it is constant irrespective of feed rate.
(Time constant is constant).

The curve corresponds to that T1 = T/2 and T2 = T/2 set in parameter No.1620 and 1621.

Time

T

| 1623 | FL rate of exponential acceleration/deceleration in cutting feed for each axis |

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	0,6 to 15000	0,6 to 12000
Inch machine	0.1 inch/min	0,6 to 6000	0,6 to 4800
Rotaion axis	1 deg/min	0,6 to 15000	0,6 to 12000

Set the lower limit (FL rate) of exponential acceleration/deceleration in cutting feed for each axis.

NOTE
Except for special applications, this parameter must be set to 0 for all axes. If a value other than 0 is specified, proper straight lines and arcs cannot be obtained.

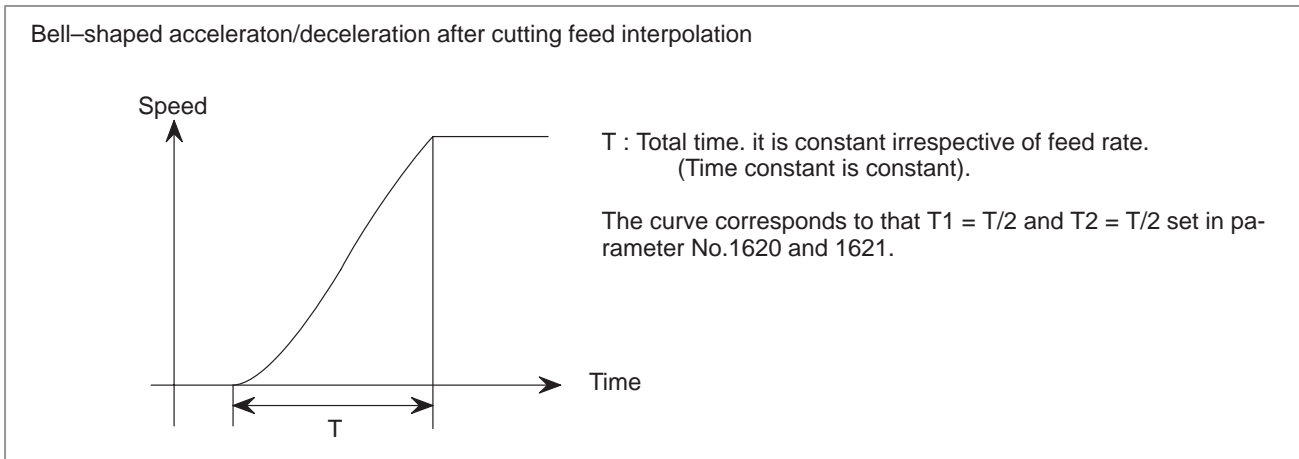| 1624 | Time constant of exponential acceleration/deceleration or bell–shaped acceleration/deceleration or linear acceleration/deceleration after interpolation, in jog feed for each axis. |

[Data type] Word axis

[Unit of data] ms

[Valid data range] 0 to 4000 (exponential acceleration/deceleration in jog feed)
0 to 512 (linear or bell–shaped acceleration/deceleration after interpolation in jog feed)
Set the time constant used for exponential acceleration/deceleration, bell–shaped acceleration/deceleration or linear acceleration/deceleration after interpolation in jog feed fot each axis.

| 1625 | FL rate of exponential acceleration/deceleration in jog feed for each axis. |

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotaion axis	1 deg/min	6 to 15000	6 to 12000

Set the lower limit (FL rate) of exponential acceleration/deceleration in cutting feed for each axis.

1626	Time constant of exponetial acceleration/deceleration in the thread cutting cycle for each axis

[Data type] Word

[Unit of data] ms

[Valid data range] 0 to 4000

Set the time constant used for exponential acceleration/deceleration in the thread cutting cycle (G76, G78 (G92 in G code system A)) for each axis.

1627	FL rate of exponential acceleration /deceleration in the thread cutting cycle for each axis

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotaion axis	1 deg/min	6 to 15000	6 to 12000

Set the lower limit (FL rate) of exponential acceleration/deceleration in the thread cutting cycle (G76, G78 (G92 in G code system A)) for each axis.

1710	
	Minimum deceleration ratio (MDR) of the inner circular cutting rate in automatic corner override

[Data type] Byte

[Unit of data] %

[Valid data range] 1 to 100

This parameter sets the minimum deceleration ratio (MDR) when the inner circular cutting speed is changed by automatic corner override.

In circular cutting with an inward offset, the actual feedrate for a specified feedrate (F) is expressed as follows:

$$F \quad \times \quad \frac{Rc}{Rp} \qquad \left(\begin{array}{l} \textbf{Rc: Radius of the path of the cutter's center.} \\ \textbf{Rp: Programmed radius} \end{array} \right.$$

Then, the actual feedrate is controlled so that the feedrate on the programmed path can achieve the specified feedrate F.
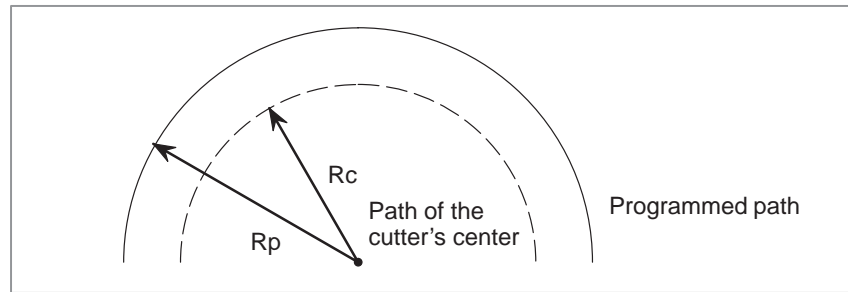
Fig. 4.11 (a) Rp and Rc

If Rc is too small in comparison with Rp, such that $Rc/Rp \doteqdot 0$, the cutter will stop. To prevent this, a minimum deceleration ratio (MDR) is set.

1711	Angle (θp) to recognize the inner corner in override

[Data type] Byte

[Unit of data] Degree

[Valid data range] 1 to 179 (standard value = 91)

This parameter sets the angle used to recognize an inner corner for inner corner override by automatic corner override.

1712	Amount of override for an inner corner

[Data type] Byte

[Unit of data] %

[Valid data range] 1 to 100 (standard value = 50)

Set the amount of override for an inner corner.

1713	Distance Le from the starting point in inner corner override

[Data type] Word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	1	0.1	0.01	mm
Inch input	0.1	0.01	0.001	inch

[Valid data range] 0 to 3999

Set distance Le from the starting point in an inner comer for corner override.

1714	Distance Ls up to the ending point in inner corner override

[Data type] Word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	1	0.1	0.01	mm
Inch input	0.1	0.01	0.001	inch

[Valid data range] 0 to 3999

Set distance Ls up to the end point in an inner corner for corner override.

If $\theta \leqq \theta p$, the inside of a comer is recognized. (θ is set in parameter 1711.)

When an inner corner is recognized, the feedrate is overridden in the range of Le in the block immediately before the intersection of the corner and Ls in the next block following the intersection.

Ls and Le are each a straight line connecting the intersection of the corner and a given point on the path of the cutter's center.

Ls and Le are set in parameters 1713 and 1714.

An override is applied from point a to b.
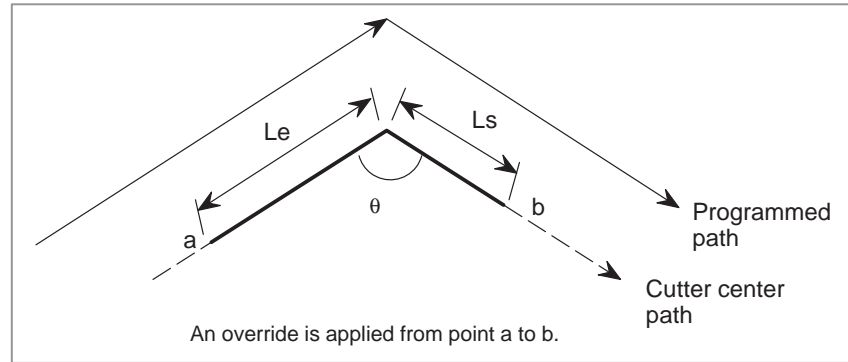
Fig.4.11 (b)   Distance Le and Ls in the automatic corner override at an inner corner

1722	Rapid traverse feedrate reduction ratio for overlapping rapid traverse blocks

[Data type] Byte axis

[Unit of data] %

[Valid data range] 1 to 100

This parameter is used when rapid traverse blocks are arranged successively, or when a rapid traverse block is followed by a block that does not cause, movement. When the feedrate for each axis of a block is reduced to the ratio set in this parameter, the execution of the next block is started.

Examples

X–axis feedrate

Fh : Rapid traverse feedrate
α : Setting of parameter No.1722 (feedrate reduction ratio)
Fd : Feedrate where deceleration is terminated: Fh x $\alpha/100$

N1 G00 X– – ;   N2 G00 X– – ;

When the function of overlapping rapid traverse blocks is enabled

When the function of overlapping rapid traverse blocks is disabled

Fh

Fd

t
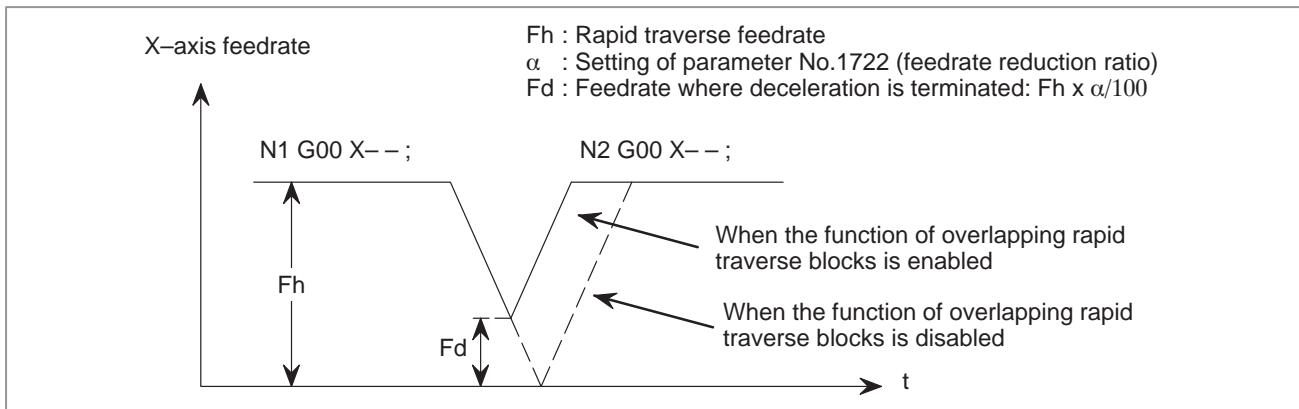
> **NOTE**
> The parameter No.1722 is effective when parameter No.1601 #4 (RT0) is set to 1.

1730	Maximum feedrate for arc radius R

[Data type] Word

[Unit of data]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	8 to 15000	0 to 12000
Inch machine	0.1 inch/min	8 to 6000	0 to 4800

Set a maximum feedrate for the arc radius set in parameter No.1731. Set this parameter when the arc radius–based feedrate clamping function is enabled.

1731	Arc radius value corresponding to a maximum feedrate

[Data type] 2–word

[Unit of data]

Unit	IS–A	IS–B	IS–C	Unit
Linear axis (millimeter machine)	0.01	0.001	0.0001	mm
Linear axis (inch machine)	0.001	0.0001	0.00001	inch

[Valid data range] 1000 to 99999999

Set the arc radius corresponding to the maximum feedrate set in parameter No.1730. Set this parameter when the arc radius–based feedrate clamping function is enabled.

1732	Minimum value (RV min) for arc radius–based feedrate clamp

[Data type] Word

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	0 to 15000	0 to 12000
Inch machine	0.1 inch/min	0 to 6000	0 to 4800

The arc radius–based feedrate clamping function reduces the maximum feedrate as the arc radius decreases. When the specified maximum feedrate is not greater than RV min (minimum value for arc radius–based feedrate clamping), RV min is used as the maximum feedrate.

1762	Exponential acceleration/deceleration time constant for cutting feed in the look–ahead control mode

[Data type] Word axis

[Unit of data] 1 ms

[Valid data range] 0 to 4000

Set an exponential acceleration/deceleration time constant for cutting feed in the look–ahead control mode.

1763	Minimum speed in exponential acceleration/deceleration for cutting feed in the look–ahead control mode

[Data type] Word axis

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotation axis	1 deg/min	6 to 15000	6 to 12000

Set minimum speed (FL) in exponential acceleration/deceleration for cutting feed in the look–ahead control mode.

1768	Time constant for linear acceleration/deceleration during cutting feed in lock–ahead control mode.

[Data type] Word axis

[Unit of data] ms

[Valid data range] 8 to 512

This parameter sets a time constant for linear acceleration/deceleration for cutting feed in the look–ahead control mode.

> **NOTE**
> The function for linear acceleration/deceleration after interpolation for cutting feed isrequired.

1770	Parameter 1 (for look–ahead control) for setting an acceleration for linear acceleration/deceleration before interpolation (maximum machining speed during linear acceleration/deceleration before interpolation)

[Data type] 2–word

[Unit of data, valid range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 240000	6 to 100000
Inch machine	0.1 inch/min	6 to 96000	6 to 48000

This parameter is used to set an acceleration for linear acceleration/ deceleration before interpolation in the look–ahead control mode. In this parameter, set the maximum machining speed during linear acceleration/ deceleration before interpolation. Set the time used to reach the maximummachining speed in parameter No.1771.
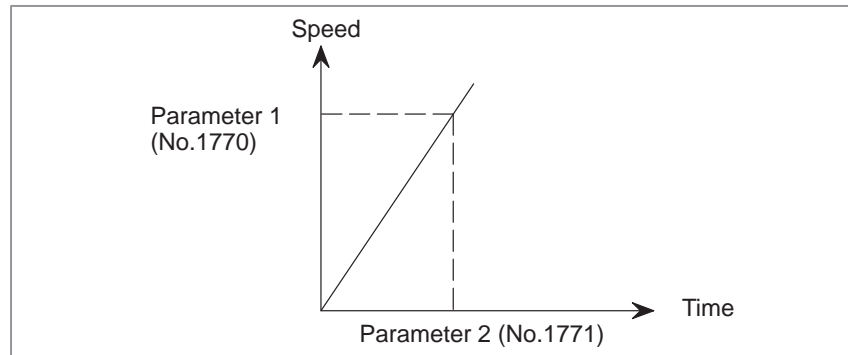
> **NOTE**
> When 0 is set in parameter No.1770 or parameter No.1771, linear acceleration/deceleration before interpolation is disabled.

1771	Parameter 2 (for look–ahead control) for setting an acceleration for linear acceleration/deceleration before interpolation (time used to reach the maximum machining speed during linear acceleration/deceleration before interpolation)

[Data type] Word

[Unit of data] 1 msec

[Valid range] 0 to 4000

This parameter is used to set an acceleration for linear acceleration/deceleration before interpolation in the look–ahead control mode. In this parameter, set the time (time constant) used to reach the speed set in parameter No.1770.

> **NOTE**
> 1 When 0 is set in parameter No.1770 or parameter No.1771, linear acceleration/deceleration before interpolation is disabled.
> 2 In parameter Nos. 1770 and 1771, set values that satisfy the following:
> Parameter No.1770/Parameter No.1771 $\geqq$ 5

1777	Minimum speed for the automatic corner deceleration function (look–ahead control)

[Data type] Word axis

[Unit of data, valid range]

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotation axis	1 deg/min	6 to 15000	6 to 12000

Set a speed at which the number of buffered pulses in deceleration is assumed to be 0 when linear acceleration/deceleration before interpolation is used.

1779	Critical angle subtended by two blocks for automatic corner deceleration (for look–ahead control)

[Data type] 2–word

[Unit of data] 0.001 deg

[Valid data range] 0 to 180000

Set a critical angle to be subtended by two blocks for corner deceleration when the angle–basedautomatic corner deceleration function is used.

The angle subtended by two blocks is defined as θ in the examples shown below.

Angle subtended by two straight lines   Angle subtended by an arc and its tangent
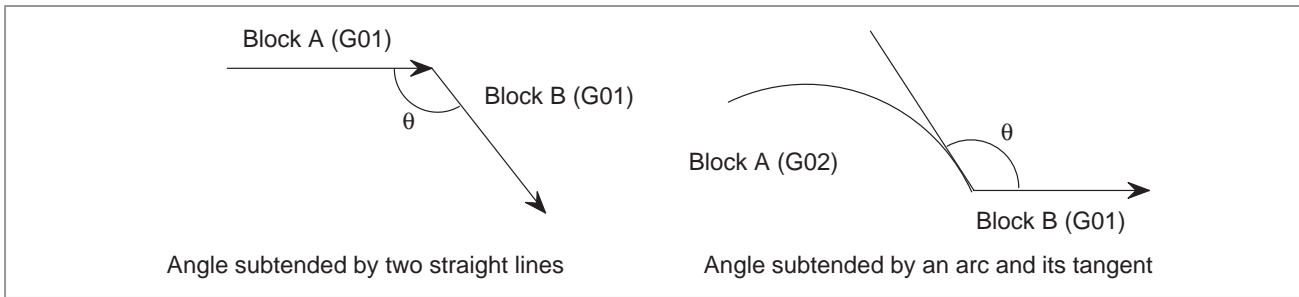
1780	Allowable speed difference for the speed difference–based corner deceleration function (for linear acceleration/deceleration before interpolation)

[Data type] Word

[Unit of data, valid range]

Increment system	Unit of data	Valid range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800

Set the speed difference for the speed difference–based automatic corner deceleration function when linear acceleration/deceleration before interpolation is used.

1783	Allowable speed difference for the speed difference based corner deceleration function (linear acceleration/deceleration before interpolation)

[Data type] Word axis

[Unit of data, valid range]

Increment system	Unit of data	Valid range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotation axis	0.1 deg/min	6 to 15000	6 to 12000

A separate allowable feedrate difference can be set for each axis. The allowable feedrate difference is set for each axis with this parameter. Among the axes that exeed the specified allowable feedrate difference, the axis with the greatest ratio of the actual feedrate difference to the allowable feedrate difference is used as the reference to calculate the reduced feedrate at the corner.

| 1784	Speed when overtravel alarm has generated during acceleration/deceleration before interpolation

[Data type] Word axis

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800

Deceleration is started beforehand to reach the feedrate set in the parameter when an overtravel alarm is issued (when a limit is reached) during linear acceleration/deceleration before interpolation. By using this parameter, the overrun distance that occurs when an overtravel alarm is output can be reduced.

> **NOTE**
> 1 When 0 is set in this parameter, the control described above is not exercised.
> 2 Use type–B linear acceleration/deceleration before interpolation (by setting bit 0 (FWB) of parameter No.1602 to 1).
> 3 The control described above is applicable only to stored stroke check 1.

4.12 PARAMETERS OF SERVO

	#7	#6	#5	#4	#3	#2	#1	#0
1800			TRC	RBK	FFR	OZR	CVR	

[Data type] Bit

CVR When velocity control ready signal VRDY is set ON before position control ready signal PRDY comes ON

0: A servo alarm is generated.

1: A servo alarm is not generated.

OZR When manual reference position return is attempted in the halt state during automatic operation (feed hold stop state) under any of the conditions listed below:

0: Manual reference position return is not performed, with P/S alarm No.091.

1: Manual reference position return is performed without an alarm occurring.

< Conditions >

(1) When there is a remaining distance to travel.

(2) When an auxiliary function (miscellaneous function, spindle–speed function, tool function) is being executed.

(3) When a cycle such as a dwell cycle or canned cycle is being executed.

FFR Feed–forward control is enabled for

0 : Cutting feed only

1 : Cutting feed and rapid traverse

RBK Backlash compensation applied separately for cutting feed and rapid traverse

0: Not performed

1: Performed

TRC The servo trace functon is:

0 : Disabled

1 : Enabled (Also set parameter No.1870.)

	#7	#6	#5	#4	#3	#2	#1	#0
1801			CIN	CCI	API		PM2	PM1
			CIN	CCI	API			

[Data type] Bit

PM1, PM2 Sets a gear ratio between the spindle and motor when the servo motor–based speed control function is used.

Magnification	PM2	PM1
1/1	0	0
1/2	0	1
1/4	1	0
1/8	1	1

$$\text{Magnification} = \frac{\text{spindle speed}}{\text{motor speed}}$$

API To use an absolute position detector for any axis, set API to 1.

CCI The in–position area for cutting feed is:

0 : Set in parameter No.1826 (same as for rapid traverse).

1 : Set in bit 5 (CIN) of parameter No.1801.

CIN When bit 4 (CCI) of parameter No.1801 = 1, the in–position area for cutting feed is:

0 : Use value in parameter No.1827 if the next block is also for cutting feed, or use value in parameter No.1826 if the next block is not for cutting feed.

1 : Use value in parameter No.1827, regardless of the next block. (The setting of parameter No.1826 is used for rapid traverse, and the setting of parameter No.1827 is used for cutting feed.)

	#7	#6	#5	#4	#3	#2	#1	#0
1802			DPS					CTS

> **NOTE**
> After this parameter is set, the power needs to be turned off.

[Data type] Bit

CTS The servo motor–based speed control function is:

0 : Not used
1 : Used

DPS When servo motor–based speed control is applied, a position coder is:

0 : Used
1 : Not used

	#7	#6	#5	#4	#3	#2	#1	#0
1803				TQF			TQA	TQI

[Data type] Bit

TQI While torque restriction is applied, in–position check is:

0 : Performed.
1 : Not performed.

TQA While torque restriction is applied, checking for an excessive error in the stopped state/during movement is:

0 : Performed.
1 : Not performed.

TQF When torque control is performed by an axis control command of the PMC axis control function, follow–up operation is:

0 : Not performed.
1 : Performed.

	#7	#6	#5	#4	#3	#2	#1	#0
1804		SAK	ANA	IVO				

[Data type] Bit axis

IVO When an attempt is made to release an emergency stop while the VRDY OFF alarm ignore signal is 1:

0 : The emergency stop state is not released until the VRDY OFF alarm ignore signal is set to 0.
1 : The emergency stop state is released.

> **NOTE**
> When a reset is issued while the VRDY OFF alarm ignore signal is set to 1 and the motor activating current is low, the reset state can also be released, provided this parameter is set to 1.

ANA When an abnormal load is detected for an axis:

    0 : Movement along all axes is stopped, and a servo alarm is output.

    1 : No servo alarm is output, and movement along only the axes of the group containing the axis with the abnormal load is stopped in interlock mode. (The group number of each axis is set in parameter No.1881.)

SAK When the VRDY OFF alarm ignore signal IGNVRY is 1, or when the VRDY OFF alarm ignore signals IGVRY1 to IGVRY8 are 1:

    0 : Servo ready signal SA is set to 0.

    1 : Servo ready signal SA remains set to 1.

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

> **NOTE**
> When this parameter has been set, the power must be turned off before operation is continued.

[Data type] Bit axis

OPTx Position detector

    0 : A separate pulse coder is not used.

    1 : A separate pulse coder is used.

APZx Machine position and position on absolute position detector when the absolute position detector is used

    0 : Not corresponding

    1 : Corresponding

> **NOTE**
> When an absolute position detector is used, after primary adjustment is performed or after the absolute position detector is replaced, this parameter must be set to 0, power must be turned off and on, then manual reference position return must be performed. This completes the positional correspondence between the machine position and the position on the absolute position detector, and sets this parameter to 1 automatically.

APCx Position detector

    0 : Other than absolute position detector

    1 : Absolute position detector (absolute pulse coder)

	#7	#6	#5	#4	#3	#2	#1	#0
1816		DM3x	DM2x	DM1x				

> **NOTE**
> When this parameter has been set, the power must be turned off before operation is continued.

[Data type] Bit axis

DM1x to DM3x Setting of detection multiplier

Set value			Detection multiplier
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 the flexble feed gear is used, do not use these parameters. Set the numerator and denominator of DMR to an appropriate values in parameters 2084 and 2085 respectively.

	#7	#6	#5	#4	#3	#2	#1	#0
1819							CRFx	FUPx
	NAHx						CRFx	FUPx

[Data type] Bit axis

FUPx To perform follow–up when the servo is off is set for each axis.

   0: The follow–up signal, *FLWU, determines whether follow–up is performed or not.
      When *FLWU is 0, follow–up is performed.
      When *FLWU is 1, follow–up is not performed.
   1: Follow–up is not performed.

> **NOTE**
> When the index table indexing function (M series) is used, be sure to set FUPx of the 4th axis to 1.

CRFx When servo alarm No.445 (software disconnection), No.446 (hardware disconnection), No.447 (hardware disconnection (separate type)), or No.421 (excessive dual position feedback error) is issued:

   0 : The reference position setting remains as is.
   1 : The system enters the reference position undefined state.

NAHx In the look–ahead control mode, advanced feed–forward is:

   0 : Used
   1 : Not used

> **NOTE**
> Set1 for a PMC–based control axis.

1820	Command multiplier for each axis (CMR)

> **NOTE**
> When this parameter has been set, the power must be turned off before operation is continued.

[Data type] Byte axis

Set a command multiplier indicating the ratio of the least command increment to the detection unit for each axis.

Least command increment = detection unit $\times$ command multiplier

Relationship between the increment system and the least command increment

(1) T series

			Least input increment	Least command increment
IS–B	Millimeter machine	Millimeter input	0.001 mm (diameter specification)	0.0005 mm
			0.001 mm (radius specification)	0.001 mm
		Inch input	0.0001 inch (diameter specification)	0.0005 mm
			0.0001 inch (radius specification)	0.001 mm
	Inch machine	Millimeter input	0.001 mm (diameter specification)	0.00005 inch
			0.001 mm (radius specification)	0.0001 inch
		Inch input	0.0001 inch (diameter specification)	0.00005 inch
			0.0001 inch (radius specification)	0.0001 inch
	Rotation axis		0.001 deg	0.001 deg

			Least input increment	Least command increment
IS–C	Millimeter machine	Millimeter input	0.0001 mm (diameter specification)	0.00005 mm
			0.0001 mm (radius specification)	0.0001 mm
		Inch input	0.00001 inch (diameter specification)	0.00005 mm
			0.00001 inch (radius specification)	0.0001 mm
	Inch machine	Millimeter input	0.0001 mm (diameter specification)	0.000005 inch
			0.0001 mm (radius specification)	0.00001 inch
		Inch input	0.00001 inch (diameter specification)	0.000005 inch
			0.00001 inch (radius specification)	0.00001 inch
	Rotation axis		0.0001 deg	0.0001 deg

(2) M series

Increment system	Least input increment and least command increment			
	IS–A	IS–B	IS–C	Units
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

Setting command multiply (CMR), detection multiply (DMR), and the capacity of the reference counter
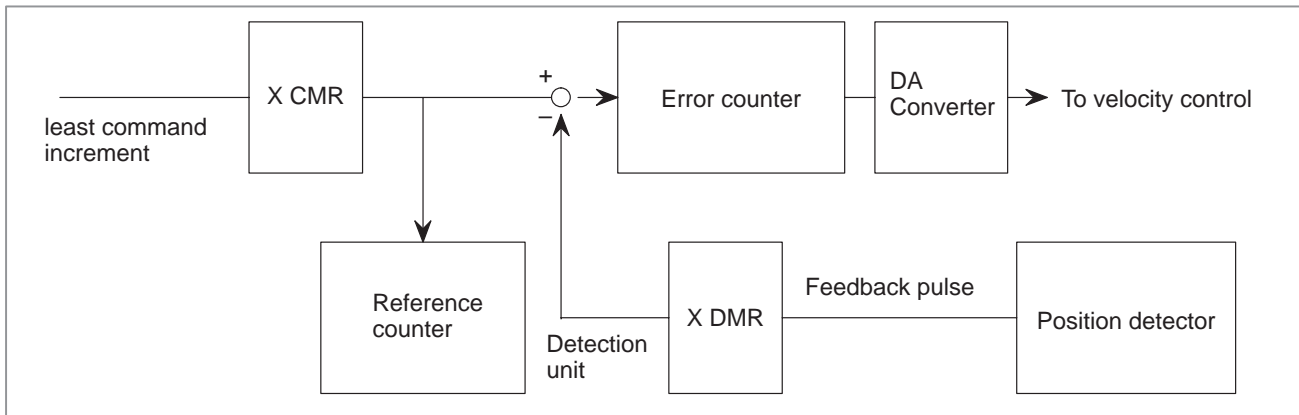
Fig.4.12 CMR, DMR, and the capacity of the reference counter

Set the magnification ratios of CMR and DMR so that the weight of positive inputs to the error counter equals that of negative inputs.

$$\frac{\text{Least command increment}}{\text{CMR}} = \text{detection unit} = \frac{\text{feedback pulse unit}}{\text{DMR}}$$

The feedback pulse unit varies according to the type of detector.

$$\text{Feedback pulse unit} = \frac{\text{the amount of travel per rotation of the pulse coder}}{\text{the number of pulses per rotation of the pulse coder (2000, 2500, or 3000)}}$$

As the size of the reference counter, specify the grid interval for the reference position return in the grid method.

Size of the reference counter = Grid interval/detection unit

Grid interval = the amount of travel per rotation of the pulse coder

The value set in the parameter is obtained as follows:

(1) When command multiplier is 1/2 to 1/27

$$\text{Set value} = \frac{1}{\text{(Command multiplier)}} + 100$$

Valid data range: 102 to 127

(2) When command multiply is 1 to 48
Set value = 2 ✕ command multiplier
Valid data range: 2 to 96

NOTE
When command multiplier is 1 to 48, the set value must be determined so that an integer can be set for command multiplier.

1821	Reference counter size for each axis

[Data type] 2–word axis

[Valid data range] 0 to 99999999

Set the size of the reference counter.

> **NOTE**
> When this parameter has been set, the power must be turned off before operation is continued.

When using the linear scale with reference marks, set the space between the mark–1 indications.

1825	Servo loop gain for each axis

[Data type] Word axis

[Unit of data] 0.01 s^{-1}

[Valid data range] 1 to 9999

Set the loop gain for position control for each axis.

When the machine performs linear and circular interpolation (cutting), the same value must be set for all axes. When the machine requires positioning only, the values set for the axes may differ from one another. As the loop gain increases, the response by position control is improved. A too large loop gain, however, makes the servo system unstable.

The relationship between the positioning deviation (the number of pulses counted by the error counter) and the feedrate is expressed as follows:

$$\textbf{Positioning deviation} = \frac{\textbf{feedrate}}{\textbf{60} \ \times \textbf{(loop gain)}}$$

Unit : Positioning deviation mm, inches, or deg
　　　Feedrate : mm/min, inches/min, or deg/min
　　　loop gain：s^{-1}

1826	In–position width for each axis

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

The in–position width is set for each axis.

When the deviation of the machine position from the specified position (the absolute value of the positioning deviation) is smaller than the in–position width, the machine is assumed to have reached the specified position. (The machine is in the in–position state.)

1827	In–position width in cutting feed for each axis

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

Set an in–position width for each axis in cutting feed. This parameter is valid when bit 4 (CCI) of parameter No.1801=1.

1828	Positioning deviation limit for each axis in movement

[Data type] 2–word axis

[Unit of data] Detection unit

[Valid data range] 0 to 99999999

Set the positioning deviation limit in movement for each axis.

If the positioning deviation exceeds the positioning deviation limit during movement, a servo alarm is generated, and operation is stopped immediately (as in emergency stop).
Generally, set the positioning deviation for rapid traverse plus some margin in this parameter.

1829	Positioning deviation limit for each axis in the stopped state

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

Set the positioning deviation limit in the stopped state for each axis.

If, in the stopped state, the positioning deviation exceeds the positioning deviation limit set for stopped state, a servo alarm is generated, and operation is stopped immediately (as in emergency stop).

1830	Axis–by–axis positional deviation limit at servo–off time

[Data type] 2–word axis

[Unit of data] Detection unit

[Valid data range] 0 to 99999999

This parameter is used to set a positional deviation limit at servo–off time, on an axis–by–axis basis.

If the value specified with this parameter is exceeded at servo–off time, a servo alarm (No.410) is issued to cause an immediate stop (same as an emergency stop). Usually, set the same value as a positional deviation at stop time (parameter No.1829).

> **NOTE**
> When this parameter is set to 0, no positional deviation limit check is made at servo–off time.

1836	Servo error amount where reference position return is possible

[Data type] Byte axis

[Unit of data] Detection unit

[Valid data range] 0 to 127

This parameter sets a servo error used to enable reference position return in manual reference position return.

In general, set this parameter to 0. (When 0 is set, 128 is assumed as the default.)

> **NOTE**
> When bit 0 (PLC01) of parameter No.2000 is set to 1, a value ten times greater than the value set in this parameter is used to make the check.
> **Example**
> When the value 10 is set in this parameter, and bit 0 (PLC01) of parameter No.2000 is set to 1, reference

1850	Grid shift and reference position shift for each axis

[Data type] 2–word axis

[Unit of data] Detection unit

[Valid data range] 0 to 99999999

A grid shift is set for each axis.

To shift the reference position, the grid can be shifted by the amount set in this parameter. Up to the maximum value counted by the reference counter can be specified as the grid shift.

1851	Backlash compensating value for each axis

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] –9999 to +9999

Set the backlash compensating value for each axis.

When the machine moves in a direction opposite to the reference position return direction after the power is turned on, the first backlash compensation is performed.

1852	Backlash compensating value used for rapid traverse for each axis

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] –9999 to +9999

Set the backlash compensating value used in rapid traverse for each axis.

This parameter is valid when RBK, #4 of parameter 1800, is set to 1.

More precise machining can be performed by changing the backlash compensating value depending on the feedrate, the rapid traverse or the cutting feed.

Let the measured backlash at cutting feed be A and the measured backlash at rapid traverse be B. The backlash compensating value is shown below

depending on the change of feedrate (cutting feed or rapid traverse) and the change of the direction of movement.

Table 4.12 Backlash compensating value

Change of feedrate Change of direction of movement	Cutting feed to cutting feed	Rapid traverse to rapid traverse	Rapid traverse to cutting feed	Cutting feed to rapid traverse
Same direction	0	0	$\pm\alpha$	$\pm(-\alpha)$
Opposite direction	$\pm A$	$\pm B$	$\pm B$ (B+α)	$\pm B$ (B+α)

$a = (A–B)/2$
The positive or negative direction for compensating values is the direction of movement.

Stopped during cutting feed   Stopped during rapid traverse

Assign the measured backlash at cutting feed (A) in parameter No.1851 and that at rapid traverse (B) in parameter No.1852.
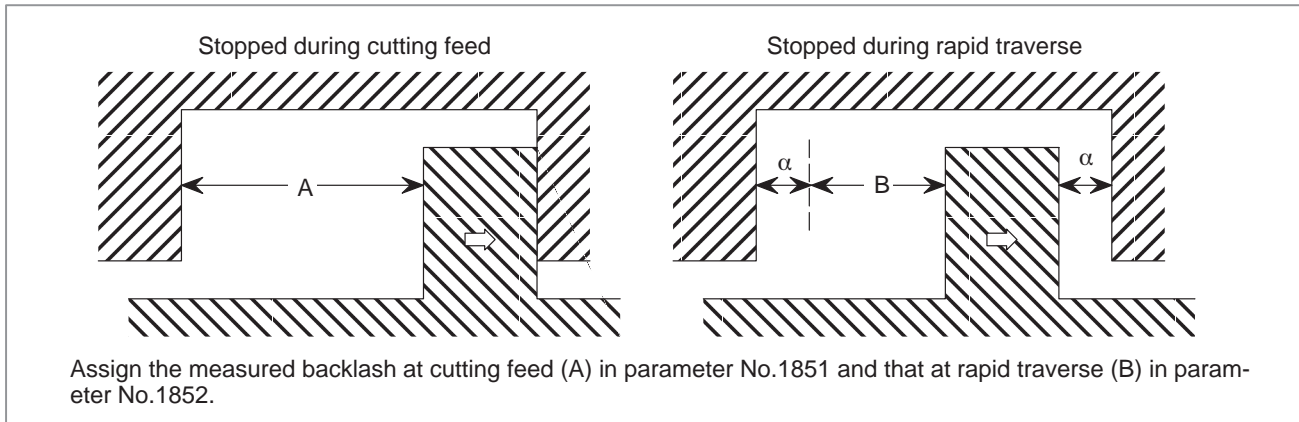
NOTE
1 Jog feed is regarded as cutting feed.
2 The backlash compensation depending on a rapid traverse and a cutting feed is not performed until the first reference position return is completed after the power is turned on. The normal backlash compensation is performed according to the value specified in parameter No.1851 irrespective of a rapid traverse and a cutting feed.
3 The backlash compensation depending on a rapid traverse and a cutting feed is performed only when RBK, #4 of parameter No.1800, is set to 1. When RBK is set to 0, the normal backlash is performed.

1870	Number of the program for storing servo trace data

[Data type] Word axis

[Valid data range] 0 to 9999

Set the number of the program for storing servo trace data.

1874	Number of the conversion coefficient for inductosyn position detection

1875	Denominator of the conversion coefficient for inductosyn position detection

NOTE
When this parameter has been set, the power must be turned off before operation is continued.

[Data type] Word axis

[Valid data range] 1 to 32767

Set a conversion coefficient for inductosyn position detection for each axis. The value set is determined as follows:

$$\frac{\text{No. 1874}}{\text{No. 1875}} = \frac{\textbf{Number of position feedback pulses per motor revolution}}{\textbf{1,000,000}}$$

1876	One–pitch interval of the inductosyn

> **NOTE**
> When this parameter has been set, the power must be turned off before operation is continued.

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 1 to 32767

Set a one–pitch interval of the inductosyn for each axis.

1877	Amount of inductosyn shift

> **NOTE**
> When this parameter has been set, the power must be turned off before operation is continued.

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] –32767 to 32767

Set the amount of inductosyn shift for each axis.

By using this parameter, calculate the machine position from the expression below.

$$\textbf{Machine position} = \left(\frac{\textbf{M–S– (parameter No. 1877)}}{\lambda} \right) \textbf{Rounded off} \times \lambda + \textbf{S}$$

M : Absolute motor position (detection unit)

S : Data of offset from the inductosyn (detection unit)

λ : One–pitch interval of the inductosyn (detection unit) (Parameter No. 1876)

The remainder of (M–S) divided by λ approaches 0. (Normally, set the value of diagnostic data No.380.)

1880	Abnormal load detection alarm timer

[Data type] Word axis

[Unit of data] ms

[Valid data range] 0 to 32767 (200 mse is assumed when 0 is set)

This parameter sets the time from the detection of an abnormal load until a servo alarm is issued. The specified value is rounded up to the nearest integral multiple of 8 msec.

[Example] When 30 is specified, the value is rounded up to 32 (msec).

1881	Group number when an abnormal load is detected

[Data type] Byte axis

[Valid data range] 0 to 4

This parameter sets the group number of each axis, used when an abnormal load is detected.

If an abnormal load is detected for an axis, only the movement along the axes of the group containing the axis with the abnormal load is stopped. If 0 is set for an axis, movement along that axis is stopped whenever an abnormal load is detected for any axis.

Example: Assume that the following settings have been made. If an abnormal load is detected for the sixth axis, movement along the second, fourth, sixth, and seventh axes is stopped. If an abnormal load is detected for the fourth axis, movement along the fourth and seventh axes is stopped.

Parameter No.1881	Setting
(First axis)	1
(Second axis)	2
(Third axis)	1
(Fourth axis)	0

> **NOTE**
> This parameter is enabled when the ANA parameter (bit 5 of parameter No.1804) is 1.

1885	Maximum allowable value for total travel during torque control

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

This parameter sets the maximum allowable value for the total travel (error counter value) for an axis placed under torque control, as specified by the axis control command of the PMC axis control function. If the total travel exceeds the parameter–set value while torque control is applied, a servo alarm (No.423) is generated.

> **NOTE**
> This parameter is enabled when the TQF parameter (bit 4 of parameter No.1803) is 0 (follow–up is not performed during torque control).

1886	Positional deviation when torque control is canceled

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

This parameter sets the positional deviation used when torque control, performed for an axis according to the axis control command of the PMC axis control function, is canceled and position control is resumed. After the positional deviation has fallen to the parameter–set value, switching to position control is performed.

> **NOTE**
> This parameter is enabled when the TQF parameter (bit 4 of parameter No.1803) is 0 (follow–up is not performed during torque control).

	#7	#6	#5	#4	#3	#2	#1	#0
1902							ASE	FMD

> **NOTE**
> After this parameter has been set, the power must be turned off then back on for the setting to become effective.

[Data type] Bit

FMD The FSSB setting mode is:

0 : Automatic setting mode.
   (When information including an axis–amplifier relationship is set on the FSSB setting screen, parameter Nos. 1023, 1905, 1910 through 1919, 1936, and 1937 are set automatically.)

1 : Manual setting 2 mode.
   (Set parameter Nos. 1023, 1905, 1910 through 1919, 1936, and 1937 manually.)

ASE When automatic setting mode is selected for FSSB setting (when the FMD parameter (bit 0 of parameter No.1902) is set to 0), automatic setting is:

0 : Not completed.

1 : Completed.
   (This bit is automatically set to 1 upon the completion of automatic setting.)

	#7	#6	#5	#4	#3	#2	#1	#0
1904								DSP

> **NOTE**
> After this parameter has been set, the power must be turned off then back on for the setting to become effective.

[Data type] Bit axis

DSP 0 : Two axes use one DSP. (Ordinary axes)

1 : One axis uses one DSP. (Axes such as a learning control axis)

— 80 —

> **NOTE**
> Parameter No.1904 is set on the FSSB setting screen. So, parameter No.1904 should not have to be specified directly. This parameter need not be set in FSSB manual setting 2 mode.

	#7	#6	#5	#4	#3	#2	#1	#0
1905	PM2	PM1						FSL

> **NOTE**
> After this parameter has been set, the power must be turned off then back on for the setting to become effective.

[Data type] Bit axis

FSL The type of interface used between the servo amplifier and servo software is:

0 : Fast type.
1 : Slow type.

The user can choose between two interface types for servo data transfer: fast type or slow type. Set this parameter so that the following conditions are satisfied:

- When a one–axis amplifier is used, either the fast type or slow type interface can be used.

- When a two–axis amplifier is used, the use of the fast type for both axes is not allowed. The slow type can be used for both axes.

- When a three–axis amplifier is used, the requirement for a two–axes amplifier described above applies to the first and second axes, and the requirement for a one–axis amplifier, again described above, applies to the third axis.

- When an odd number is specified for parameter No.1023, the fast type interface must be used. However, the slow type may be used for an EGB workpiece axis, learning control axis, high–speed current loop axis, and high–speed interface axis.

- When an even number is specified for parameter No.1023, only the slow type interface can be used. (The FSL bit must always be set to 1.)

CNC			
Controlled axis number	Program axis name No.1020	Servo axis number No.1023	Interface type Fast/Slow
1	X	1	F
2	Y	2	F
3	Z	3	S
4	A	4	S
5	B	5	F
6	C	6	S

2–axis amplifier — X (Fast) / A (Slow)
1–axis amplifier — Y (Fast)
2–axis amplifier — Z (Slow) / B (Fast)
1–axis amplifier — C (Slow)

PM1 The first pulse module is:

  0 : Not used.
  1 : Used.

PM2 The second pulse module is:

  0 : Not used.
  1 : Used.

> **NOTE**
> When automatic setting mode is selected for FSSB setting (when the FMD parameter (bit 0 of parameter No.1902) is set to 0), parameter No.1905 is automatically set when input is performed with the FSSB setting screen. When manual setting 2 mode is selected for FSSB setting (when the FMD parameter (bit 0 of parameter No.1902) is set to 1), parameter No.1905 must be set directly. When a pulse module is used, a connector number must be set in the corresponding parameter (No.1936 or No.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)

> **NOTE**
> After these parameters have been set, the power must be turned off then back on for the settings to become effective.

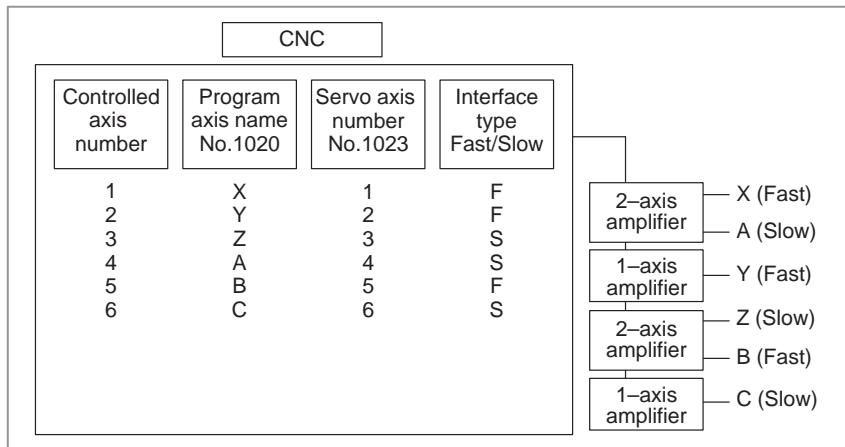**[Data type]** Byte

[Valid data range] 0 to 3, 16, 40, 48

These parameters set address conversion table values for slaves 1 to 10.

A slave is the generic name given to a device such as a servo amplifier or pulse module, connected to the CNC via an FSSB optical cable. Smaller numbers, starting from 1 are assigned to slaves closer to the CNC; the maximum number that can be assigned is 10. A two–axis amplifier has two slaves, while a three–axis amplifier has three slaves. Set each parameter as described below, depending on whether the slave is an amplifier or pulse module, or when no slave exists.

- When the slave is an amplifier:
  Set the value obtained by subtracting 1 from the setting of parameter No.1023 for the axis to which the amplifier is assigned.

- When the slave is a pulse module:
  Set 16 for the first pulse module (closest to the CNC). Set 48 for the second pulse module (furthest from the CNC).

- When no slave exists
  Set 40. When using the simple electronic gearbox (EGB) function, however, set a value as described below.

NOTE
1 When using the simple electronic gearbox (EGB) function
   The EGB axis (axis set with parameter No.7771) does not actually require an amplifier. So, assume that the EGB axis is connected to a dummy amplifier. Accordingly, as the address conversion table value for a nonexistent slave, set the value obtained by subtracting 1 from the setting made for parameter No.1023 for the EGB axis, instead of setting 40.
2 When automatic setting mode is selected for FSSB setting (when the FMD parameter (bit 0 of parameter No.1902) is set to 0), parameters No.1910 through No.1919 are automatically set when input is performed with the FSSB setting screen. When manual setting 2 mode is selected for FSSB setting (when the FMD parameter (bit 0 of parameter No.1902) is set to 1), parameter No.1910 through No.1919 must be directly set.

• Examples of axis configurations and parameter settings

CNC

Controlled axis number	Program axis name No.1020	Servo axis number No.1023
1	X	1
2	Y	3
3	Z	4
4	A	2

	Slave number	ATR No.1910 to 1919	Axis
1–axis amplifier	1	0	X
2–axis amplifier	2	1	A
	3	2	Y
M1	4	16	(M1)
1–axis amplifier	5	3	Z
M2	6	48	(M2)
	7	40	(None)
	8	40	(None)
	9	40	(None)
	10	40	(None)

CNC

Controlled axis number	Program axis name No.1020	Servo axis number No.1023
1	X	1
2	Y	3
3	Z	4
4	A	2

	Slave number	ATR No.1910 to 1919	Axis
1–axis amplifier	1	0	X
2–axis amplifier	2	1	Y
	3	2	A
1–axis amplifier	4	4	Z
M1	5	16	(M1)
M2	6	48	(M2)
	7	40	(None)
	8	40	(None)
	9	40	(None)
	10	40	(None)

Note) M1/M2: First pulse module/second pulse module

1920	Controlled axis number for slave 1 (dedicated to the FSSB setting screen)
1921	Controlled axis number for slave 2 (dedicated to the FSSB setting screen)
1922	Controlled axis number for slave 3 (dedicated to the FSSB setting screen)
1923	Controlled axis number for slave 4 (dedicated to the FSSB setting screen)
1924	Controlled axis number for slave 5 (dedicated to the FSSB setting screen)
1925	Controlled axis number for slave 6 (dedicated to the FSSB setting screen)
1926	Controlled axis number for slave 7 (dedicated to the FSSB setting screen)
1927	Controlled axis number for slave 8 (dedicated to the FSSB setting screen)
1928	Controlled axis number for slave 9 (dedicated to the FSSB setting screen)
1929	Controlled axis number for slave 10 (dedicated to the FSSB setting screen)

> **NOTE**
> After these parameters have been set, the power must be
> turned off then back on for the settings to become effective.

[Data type] Byte

[Valid data range] 0 to 3

These parameters are used to set the controlled axis numbers for slaves 1 to 10.

> **NOTE**
> These parameters are set using the FSSB setting screen.
> So, these parameters should not normally have to be
> specified directly. These parameters need not be set in
> FSSB manual setting mode.

| 1931 | Connector number for the first pulse module (dedicated to the FSSB setting screen) |
| 1932 | Connector number for the second pulse module (dedicated to the FSSB setting screen) |

> **NOTE**
> After these parameters have been set, the power must be
> turned off then back on for the settings to become effective.

[Data type] Byte axis

[Valid data range] 0 to number of connectors provided on each pulse module

When a pulse module is used, these parameters set a pulse module connector number for each axis.

> **NOTE**
> These parameters are set using the FSSB setting screen.
> So, these parameters should not normally have to be
> specified directly. These parameters need not be set in
> FSSB manual setting 2 mode.

1933	Cs contour control axis (dedicated to the FSSB setting screen)

> **NOTE**
> After this parameter has been set, the power must be turned off then back on for the setting to become effective.

[Data type] Byte axis

[Valid data range] 0, 1

When Cs contour control is to be applied for an axis, this parameter must be set to 1 for that axis.

> **NOTE**
> This parameter is set using the FSSB setting screen. So, this parameter should not normally have to be specified directly. This parameter need not be set in FSSB manual setting 2 mode.

1936	Connector number of the first pulse module

1937	Connector number of the second pulse module

> **NOTE**
> After these parameters have been set, the power must be turned off then back on for the settings to become effective.

[Data type] Byte axis

[Valid data range] 0 to 7

When a pulse module is used, each of these parameters sets the value obtained by subtracting 1 from a pulse module connector number for each axis. That is, values of 0 through 7 are set for connector numbers 1 through 8. In addition, bits 6 and 7 of parameter No.1905 must be set. For an axis that does not use a pulse module, 0 must be set.

The user can freely specify the connector to be used for a given axis. When using connectors, start from that connector having the smallest connector number. For example, connector number 4 cannot be used if connector number 3 is not being used.

Example:

Controlled axis	Connector number for the first pulse module	Connector number for the second pulse module	No.1936	No.1937	No.1905 (#7, #6)
X	1	Not used	0	0	0,1
Y	Not used	2	0	1	1,0
Z	Not used	1	0	0	1,0
A	Not used	Not used	0	0	0,0

> **NOTE**
> When automatic setting mode is selected for FSSB setting (when bit 0 of parameter No.1902 is set to 0), these parameters are automatically set when input is performed with the FSSB setting screen. When manual setting 2 mode is selected for FSSB setting (when bit 0 of parameter No.1902 is set to 1), these parameters must be set directly.

The following parameters are not explained in this manual. Refer to FANUC AC SERVO MOTOR α Series PARAMETER MANUAL (B–65150E).

No.	Data type	Contents							
2000	Bit axis				PGEX	PRMC		DGPR	PLC0
2001	Bit axis	AMR7	AMR6	AMR5	AMR4	AMR3	AMR2	AMR1	AMR0
2002	Bit axis	VFSE				PFSE			
2003	Bit axis	V0FS	OVSC	BLEN	NPSP	PIEN	OBEN	TGAL	
2004	Bit axis		DLY0						
2005	Bit axis	SFCM	BRKC					FEED	
2006	Bit axis		DCBE		ACCF	SPVE	PKVE	SBSM	FCBL
2007	Bit axis	FRCA	FAD						
2008	Bit axis	LAXD	PFBS	VCTM	SPPC	SPPR	VFBA	TNOM	
2009	Bit axis	BLST	BLCU				ADBL	IQOB	SERD
2010	Bit axis	POLE		HBBL	HBPE	BLTE	LINE		
2011	Bit axis			RCCL				FFALWY	SYNMOD
2012	Bit axis	STNG		VCM2	VCM1			MSFE	
2013	Bit axis	(Reserve)							
2014	Bit axis	(Reserve)							
2015	Bit axis		BLAT	TDOU				SSG1	PGTW
2016	Bit axis	NFL8	NFL7	NFL5		K2VC			ABNT
2017	Bit axis	PK25	OVCR	RISC	HTNG				DBST
2018	Bit axis	PFBC						MOVO	
2019	Bit axis	DPFB			SPSY				
2020	Word axis	Motor number							
2021	Word axis	Load inertia ratio							
2022	Word axis	Direction of motor rotation							
2023	Word axis	Number of velocity pulses							
2024	Word axis	Number of position pulses							
2028	Word axis	Position gain switching speed							
2029	Word axis	Effective speed for integral acceleration at low speed							
2030	Word axis	Effective speed for integral acceleration at low speed							
2033	Word axis	Position feedback pulse							
2034	Word axis	Damping control gain							
2039	Word axis	Second–stage acceleration for two–stage backlash acceleration							
2040	Word axis	Current loop integral gain (PK1)							
2041	Word axis	Current loop proportional gain (PK2)							

No.	Data type	Contents
2042	Word axis	Current loop gain (PK3)
2043	Word axis	Velocity loop integral gain (PK1V)
2044	Word axis	Velocity loop proportional gain (PK2V)
2045	Word axis	Velocity loop incomplete integral gain (PK3V)
2046	Word axis	Velocity loop gain (PK4V)
2047	Word axis	Observer parameter (POA1)
2048	Word axis	Backlash acceleration
2049	Word axis	Maximum amplitude for dual position feedback
2050	Word axis	Observer parameter (POK1)
2051	Word axis	Observer parameter (POK2)
2053	Word axis	Current dead zone compensation (PPMAX)
2054	Word axis	Current dead zone compensation (PDDP)
2055	Word axis	Current dead zone compensation (PHYST)
2056	Word axis	Counterelectromotive force compensation (EMFCMP)
2057	Word axis	Current phase lead compensation (PVPA)
2058	Word axis	Current phase lead compensation (PALPH)
2059	Word axis	Counterelectromotive force compensation (EMFBAS)
2060	Word axis	Torque limit
2061	Word axis	Counterelectromotive force compensation (EMFLMT)
2062	Word axis	Overload protection coefficient (OVC1)
2063	Word axis	Overload protection coefficient (OVC2)
2064	Word axis	Soft disconnection alarm level
2065	Word axis	Overload protection coefficient (OCVLMT)
2066	Word axis	250–us acceleration feedback
2067	Word axis	Torque command filter
2068	Word axis	Feed forward coefficient
2069	Word axis	Velocity feed forward coefficient
2070	Word axis	Backlash acceleration timing
2071	Word axis	Backlash acceleration effective duration
2072	Word axis	Static friction compensation
2073	Word axis	Stop judgment parameter
2074	Word axis	Velocity–dependent current loop gain
2076	Word axis	1–ms acceleration feedback gain
2077	Word axis	Overshoot prevention counter
2078	Word axis	Conversion coefficient for dual position feedback (numerator)
2079	Word axis	Conversion coefficient for dual position feedback (denominator)
2080	Word axis	First–order lag time constant for dual position feedback
2081	Word axis	Zero width for dual position feedback
2082	Word axis	Backlash acceleration stop amount
2083	Word axis	Brake control timer (ms)
2084	Word axis	Flexible feed gear (numerator)
2085	Word axis	Flexible feed gear (denominator)
2086	Word axis	Rated current parameter

No.	Data type	Contents							
2087	Word axis	Torque offset							
2088	Word axis	Machine velocity feedback coefficient gain							
2089	Word axis	Backlash acceleration base pulse							
2091	Word axis	Non–linear control parameter							
2092	Word axis	Look–ahead feed forward coefficient							
2097	Word axis	Static friction compensation stop parameter							
2098	Word axis	Current phase lead compensation coefficient							
2099	Word axis	N–pulse suppression level							
2101	Word axis	Overshoot compensation effective level							
2102	Word axis	Final clamp value for actual current limit							
2103	Word axis	Amount of track back upon detection of unexpected disturbance torque							
2104	Word axis	Threshold for detecting abnormal load during cutting							
2105	Word axis	Torque constant							
2109	Word axis	Fine acceleration/deceleration time constant (BELLTC)							
2110	Word axis	Magnetic saturation compensation (base/coefficient)							
2111	Word axis	Deceleration torque limit (base/coefficient)							
2112	Word axis	AMR conversion coefficient 1							
2113	Word axis	Notch filter center frequency (Hz)							
2116	Word axis	Dynamic friction for abnormal load detection/cancel							
2118	Word axis	Excessive error level between semi–closed and closed loops for dual position feedback.							
2119	Word axis	Stop level with variable proportional gain							
2121	Word axis	Conversion coefficient for number of feedback pulses							
2122	Word axis	Conversion coefficient for detected resistance							
2126	Word axis	Time constant for switching position feedback							
2127	Word axis	Non–interacting control coefficient							
2128	Word axis	Weak magnetic flux compensation (coefficient)							
2129	Word axis	Weak magnetic flux compensation (base/limit)							
2130	Word axis	Two thrust ripple compensations per magnetic pole pair							
2131	Word axis	Four thrust ripple compensations per magnetic pole pair							
2132	Word axis	Six thrust ripple compensations per magnetic pole pair							
2138	Word axis	AMR conversion coefficient 2							
2142	Word axis	Threshold for detecting abnormal load during rapid traverse							
2143	Word axis	Fine acceleration/deceleration time constant 2 (ms)							
2144	Word axis	Position feed forward coefficient for cutting							
2145	Word axis	Velocity feed forward coefficient for cutting							
2165	Word axis	Maximum amplifier current							
2200	Bit axis					ABGO	IQOB		
2201	Bit axis		CPEE		SPVC				CROF
2202	Bit axis				DUAL	OVS1			FAGO
2203	Bit axis				FRC2				
2209	Bit axis					FADL			

4.13
PARAMETERS OF DI/DO

	#7	#6	#5	#4	#3	#2	#1	#0
3001	MHI					RWM		

[Data type] Bit

RWM RWD signal indicating that rewinding is in progress

0 : Output only when the tape reader is being rewound by the reset and rewind signal RRW

1 : Output when the tape reader is being rewound or a program in memory is being rewound by the reset and rewind signal RRW

MHI Exchange of strobe and completion signals for the M, S, T, and B codes

0 : Normal

1 : High–speed

	#7	#6	#5	#4	#3	#2	#1	#0
3002				IOV				

[Data type] Bit

IOV For the feedrate override signal, second feedrate override signal, and rapid traverse override signal:

0 : Negative logic is used.

1 : Positive logic is used.

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

[Data type] Bit

ITL Interlock signal

0 : Enabled

1 : Disabled

ITX Interlock signals for each axis

0 : Enabled

1 : Disabled

DIT Interlock for each axis direction

0 : Enabled

1 : Disabled

DEC Deceleration signal (*DEC1 to *DEC4) for reference position return

0 : Deceleration is applied when the signal is 0.

1 : Deceleration is applied when the signal is 1.

MVX The axis–in–movement signal is set to 0 when:

0 : Distribution for the axis is completed. (The signal is set to 0 in deceleration.)

1 : Deceleration of the axis is terminated, and the current position is in the in–position.

If, however, a parameter specifies not to make in–position during deceleration, the signal turns to "0" at the end of deceleration.

	#7	#6	#5	#4	#3	#2	#1	#0
3004			OTH				BCY	BSL

[Data type] Bit

BSL The block start interlock signal *BSL and cutting block start interlock signal *CSL are:

   0 : Disabled.
   1 : Enabled.

BCY When more than one operation is performed by one block command such as a canned cycle, the block start interlock signal *BSL is:

   0 : Checked only at the beginning of the first cycle.
   1 : Checked at the beginning of every cycle.

> **NOTE**
> This is enabled when the BSL parameter (bit 0 of parameter No.3004) is set to 1.

OTH The overtravel limit signal is:

   0 : Checked
   1 : Not checked

> **WARNING**
> For safety, usually set 0 to check the overtravel limit signal.

	#7	#6	#5	#4	#3	#2	#1	#0
3006						EPS	EPN	GDC

GDC As the deceleration signal for reference position return:

   0 : X009/X007 is used.
   1 : G196/G1196 is used. (X009/X007 is disabled.)

EPN Workpiece number search signals are assigned to:

   0 : PN1, PN2, PN4, PN8, and PN16.
   1 : EPN0 to EPN13.

**EPS** When a program is searched using the workpiece number search function, it is started by:

   0 : Automatic operation start signal ST (when automatic operation (memory operation) is started).
   1 : Workpiece number search start signal EPNS. (Search is not started by ST.)

3010	Time lag in strobe signals MF, SF, TF, and BF

[Data type] Word

[Unit of data] 1 ms

[Valid data range] 16 to 32767

The time required to send strobe signals MF, SF, TF, and BF after the M, S, T, and B codes are sent, respectively.
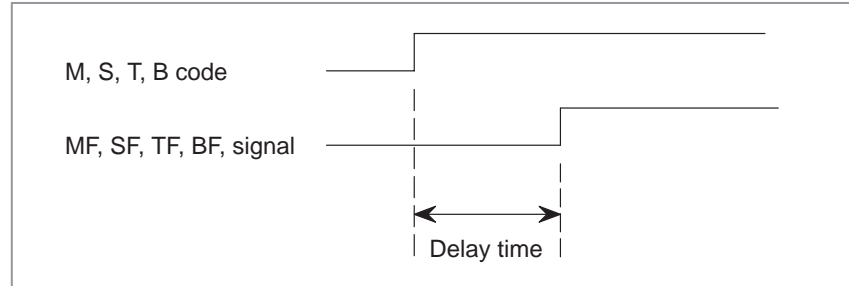
Fig. 4.13 (a) Delay time of the strobe signal

> **NOTE**
> The time is counted in units of 8 ms. If the set value is not a multiple of eight, it is raised to the next multiple of eight.
> **Example**
> When 30 is set, 32 ms is assumed.
> When 32 is set, 32 ms is assumed.
> When 100 ie set, 104 ms is assumed.

3011	Acceptable width of M, S, T, and B function completion signal (FIN)

[Data type] Word

[Unit of data] 1 ms

[Valid data range] 16 to 32767

Set the minimum signal width of the valid M, S, T, and B function completion signal (FIN).

Fig. 4.13 (b) Valid width of the FIN (M,S, T, and B function completion) signal

> **NOTE**
> The time is counted in units of 8 ms. If the set value is not a multiple of eight, it is raised to the next multiple of eight.
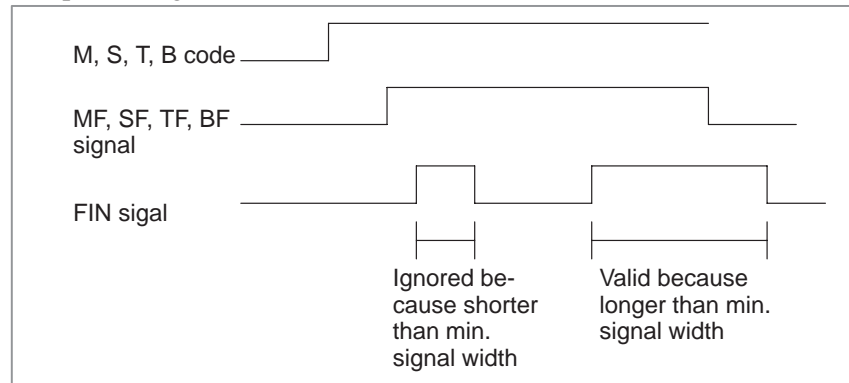> **Example**
> When 30 is set, 32 ms is assumed.

3017	Output time of reset signal RST

[Data type] Byte

[Unit of data] 16 ms

[Valid data range] 0 to 255

To extend the output time of reset signal RST, the time to be added is specified in this parameter.

RST signal output time = time veguired for reset + parameter $\times$ 16 ms

3030	Allowable number of digits for the M code

3031	Allowable number of digits for the S code

3032	Allowable number of digits for the T code

3033	Allowable number of digits for the B code

[Data type] Byte

[Valid data range] 1 to 8

Set the allowable numbers of digits for the M, S, T, and B codes.

> **NOTE**
> Up to 5 digits can be specified in the S code

4.14
PARAMETERS OF MDI, DISPLAY, AND EDIT

3100	#7	#6	#5	#4	#3	#2	#1	#0
	COR				FKY	SKY	CEM	
	COR				FKY	SKY	CEM	

[Data type] Bit

CEM On screens such as the operation history screen and help screen, keys on the MDI panel are indicated:

0 : In English.
1 : With graphics qualifying for CE marking. (A character generator supporting graphics qualifying for CE marking is required.)

SKY On the 7.2– or 8.4–inch LCD, the keyboard format uses:

0 : Standard keys.
1 : Small keys.

> **NOTE**
> Set this parameter when using the 9.5″/10.4″ LCD (with ten soft keys). After this parameter has been set, the power must be turned off then back on for the setting to become effective.

FKY MDI keyboard

0 : Small type keys are used.
1 : Standard keys are used.

> **NOTE**
> Set this parameter when using the 7.2″/8.4″ LCD (with seven soft keys). After this parameter has been set, the power must be turned off then back on for the setting to become effective.

COR 7–pieces type soft key display

0 : Monochrome display
1 : Color display

> **NOTE**
> When using the 8.4″ LCD, set this bit to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
3101				BGD			KBF	

[Data type] Bit

KBF   When the screen or mode is changed, the contents of the key–in buffer are:
        0 : Cleared.
        1 : Not cleared.

> **NOTE**
> When KBF = 1, the contents of the key–in buffer can all be cleared at one time by pressing the SHIFT key followed by the CAN key.

BGD   In background editing, a program currently selected in the foreground:
        0 : Cannot be selected. (BP/S alarm No.140 is issued disabling selection.)
        1 : Can be selected. (However, the program cannot be edited, only displayed.)

	#7	#6	#5	#4	#3	#2	#1	#0
3102		SPN	HNG	ITA	CHI	FRN	GRM	JPN

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

> **NOTE**
> When this parameter is set, the power must be turned off before operation is confinued.

[Data type] Bit

These bits select the language to be used for the display.

POR	SPN	HNG	ITA	CHI	FRN	GRM	JPN	Language
0	0	0	0	0	0	0	0	English
0	0	0	0	0	0	0	1	Japanese
0	0	0	0	0	0	1	0	German
0	0	0	0	0	1	0	0	French
0	0	0	0	1	0	0	0	Chinese
0	0	0	1	0	0	0	0	Italian
0	0	1	0	0	0	0	0	Korean
0	1	0	0	0	0	0	0	Spanish
1	0	0	0	0	0	0	0	Portuguese

	#7	#6	#5	#4	#3	#2	#1	#0
3104	DAC	DAL	DRC	DRL	PPD			MCN

[Data type] Bit

MCN Machine position

0 : Not displayed according to the unit of input.
(Regardless of whether input is made in mm or inches, the machine position is displayed in mm for millimeter machines, or in inches for inch machines.)

1 : Displayed according to the unit of input.
(When input is made in mm, the machine position is displayed in mm, and when input is made in inches, the machine position is displayed in inches accordingly.)

PPD Relative position display when a coordinate system is set

0 : Not preset
1 : Preset

> **NOTE**
> When PPD is set to 1 and the absolute position display is preset by one of the following, the relative position display is also preset to the same value as the absolute position display:
> 1) The manual reference position return
> 2) Setting of a coordinate system by G92 (G50 for T series G code system A)

DRL Relative position

0 : The actual position displayed takes into account tool length offset (M series) or tool offset (T series).

1 : The programmed position displayed does not take into account tool length offset (M series) or tool offset (T series).

> **NOTE**
> When tool geometry compensation of the T system is to be performed by shifting the coordinate system (with bit 4 (LGT) of parameter No.5002 set to 0), the programmed position, ignoring tool offset, is displayed (with this parameter set to 1), but the programmed position, ignoring tool geometry compensation, cannot be displayed.

DRC Relative position

0 : The actual position displayed takes into account cutter compensation (M series) or tool nose radius compensation (T series).

1 : The programmed position displayed does not take into account cutter compensation (M series) or tool nose radius compensation (T series).

DAL Absolute position

0 : The actual position displayed takes into account tool length offset (M series) or tool offset (T series).

1 : The programmed position displayed does not take into account tool length offset (M series) or tool offset (T series).

> **NOTE**
> When tool geometry compensation of the T system is to be performed by shifting the coordinate system (with bit 4 (LGT) of parameter No.5002 set to 0), the programmed position, ignoring tool offset, is displayed (with this parameter set to 1), but the programmed position, ignoring tool geometry compensation, cannot be displayed.

DAC Absolute position

0 : The actual position displayed takes into account cutter compensation (M series) or tool nose radius compensation (T series).

1 : The programmed position displayed does not take into account cutter compensation (M series) or tool nose radius compensation (T series).

	#7	#6	#5	#4	#3	#2	#1	#0
3105						DPS	PCF	DPF
	SMF					DPS	PCF	DPF

[Data type] Bit

DPF Display of the actual speed on the current position display screen, program check screen and program screen (MD1 mode)

0 : Not displayed

1 : Displayed

PCF Addition of the movement of the PMC–controlled axes to the actual speed display

0 : Added

1 : Not added

> **NOTE**
> For each setting, movement along any axis other than those controlled by the CNC (see the description of parameter No. 1010) is not reflected in the actual speed display.

DPS Actual spindle speed and T code

0 : Not always displayed

1 : Always displayed

> **NOTE**
> For the M series, the threading and synchronous feed option is required to display the actual spindle speed.

SMF During simplified synchronous control, movement along a slave axis is:

0 : Included in the actual speed display

1 : Not included in the actual speed display

> **NOTE**
> This parameter is valid when simplified synchronous control is applied according to the setting of parameter No.8311 (master and slave axes can be arbitrarily selected).

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

[Data type] Bit

GPL   On the program list screen, the list–by–group function is:

    0 : Disabled

    1 : Enabled

SPD   Names for actual spindle speed values are displayed:

    0 : Regardless of the selected spindle position coder
       (in second position coder selection signal (PC2SLC))

    1 : Depending of the selected spindle position coder
       (in second position coder selection signal (PC2SLC))

SPD=0	SPD=1	
	Spindles 1	Spindles 2
Spindles 1 and 2	Spindles 1	Spindles 2
S	S1	S2
SACT	SACT1	SACT2
ACT, S		

OPH   The operation history screen is:

    0 : Not displayed.

    1 : Displayed.

SOV   The spindle override value is:

    0 : Not displayed.

    1 : Displayed.

> **NOTE**
> This parameter is enabled only when bit 2 (DPS) of parameter No.3105 is set to 1.

OHS   Operation history sampling is:

    0 : Performed.

    1 : Not performed.

	#7	#6	#5	#4	#3	#2	#1	#0
3107	MDL			SOR		DNC		NAM

[Data type] Bit

NAM   Program list

    0 : Only program numbers are displayed.

    1 : Program numbers and program names are displayed.

DNC   Upon reset, the program display for DNC operation is:

    0 : Not cleared

    1 : Cleared

SOR   Display of the program directory

    0 : Programs are listed in the order of registration.

    1 : Programs are listed in the order of program number.

MDL Display of the modal state on the program display screen

0 : Not displayed

1 : Displayed (only in the MDI mode)

	#7	#6	#5	#4	#3	#2	#1	#0
3108	JSP	SLM		WCI				
	JSP	SLM		WCI			PCT	

[Data type] Bit

PCT On the 7–pieces type soft key display program check screen and 12–pieces type soft key display position screen, T code displayed
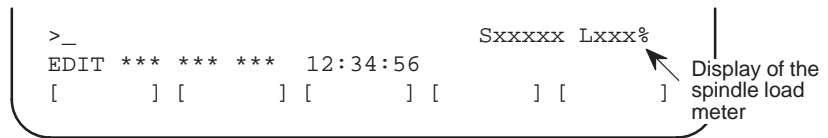
0 : is a T code specified in a program (T).

1 : is a T code specified by the PMC (HD. T/NX. T)

WCI On the workpiece coordinate system screen, a counter input is:

0 : Disabled.

1 : Enabled.

SLM The spindle load meter is:

0 : Not displayed.

1 : Displayed.

```
>_                                    Sxxxxx Lxxx%
EDIT *** *** ***   12:34:56
[       ] [        ] [        ] [        ] [          ]
```
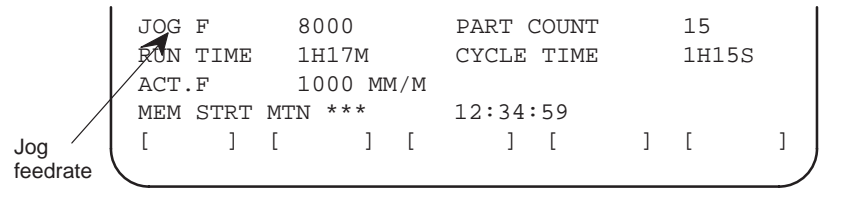Display of the spindle load meter

> **NOTE**
> 1 This parameter is enabled only when the DPS parameter (bit 2 of parameter No.3105) is set to 1.
> 2 When displaying the spindle load meter for an analog spindle, also set parameter Nos.3161, 3162, and 3163.

JSP On the current position display screen and program check screen, jog feed is:

0 : Not displayed.

1 : Displayed.

> **NOTE**
> In manual operation mode, the jog feedrate is displayed. In automatic operation mode, the dry run feedrate is displayed. In each case, the feedrate to which a manual feedrate override has been applied is displayed.
>
> ```
> JOG F       8000        PART COUNT      15
> RUN TIME    1H17M       CYCLE TIME      1H15S
> ACT.F       1000 MM/M
> MEM STRT MTN ***        12:34:59
> [       ] [        ] [        ] [      ] [        ]
> ```
> Jog feedrate

	#7	#6	#5	#4	#3	#2	#1	#0
3109			RHD			IKY	DWT	
			RHD			IKY		

[Data type] Bit

DWT Characters G and W in the display of tool wear/geometry compensation amount

0 : The characters are displayed at the left of each number.
1 : The characters are not displayed.

IKY On the tool offset screen and workpiece shift screen (T series), soft key **[INPUT]** is:

0 : Displayed.
1 : Not displayed.

RHD When a manual handle interrupt is generated, the relative position display is:

0 : Not updated.
1 : Updated.

> **NOTE**
> This parameter is enabled when the INH parameter (bit 2 of parameter No.7100) is 1.

	#7	#6	#5	#4	#3	#2	#1	#0
3110						AHC		

[Data type] Bit

AHC Alarm message history data:

0 : Can be cleared.
1 : Can not be cleared
(Such data can be cleared using the [CLEAR] soft key.)

	#7	#6	#5	#4	#3	#2	#1	#0
3111	NPA	OPS	OPM			SVP	SPS	SVS

[Data type] Bit

SVS Servo tuning screen

0 : Not displayed
1 : Displayed

SPS Spindle tuning screen

0 : Not displayed
1 : Displayed

SVP Synchronization errors displayed on the spindle tuning screen

0 : Instantaneous values are displayed.
1 : Peak–hold values are displayed.

OPM Operating monitor

0 : Not displayed
1 : Displayed

OPS The speedometer on the operating monitor screen indicates:

0 : Spindle motor speed
1 : Spindle speed

NPA Action taken when an alarm is generated or when an operator message is entered

    0 : The display shifts to the alarm or message screen.

    1 : The display does not shift to the alarm or message screen.

	#7	#6	#5	#4	#3	#2	#1	#0
3112			OPH		EAH	OMH		SGD

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

SGD Servo waveform

    0 : Not displayed

    1 : Displayed

> **NOTE**
> If SGD is set to 1, no graphic display other than servo waveform display is done.

OMH The external operator message history screen is:

    0 : Not displayed.

    1 : Displayed.

EAH Messages of the exfernal alam/macro alarm in alarm history:

    0 : Not recorded

    1 : Recorded

OPH The operation history log function is:

    0 : Displayed.

    1 : Enable.

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

[Data type] Bit

MHC External operator message history data:

    0 : Cannot be cleared.

    1 : Can be cleared.

    (Such data can be cleared using the [**CLEAR**] soft key.)

MS0, MS1 A combination of the number of characters preserved as external operator message history data and the number of history data items is set according to the table below.

MS1	MS0	Number of history data characters	Number of history data items
0	0	255	8
0	1	200	10
1	0	100	18
1	1	50	32

> **NOTE**
> When the values of MS0 and MS1 are changed, all preserved external operator message history data is cleared.

	#7	#6	#5	#4	#3	#2	#1	#0
3114		ICS	IUS	IMS	ISY	IOF	IPR	IPO

[Data type] Bit

IPO When the <POS> function key is pressed while the position display screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

IPR When the <PROG> function key is pressed while the program screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

IOF When the <OFFSET/SETTING> function key is pressed while the offset/setting screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

ISY When the <SYSTEM> function key is pressed while the system screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

IMS When the <MESSAGE> function key is pressed while the message screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

IUS When the <USER> or <GRAPH> function key is pressed while the user or graph screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

ICS When the <CUSTOM> function key is pressed while the custom screen is being displayed:

0 : The screen is changed.
1 : The screen is not changed.

	#7	#6	#5	#4	#3	#2	#1	#0
3115					NDFx	SFMx	NDAx	NDPx
		D10x			NDFx		NDAx	NDPx

[Data type] Bit axis

NDPx Display of the current position for each axis

0 : The current position is displayed.
1 : The current position is not displayed.

NDAx Position display using absolute coordinates and relative coordinates is:

0 : Performed.
1 : Not performed. (Machine coordinates are displayed.)

SFMx In current position display, subscripts are:

   0 : Added to the absolute, relative, and machine coordinate axis names.
   1 : Assed only to the machine coordinate axis names.

NDFx To the actual speed display, axis movement data is:

   0 : Added.
   1 : Not added.

> **NOTE**
> Even if the PCF parameter (bit 1 of parameter No.3105) is set to 0, so as to add PMC controlled axis movement data to the actual speed display, the movement data for a PMC controlled axis for which NDFx is set to 1 is not added to the actual speed display.

D10x The current positions (absolute position, relative position, machine position, remaining travel, and travel by manual handle interrupt), and workpiece zero–point offset are:

   0 : Displayed as usual. (Not multiplied by ten.)
   1 : Multiplied by ten, and displayed.

   Example: The current position on the Y–axis is multiplied by ten and displayed.

$$X\ 1.2345 \rightarrow X\ 1.2345$$
$$Y\ 1.2345 \rightarrow Y\ 12.345$$
$$Z\ 1.2345 \rightarrow Z\ 1.2345$$

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

PWR Alarm No.100 (parameter enable) :

   0 : Clear by **[CAN]** + **[RESET]** key
   1 : Clear by **[RESET]** key

	#7	#6	#5	#4	#3	#2	#1	#0
3117							SPP	

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

SPP On the diagnostic screen, spindle position data (the number of pulses from the position coder, detected after the detection of the one–revolution signal) is:

   0 : Not displayed.
   1 : Displayed. (Diagnostic Nos. 445 to 447)

	#7	#6	#5	#4	#3	#2	#1	#0
3118					MDC		AS2	AS1
					MDC			

[Data type] Bit

AS1, AS2 When the actual spindle speeds (SACT) of the first spindle, second spindle, and third spindle are displayed, each value is:

0 : The value calculated based on the feedback pulses from the position coder.

1 : The value calculated from the spindle motor speed (the same as the spindle speed displayed on the operating monitor screen).

MDC Maintenance information by operating soft key :

0 : All clear disable.

1 : All clear enable.

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

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

NVG When a color display device is used, VGA mode is:

0 : Used.

1 : Not used.

3120	Time from the output of an alarm to the termination of sampling (waveform diagnosis function)

[Data type] Word

[Unit of data] ms

[Valid data range] 1 to 32760

When the waveform diagnosis function is used, this parameter sets the time form the output of a servo alarm until data collection. Storage operation is stopped because of the alarm. (This means that the termination of data collection can be delayed by a specified time.)

3122	Time interval used to record time data in operation history

[Data type] Word

[Unit of data] Minutes

[Valid data range] 0 to 1439

Time data is recorded in operation history at set intervals. When 0 is specified in this parameter, 10 minutes is assumed as the default. However, NOTE that time data is not recorded if there is no data to be recorded at the specified time.

3123	Time until screen clear function is applied

[Data type] Bytes

[Unit of data] Minutes

[Valid data range] 1 to 255

This parameter specifies the period that must elapse before the screen clear function is applied. If 0 is set, the screen is not cleared.

Moreover, this parameter is valid only when it is set on the path 1 side.

	#7	#6	#5	#4	#3	#2	#1	#0
3124	D08	D07	D06	D05	D04	D03	D02	D01
3125	D16	D15	D14	D13	D12	D11	D10	D09
3126	D24	D23	D22	D21	D20	D19	D18	D17
3127								D25

[Data type] Bit

Dxx (xx: 01 to 25) When modal G code is displayed on the program check screen in 9–inch display mode and the program check–P screen when two–path control is applied, the xx group G code is:

0 : Displayed.
1 : Not displayed.

> **NOTE**
> Set these parameters when using the display with seven soft keys.

3131	Subscript of each axis name

[Data type] Byte axis

This parameter specifies a subscript (one character) of each axis name with a code.
Set a suffix (single character) for the name of each axis by specifying a character code.
When the loader control function is used, a suffix (single character) specified with this parameter can be displayed after the axis name, to indicate whether the coordinates displayed on the current position display screen are those for controlled axes belonging to the machine or those for controlled axes belonging to the loader.

> **NOTE**
> 1 For characters and codes, see the correspondence table in Appendix 1.
> 2 When code 0 is specified, 1 or 2 is displayed.

[Example] When the configuration of axes is X, Z, C and Y in path 1 B in path 2

(1) Setting for path 1
Parameter 3131x . . . . 65 (A)
Parameter 3131z . . . . 49 (1)   XA, Z1, CS, and Y1 are
Parameter 3131c . . . . 83 (S)   displayed as axis names.
Parameter 3131y 0 (1)

(2) Setting for path 2
Parameter 3131x . . . . 66 (B)   XB, Z2, and B are dis-
Parameter 3131z . . . . 0 (2)   played as axis names.
Parameter 3131b . . . . 32 (space)

3132	Axis name (absolute coordinate) for current position display

3133	Axis name (relative coordinate) for current position display

[Data type] Byte axis

[Valid data range] 0 to 255

These parameters set the axis name for current position display.

When G code system B or C is used, the axis name set in parameter No.3132 is used for both absolute and relative coordinate axes.

The values set in these parameters are used only for display. For a command address, the axis name set in parameter No.1020 is used.

When 0 is specified in these parameters, the value set in parameter No.1020 is used.

3134	Axis display order on workpiece coordinate system screen and workpiece shift screen

[Data type] Byte axis

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

This parameter specifies the order in which axes are displayed on the workpiece coordinate system screen and workpiece shift screen (for T series).

3141	Machine name loader name (1st character)

3142	Machine name loader name (2nd character)

3143	Machine name loader name (3rd character)

3144	Machine name loader name (4th character)

3145	Machine name loader name (5th character)

3146	Machine name loader name (6th character)

3147	Machine name loader name (7th character)

[Data type] Byte

Set the machine/loader name by specifying character codes.

When the loader control function is used, a name consisting of up to seven characters (arbitrary character string consisting of numerics, alphabetics, and/or symbols) can be displayed in the status display line on the screen, to indicate whether the currently displayed screen is for the machine or for the loader.

NOTE
1 These parameters are valid when the loader control function is used.
2 Set the parameters for the machine and loader separately.
3 For details of character codes, see Appendix A.

[Example] When the names of machine and loader are specified as NC and LOADER, respectively.

(1) Setting for machine
   Parameter 3141 = 78 (N)
   Parameter 3142 = 67 (C)
   Parameter 3143 = 32 (Space)
   Parameter 3144 = 32 (Space)
   Parameter 3145 = 32 (Space)
   Parameter 3146 = 32 (Space)
   Parameter 3147 = 32 (Space)

(2) Setting for loader
   Parameter 3141 = 76 (L)
   Parameter 3142 = 79 (O)
   Parameter 3143 = 65 (A)
   Parameter 3144 = 68 (D)
   Parameter 3145 = 69 (E)
   Parameter 3146 = 82 (R)
   Parameter 3147 = 32 (Space)

3151	Number of the axis for which the first load meter for the servo motor is used
3152	Number of the axis for which the second load meter for the servo motor is used
3153	Number of the axis for which the third load meter for the servo motor is used
3154	Number of the axis for which the fourth load meter for servo motor is used

[Data type] Byte

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

Set the numbers of the axes for which measurement values on the load meters for the eight servo motors are displayed. Set the parameters to 0 for those axes for which a load meter need not be displayed.

	#7	#6	#5	#4	#3	#2	#1	#0
3201	MIP	NPE	N99		PUO	REP	RAL	RDL

[Data type] Bit

RDL When a program is registered by input/output device external control

   0 : The new program is registered following the programs already registered.

   1 : All registered programs are deleted, then the new program is registered.
      Note that programs which are protected from being edited are not deleted.

RAL When programs are registered through the reader/puncher interface

   0 : All programs are registered.

   1 : Only one program is registered.

REP Action in response to an attempt to register a program whose number is the same as that of an existing program

   0 : An alarm is generated.

   1 : The existing program is deleted, then the new program is registered.
      Note that if the existing program is protected from being edited, it is not deleted, and an alarm is generated.

PUO When address O of a program number is output in ISO code:

   0 : ":" is output.

   1 : "O" is output.

N99 With an M99 block, when bit 6 (NPE) of parameter No.3201 = 0, program registration is assumed to be:

   0 : Completed

   1 : Not completed

NPE With an M02, M30, or M99 block, program registration is assumed to be:

   0 : Completed

   1 : Not completed

MIP Program registration by external start signal (MINP) :

   0 : Not performed.

   1 : Performed.

	#7	#6	#5	#4	#3	#2	#1	#0
3202		PSR	CPD	NE9	OSR	CND	OLV	NE8

[Data type] Bit

NE8 Editing of subprograms with program numbers 8000 to 8999

0 : Not inhibited

1 : Inhibited

The following edit operations are disabled:

(1) Program deletion (Even when deletion of all programs is specified, programs with program numbers 8000 to 8999 are not deleted.)

(2) Program output (Even when outputting all programs is specified, programs with program numbers 8000 to 8999 are not output.)

(3) Program number search

(4) Program editing of registered programs

(5) Program registration

(6) Program collation

(7) Displaying programs

OLV When a program other than the selected program is deleted or output:

0 : The display of the selected program is not held.
1 : The display of the selected program is held.

CND By using the [**CONDENSE**] soft key on the program directory screen, the program condensing operation is:

0 : Not performed. (The [**CONDENSE**] soft key is not displayed.)
1 : Performed.

OSR In programming number search, when pressing soft key [**O–SEARCH**] without inputting program number by key :

0 : Search the following program number
1 : Operation is invalid

NE9 Editing of subprograms with program numbers 9000 to 9999

0 : Not inhibited

1 : Inhibited

The following program editing during operation is invalid.

(1) Program deletion (Even when deletion of all programs is specified, programs with program numbers 9000 to 9999 are not deleted.)

(2) Program punching (Even when punching of all programs is specified, programs with program numbers 9000 to 9999 are not punched.)

(3) Program number search

(4) Program editing after registration

(5) Program registration

(6) Program collation

(7) Displaying programs

CPD When an NC program is deleted, a confirmation message and confirmation soft key are:

0 : Not output.
1 : Output.

PSR   Search for the program number of a protected program

0 : Disabled
1 : Enabled

	#7	#6	#5	#4	#3	#2	#1	#0
3203	MCL	MER	MZE					

[Data type] Bit

MZE   After MDI operation is started, program editing during operation is:

0 : Enabled
1 : Disabled

MER   When the last block of a program has been executed at single block operation in the MDI mode, the executed block is:

0 : Not deleted
1 : Deleted

> **NOTE**
> When MER is set to 0, the program is deleted if the end–of–record mark (%) is read and executed. (The mark % is automatically inserted at the end of a program.)

MCL   Whether a program prepared in the MDI mode is cleared by reset

0 : Not deleted
1 : deleted

	#7	#6	#5	#4	#3	#2	#1	#0
3204		MKP				EXK		PAR

[Data type] Bit

PAR   When a small keyboard is used, characters [and] are:

0 : Used as [and].
1 : Used as (and).

EXK   The input character extension function is:

0 : Not used.
1 : Used. (When a small keyboard is used, the three characters (,), and @ can be entered using soft keys.)

> **NOTE**
> The [C–EXT] soft key is used to select an operation on the program screen. This soft key enables the entry of "(", ")", and "@" using soft keys. This soft key is useful when using the small MDI keyboard, which does not have the "(", ")", and "@" keys.

MKP   When M02, M30, or EOR(%) is executed during MDI operation, the created MDI program is:

0 : Erased automatically.
1 : Not erased automatically.

> **NOTE**
> If the MER parameter (bit 6 of parameter No.3203) is 1, executing the last block provides a choice of whether to automatically erase a created program.

	#7	#6	#5	#4	#3	#2	#1	#0
3205	MCK						CHG	COL

[Data type] Bit

COL When a program is displayed or output, any colons (:) in the comments of the program are:

0 : Converted to letter O

1 : Displayed or output as is

CHG When the change function of the extended edit function is used:

0 : Once the user has decided whether to make a change, the cursor is moved to the target position.

1 : The cursor is moved to the change source, after which the user can choose whether to make a change.

MCK The system tape memory check function is:

0 : Not used.

1 : Used. (This setting is inhibited.)

3210	Password

[Data type] 2–word axis

This parameter sets a password for protecting program Nos. 9000 to 9999. When a value other than zero is set in this parameter and this value differs from the keyword set in parameter No.3211, bit 4 (NE9) of parameter No.3202 for protecting program Nos. 9000 to 9999 is automatically set to 1. This disables the editing of program Nos. 9000 to 9999. Until the value set as the password is set as a keyword, NE9 cannot be set to 0 and the password cannot be modified.

> **NOTE**
> 1 The state where password = 0 and password = keyword is referred to as the locked state. When an attempt is made to modify the password by MDI input operation in this state, the warning message "WRITE PROTECTED" is displayed to indicate that the password cannot be modified. When an attempt is made to modify the password with G10 (programmable parameter input), P/S alarm No.231 is issued.
> 2 When the value of the password is not 0, the parameter screen does not display the password. Care must be taken in setting a password.

3211	Keyword

[Data type] 2–word axis

When the value set as the password (set in parameter No.3210) is set in this parameter, the locked state is released and the user can now modify the password and the value set in bit 4 (NE9) of parameter No.3202.

> **NOTE**
> The value set in this parameter is not displayed. When the power is turned off, this parameter is set to 0.

3216	Increment in sequence numbers inserted automatically

Setting entry is acceptable.

[Data type] Word

[Valid data range] 0 to 9999

Set the increment for sequence numbers for automatic sequence number insertion (when SEQ, #5 of parameter 0000, is set to 1.)

	#7	#6	#5	#4	#3	#2	#1	#0
3290	KEY	MCM		IWZ	WZO	MCV	GOF	WOF

[Data type] Bit

WOF Setting the tool offset value by MDI key input is:

0 : Not disabled
1 : Disabled (With parameter No.3294 and No.3295, set the offset number range in which updating the setting is to be disabled.)

GOF Setting the tool offset value by MDI key input is:

0 : Not disabled
1 : Disabled (With parameter No.3294 and No.3295, set the offset number range in which updating the setting is to be disabled.)

MCV Macro variable setting by MDI key input is:

0 : Not disabled
1 : Disabled

WZO Setting a workpiece zero point offset value by MDI key input is:

0 : Not disabled
1 : Disabled

IWZ Setting a workpiece zero point offset value or workpiece shift value (T–series) by MDI key input in the automatic operation activation or halt state is:

0 : Not disabled
1 : Disabled

MCM The setting of custom macros by MDI key operation is:

0 : Enabled regardless of the mode.
1 : Enabled only in the MDI mode.

KEY For memory protection keys:

0 : The KEY1, KEY2, KEY3, and KEY4 signals are used.
1 : Only the KEY1 signal is used.

> **NOTE**
> The functions of the signals depend on whether KEY=0 or KEY=1.
> When KEY = 0:
> – KEY1: Enables a tool offset value and a workpiece zero point offset value to be input.
> – KEY2: Enables setting data and macro variables to be input.
> – KEY3: Enables program registration and editing.
> – KEY4: Enables PMC data (counter and data table) to be input.
>
>   When KEY = 1:
> – KEY1: Enables program registration and editing, and enables PMC parameter input.
> – KEY2 to KEY4: Not used

	#7	#6	#5	#4	#3	#2	#1	#0
3291								WPT

[Data type] Bit

   WPT The input of the tool wear compensation amount is:

     0 : Enabled according to memory protection key signal KEY1.

     1 : Enabled regardless of memory protection key signal KEY1.

3294	Start number of tool offset values whose input by MDI is disabled
3295	Number of tool offset values (from the start number) whose input by MDI is disabled

[Data type] Word

When the modification of tool offset values by MDI key input is to be disabled using bit 0 (WOF) of parameter No.3290 and bit 1 (GOF) of parameter No.3290, parameter Nos. 3294 and 3295 are used to set the range where such modification is disabled. In parameter No.3294, set the offset number of the start of tool offset values whose modification is disabled. In parameter No.3295, set the number of such values.

When 0 or a negative value is set in parameter No.3294 or parameter No.3295, no modification of the tool offset values is allowed.

When the value set with parameter No.3294 is greater than the maximum tool offset count, no modification is allowed.

[Example]

The following setting disables the modification of both the tool geometry compensation values and tool wear compensation values corresponding to offset numbers 100 to 110:

Bit 1 (GOF) of parameter No.3290=1 (Disables tool offset value modification.)

Bit 0 (WOF) of parameter No.3290=1 (Disables tool wear compensation value modification.)

Parameter No.3294 = 100

Parameter No.3295 = 11

If bit 0 (WOF) of parameter No.3290 is set to 0, the modification of the tool offset values alone is disabled. The tool wear compensation values may be modified.

4.15 PARAMETERS OF PROGRAMS

3401	#7	#6	#5	#4	#3	#2	#1	#0
	GSC	GSB					FCD	DPI
			ABS	MAB				DPI

[Data type] Bit

DPI When a decimal point is omitted in an address that can include a decimal point

0 : The least input increment is assumed.

1 : The unit of mm, inches, or second is assumed. (Pocket calculator type decimal point input)

FCD When an F command and a G command (G98, G99) for feed per minute or feed per rotation are specified in the same block, and the G command (G98, G99) is specified after the F command, the F command is:

0 : Assumed to be specified in the mode (G98 or G99) when the F command is specified

1 : Assumed to be specified in the mode of the G command (G98 or G99) of the same block

---

NOTE
1 When FCD = 1:
If the block containing a G command (G98, G99) does not include an F command, the last F command specified is assumed to be specified in the G command mode of the block.
Example
N1 G99 ;
N2 Faaaa G98 ; - Faaaa is assumed to be specified in the G98 mode.
N3 Fbbbb ;   - Fbbbb is assumed to be specified in the G98 mode.
N4 G99 ;   - Fbbbb is assumed to be specified in the G99 mode.
2 In G code system B or C, G98 and G99 function are specified in G94 and G95.

MAB Switching between the absolute and incremental commands in MDI operation

0 : Performed by G90 or G91

1 : Depending on the setting of ABS, #5 of parameter No.3401

ABS Program command in MDI operation

0 : Assumed as an incremental command

1 : Assumed as an absolute command

NOTE
ABS is valid when MAB, #4 of parameter No.3401, is set to 1.

GSB, GSC The G code system is set.

GSC	GSB	G code
0	0	G code system A
0	1	G code system B
1	0	G code system C

	#7	#6	#5	#4	#3	#2	#1	#0
3402	G23	CLR			G91			G01
	G23	CLR			G91	G19	G18	G01

[Data type] Bit

G01 Mode entered when the power is turned on or when the control is cleared

0 : G00 mode (positioning)
1 : G01 mode (linear interpolation)

G18 and G19 Plane selected when power is turned on or when the control is cleared

G19	G18	G17, G18 or G19 mode
0	0	G17 mode (plane XY)
0	1	G18 mode (plane ZX)
1	0	G19 mode (plane YZ)

G91 When the power is turned on or when the control is cleared

0 : G90 mode (absolute command)
1 : G91 mode (incremental command)

CLR Reset button on the MDI panel, external reset signal, reset and rewind signal, and emergency stop signal

0 : Cause reset state.
1 : Cause clear state.

For the reset and clear states, refer to Operator's manual.

G23 When the power is turned on

0 : G22 mode
1 : G23 mode

	#7	#6	#5	#4	#3	#2	#1	#0
3403		AD2	CIR					

[Data type] Bit

CIR When neither the distance (I, J, K) from a start point to the center nor an arc radius (R) is specified in circular interpolation (G02, G03):

0 : The tool moves to an end point by linear interpolation.
1 : P/S alarm No.022 is issued.

AD2 Specification of the same address two or more times in a block is:

0 : Enabled
1 : Disabled (P/S alarm No.5074)

NOTE
1 When 1 is set, specifying two or more G codes of the same group in a block will also result in an alarm being issued.
2 Up to three M codes can be specified in a single block.

	#7	#6	#5	#4	#3	#2	#1	#0
3404	M3B	EOR	M02	M30		SBP	POL	
	M3B	EOR	M02	M30		SBP	POL	NOP

[Data type] Bit

NOP When a program is executed, a block consisting of an O number, EOB, or N number is:

0 : Not ignored, but regarded as being one block.
1 : Ignored.

POL For a command address allowing a decimal point, omission of the decimal point is:

0 : Enabled
1 : Disabled (P/S alarm No.5073)

SBP Address P of the block including M198 in the subprogram call function

0 : Indicating a file number
1 : Indicating a program number

M30 When M30 is specified in a memory operation:

0 : M30 is sent to the machine, and the head of the program is automatically searched for. So, when the ready signal FIN is returned and a reset or reset and rewind operation is not performed, the program is executed, starting from the beginning.
1 : M30 is sent to the machine, but the head of the program is not searched for. (The head of the program is searched for by the reset and rewind signal.)

M02 When M02 is specified in memory operation

0 : M02 is sent to the machine, and the head of the program is automatically searched for. So, when the end signal FIN is returned and a reset or reset and rewind operation is not performed, the program is executed, starting from the beginning.
1 : M02 is sent to the machine, but the head of the program is not searched for. (The head of the program is searched for by the reset and rewind signal.)

EOR When the end–of–record mark (%) is read during program execution:

0 : P/S alarm No.5010 occurs. (Automatic operation is stopped, and the system enters the alarm state.)
1 : No alarm occurs. (Automatic operation is stopped, and the system is reset.)

M3B The number of M codes that can be specified in one block

0 : One
1 : Up to three

3405	#7	#6	#5	#4	#3	#2	#1	#0
	QAB	QLG	DDP	CCR	G36	PPS	DWL	AUX
							DWL	AUX

[Data type] Bit

AUX The least increment of the command of the second miscellaneous function specified with a decimal point

0 : Assumed to be 0.001

1 : Depending on the input increment. (For input in mm, 0.001 is assumed, or for input in inches, 0.0001 is assumed.)

DWL The dwell time (G04) is:

0 : Always dwell per second.

1 : Dwell per second in the feed per minute mode, or dwell per rotation in the feed per rotation mode.

PPS The passing–point signal output function is:

0 : Not used

1 : Used

G36 For a G code used with the automatic tool compensation function:

0 : G36/G37 is used.

1 : G37.1/G37.2 is used.

> **NOTE**
> If it is necessary to perform circular threading (counterclockwise), set this parameter to 1.

CCR Addresses used for chamfering and corner rounding

0 : Address used for chamfering and corner rounding is "I" or "K", not "C". In direct drawing dimension programming, addresses ",C", ",R", and ",A" (with comma) are used in stead of "C", "R", and "A".

1 : Addresses used for chamfering, corner rounding, and direct drawing dimension programming are "C", "R", and "A" without comma. Thus, addresses A and C cannot be used as the names of axes.

DDP Angle commands by direct drawing dimension programming

0 : Normal specification

1 : A supplementary angle is given.

QLG When the passing–point signal output function is used, the remaining distance to be traveled specified in address ",Q" is:

0 : The combined distance of all axes

1 : The distance of the longest axis

> **NOTE**
> This parameter is valid when bit 7 (QAB) of parameter No.3405 = 0.

QAB When the passing–point signal output function is used, address ",Q" specifies:

0 : Remaining distance to be traveled

1 : Coordinate value of the longest axis

	#7	#6	#5	#4	#3	#2	#1	#0
3406	C07		C05	C04	C03	C02	C01	
	C07		C05	C04	C03	C02	C01	

	#7	#6	#5	#4	#3	#2	#1	#0
3407		C14			C11	C10		C08
	C15	C14	C13		C11	C10	C09	C08

	#7	#6	#5	#4	#3	#2	#1	#0
3408								C16
				C20	C19	C18	C17	C16

	#7	#6	#5	#4	#3	#2	#1	#0
3409	CFH							
	CFH							

[Data type] Bit

Cxx (xx: 01 to 19) When bit 6 (CLR) of parameter No.3402 is 1, the reset button on the MDI panel, the external reset signal, the reset and rewind signal, or emergency stop will,

0 : Clear the G code with group number xx.
1 : Not clear the G code with group number xx.

CFH When bit 6 (CLR) of parameter No.3402 is 1, the reset button on the MDI panel, the external reset signal, the reset and rewind signal, or emergency stop will,

0 : Clear F codes, H codes (for the M series), D codes (for the M series), and T codes (for the T series).
1 : Not clear F codes, H codes (for the M series), D codes (for the M series), and T codes (for the T series).

3410	Tolerance of arc radius

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

[Valid data range] 1 to 99999999

When a circular interpolation command (G02, G03) is executed, the tolerance for the radius between the start point and the end point is set. If the difference of radii between the start point and the end point exceeds the tolerance set here, a P/S alarm No.20 is informed.

> **NOTE**
> When the set value is 0, the difference of radii is not checked.

3411	M code preventing buffering 1

3412	M code preventing buffering 2

3413	M code preventing buffering 3

⋮ ⋮

3420	M code preventing buffering 10

[Data type] Byte

[Valid data range] 0 to 255

Set M codes that prevent buffering the following blocks. If processing directed by an M code must be performed by the machine without buffering the following block, specify the M code.

M00, M01, M02, and M30 always prevent buffering even when they are not specified in these parameters.

3421	Minimum value 1 of M code preventing buffering

3422	Maximum value 1 of M code preventing buffering

3423	Minimum value 2 of M code preventing buffering

3424	Maximum value 2 of M code preventing buffering

3425	Minimum value 3 of M code preventing buffering

3426	Maximum value 3 of M code preventing buffering

3427	Minimum value 4 of M code preventing buffering

3428	Maximum value 4 of M code preventing buffering

3429	Minimum value 5 of M code preventing buffering

3430	Maximum value 5 of M code preventing buffering

3431	Minimum value 6 of M code preventing buffering

3432	Maximum value 6 of M code preventing buffering

[Data type] Word

[Valid data range] 0 to 65535

When a specified M code is within the range specified with parameter Nos. 3421 and 3422, 3423 and 3424, 3425 and 3426, 3427 and 3428, 3429 and 3430, or 3431 and 3432, buffering for the next block is not performed until the execution of the block is completed.

NOTE
1 The specification of a minimum value that exceeds the specified maximum value is invalid.
2 When there is only one data item, set the following: minimum value = maximum value.

	#7	#6	#5	#4	#3	#2	#1	#0
3450				NPS	CQD			
					CQD			AUP

[Data type] Bit

AUP When a command for the second miscellaneous function contains a decimal point or negative sign:

0 : The command is invalid.
1 : The command is valid.

> **NOTE**
> For the T series, a decimal point and negative sign are supported for commands for the second miscellaneous function, regardless of the setting made with this parameter.

CQD The method used for determining the amount of travel in circular interpolation is:

0 : Series 16 type.
1 : Series 15 type.

NPS A block that contains M98 Pxxx or M99, and which contains no addresses other than O and N functions:

0 : As a one–block NC statement involving no movement.
(A single–block stop is caused.)
1 : As a macro statement.
(A single–block stop is not caused. Moreover, the block is not regarded as a block involving no movement in tool–tip radius compensation mode.)

3460	Address for second miscellaneous function

[Data type] Byte

This parameter specifies the address used for the second miscellaneous function, as follows:

Address	A	B	C	U	V	W
Set value	65	66	67	85	86	87

> **NOTE**
> 1 Address B is assumed when a value other than the above is set.
> 2 Axes names cannot be used to specify the address.

4.16
PARAMETERS OF PITCH ERROR COMPENSATION

3620	Number of the pitch error compensation position for the reference position for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Word axis

[Unit of data] Number

[Valid data range] 0 to 1023

Set the number of the pitch error compensation position for the reference position for each axis.

Compensation position number	31	32	33	34	35	36	37
Set compensating value	+3	−1	−1	+1	+2	−1	−3

Fig. 4.16 Pitch error compensation position number and value (Example)

In the above example, set 33 as the number of the pitch error compensation position for the reference position.

3621	Number of the pitch error compensation position at extremely negative position for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Word axis

[Unit of data] Number

[Valid data range] 0 to 1023

Set the number of the pitch error compensation position at the extremely negative position for each axis.

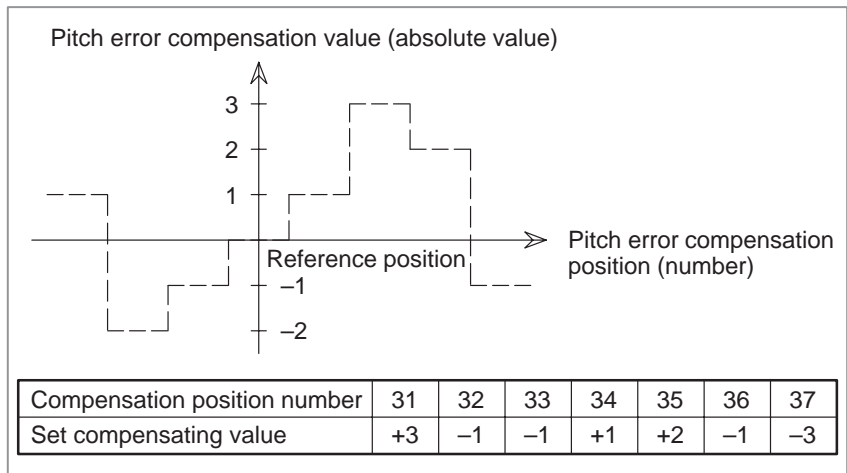| 3622	Number of the pitch error compensation position at extremely positive position for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Word axis

[Unit of data] Number

[Valid data range] 0 to 1023

Set the number of the pitch error compensation position at the extremely positive position for each axis.

> **NOTE**
> This value must be larger than set value of parameter (No.3620).

3623	Magnification for pitch error compensation for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte axis

[Unit of data] 1

[Valid data range] 0 to 100

Set the magnification for pitch error compensation for each axis.

If the magnification is set to 1, the same unit as the detection unit is used for the compensation data. If the magnitication is set to 0, the pith error compensation is not valid.

3624	Interval between pitch error compensation positions for each axis

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] 0 to 99999999

The pitch error compensation positions are arranged with equal spacing. The space between two adjacent positions is set for each axis. The minimum interval between pitch error compensation positions is limited and obtained from the following equation:

Minimum interval between pitch error compensation positions = maximum feedrate (rapid traverse rate)/7500

Units: Minimum interval between pitch error compensation positions: mm, inch, deg
Maximum feedrate: mm/min, inch/min, deg/min

Example: When the maximum feedrate is 15000 mm/min, the minimum interval between pitch error compensation positions is 2 mm.

If setting a magnification causes the absolute value of the compensation amount at a compensation position to exceed 100, enlarge the interval between the compensation positions by using a multiple calculated as follows:

Multiple = maximum compensation amount (absolute value)/128
(Round the remainder up to the nearest integer.)

Minimum interval between pitch error compensation positions
= Value obtained from the above maximum feedrate x multiple

Example 1) For linear axis

- Machine stroke: –400 mm to + 800 mm
- Interval between the pitch error compensation positions: 50 mm
- No.of the compensation position of the reference position: 40

If the above is specified, the No.of the farthest compensation point in the negative direction is as follows:

No.of the compensation position of the reference position – (Machine stroke length in the negative direction/Interval between the compensation points) + 1
= 40 – 400/50 + 1
=33

No.of the farthest compensation position in the positive direction is as follows:

No.of the compensation position of the reference position + (Machine stroke length in the positive direction/Interval between the compensation positions)
= 40 + 800/50
= 56

The correspondence between the machine coordinate and the compensation position No.is as follows:

Machine coordinate (mm)	–400	–350	–100	–50	0	50	100	750	800
Compensation point No.	33		39	40	41	42		56	
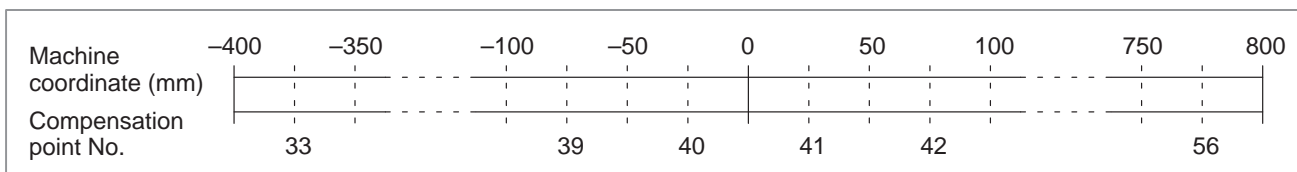
Therefore, set the parameters as follows:

Parameter	Setting
No. 3620: Compensation point number for reference position	40
No. 3621: Compensation point number for farthest point in the negative direction	33
No. 3622: Compensation point number for farthest point in the positive direction	56
No. 3623: Compensation magnification	1
No. 3624: Compensation point interval	50000

The compensation value is output at the compensationn position No.corresponding to each section between the coordinates.

The following is an example of the compensation values.

No.	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	.....	56
Compensation values	+2	+1	+1	−2	0	−1	0	−1	+2	+1	0	−1	−1	−2	0	+1	+2	.....	+1
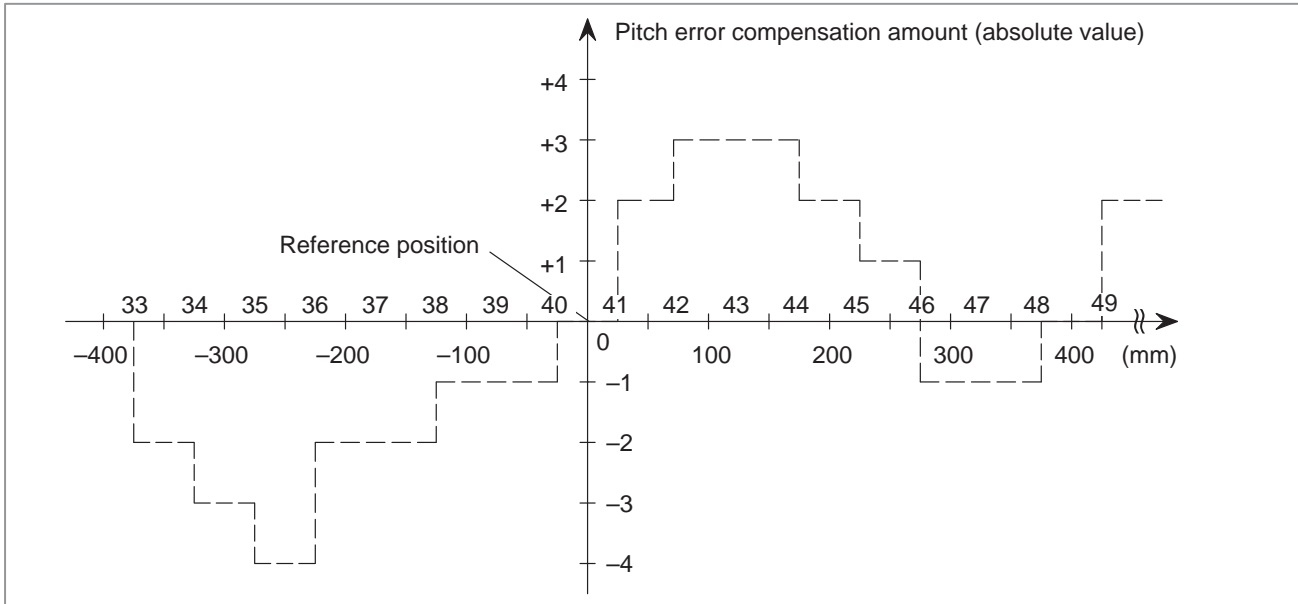
Example 2) For the rotation axis

- Amount of movement per rotation: 360°
- Interval between pitch error compensation position: 45°
- No.of the compensation position of the reference position: 60

If the above is specified, the No.of the farthest compensation position in the negative direction for the rotation axis is always equal to the compensation position No.of the reference position.

The No.of the farthest compensation position in the positive direction is as follows:

No.of the compensation position of the reference position + (Move amount per rotation/Interval between the compensation position)
= 60 + 360/45
= 68

The correspondence between the machine coordinate and the compensation position No.is as follows:

The compensation value is output at the circled position.

If the sum of the compensation value from 61 to 68 is not zero, the pitch error per rotation accumulates, resulting in a positional shift.

For compensation position 60, set the same compensation value as for 68.
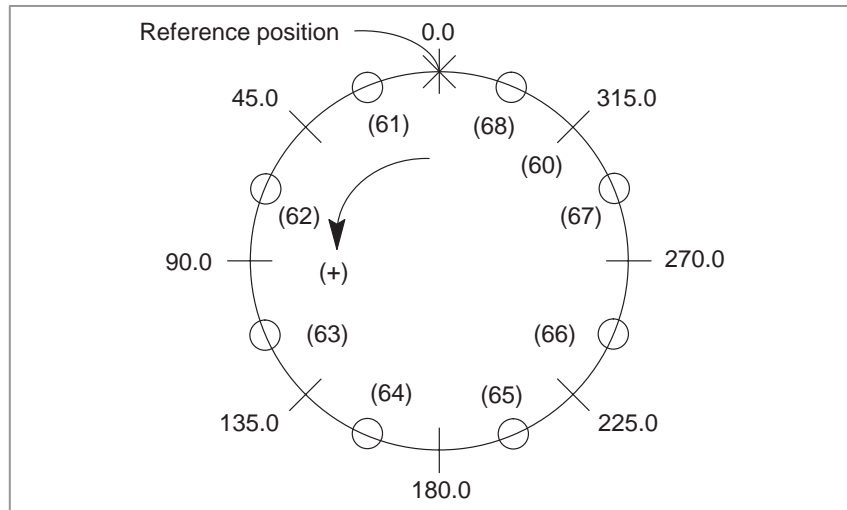
Set the parameters as follows:

Parameter	Setting
No. 3620: Compensation point number for reference position	60
No. 3621: Compensation point number for farthest point in the negative direction	60
No. 3622: Compensation point number for farthest point in the positive direction	68
No. 3623: Compensation magnification	1
No. 3624: Compensation point interval	45000

The following is an example of compensation values.

No.of the compensation position	60	61	62	63	64	65	66	67	68
Compensation value	+1	−2	+1	+3	−1	−1	−3	+2	+1
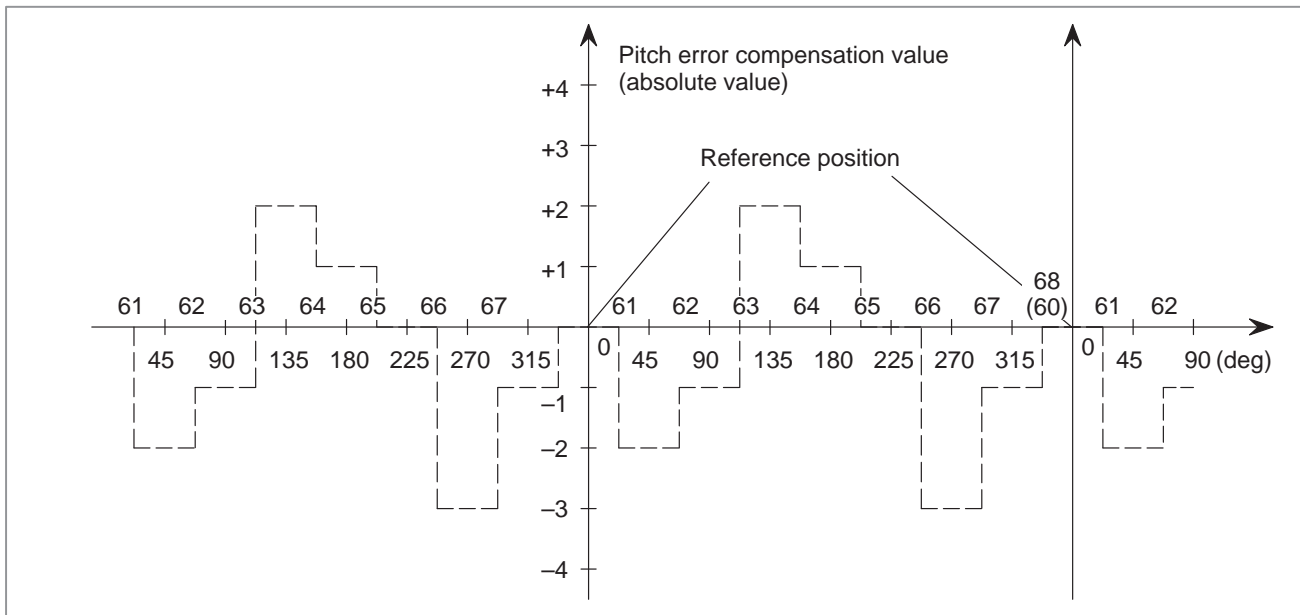
4.17
PARAMETERS OF
SPINDLE CONTROL

	#7	#6	#5	#4	#3	#2	#1	#0
3700							NRF	

[Data type] Bit

NRF The first move command (such as G00 and G01) after the serial spindle is switched to Cs axis contouring control performs:

0 : Positioning after returning to the reference position.
1 : Normal positioning.

	#7	#6	#5	#4	#3	#2	#1	#0
3701				SS2			ISI	

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

ISI The serial interface for the first and second spindles are:

0 : Used.
1 : Not used.

> **NOTE**
> This parameter is valid when the spindle serial output option is provided. It is used when the CNC is started with serial interface control for the first and second serial spindles disabled temporarily (for example, for CNC startup adjustment). Usually, it should be set to 0.
> If the serial interface for the third serial spindle is disabled for the same reason, parameter SS3 (bit 5 of parameter No.3701) must be 0. (This parameter does not disable the serial interface of the third spindle.)
> If this parameter is set to 1 when using the serial spindle and analog spindle at the same time, the analog spindle is set the first axis.

SS2 In serial spindle control, the second spindle is:

0 : Not used.
1 : Used.

> **NOTE**
> This parameter is valid, when the spindle serial output option is provided and parameter ISI(bit 1 of parameter No.3701)is 0.
> When the spindle synchronization option is provided, it is set automatically when power is switched on. Setting this parameter enables:
> 1　Confirmation of connection of the second serial spindle amplifier, and communication with it
> 2　Control of the second spindle during asynchronous control (SIND2)
> The simplified spindle synchronization function requires that two serial spindles be connected. So this parameter must be set; it will not be set automatically. When this parameter is set, it is also necessary to set the serial spindle parameter for the second spindle.

3702	#7	#6	#5	#4	#3 OR2	#2 OR1	#1	#0

NOTE
When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

OR1 Whether the stop–position external–setting type orientation function is used by the first spindle motor

0 : Not used
1 : Used

OR2 Whether the stop–position external–setting type orientation function is used by the second spindle motor

0 : Not used
1 : Used

3705	#7	#6	#5	#4 EVS	#3	#2	#1	#0 ESF
		SFA	NSF		SGT	SGB	GST	ESF

[Data type] Bit

ESF When the spindle control function (Spindle analog outpu or Spindle serial output) is used, and the constant surface speed control function is used or bit 4 (GTT) of parameter No.3705 is set to 1:

0 : S codes and SF are output for all S commands.
1 : S codes and SF are not output for an S command in constant surface speed control mode (G96 mode) or for an S command used to specify maximum spindle speed clamping (G50S——;).

NOTE
For the T series, this parametar is enabled when bit 4 (EVS) of parameter No.3705 is set to 1.
For the M series, SF is not output:
(1) For an S command used to specify maximum spindle speed clamping (G92S——;) in constant surface speed control mode
(2) When bit 5 (NSF) of parameter No.3705 is set to 1

GST The SOR signal is used for:

0 : Spindle orientation
1 : Gear shift

SGB Gear switching method

0 : Method A (Parameters 3741 to 3743 for the maximum spindle speed at each gear are used for gear selection.)
1 : Method B (Parameters 3751 and 3752 for the spindle speed at the gear switching point are used for gear selection.)

SGT Gear switching method during tapping cycle (G84 and G74)

0 : Method A (Same as the normal gear switching method)
1 : Method B (Gears are switched during tapping cycle according to the spindle speed set in parameters 3761 and 3762).

EVS When the spindle control function (Spindle analog output or Spindle serial output) is used, S codes and SF are:

0 : Not output for an S command.
1 : Output for an S command.

> **NOTE**
> The output of S codes and SF for an S command in constant surface speed control mode (G96), or for an S command used to specify maximum spindle speed clamping (G50S——;) depends on the setting of bit 0 (ESF) of parameter No.3705.

NSF When an S code command is issued in constant surface speed control,

0 : SF is output.
1 : SF is not output.

SFA The SF signal is output:

0 : When gears are switched.
1 : Irrespective of whether gears are switched.

	#7	#6	#5	#4	#3	#2	#1	#0
3706	TCW	CWM	ORM				PG2	PG1
	TCW	CWM	ORM	GTT			PG2	PG1

[Data type] Bit

PG2 and PG1 Gear ratio of spindle to position coder

Magnification	PG2	PG1
×1	0	0
×2	0	1
×4	1	0
×8	1	1

$$\text{Magnification} = \frac{\textbf{Number of spindle revolutions}}{\textbf{Number of position coder revolutions}}$$

GTT Selection of a spindle gear selection method

0: Type M.
1 : Type T.

> **NOTE**
> 1 Type M:
>   The gear selection signal is not entered. In response to an S command, the CNC selects a gear according to the speed range of each gear specified beforehand in parameters. Then the CNC reports the selection of a gear by outputting the gear selection signal. The spindle speed corresponding to the gear selected by the gear selection signal is output.
>   Type T:
>   The gear selection signal is entered. The spindle speed corresponding to the gear selected by this signal is output.
> 2 When the constant surface speed control option is selected, type T is selected, regardless of whether this parameter is specified.
> 3 When type T spindle gear switching is selected, the following parameters have no effect:
>   No.3705#2 SGB, No.3751, No.3752, No.3705#3 SGT, No.3761, No.3762, No.3705#6 SFA, No.3735, No.3736
>   However, parameter No.3744 is valid.

ORM   Voltage polarity during spindle orientation

   0 : Positive
   1 : Negative

TCW, CWM   Voltage polarity when the spindle speed voltage is output

TCW	CWM	Voltage polarity
0	0	Both M03 and M04 positive
0	1	Both M03 and M04 negative
1	0	M03 positive, M04 negative
1	1	M03 negative, M04 positive

	#7	#6	#5	#4	#3	#2	#1	#0
3707							P22	P21

[Data type] Bit

P22 and P21   Gear ratio of spindle to second position coder

Magnification	P22	P21
×1	0	0
×2	0	1
×4	1	0
×8	1	1

$$\text{Magnification} = \frac{\text{Number of spindle revolutions}}{\text{Number of position coder revolutions}}$$

	#7	#6	#5	#4	#3	#2	#1	#0
3708				SVD			SAT	SAR
								SAR

[Data type] Bit

SAR The spindle speed arrival signal is:

0 : Not checked
1 : Checked

SAT Check of the spindle speed arrival signal at the start of executing the thread cutting block

0 : The signal is checked only when SAR, #0 of parameter 3708, is set.
1 : The signal is always checked irrespective of whether SAR is set.

> **NOTE**
> When thread cutting blocks are consecutive, the spindle speed arrival signal is not checked for the second and subsequent thread cutting blocks.

SVD When the SIND signal is on, the detection of spindle speed fluctuation is:

0 : Disabled
1 : Enabled

	#7	#6	#5	#4	#3	#2	#1	#0
3709					MRS	MSI		SAM

[Data type] Bit

SAM The sampling frequency to obtain the average spindle speed

0 : 4 (Normally, set to 0.)
1 : 1

MSI In multi–spindle control, the SIND signal is valid

0 : Only when the first spindle is valid (SIND signal for the 2nd, 3rd spindle becomes ineffective)
1 : For each spindle irrespective of whether the spindle is selected (Each spindle has its own SIND signal).

MRS Actual spindle speed signals and S 12–bit code signals to be output when multi–spindle control is performed

0 : Signals common to the first and second spindles are used, and the signals for the spindle selected by the spindle selection signal are output.
1 : Separate signals are output to the first and second spindles.

Signal	When MRS is 0	When MRS is 1
Actual spindle speed signals AR0 to AR15 (F040, F041)	First spindle Second spindle	First spindle
S 12–bit code signals R01O to R12O (F036, F037)	First spindle Second spindle	First spindle
Actual spindle speed signals AR20 to AR215 (F206, F207)	–	Second spindle
S12–bit code signals R01O2 to R12O2 (F204, F205)	–	Second spindle

	#7	#6	#5	#4	#3	#2	#1	#0
3715								NSAx

[Data type] Bit axis

NSAx This parameter specifies an axis for which confirmation of the spindle speed reached signal (SAR) is unnecessary when a move command is executed for the axis. When a move command is issued only for an axis for which 1 is set in this parameter, the spindle speed reached signal (SAR) is not checked.

3730	Data used for adjusting the gain of the analog output of spindle speed

[Data type] Word

[Unit of data] 0.1 %

[Valid data range] 700 to 1250

Set data used for adjusting the gain of the analog output of spindle speed.

[Adjustment method]

(1) Assign standard value 1000 to the parameter.
(2) Specify the spindle speed so that the analog output of the spindle speed is the maximum voltage (10 V).
(3) Measure the output voltage.
(4) Assign the value obtained by the following equation to parameter No.3730.

$$\textbf{Set value} = \frac{\textbf{10 (V)}}{\textbf{Measured data (V)}} \times \textbf{1000}$$

(5) After setting the parameter, specify the spindle speed so that the analog output of the spindle speed is the maximum voltage. Confirm that the output voltage is 10V.

> **NOTE**
> This parameter needs not to be set for serial spindles.

3731	Compensation value for the offset voltage of the analog output of the spindle speed

[Data type] Word

[Unit of data] Velo

[Valid data range] –1024 to +1024

Set compesation value for the offset voltage of the analog output of the spindle speed.
Set value = –8191 × Offset voltage (V)/12.5

[Adjustment method]

(1) Assign standard value 0 to the parameter.

(2) Specify the spindle speed so that the analog output of the spindle speed is 0.

(3) Measure the output voltage.

(4) Assign the value obtained by the following equation to parameter No.3731.

$$\text{Set value} = \frac{-8191 \times \textbf{Offset voltage (V)}}{12.5}$$

(5) After setting the parameter, specify the spindle speed so that the analog output of the spindle speed is 0. Confirm that the output voltage is 0V.

> **NOTE**
> This parameter need not to be set for serial spindles.

3732	The spindle speed during spindle orientation or the spindle motor speed during spindle gear shift

[Data type] 2–word

[Valid data range] 0 to 20000

Set the spindle speed during spindle orientation or the spindle motor speed during gear shift.

When GST, #1 of parameter 3705, is set to 0, set the spindle speed during spindle orientation in rpm.

When GST, #1 of parameter 3705, is set to 1, set the spindle motor speed during spindle gear shift calculated from the following formula.

For a serial spindle

$$\text{Set value} = \frac{\textbf{Spindle motor speed during spindle gear shift}}{\textbf{Maximum spindle motor speed}} \times \textbf{16383}$$

For an analog spindle

$$\text{Set value} = \frac{\textbf{Spindle motor speed during spindle gear shift}}{\textbf{Maximum spindle motor speed}} \times \textbf{4095}$$

3735	Minimum clamp speed of the spindle motor

[Data type] Word

[Valid data range] 0 to 4095

Set the minimum clamp speed of the spindle motor.

$$\text{Set value} = \frac{\textbf{Minimum clamp speed of the spindle motor}}{\textbf{Maximum spindle motor speed}} \times \textbf{4095}$$

3736	Maximum clamp speed of the spindle motor

[Data type] Word

[Valid data range] 0 to 4095

Set the maximum clamp speed of the spindle motor.

$$\text{Set value} = \frac{\textbf{Maximum clamp speed of the spindle motor}}{\textbf{Maximum spindle motor speed}} \times \textbf{4095}$$
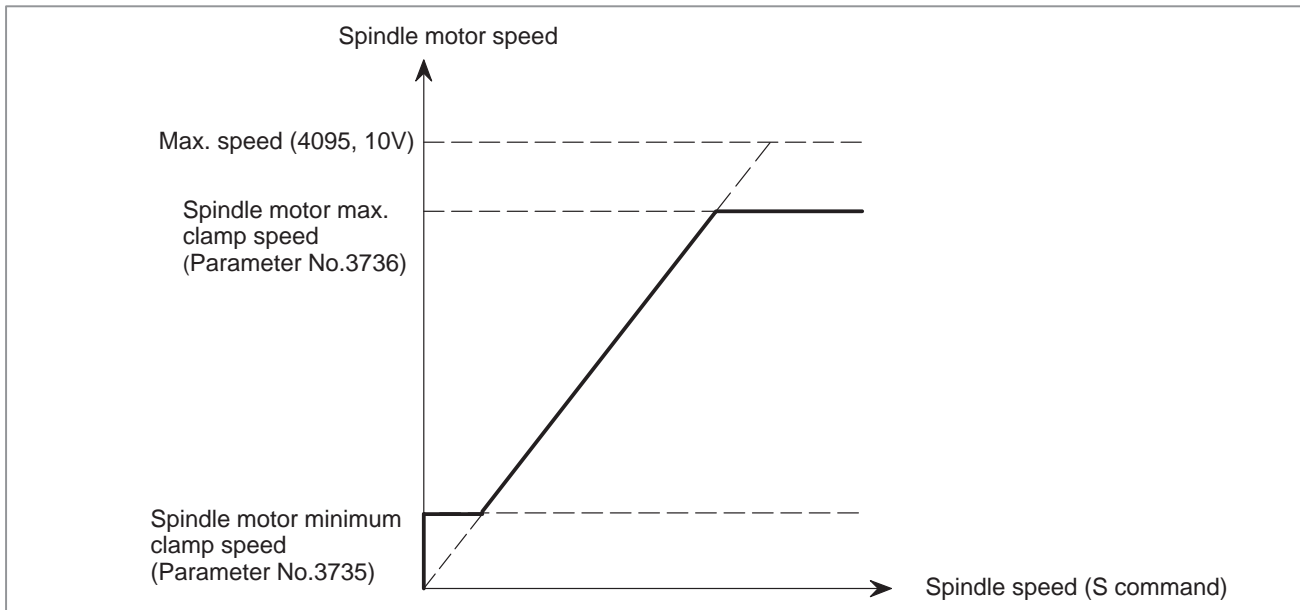
Fig. 4.17 (a) Maximum clamp speed of spindle motor

3740	Time elapsed prior to checking the spindle speed arrival signal

[Data type] Byte

[Unit of data] msec

[Valid data range] 0 to 225

Set the time elapsed from the execution of the S function up to the checking of the spindle speed arrival signal.

3741	Maximum spindle speed for gear 1
3742	Maximum spindle speed for gear 2
3743	Maximum spindle speed for gear 3
3744	Maximum spindle speed for gear 4

[Data type] Word

[Unit of data] rpm

[Valid data range] 0 to 32767

Set the maximum spindle speed corresponding to each gear.
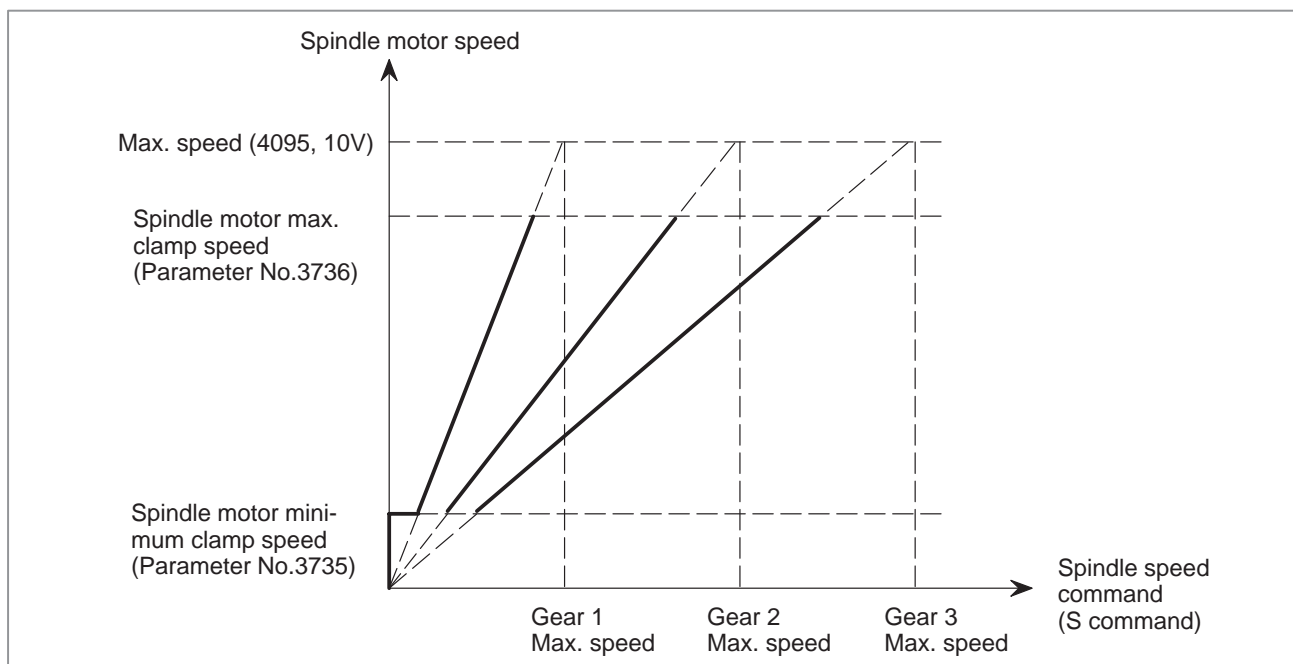
Fig. 4.17 (b) Maximum spindle speed corresponding to gear 1/2/3

3751	
	Spindle motor speed when switching from gear 1 to gear 2

3752	
	Spindle motor speed when switching from gear 2 to gear 3

[Data type] Word

[Valid data range] 0 to 4095

For gear switching method B, set the spindle motor speed when the gears are switched.

$$\textbf{Set value} = \frac{\textbf{Spindle motor speed when the gears are switched}}{\textbf{Maximum spindle motor speed}} \times \textbf{4095}$$
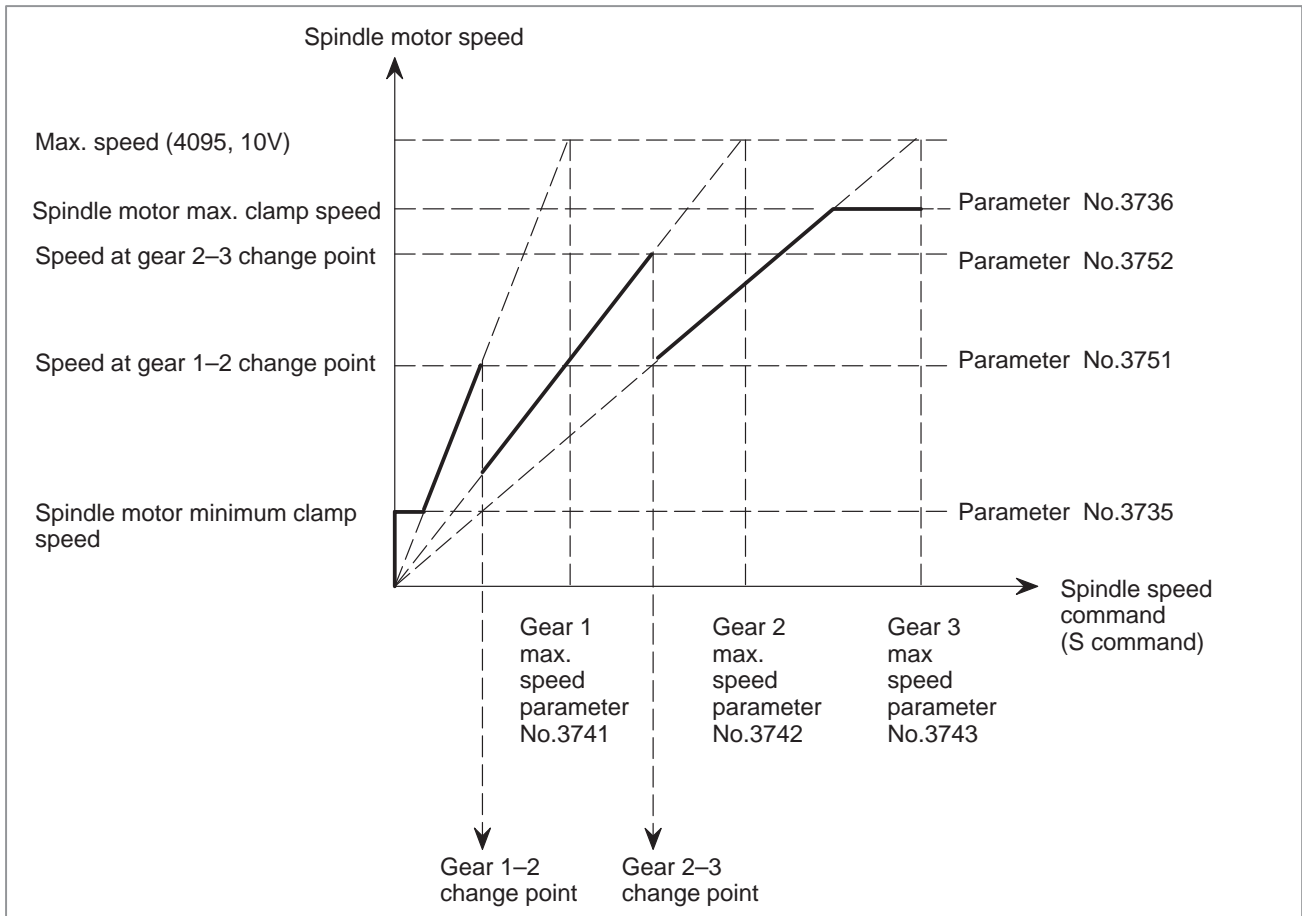
Fig. 4.17 (c) Spindle motor speed at gear 1–2/2–3 change point

3761	
	Spindle speed when switching from gear 1 to gear 2 during tapping

3762	
	Spindle speed when switching from gear 2 to gear 3 during tapping

[Data type] Word

[Unit of data] rpm

[Valid data range] 0 to 32767

When method B is selected (SGT,#3 of parameter 3705, is set to 1) for the tapping cycle gear switching method, set the spindle speed when the gears are switched.
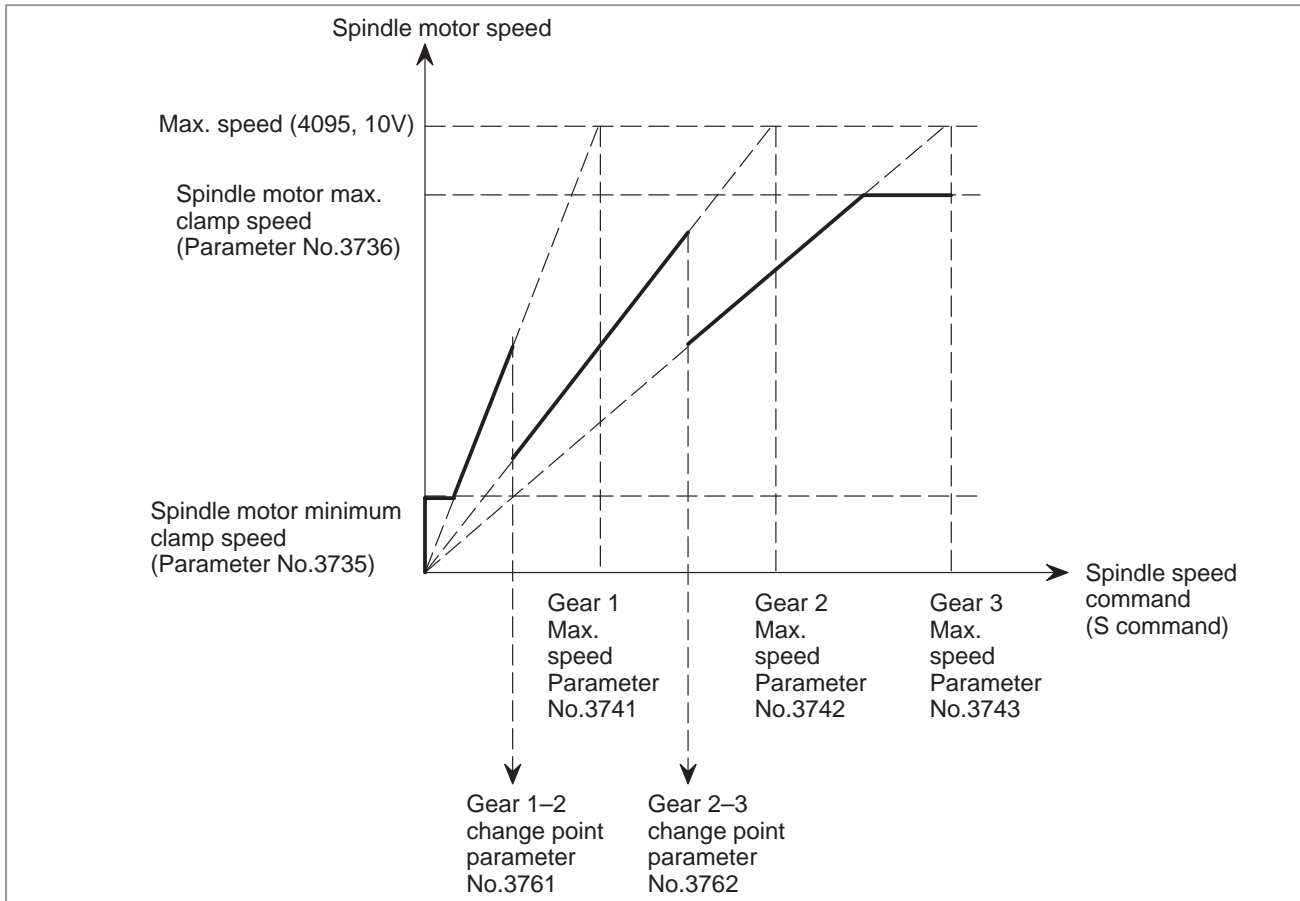
Fig. 4.17 (d) Spindle motor speed at gear 1–2/2–3 change point during tapping

3770	
	Axis as the calculation reference in constant surface speed control

[Data type] Byte

[Valid data range] 1, 2, 3, ..., number of control axes

Set the axis as the calculation reference in constant surface speed control.

> **NOTE**
> When 0 is set, constant surface speed control is always applied to the X–axis. In this case, specifying P in a G96 block has no effect on the constant surface speed control.

3771	Minimum spindle speed in constant surface speed control mode (G96)

[Data type] Word
[Unit of data] rpm
[Valid data range] 0 to 32767

Set the minimum spindle speed in the constant surface speed control mode (G96).
The spindle speed in constant surface speed control is clamped to the speed given by parameter 3771.

3772	Maximum spindle speed

[Data type] Word
[Unit of data] rpm
[Valid data range] 0 to 32767

This parameter sets the maximum spindle speed.
When a command specifying a speed exceeding the maximum speed of the spindle is specified , or the speed of the spindle exceeds the maximum speed because of the spindle speed override function, the spindle speed is clamped at the maximum speed set in the parameter.

NOTE
1 In the M series, this parameter is valid when the constant surface speed control option is selected.
2 When the constant surface speed control option is selected, the spindle speed is clamped at the maximum speed, regardless of whether the G96 mode or G97 mode is specified.
3 When 0 is set in this parameter, the speed of the spindle is not clamped.
4 When spindle speed command control is applied using the PMC, this parameter has no effect, and the spindle speed is not clamped.
5 When the multi–spindle control option is selected (T series), set the maximum speed for each spindle in the following parameters:
   Parameter No.3772: Sets the maximum speed for the first spindle.
   Parameter No.3802:   Sets the maximum speed for the second spindle.
   Parameter No.3822: Sets the maximum speed for the third spindle.

3802	Maximum speed of the second spindle

[Data type] Word
[Unit of data] rpm
[Valid data range] 0 to 32767

Parameter sets the maximum speed for the second spindle.
When a command specifying a speed exceeding the maximum speed of the spindle is specified, or the speed of the spindle exceeds the maximum speed because of the spindle speed override function, the spindle speed is clamped at the maximum speed set in the parameter.

> **NOTE**
> 1 This parameter is valid when the multi–spindle control option is selected.
> 2 When the constant surface speed control option is selected, the spindle speed is clamped at the specified maximum speed, regardless of whether the G96 mode or G97 mode is specified.
> 3 When 0 is set in this parameter, the setting of parameter No.3772 for the first spindle is used.
> When 0 is set in parameter No.3772, the spindle speed is not clamped.
> 4 When spindle speed command control is applied using the PMC, this parameter has no effect, and the spindle speed is not clamped.

3811	Maximum spindle speed for gear 1 of the second spindle

3812	Maximum spindle speed for gear 2 of the second spindle

[Data type] Word

[Unit of data] rpm

[Valid data range] 0 to 32767

Set the maximum spindle speed for each gear of the second spindle.

> **NOTE**
> These parameters are used for the multi–spindle control.

3820	Data for adjusting the gain of the analog output of the third–spindle speed

[Data type] Word

[Unit of data] 0.1%

[Valid data range] 700 to 1250

Set the data used for adjusting the gain of the analog output of the third spindle speed.

> **NOTE**
> This parameter is used for controlling the multi–spindles.

3821	Offset–voltage compensation value of the analog output of the third–spindle speed

[Data type] Word

[Unit of data] Velo

[Valid data range] –1024 to 1024

Set the offset–voltage compensation value of the analog output of the third–spindle speed.

> **NOTE**
> This parameter is used for controlling the multi–spindles.

3822	Maximum speed of the third spindle

[Data type] Word

[Unit of data] rpm

[Valid data range] 0 to 32767

This parameter sets the maximum speed for the third spindle.

When a command specifying a speed exceeding the maximum spindle speed is specified, or the spindle speed exceeds the maximum speed because of the spindle speed override function, the spindle speed is clamped at the maximum speed set in the parameter.

> **NOTE**
> 1 This parameter is valid when the multi–spindle control option is selected.
> 2 When the constant surface speed control option is selected, the spindle speed is clamped at the specified maximum speed, regardless of whether the G96 mode or G97 mode is set.
> 3 When 0 is set in this parameter, the setting of parameter No.3772 for the first spindle is used. When 0 is set in parameter No.3772, the spindle speed is not clamped.
> 4 When spindle speed command control is applied using the PMC, this parameter has no effect, and the speed of the spindle is not clamped.

3831	Maximum spindle speed for gear 1 of the third spindle

3832	Maximum spindle speed for gear 2 of the third spindle

[Data type] Word

[Unit of data] rpm

[Valid data range] 0 to 32767

Set the maximum spindle speed for each gear of the third spindle.

> **NOTE**
> These parameters are used for the multi–spindle control.

Table 4.17 (a) Parameters for control of serial interface spindle Cs contouring control axis

No.	Data type		Description
3900	Byte	First group for the first spindle	Number of the servo axis whose loop gain is to be changed according to the set values of parameters 3901 to 3904 when the Cs contouring axis is controlled (set values 0 to 8)
3901	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 1 selection
3902	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 2 selection
3903	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 3 selection
3904	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 4 selection
3910	Byte	Second group for the first spindle	Number of the servo axis whose loop gain is to be changed according to the set values of parameters 3911 to 3914 when the Cs contouring axis is controlled (set values 0 to 8)
3911	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 1 selection
3912	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 2 selection
3913	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 3 selection
3914	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 4 selection
3920	Byte	Third group for the first spindle	Number of the servo axis whose loop gain is to be changed according to the set values of parameters 3921 to 3924 when the Cs contouring axis is controlled (set values 0 to 8)
3921	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 1 selection
3922	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 2 selection
3923	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 3 selection
3924	Word		Loop gain for the servo axis when the Cs contouring axis is controlled for spindle gear 4 selection

<Setting method>

First, select servo axes which perform interpolation with the Cs contouring axis. (Up to five axes can be selected.)

When there is no servo axis for interpolation with the Cs contouring axis, set the parameters 3900, 3910, 3920, 3930, and 3940 to 0 to terminate parameter setting.

When there are servo axes for interpolation with the Cs contouring axis, the parameters must be set according to the procedure below for each axis.

(1) Set the number of a servo axis (1 to 8) for interpolation with the Cs contouring axis in parameters 39n0 (n = 0, 1, 2, 3, and 4).

(2) Set loop gain values of the servo axis specified in NO TAG above which is used when the Cs contouring axis is controlled in parameters 39n1, 39n2, 39n3, and 39n4. (There are four stages for main gears used.)

(3) When the number of specified servo axes is less than 5, set the remaining parameters (39n0) to 0 to terminate parameter setting. When the number of a Cs contouring axis is set to parameter 39n0, the parameter is assumed to be set to 0.

> **NOTE**
>   The loop gain used for Cs contouring control is selected
>   when the mode changes from the spindle mode to the Cs
>   contouring axis control mode according to the gears set at
>   this time.
>   If gears are switched in the Cs contouring axis control mode,
>   the loop gain cannot be changed.

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (1/7)

No.	Data type	Description
4000	Bit	Bit parameter
4001	Bit	Bit parameter
4002	Bit	Bit parameter
4003	Bit	Bit parameter
4004	Bit	Bit parameter
4005	Bit	Bit parameter
4006	Bit	Bit parameter
4007	Bit	Bit parameter
4008	Bit	Bit parameter
4008	Bit	Bit parameter
4009	Bit	Bit parameter
4010	Bit	Bit parameter
4011	Bit	Bit parameter
4012	Bit	Bit parameter
4013	Bit	Bit parameter
4014	Bit	Bit parameter
4015	Bit	Bit parameter (Cannot be changed by the user. See Note 1.)
4016	Bit	Bit parameter
4017	Bit	Bit parameter
4018	Bit	Bit parameter
4019	Bit	Bit parameter (for setting parameters automatically. See Note 2.)
4020	Word	Maximum motor speed
4021	Word	Maximum speed when the C axis is controlled
4022	Word	Speed arrival detection level
4023	Word	Speed detection level
4024	Word	Speed zero detection level
4025	Word	Torque limit value
4026	Word	Load detection level 1
4027	Word	Load detection level 2
4028	Word	Output limit pattern
4029	Word	Output limit value
4030	Word	Soft start/stop time
4031	Word	Position coder method orientation stop position
4032	Word	Acceleration/deceleration time constant when the spindle synchronization is controlled
4033	Word	Arrival level for the spindle synchronization speed
4034	Word	Shift amount when the spindle phase synchronization is controlled
4035	Word	Spindle phase synchronization compensation data
4036	Word	Feed forward factor
4037	Word	Velocity loop feed forward factor
4038	Word	Orientation speed
4039	Word	Slip compensation gain
4040	Word	Normal velocity loop proportional gain (HIGH)
4041	Word	Normal velocity loop proportional gain (LOW)
4042	Word	Velocity loop proportional gain during orientation (HIGH)
4043	Word	Velocity loop proportional gain during orientation (LOW)
4044	Word	Velocity loop proportional gain in servo mode/synchronous control (HIGH)
4045	Word	Velocity loop proportional gain in servo mode/synchronous control (LOW)
4046	Word	Velocity loop proportional gain when the C axis is controlled (HIGH)
4047	Word	Velocity loop proportional gain when the C axis is controlled (LOW)
4048	Word	Normal velocity loop integral gain (HIGH)
4049	Word	Normal velocity loop integral gain (LOW)

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (2/7)

No.	Data type	Description
4050	Word	Velocity loop integral gain during orientation (HIGH)
4051	Word	Velocity loop integral gain during orientation (LOW)
4052	Word	Velocity loop integral gain in servo mode/synchronous control (HIGH)
4053	Word	Velocity loop integral gain in servo mode/synchronous control (LOW)
4054	Word	Velocity loop integral gain when the C axis is controlled (HIGH)
4055	Word	Velocity loop integral gain when the C axis is controlled (LOW)
4056	Word	Gear ratio (HIGH)
4057	Word	Gear ratio (MEDIUM HIGH)
4058	Word	Gear ratio (MEDIUM LOW)
4059	Word	Gear ratio (LOW)
4060	Word	Position gain during orientation (HIGH)
4061	Word	Position gain during orientation (MEDIUM HIGH)
4062	Word	Position gain during orientation (MEDIUM LOW)
4063	Word	Position gain during orientation (LOW)
4064	Word	Position gain change ratio when orientation is completed
4065	Word	Position gain in servo mode/synchronous control (HIGH)
4066	Word	Position gain in servo mode/synchronous control (MEDIUM HIGH)
4067	Word	Position gain in servo mode/synchronous control (MEDIUM LOW)
4068	Word	Position gain in servo mode/synchronous control (LOW)
4069	Word	Position gain when the C axis is controlled (HIGH)
4070	Word	Position gain when the C axis is controlled (MEDIUM HIGH)
4071	Word	Position gain when the C axis is controlled (MEDIUM LOW)
4072	Word	Position gain when the C axis is controlled (LOW)
4073	Word	Grid shift amount in servo mode
4074	Word	Reference position return speed in Cs contouring control mode or servo mode
4075	Word	Orientation completion signal detection level
4076	Word	Motor velocity limit value during orientation
4077	Word	Orientation stop position shift amount
4078	Word	MS signal constant = (L/2)/(2 x π x H) x 4096
4079	Word	MS signal gain adjustment
4080	Word	Regenerative power limit
4081	Word	Delay time prior motor power shut–off
4082	Word	Acceleration/deceleration time setting
4083	Word	Motor voltage during normal rotation
4084	Word	Motor voltage during orientation
4085	Word	Motor voltage in servo mode/synchronous control
4086	Word	Motor voltage when the C axis is controlled
4087	Word	Over–speed detection level
4088	Word	Excessive velocity deviation detection level when the motor is constrained
4089	Word	Excessive velocity deviation detection level when the motor is rotated
4090	Word	Overload detection level
4091	Word	Position gain change ratio when returning to the origin in the servo mode
4092	Word	Position gain change ratio when returning to the origin in C axis control
4093	Word	Reserved
4094	Word	Disturbance torque compensation constant (Acceleraton feedback gain)
4095	Word	Speed meter output voltage adjustment value
4096	Word	Load meter output voltage adjustment value
4097	Word	Spindle velocity feedback gain
4098	Word	Maximum speed at which position coder signal can be detected
4099	Word	Delay time for energizing the motor
4100	Word	Base velocity of the motor output specification
4101	Word	Limit value for the motor output specification
4102	Word	Base speed
4103	Word	Magnetic flux weakening start velocity
4104	Word	Current loop proportional gain during normal operation
4105	Word	Current loop proportional gain when the C axis is controlled
4106	Word	Current loop integral gain during normal operation
4107	Word	Current loop integral gain when the C axis is controlled
4108	Word	Zero point of current loop integral gain
4109	Word	Current loop proportional gain velocity factor

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (3/7)

No.	Data type	Description
4110	Word	Current conversion constant
4111	Word	Secondary current factor for exciting current
4112	Word	Current expectation constant
4113	Word	Slip constant
4114	Word	High–speed rotation slip compensation constant
4115	Word	Compensation constant of voltage applied to motor in the dead zone
4116	Word	Electromotive force compensation constant
4117	Word	Electromotive force phase compensation constant
4118	Word	Electromotive force compensation velocity factor
4119	Word	Time constant of voltage filter for electromotive force compensation
4120	Word	Dead zone compensation data
4121	Word	Time constant for changing the torque
4122	Word	Velocity filter
4123	Word	Overload detection time setting
4124	Word	Voltage compensation factor during deceleration
4125	Word	Timer during automatic running
4126	Word	Velocity command during automatic running
4127	Word	Load meter displayed value for maximum output
4128	Word	Maximum output zero point
4129	Word	Secondary current factor during rigid tapping
4130	Word	Constant for compensating for the phase of the electromotive force at deceleration
4131	Word	Time constant of the speed detection filter at the Cs contour control
4132	Word	Conversion constant of the phase–V current
4133	Word	Motor model code
4134	2–Word	Reserved
4135	2–Word	Grid shift amount when the C axis is controlled
4136	Word	Motor voltage during normal rotation
4137	Word	Motor voltage in the servo mode/synchronous control mode
4138	Word	Base speed of the motor output specifications
4139	Word	Limit value for the motor output specifications
4140	Word	Base speed
4141	Word	Magnetic flux weakening start velocity
4142	Word	Current loop proportional gain during normal operation
4143	Word	Current loop integral gain during normal operation
4144	Word	Zero point of the current loop integral gain
4145	Word	Velocity factor of the current loop proportional gain
4146	Word	Current conversion constant
4147	Word	Secondary current factor for activating current
4148	Word	Current expectation constant
4149	Word	Slip constant
4150	Word	High–speed rotation slip compensation constant
4151	Word	Compensation constant for voltage applied to motor in the dead zone
4152	Word	Electromotive force compensation constant
4153	Word	Electromotive force phase compensation constant
4154	Word	Velocity factor of the electromotive force compensation
4155	Word	Voltage compensation factor during deceleration
4156	Word	Slip compensation gain
4157	Word	Time constant for changing the torque
4158	Word	Maximum output zero point
4159	Word	Secondary current factor during rigid tapping
4160	Word	Hysteresis of the speed detection level
4161	Word	Constant for compensating for the phase of the electromotive for at deceleration
4162	Word	Velocity loop integral gain (HIGH) in Cs contour control cutting feed
4163	Word	Velocity loop integral gain (LOW) in Cs contour control cutting feed
4164	Word	Conversion constant of phase–V current
4165	Word	Time constant of voltage filter for eletromotive force compensation
4166	Word	Regenerative power limit
4167	Word	Reserved
4168	Word	Overload current alarm detection level (for low speed characteristic)
4169	Word	Overload current alarm detection time constant

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (4/7)

No.	Data type	Description
4170	Word	Overload current alarm detection level (for high speed characteristic)
4171	Word	Arbitrary gear data between spindle and Position coder (HIGH No.of teeth on the spindle)
4172	Word	Arbitrary gear data between spindle and position coder (HIGH No.of teeth on PC)
4173	Word	Arbitrary gear data between spindle and position coder (LOW No.of teeth on spindle)
4174	Word	Arbitrary gear data between spindle and position coder (LOW No.of teeth on PC)
4175	Word	Delay timer at ON of electromagnetic contactor in unit (S series) Spindle analog override zero level (α series)
4176	Bit	Bit parameter
4177	Bit	Bit parameter
4178	Bit	Bit parameter
4179	Bit	Bit parameter
4180	Bit	Bit parameter
4181	Bit	Bit parameter
4182	Bit	Bit parameter
4183	Bit	Bit parameter
4184	Bit	Bit parameter
4185	Bit	Bit parameter
4186	Bit	Bit parameter
4187	Bit	Bit parameter
4188	Bit	Bit parameter
4189	Bit	Bit parameter
4190	Bit	Bit parameter
4192	Bit	Bit parameter
4193	Bit	Bit parameter
4194	Bit	Bit parameter
4195	Bit	Bit parameter
4196	Word	Maximum motor speed
4197	Word	Reached speed level
4198	Word	Speed detection level
4199	Word	Speed zero detection level
4200	Word	Torque limit value
4201	Word	Load detection level 1
4202	Word	Output limit pattern
4203	Word	Output limit value
4204	Word	Position coder method orientation stop position
4205	Word	Orientation speed
4206	Word	Proportional gain (HIGH) of the normal velocity loop
4207	Word	Proportional gain (LOW) of the normal velocity loop
4208	Word	Velocity loop proportional gain during orientation (HIGH)
4209	Word	Velocity loop proportional gain during orientation (LOW)
4210	Word	Velocity loop proportional gain in the servo mode (HIGH)
4211	Word	Velocity loop proportional gain in the servo mode (LOW)
4212	Word	Normal velocity loop integral gain
4213	Word	Velocity loop integral gain during orientation
4214	Word	Velocity loop integral gain in the servo mode (HIGH)
4215	Word	Reserved
4216	Word	Gear ratio (HIGH)
4217	Word	Gear ratio (LOW)
4218	Word	Position gain during orientation (HIGH)
4219	Word	Position gain during orientation (LOW)
4220	Word	Position gain change ratio when orientation is completed
4221	Word	Position gain in the servo mode (HIGH)
4222	Word	Position gain in the servo mode (LOW)
4223	Word	Grid shift amount in the servo mode
4224	Word	Reserved
4225	Word	Reserved
4226	Word	Detection level of orientation completion signal
4227	Word	Motor velocity limit value during orientation
4228	Word	Shift amount of orientation stop position
4229	Word	MS signal constant = (L/2)/(2 x π x H) x 4096

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (5/7)

No.	Data type	Description
4230	Word	MS signal gain adjustment
4231	Word	Regenerative power limit
4232	Word	Delay time up to motor power shut–off
4233	Word	Acceleration/deceleration time setting
4234	Word	Spindle load monitor observer gain 1
4235	Word	Spindle load monitor observer gain 2
4236	Word	Motor voltage during normal rotation
4237	Word	Motor voltage during orientation
4238	Word	Motor voltage in the servo mode
4239	Word	Position gain change ratio when returning to the origin in the servo mode
4240	Word	Feed forward coefficient
4241	Word	Feed forward coefficient in velocity loop
4242	Word	Reserved
4243	Word	Arbitrary gear data between spindle and position coder (SUB/HIGH No.of teeth on spindle)
4244	Word	Arbitrary gear data between spindle and position coder (SUB/HIGH No.of teeth on PC)
4245	Word	Arbitrary gear data between spindle and position coder (SUB/LOW No.of teeth on spindle)
4246	Word	Arbitrary gear data between spindle and position coder (SUB/LOW No.of teeth on PC)
4247	Word	Word Spindle load monitor magnetic flux compensation time constant (for high–speed characteristic on the MAIN side)
4248	Word	Word Spindle load motor torque constant (for high–speed characteristic on the MAIN side)
4249	Word	Word Spindle load monitor observer gain 1 (on the MAIN side)
4250	Word	Word Spindle load monitor observer gain 2 (on the MAIN side)
4251	Word	Word Spindle load monitor magnetic flux compensation time constant (for low–speed characteristic on the MAIN side)
4252	Word	Word Spindle load monitor magnetic flux compensation time constant (for high–speed characteristic)
4253	Word	Word Spindle load monitor magnetic flux compensation time constant (for low–speed characteristic)
4254	Word	Word Slip correction gain (for high–speed characteristic)
4255	Word	Word Slip correction gain (for low–speed characteristic)
4256	Word	Base velocity of the motor output specifications
4257	Word	Limit value for the motor output specifications
4258	Word	Base speed
4259	Word	Magnetic flux weakening start velocity
4260	Word	Current loop proportional gain during normal operation
4261	Word	Current loop integral gain during normal operation
4262	Word	Zero point of current loop integral gain
4263	Word	Velocity factor of current loop proportional gain
4264	Word	Current conversion constant
4265	Word	Secondary current factor for excitation current
4266	Word	Current expectation constant
4267	Word	Slip constant
4268	Word	Compensation constant for high–speed rotation slip
4269	Word	Compensation constant for voltage applied to motor in the dead zone
4270	Word	Electromotive force compensation constant
4271	Word	Phase compensation constant of electromotive force
4272	Word	Compensation velocity factor for electromotive force
4273	Word	Time constant for changing the torque
4274	Word	Displayed value of load meter for maximum output
4275	Word	Maximum output zero point
4276	Word	Secondary current factor in rigid tapping
4277	Word	Constant for compensating for the phase of the electromotive force at deceleration
4278	Word	Time constant of the speed detection filter
4279	Word	Reserved

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (6/7)

No.	Data type	Description
4280	Word	Time constant of voltage filter for electromotive force compensation
4281	Word	Word Spindle load monitor torque constant (for low–speed characteristic on the MAIN side)
4282	Word	Word Spindle load monitor torque constant (for high–speed characteristic)
4283	Word	Word Spindle load monitor torque constant (for low–speed characteristic)
4284	Word	Motor voltage during normal rotation
4285	Word	Motor voltage in the servo mode
4286	Word	Base speed of the motor output specifications
4287	Word	Limit value for the motor output specifications
4288	Word	Base speed
4289	Word	Magnetic flux weakening start velocity
4290	Word	Current loop proportional gain during normal operation
4291	Word	Current loop integral gain during normal operation
4292	Word	Zero point of current loop integral gain
4293	Word	Velocity factor of current loop proportional gain
4294	Word	Current conversion constant
4295	Word	Secondary current factor for excitation current
4296	Word	Current expectation constant
4297	Word	Slip constant
4298	Word	Compensation constant for high–speed rotation slip
4299	Word	Compensation constant for voltage applied to motor in the dead zone
4300	Word	Electromotive force compensation constant
4301	Word	Phase compensation constant for electromotive force
4302	Word	Compensation velocity factor for electromotive force
4303	Word	Time constant for changing the torque
4304	Word	Maximum output zero point
4305	Word	Secondary current factor in rigid tapping
4306	Word	Constant for compensating for the phase of the electromotive force at deceleration
4307	Word	Limit of regenerative power
4308	Word	Time constant of voltage filter for electromotive voltage compensation
4309	Word	Motor model code
4310	2–word	Reserved
4311	2–word	Reserved
4312	Word	Position coder method orientation end signal width 2 (MAIN)
4313	Word	Magnetic sensor method orientation end signal width 1 (MAIN)
4314	Word	Magnetic sensor method orientation end signal width 2 (MAIN)
4315	Word	Magnetic sensor method orientation stop position shift amount (MAIN)
4316	Word	Position coder method orientation end signal width 2 (SUB)
4317	Word	Magnetic sensor method orientation end signal width 1 (SUB)
4318	Word	Magnetic sensor method orientation end signal width 2 (SUB)
4319	Word	Magnetic sensor method orientation stop position shift amount (SUB)
4320	Word	Spindle orientation deceleration constant (MAIN/HIGH)
4321	Word	Spindle orientation deceleration constant deceleration (MAIN/MEDIUM HIGH)
4322	Word	Spindle orientation deceleration constant deceleration (MAIN/MEDIUM LOW)
4323	Word	Spindle orientation deceleration constant deceleration (MAIN/LOW)
4324	Word	Spindle orientation deceleration constant deceleration (SUB/HIGH)
4325	Word	Spindle orientation deceleration constant deceleration (SUB/LOW)
4326	Word	Width of pulses when switching to the spindle orientation control mode (MAIN)
4327	Word	Width of pulses when switching to the spindle orientation control mode (SUB)
4328	Word	Word Position coder–based spindle orientation command multiplication (MAIN)
4329	Word	Word Position coder–based spindle orientation command multiplication (SUB)
4330	Word	Word Motor excitation delay time at spindle orientation (MAIN)
4331	Word	Word Motor excitation delay time at spindle orientation (SUB)
4332	Word	Reserved
4333	Word	Reserved
4334	Word	No.of arbitrary pulses of speed detector (MAIN)
4335	Word	No.of arbitrary pulses of speed detector (SUB)
4336	Word	Magnetic flux change point for spindle synchronus acc./dec/ time calculation.
4337	Word	Velocity compensation factor of velocity loop gain (MAIN)
4338	Word	Velocity compensation factor of velocity loop gain (SUB)
4339	Word	Word Torque clamp level

Table 4.17 (b) Parameters for serial interface spindle amplifier (α series, S series) (7/7)

No.	Data type	Description
4340	Word	Word Bell–shaped acceleration/deceleration time constant for spindle synchronization
4341	Word	Word Abnormal load detection level
4342	Word	Reserved
4343	Word	N pulse suppress
4344	Word	Loock–ahead feed forward coefficient
4345	Word	Word Spindle motor speed command detection level
4346	Word	Incomplete integral coefficient
4347	Word	Word Detection level for spindle 1–to–2 speed difference at slave operation
4348	Word	Overload current alarm detection level (for low speed characteristic)
4349	Word	Overload current alarm detection time constant
4350	Word	Overload current alarm detection level (for high speed characteristic)
4351	Word	Compensation for current detection offset

Notes on parameters of the spindle amplifier with the serial interface

---

NOTE

1 Among the parameters of the spindle amplifier with the serial interface, parameters Nos. 4015 and 4191 cannot be changed by the users.
  These parameters require to assign optional software to the CNC and are automatically set depending on the type of the software.

2 To set the parameters of the spindle amplifier with the serial interface automatically, set #7 of parameter No.4019 (if the sub spindle is set in the CNC with the spindle switching function, use parameter No.4195) to 1, assign the model code of the motor to be used to parameter No.4133 (if the sub spindle is set in the CNC with the spindle switching function, use parameter No.4309), turn off the power of the CNC and spindle amplifier, and restart the CNC and spindle amplifier.

3 Parameters No.4000 to No.4351 are used in the processing on the spindle amplifier. See FANUC AC SPINDLE MOTOR α series PARAMETER MANUAL (B–65150E) and FANUC AC SPINDLE SERVO UNIT serial interface S series MAINTENANCE MANUAL (B–65045E).

4 The CNC can control up to two spindle amplifier with the serial interface.
  Up to three spindle amplifiers can be controlled in the Series 16 performing single–path control. When the spindle control amplifier provides the spindle switching function, one spindle amplifier can control two spindle motors using the switching function.
  The output switching function can be used in spindle motors to be connected.
  Up to four spindles, or eight types, (or, for the Series 16 performing single–path control, up to six spindles, or 12 types) can be used by switching the spindle motors. (The number of spindles that can controlled simultaneously is the same as the number of spindle amplifiers, that is two spindles (or, for the Series 6 performing single–path control, three spindles).) Parameters of the spindle amplifier with the serial interface correspond to the above functions as follows:
  (1) Parameter No.4000 to No.4351 "S1": First spindle amplifier
     Parameter No.4000 to No.4351 "S2": Second spindle amplifier
     Parameter No.4000 to No.4351 "S3": Third spindle amplifier
  (2) Parameter No.4000 to No.4175 "S1"/"S2"/"S3": When the spindle switching function is not provided, or for the main spindle in the spindle amplifier when the function is provided.
     Parameter No.4176 to No.4351 "S1"/"S2"/"S3": For the sub spindle in the spindle amplifier when the spindle switching function is provided.
  (3) Parameters at low speed when the output switching function is provided.
     Parameters No.4136 to No.4175 "S1"/"S2"/"S3": When the spindle switching function is not provided, or for the main spindle when the function is provided.
     Parameters No.4284 to No.4351 "S1"/"S2"/"S3": For the sub spindle when the spindle switching function is provided.

5 The CNC stores the parameters of the spindle amplifier with the serial interface. The CNC sends them to the spindle amplifier at the system power on and they are used in the unit.
  These parameters are sent from the CNC to the spindle amplifier in a batch when:
  – The CNC is switched on.
  – The serial spindle is restarted by a reset that is carried out after spindle communication alarm 749 occurs (because the spindle control unit is switched off or because of noise).
  If these parameters are rewritten, they are sent from the CNC to the spindle amplifier sequentially when:
  – The parameters have been entered from the MDI.
  – The parameters have been entered as programmable (G10).
  – The parameters have been entered via the reader/punch interface.
  To set parameters automatically, upload parameters corresponding to the motor model from the spindle amplifier to the CNC prior to the procedure specified above.
  The parameters of the spindle amplifier with serial interface can be changed after the system starts. Changing the parameters (No.4000 to No.4351 "S1", "S2", "S3") in the CNC sends them to the spindle amplifier at an appropriate time and the parameters in the unit are updated. Be careful not to change parameters incorrectly.

	#7	#6	#5	#4	#3	#2	#1	#0
4800	SPK						ND2	ND1

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit type

ND1 In controlling the spindle synchronization, the direction of the first spindle (master spindle) motor rotation is:
　　0 : The direction indicated by the command sign
　　1 : The opposite direction to that indicated by the command sign

ND2 In controlling the spindle synchronization, the direction of the 2nd spindle (slave spindle) motor rotation is:
　　0 : The direction indicated by the command sign
　　1 : The opposite direction to that indicated by the command sign

SPK As the parking signals for simple spindle synchronous control:
　　0 : PKESS1 <G122#6> (first spindle) and PKESS2 <G122#7> (second spindle) are used.
　　1 : PKESS1 <G031#6> (first spindle) and PKESS2 <G031#7> (second spindle) are used.

4810	Error pulse between two spindles when synchronizing phases in the serial spindle synchronization control mode

[Data type] Byte type

[Unit of data] Pulse

[Valid data range] 0 to 255

Set the difference in error pulses between two spindles when synchronizing phases in the serial spindle synchronization control mode.

When the difference in error pulse between two spindles is within the value set in this parameter, the spindle phase synchronization completion signal FSPPH <F044#3> becomes "1".

This parameter is used to check the difference in phase in synchronization control and to confirm the completion of synchronization in the serial spindle synchronization control mode.

4811	Allowable error count for the error pulses between two spindles in the serial spindle synchronization control mode or simple synchronous control mode

[Data type] Word type

[Unit of data] Pulse

[Valid data range] 0 to 32767

Set the allowable error count for the error pulses between two spindles in the serial spindle synchronization control mode or simple synchronous control mode.

NOTE
This parameter is used to output the inter–spindle phase error detection signal SYCAL in the serial spindle synchronization control mode. The SYCAL <F044#4> signal becomes "1" when a phase error exceeding the value set in this parameter is found.

When you are going to use this parameter to detect error pulses during simplified synchronization control, pay attention to the mode of the spindle, and set the parameter as required. (The parameter is invalid in spindle mode. It is valid in Cs contour control, rigid tapping, and spindle positioning mode; the detection unit per pulse differs, however.)

	#7	#6	#5	#4	#3	#2	#1	#0
4900								FLR

[Data type] Bit

FLR When the spindle speed fluctuation detection function is used, the rates of allowance (q) and fluctuation (r) those are set in parameter No.4911 and No.4912, respectively are set in steps of:

0 : 1%

1 : 0.1%

4911	Rapid (q) of the fluction of spindle speed which is assumed to be the specified spindle speed

[Data type] Word type

[Unit of data]

[Valid data range]

Unit of data	1%	0. 1% (T series)
Data range	1 to 100	1 to 1000

NOTE
Unit of data depends on parameter No.4900#0 FLR (T series only)

Set the ratio (q) of the spindle speed which is assumed to be the specified spindle speed in the spindle speed fluctuation detection function.

Let the commanded speed be Sc. When the actual spindle speed reaches between (Sc–Sq) and (Sc + Sq), it is assumed to be the commanded speed. The spindle speed fluctuation detection starts.

where, $Sq = Sc \times \dfrac{q}{100}$

4912	Spindle speed fluctuation ratio (r) for which no alarm is activated in the spindle speed fluctuation detection function

[Data type] Word

[Unit of data]

[Valid data range]

Unit of data	1%	0. 1% (T series)
Data range	1 to 100	1 to 1000

> **NOTE**
> Unit of data depends on parameter No.4900#0 FLR (T series only).

Set the spindle speed fluctuation ratio (r) for which no alarm is activated in the spindle speed fluctuation detection function (see Fig.4.17 (e)).

4913	Spindle speed fluctuation value (d) for which no alarm is activated in the spindle speed fluctuation detection function

[Data type] Word

[Unit of data] rpm

[Valid data range] 0 to 32767

Set the allowable fluctuation speed (Sd) for which no alarm is activated in the spindle speed fluctuation detection function.

The function for detecting spindle speed fluctuation checks whether the actual speed varies for the specified speed or not. Sd or Sr, whichever is greater, is taken as the allowable fluctuation speed (Sm). An alarm is activated when the actual spindle speed varies for the commanded speed (Sc) under the condition that the variation width exceeds the allowable variation width (Sm).

Sd: The allowable constant variation width which is independent of the specified spindle speed (Sd is set with parameter 4913.)

Sr: The allowable variation width which is obtained by multiplying Sc (commanded spindle speed) by r (constant ratio). (r is set with parameter 4912.)

Sm: Sd or Sr, whichever is greater
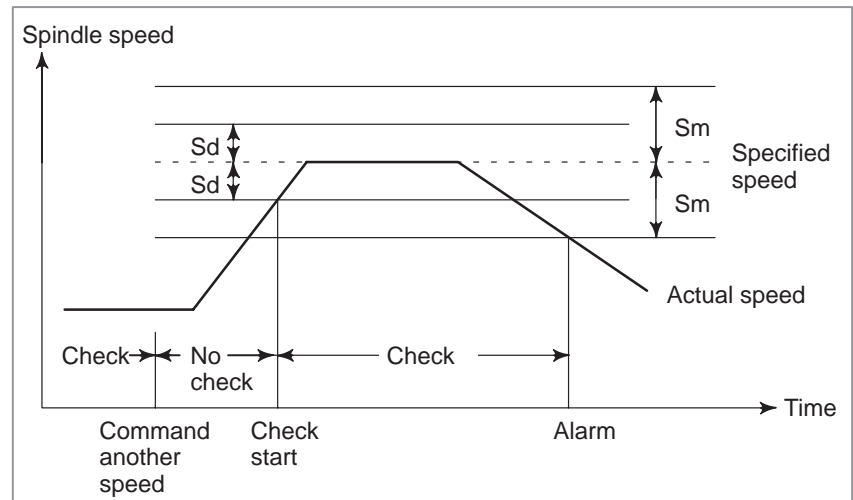
Fig.4.17 (e) Sd and Sm

4914	Time (p) elapsed from when the commanded spindle speed is changed to the start of spindle speed fluctuation detection

[Data type] 2–word

[Unit of data] ms

[Valid data range] 0 to 999999

Set the time elapsed from when the specified spindle speed is changed to the start of spindle speed fluctuation detection in the spindle speed fluctuation detection function. That is, the fluctuation in the spindle speed is not detected until the specified time elapses from when the specified spindle speed is changed.
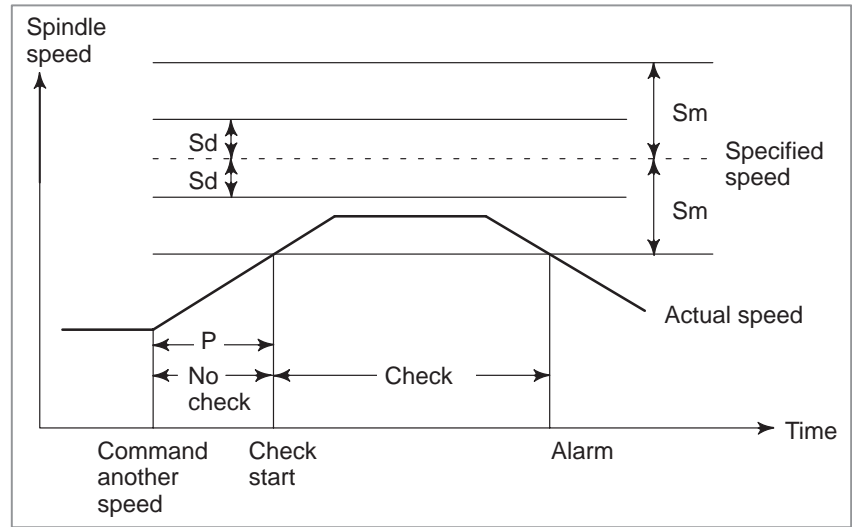
Fig.4.17 (f) Sd and Sm

4950	#7	#6	#5	#4	#3	#2	#1	#0
	IMB	ESI	TRV			ISZ	IDM	IOR

[Data type] Bit

IOR Resetting the system in the spindle positioning mode

0 : Does not releases the mode.
1 : Releases the mode

IDM The positioning direction for the spindle using a M code is

0 : The positive direction
1 : The negative direction

ISZ When an M code for spindle orientation is specified in spindle positioning:

0 : The spindle rotation mode is cleared and the mode is switched to the spindle positioning mode, and spindle orientation operation is performed.
1 : The spindle rotation mode is cleared and the mode is switched to the spindle positioning mode but spindle orientation operation is not performed.

TRV   Rotation direction of spindle positioning is set to:

0 : The positive direction
1 : The reverse direction

ESI   Selection of a spindle positioning specification

0 : The conventional specificaion is used.
1 : The extended specificaion is used.

> **NOTE**
> The extended specification includes the following two extensions:
> (1) With the conventional specification, the number of M codes for specifying a spindle positioning angle is always 6. With the extended specification, an arbitrary number of such M codes from 1 to 256 can be selected by parameter setting (See parameter No.4964.)
> (2) The maximum feedrate for spindle positioning (setting of parameter No.1420) can be extended from 240000 to 269000 (in increments of 10 deg/min).

IMB   When the spindle positioning function is used, half–fixed angle positioning based on M codes uses:

0 : Specification A
1 : Specification B

> **NOTE**
> In the case of half–fixed angle positioning based on M codes, three types of spindle positioning operations can occur:
> (1) The spindle rotation mode is cleared, then the mode is switched to the spindle positioning mode.
> (2) Spindle positioning is performed in the spindle positioning mode.
> (3) The spindle positioning mode is cleared, then the mode is switched to the spindle rotation mode.
> In the case of specifiection A:
> Operations (1) to (3) are specified using separate M codes.
> (1) Specified using M codes for performing spindle orientation.
>   (See parameter No.4960)
> (2) Specified using M codes for specifying a spindle positioning angle. (See parameter No.4962)
> (3) Specified using M codes for clearing spindle positioning operation. (See parameter No.4961.)
> In the case of specification B:
> When M codes for specifying a spindle positioning angle are specified, operations (1) to (3) are performed successively. (See parameter No.4962.)

4960	M code specifying the spindle orientation

[Data type] Word

[Unit of data] Integer

[Valid data range] 6 to 97

Set an M code to change the spindle rotating mode to the spindle positioning mode. Setting the M code performs the spindle orientation. Spindle positioning can be specified from the next block.

4961	M code releasing the spindle positioning mode

[Data type] Word

[Unit of data] Integer

[Valid data range] 6 to 97

Set the M code to release the spindle positioning mode and to change the mode to the spindle rotating mode.

4962	M code for specifying a spindle positioning angle

[Data type] Word

[Unit of data] Integer

[Valid data range] 6 to 92

Two methods are availablel for specifying spindle positioning. One method uses address C for arbitrary–angle positioning. The other use an M code for half–fixed angle positioning. This parameter sets an M code for the latter method.

- When bit 6 (ESI) of parameter No.4950=0
  Six M code from M α to M(α+5) are used for half–fixed angle positioning, when α is the value of this parameter.
- When bit 6(ESI) of parameter No.4950=1
  Set the start M code in this parameter, and set the number of M codes in parameter No.4964. Then β M codes from Mα to M(α+β–1) are used for half fixed angle positioning.

The table below indicates the relationship between the M codes and positioning angles.

M code	Positioning angle	Example: Positioning angle when θ = 30°
Mα	θ	30°
M (α+1)	2θ	60°
M (α+2)	3θ	90°
M (α+3)	4θ	120°
M (α+4)	5θ	150°
M (α+5)	6θ	180°
⋮	⋮	⋮
M (α+n)	$(n+1)\,\theta$	

> **NOTE**
> θ represents the basic angular diplacement set in pamrameter No.4963.

4963	M code for specifying a spindle positioning angle

[Data type] Word

[Unit of data] deg

[Valid data range] 1 to 60

This parameter sets a basic angular displacement used for half–fixed angle positioning using M codes.

4964	Number of M codes for specifying a spindle positioning angle

[Data type] Byte

[Unit of data] Integer

[Valid data range] 0, 1 to 255

This parameter sets the number of M codes used for Half–fixed angle positioning using M codes.

As many M codes as the number specified in this parameter, starting with the M code specified in parameter No.4962, are used to specify half–fixed angle positioning.

Let α be the value of parameter No.4962, and let β be the value of parameter No.4964. That is, M codes from Mα to M (α+5) are used for half–fixed angle positioning.

> **NOTE**
> 1 This parameter is valid when bit 6 (ESI) of parameter No.4950=1.
> 2 Make sure that M codes from Mα to M (α+β–1) do not duplicate other M codes.
> 3 Setting this parameter to 0 has the same effect as setting 6. That is, M code from Mα to M (α+5) are used for half–fixed angle positioning.

4970	Servo loop gain of the spindle

[Data type] Word type

[Unit of data] 0.01 s^{-1}

[Valid data range] 1 to 9999

Set the servo loop gain of the spindle in the spindle positioning mode.

4971	Servo loop gain multiplier of the spindle for gear 1

4972	Servo loop gain multiplier of the spindle for gear 2

4973	Servo loop gain multiplier of the spindle for gear 3

4974	Servo loop gain multiplier of the spindle for gear 4

[Data type] Word type

[Unit of data]

[Valid data range]

Set the servo loop gain multipliers of the spindle for gears 1 to 4.
The multipliers are used to convert the amount of the position deviation to the voltage used in the velocity command. Assign the data obtained from the following equation to the parameters.

Loop gain multiplier = 2048000 $\times$ E $\times$ A/L

where;

E : Voltage required to rotate the spindle motor at 1000 rpm in the velocity command

L : Rotation angle of the spindle per one motor rotation (normally 360)

A : Unit used for the detection (degree)

Example

Let E be 2.2 V, L be 360 degrees, and A be 0.088 degrees/pulse.

Loop gain multiplier = 2048000 $\times$ 2.2 $\times$ 0.088/360 = 1101

* When the voltage specified for the spindle motor is 10 V at a spindle speed of 4500 rpm, E is regarded as 2.2 V.

> **NOTE**
> The above parameters No.4970 to No.4974 are for analog spindles.

4.18
PARAMETERS OF TOOL COMPENSATION

	#7	#6	#5	#4	#3	#2	#1	#0
5001		EVO	TPH	EVR	TAL	OFH	TLB	TLC

[Data type] Bit type

TLC   Tool length compensation

0 : Tool length compensation A or B (Conforms to TLB in parameter No.5001)

1 : Tool length compensation C

TLB   Tool length compensation axis

0 : Always Z axis irrespective of plane specification (Tool length compensation A)

1 : Axis perpendicular to plane specification (G17, G18, and G19) (Tool length compensation B)

OFH   Offset number of tool length compensation, cutter compensation and tool offset

0 : Specifies the tool length compensation using an H code, and cutter compensation C using a D code
Tool offset conforms to TPH in parameter No.5001#5.

1 : Specifies the tool length compensation, cutter compensation and tool offset using H codes

TAL   Tool length compensation C

0 : Generates an alarm when two or more axes are offset

1 : Not generate an alarm even if two or more axes are offset

EVR   When a tool compensation value is changed in cutter compensation C mode:

0 : Enables the change, starting from that block where the next D or H code is specified.

1 : Enables the change, starting from that block where buffering is next performed.

TPH   Specifies whether address D or H is used as the address of tool offset number (G45 to G48).

0 : D code

1 : H code

> **NOTE**
>   TPH is valid when OFH in parameter No.5001#2 is 0.

EVO   Specifies whether an offset is effective in the next block to be buffered or the next block for which an H code is specified when the offset value is changed in tool length offset A or B.

0 : Next block in which an H code is specified.

1 : Next block to be buffered.

		#7	#6	#5	#4	#3	#2	#1	#0
		WNP	LWM	LGC	LGT		LWT	LGN	LD1
5002									

[Data type] Bit

LD1 Offset number of tool offset (Wear offset number when option of tool geometry/wear compensation is selected)

0 : Specified using the lower two digits of a T code
1 : Specified using the lower one digit of a T code

LGN Geometry offset number of tool offset (When the option of tool geometry/wear compensation is selected, it is effective.)

0 : Is the same as wear offset number
1 : Specifies the geometry offset number by the tool selection number

LWT Tool wear compensation is performed by:

0 : Moving the tool.
1 : Shifting the coordinate system.
   (Only when the LGT parameter (bit 4 of No.5002) is set to 0)

LGT Tool geometry compensation (When the option of tool geometry/wear compensation is selected, this parameter is effective. Whenever the option is not selected, compensation is made according to the tool movement.

0 : Compensated by the shift of the coordinate system (Compensation is made in the block of T code regardless of LWM at this time.)
1 : Compensated by the tool movement

LGC Tool geometry compensation (It is effective when the option of tool geometry / wear compensation is selected and LGT = 0. When LGT is 1, it is always canceled.)

0 : Not canceled by offset number 0
1 : Canceled by offset number 0

LWM Tool offset (Wear compensation when option of tool geometry/wear offset is selected, or geometry and wear compensation when LGT = 1.)

0 : is done in the T code block
1 : is done together with the axis movement

> **NOTE**
> When the option of tool geometry/wear compensation is equipped and LGT = 0, the offset is done in a T code block regardless of this parameter.

WNP Imaginary tool tip direction used for tool nose radius compensation, when the geometry/wear compensation option is equipped, is the direction specified by:

0 : Geometry offset number
1 : Wear offset number

		#7	#6	#5	#4	#3	#2	#1	#0
5003		TGC	LVC				CCN		
			LVK				CCN	SUV	SUP

[Data type] Bit

SUP Start up or cancel in cutter compensation C

0 : Type A

1 : Type B

SUV When G40, G41, and G42 are specified independently,

0 : The start up and cancel operation conforms to the standard specification.

1 : Moves by a distance corresponding to the offset vector which is vertical to the next block movement.

CCN When automatic reference position return (G28) is specified in the cutter compensation C mode (M series) or in tool nose radius compensation (T series):

0 : The tool nose radius compensation vector is cancelled in movement to an intermediate position.

1 : The tool nose radius compensation vector is not cancelled in movement to an intermediate position, but is cancelled in movement to the reference position.

LVC Offset value of tool offset

0 : Not cleared, but held by reset

1 : Cleared by reset

LVK Tool length offset value

0 : Cleared by reset

1 : Not cleared, but held by reset

TGC Tool geometry compensation value

0 : Not canceled by reset

1 : Canceled by reset

(Valid when LVC, #6 of parameter No.5003, is "1")

		#7	#6	#5	#4	#3	#2	#1	#0
5004		Y03						ORC	
							ODI		

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit type

ORC Tool offset value

0 : Set by the diameter specification

(Can be set in only the axis under diameter programming)

1 : Set by the radius specification

ODI A cutter compensation amount is set using:

0 : A radius.

1 : A diameter.

Y03 Y axis offset is :

0 : Used for 4th axis.
1 : Used for 3rd axis.

	#7	#6	#5	#4	#3	#2	#1	#0
5005		TLE	QNI			PRC		CNI

CNI On the offset screen, Y–axis offset screen, and macro screen, the [**INP.C**] soft key is:

0: Used.
1: Not used. (The [**INP.C**] soft key is not displayed.)

PRC Direct input of tool offset value and workpiece coordinate-system shift value

0 : Not use a PRC signal
1 : Uses a PRC signal

QNI In the function of input of offset value measured B

0 : Not automatically select the tool offset number
1 : Automatically selects a tool offset number

TLE When the tool offset measurement value direct input B function is used, a tool offset value, set by the offset write signal, is:

0 : Always received in offset write mode.
1 : Received only in offset write mode and during movement along an axis (where "during movement along an axis" means that the positional deviation value is other than 0).

	#7	#6	#5	#4	#3	#2	#1	#0
5006							TGC	OIM
								OIM

[Data type] Bit

OIM When the unit is switched between the inch and metric systems, automatic tool offset value conversion is:

0 : Not performed
1 : Performed

TGC When a T code is specified in a block containing G50, G04, or G10:

0 : No alarm occurs.
1 : P/S alarm No.245 occurs.

	#7	#6	#5	#4	#3	#2	#1	#0
5008							CNC	CNI
						G39	CNC	CNI

[Data type] Bit

CNI Interference check for cutter compensation C (M series) or tool–tip radius compensation (T series) is:

0 : Performed
1 : Not performed

CNC During interference check for cutter compensation C (M series) or tool–tip radius compensation (T series), when the direction of movement after application of the offset differs from the programmed direction by between 90° and 270°:

    0 : An alarm is issued.
    1 : No alarm is issued.

G39 The corner rounding function (G39) in cutter compensation C mode is:

    0 : Disabled.
    1 : Enabled.

5010	Limit value that ignores the vector when a tool moves on the outside of a corner during tool nose radius compensation
	Limit value that ignores the vector when a tool moves on the outside of a corner during cutter compensation C

[Data type] Word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

[Valid data range] 0 to 16383

This parameter sets the limit value that ignores a slight movement occurring when a tool moves on the outside of the corner during cutter compensation C.
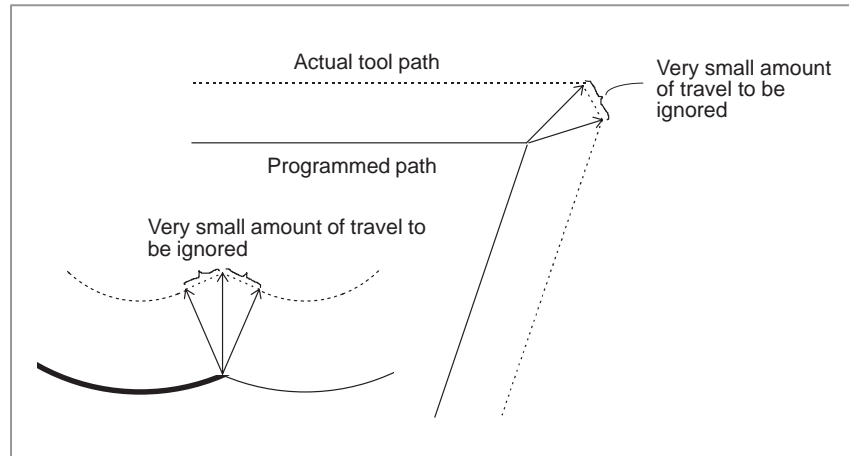
5013	Maximum value of tool wear compensation

[Data type] 2–word

[Unit of data]

Increment system	IS–B	IS–C	Units
Millimeter input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

[Valid data range]

Increment system	IS–B	IS–C
Millimeter input	0 to 999999	0 to 9999999
Inch input	0 to 999999	0 to 9999999

This parameter sets the maximum allowable tool wear compensation value. If an attempt is made to set a tool wear compensation value, the absolute value of which exceeds the value set in this parameter, the following alarm or warning is output:

Input from MDI   Warning: Too many digits
Input by G10   P/S alarm No.032: Offset value is out of range by G10.

5014	Maximum value of incremental input for tool wear compensation

[Data type] 2–word

[Unit of data]

Increment system	IS–B	IS–C	Units
Millimeter input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

[Valid data range]

Increment system	IS–B	IS–C
Millimeter input	0 to 999999	0 to 9999999
Inch input	0 to 999999	0 to 9999999

Set the maximum allowable value for the tool wear compensation value, input as an incremental value. If the incremental input value (absolute value) exceeds the set value, the following alarm or warning message is output:

Input from MDI   Warning: Setting value out of range.
Input using G10   P/S alarm No.032: Offset value is out of range by G10.

5015	Distance (XP) betweeen reference position and X axis + contact surface

5016	Distance (XM) betweeen reference position and X axis – contact surface

5017	Distance (ZP) betweeen reference position and Z axis + contact surface

5018	Distance (ZM) betweeen reference position and Z axis – contact surface

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

[Valid data range] –99999999 to 99999999

These parameters are related to the function of input of tool offset value measured B.

They set the distance (with sign) between the measurement reference position and sensor contact surface. For an axis under diameter programming, set it by a diameter value.
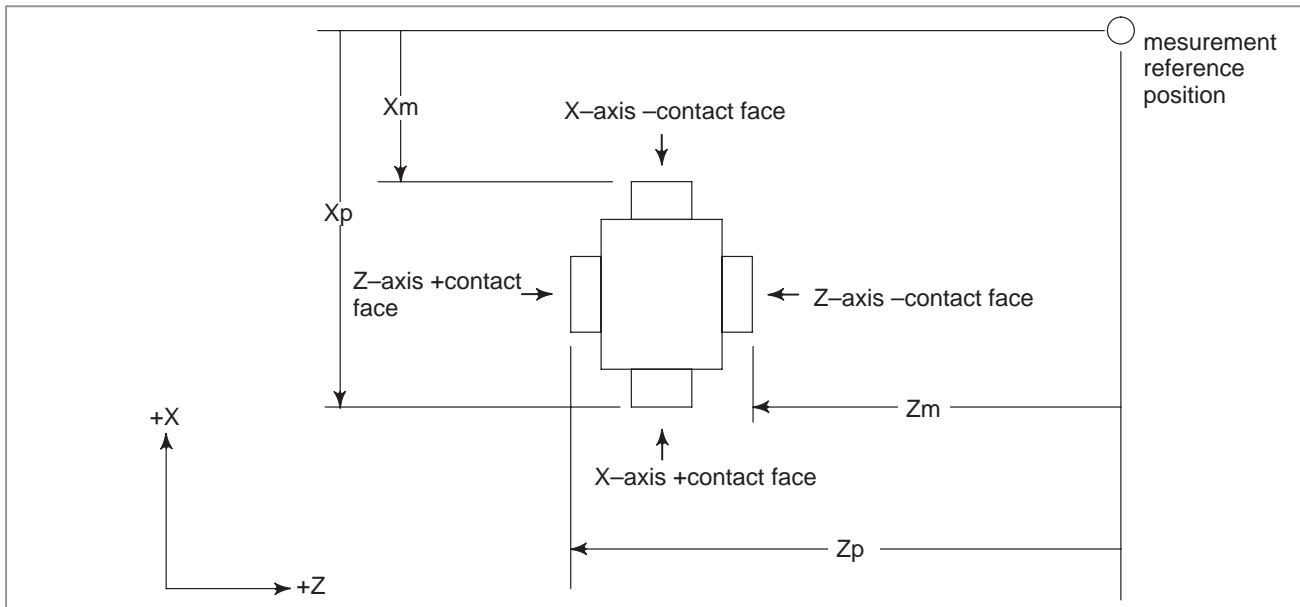
Fig. 4.18 Distance along X and Z axes from the reference position to +/– contact surfaces

5020	Tool offset number used for the input of tool offset value measured B

[Data type] Byte

[Valid data range] 0 to the number of tools to be compensated.

Set tool offset number used for the input of tool offset value measured B function (i.e. when workpiece coordinate system shift value is set). (The tool offset number corresponding to the measured tool shall be set in advance.) This parameter is valid when the tool offset number is not selected automatically (QNI, #5 of parameter 5005, is zero).

4.19 PARAMETERS OF CANNED CYCLES

4.19.1 Parameter of canned Cycle for Drilling

	#7	#6	#5	#4	#3	#2	#1	#0
5101		M5T			ILV	RTR		FXY
	M5B	M5T	RD2	RD1			EXC	FXY

[Data type] Bit

FXY The drilling axis in the drilling canned cycle is:

0 : Always the Z–axis
1 : The axis selected by the program

> **NOTE**
> In the case of the T system, this parameter is valid only for the drilling canned cycle in the Series 15 format.

EXC G81

0 : Specifies a drilling canned cycle
1 : Specifies an external operation command

RTR G83 and G87

0 : Specify a high–speed peck drilling cycle
1 : Specify a peck drilling cycle

ILV Initial point position in drilling canned cycle

0 : Not updated by reset
1 : Updated by reset

RD2, RD1 Set the axis and direction in which the tool in drilling canned cycle G76 or G87 is got free. RD2 and RD1 are set as shown below by plane selection.

RD2	RD1	G17	G18	G19
0	0	+X	+Z	+Y
0	1	–X	–Z	–Y
1	0	+Y	+X	+Z
1	1	–Y	–X	–Z

M5T When a spindle rotates from the forward to the reverse direction and vice versa in tapping cycles G84 and G74 for M series (G84 and G88 for T series), befor M04 or M03 is output:

For T series

0 : Not output M05
1 : Outputs M05

For M series

0 : Outputs M05
1 : Not output M05

M5B In drilling canned cycles G76 and G87:

0 : Outputs M05 before an oriented spindle stops
1 : Not output M05 before an oriented spindle stops

	#7	#6	#5	#4	#3	#2	#1	#0
5102	RDI	RAB		K0E	F16	QSR	MRC	

[Data type] Bit

MRC When a target figure other than a monotonically increasing or monotonically decreasing figure is specified in a multiple repetitive turning canned cycle (G71, G72):

0 : No alarm occurs.

1 : P/S alarm No.064 is occurs.

> **NOTE**
>   This parameter is valid for multiple repetitive turning canned cycle type I.

QSR Before a multiple repetitive canned cycle (G70 to G73) is started, a check to see if the program contains a block that has the sequence number specified in address Q is:

0 : Not made.

1 : Made. (If the sequence number specified in address Q cannot be found, an alarm occurs and the canned cycle is not executed.)

F16 When the Series 10/11 format is used (with bit 1 (FCV) of parameter No.0001 set to 1), a canned drilling cycle is specified using :

0 : Series 10/11 format

1 : Series 21 format. (However, the number of repetitions is specified using address L.)

K0E When K0 is specified in a hole machining canned cycle (G80 to G89):

0 : Hole machining is performed once.

1 : Hole machining is not performed. Instead, the hole machining data is merely memorized.

RAB The R command for the drilling canned cycle in the Series 10/11 format is:

0 : Regarded as an incremental command

1 : Regarded as:
     An absolute command in the case of G code system A
     An absolute command in the case of G code system B or C when the G90 mode is specified.
     An incremental command in the case of G code system B or C when the G91 mode is specified.

RDI The R command for the drilling canned cycle in the Series 10/11 format:

0 : Is regarded as the specification of a radius

1 : Follows the specification of a diameter/radius for the drilling axis

	#7	#6	#5	#4	#3	#2	#1	#0
5103						P15		
							QZA	SIJ

[Data type] Bit

SIJ A tool shift value for the drilling canned cycle G76 or G87 is specified by:

0 : Address Q

1 : Address I, J, or K

QZA   When the specification of the depth of cut (Q) for each time is omitted, or if Q0 is specified in a high–speed peck drilling canned cycle (G73) or peck drilling canned cycle (G83):

0 : No alarm is issued.
1 : An alarm (No.045) is issued.

P15   When the FS10/11 command format is used, the machining sequence for pocketing using multiple repetitive canned cycle G71 or G72 follows:

0 : FS21 specification
1 : FS10/11 specification

5110	C–axis clamp M code in drilling canned cycle

[Data type] Byte

[Valid data range] 0 to 99

This parameter sets the C–axis clamp M code in a drilling canned cycle.

5111	Dwell time when C–axis unclamping is specified in drilling canned cycle

[Data type] Word

[Unit of data] ms

[Valid data range] 0 to 32767

This parameter sets the dwell time when C–axis unclamping is specified in a drilling canned cycle.

5112	Spindle forward–rotation M code in drilling canned cycle

[Data type] Byte

[Valid data range] 0 to 255

This parameter sets the spindle forward–rotation M code in a drilling canned cycle.

> **NOTE**
> M03 is output when "0" is set.

5113	Spindle reverse–rotation M code in drilling canned cycle

[Data type] Byte

[Valid data range] 0 to 255

This parameter sets the spindle reverse–rotation M code in a drilling canned cycle.

> **NOTE**
> M04 is output when "0" is set.

5114	Return or clearance value of drilling canned cycle G83
	Return value of high–speed peck drilling cycle G73

[Data type] Word

[Unit of data]

Increment system	IS−A	IS−B	IS−C	Unit
Millimeter input	0.01	0.001	0.001	mm
Inch input	0.001	0.0001	0.0001	inch

[Valid data range] 0 to 32767

For 16–MC, this parameter sets the return value in high–speed peck drilling cycle G73 (G83 for 16–TC).
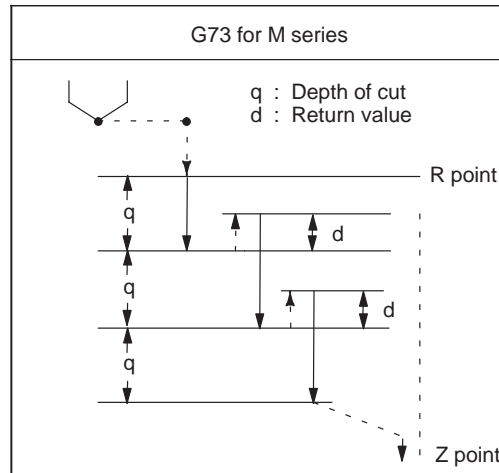
Fig. 4.19.1 (a) High–speed peck drilling cycle G73

For 16–TC, this parameter sets the return or clearance value in drilling canned cycle G83.
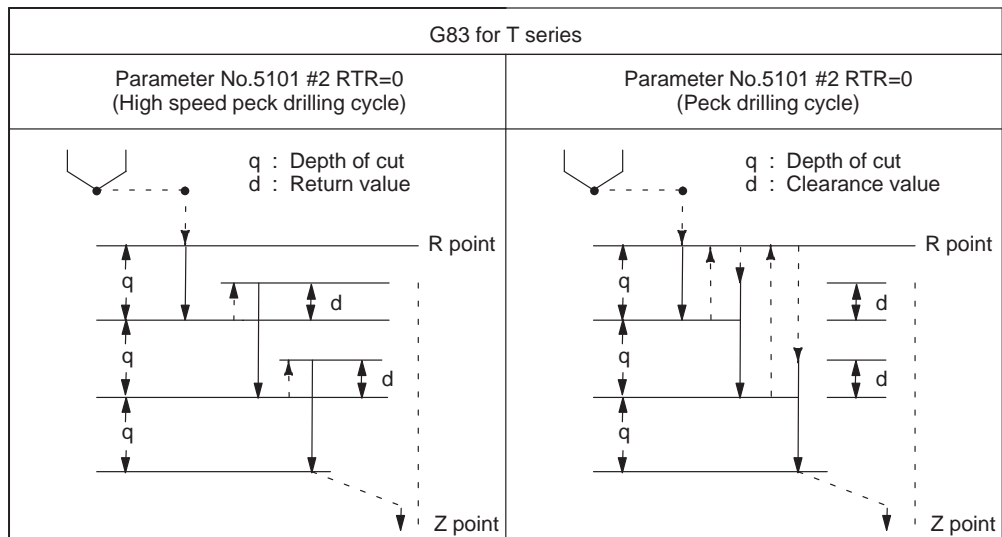
Fig. 4.19.1 (b) Drilling canned cycle G83

5115	Clearance of canned cycle G83

[Data type] Word

[Unit of data]

Increment system	IS−A	IS−B	IS−C	Unit
Millimeter input	0.01	0.001	0.001	mm
Inch input	0.001	0.0001	0.0001	inch

[Valid data range] 0 to 32767

This parameter sets the clearance of peck drilling cycle G83.
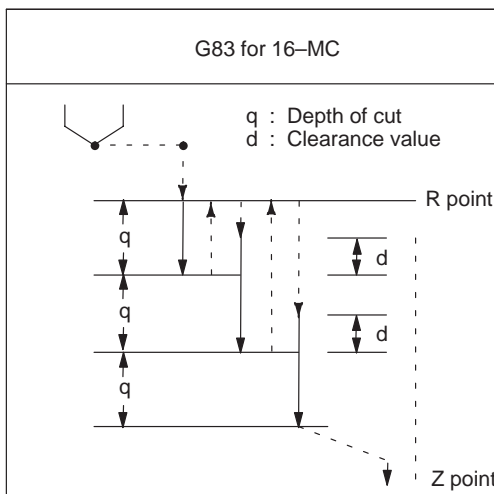
Fig. 4.19.1 (c) Peck drilling cycle G83

4.19.2
Parameter of Thread Cutting Cycle

5130	Chamfering distance in the thread cutting cycles G76 and G92

[Data type] Byte

[Unit of data] 0.1 pitch

[Valid data range] 0 to 127

This parameter sets the chamfering in the thread cutting cycles G76 and G92.

4.19.3
Parameter of Multiple Repetitive Canned Cycle

5132	Depth of cut in multiple repetitive canned cycles G71 and G72

[Data type] 2–word

[Unit of data]

Increment system	IS−B	IS−C	Unit
Millimeter input	0.001	0.001	mm
Inch input	0.0001	0.0001	inch

[Valid data range] 0 to 99999999

This parameter sets the depth of cut in multiple repetitive canned cycles G71 and G72.

5133	Escape in multiple repetitive canned cycles G71 and G72.

[Data type] 2–word

[Unit of data]

Increment system	IS−B	IS−C	Unit
Millimeter input	0.001	0.001	mm
Inch input	0.0001	0.0001	inch

[Valid data range] 0 to 99999999

This parameter sets the escape in multiple repetitive canned cycle G71 and G72.

5135	Escape in multiple repetitive canned cycle G73 in X–axis direction

5136	Escape in multiple repetitive canned cycle G73 in Z–axis direction

[Data type] 2–word

[Unit of data]

Increment system	IS−B	IS−C	Unit
Input in mm	0.001	0.001	mm
Input in inches	0.0001	0.0001	inch

[Valid data range] −99999999 to 99999999

This parameter sets the escape in multiple repetitive canned cycle G73 of an X, then Z axis.

5137	Division count in multiple repetitive canned cycle G73

[Data type] 2–word

[Unit of data] Cycle

[Valid data range] 1 to 99999999

This parameter sets the division count in multiple repetitive canned cycle G73.

5139	Return in multiple canned cycles G74 and G75

[Data type] 2–word

[Unit of data]

Increment system	IS−B	IS−C	Unit
Metric input	0.001	0.001	mm
Inch input	0.0001	0.0001	inch

[Valid data range] 0 to 99999999

This parameter sets the return in multiple repetitive canned cycles G74 and G75.

5140	Minimium depth of cut in the multiple repetitive canned cycle G76

[Data type] 2–word

[Unit of data]

Increment system	IS–B	IS–C	Unit
Metric input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

[Valid data range] 0 to 99999999

This parameter sets the minimum depth of cut in the multiple repetitive canned cycle G76.

5141	Finishing allowance in the multiple repetitive canned cycle G76

[Data type] 2–word

[Unit of data]

Increment system	IS–B	IS–C	Unit
Metric input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

[Valid data range] 1 to 99999999

This parameter sets the finishing allowance in multiple repetitive canned cycle G76.

5142	Repetition count of final finishing in multiple repetitive canned cycle G76

[Data type] 2–word

[Unit of data] Cycle

[Valid data range] 1 to 99999999

This parameter sets the repetition count in multiple repetitive canned cycle G76.

5143	Tool nose angle in multiple repetitive canned cycle G76

[Data type] 2–word

[Unit of data] Degree

[Valid data range] When FS15 format is used: 0 to 120
When FS15 format is not used: 0, 29, 30, 55, 60, 80

This parameter sets the tool nose angle in multiple repetitive canned cycle G76.

4.19.4
Parameters of Peck Drilling Cycle of a Small Diameter

	#7	#6	#5	#4	#3	#2	#1	#0
5160						NOL	OLS	

[Data type] Bit

OLS When an overload torque signal is received in a peck drilling cycle of a small diameter, the feed and spindle speed are

0 : Not changed.
1 : Changed.

NOL When the depth of cut per action is satisfied although no overload torque signal is received in a peck drilling cycle of a small diameter, the feed and spindle speed are:

0 : Not changed.
1 : Changed.

5163	M code that specifies the peck drilling cycle mode of a small diameter

[Data type] 2–word

[Valid data range] 1 to 99999999

This parameter sets an M code that specifies the peck drilling cycle mode of a small diameter.

5164	Percentage of the spindle speed to be changed when the tool is retracted after an overload torque signal is received

[Data type] Byte

[Unit of data] %

[Valid data range] 1 to 255

This parameter sets the percentage of the spindle speed to be changed when the tool is retracted because the overload torque signal is received in a peck drilling cycle of a small diameter.

$$S2 = S1 \times d1 \div 100$$
     S1: Spindle speed to be chaged
     S2: Spindle speed changed
d1 is set as a percentage.

5165	Percentage of the spindle speed to be changed when the tool is retracted without an overload torque signal received

[Data type] Byte

[Unit of data] %

[Valid data range] 1 to 255

This parameter sets the percentage of the spindle speed to be changed when the tool is retracted without the overload torque signal received in a peck drilling cycle of a small diameter.

$$S2 = S1 \times d2 \div 100$$
     S1: Spindle speed to be chaged
     S2: Spindle speed changed
d2 is set as a percentage.

5166	Percentage of cutting feedrate to be changed when the tool is retracted after an overload torque signal is received

[Data type] Byte

[Unit of data] %

[Valid data range] 1 to 255

This parameter sets the percentage of the cutting feedrate to be changed when the tool is retracted because the overload torque signal is received in a peck drilling cycle of a small diameter.

$$F2 = F1 \times b1 \div 100$$
   F1: Cutting feedrate to be changed
   F2: Changed cutting feedrate
b1 is set as a percentage.

5167	Percentage of the cutting feedrate to be changed when the tool is retracted without an overload torque signal received

[Data type] Byte

[Unit of data] %

[Valid data range] 1 to 255

This parameter sets the percentage of the cutting feedrate tot be changed when the tool is retracted without the overload torque signal received in a peck drilling cycle of a small diameter.

$$F2 = F1 \times b2 \div 100$$
   F1: Cutting feedrate to be changed
   F2: Changed cutting feedrate
b2 is set as a percentage.

5168	Lower limit of the percentage of the cutting feedrate in a peck drilling cycle of a small diameter

[Data type] Byte

[Unit of data] %

[Valid data range] 0 to 255

This parameter sets the lower limit of the percentage of the cutting feedrate changed repeatedly in a peck drilling cycle of a small diameter to the specified cutting feedrate.

$$FL = F \times b3 \div 100$$
   F: Specified cutting feedrate
   FL: Changed cutting feedrate
Set b3 as a percentage.

5170	Number of the macro variable to which the total number of retractions during cutting is output

[Data type] Word

[Valid data range] 100 to 149

This parameter sets the number of the macro variable to which the total number of times the tool is retracted during cutting in a peck drilling cycle mode of a small diameter is output.

> **NOTE**
> The total number cannot be output to common variables 500 to 531.

5171	Number of the macro variable to which the total umber of retractions because of an overload signal is output

[Data type] Word

[Valid data range] 100 to 149

This parameter sets the common variable number of the custom macro to which the number of times the tool is retracted after the overload signal is received during cutting in a peck drilling cycle mode of a small diameter is output.

> **NOTE**
> The total number cannot be output to common variables 500 to 531.

5172	Speed of retraction to point R when no address I is issued

[Data type] Word

[Unit of data] mm/min

[Valid data range] 0 to 400

This parameter sets the speed of retraction to point R when no address I is issued in a peck drilling cycle of a small diameter.

5173	Speed of advancing to the position just before the bottom of a hole when no address I is issued

[Data type] Word

[Unit of data] mm/min

[Valid data range] 0 to 400

This parameter sets the speed of advancing to the position just before the bottom of a previously machined hole when no address I is issued in a peck drilling cycle of a small diameter.

5174	Clearance in a peck drilling cycle of a small diameter

[Data type] Word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Linear axis (millimeter input)	0.01	0.001	0.0001	mm
Linear axis (inch input)	0.001	0.0001	0.00001	inch

[Valid data range] 0 to 32767

This parameter sets the clearance in a peck drilling cycle of a small diameter.

4.20
PARAMETERS OF
RIGID TAPPING

		#7	#6	#5	#4	#3	#2	#1	#0
5200		SRS	FHD		DOV	SIG	CRG	VGR	G84
			FHD	PCP	DOV	SIG	CRG	VGR	G84

[Data type] Bit

G84 Method for specifying rigid tapping

0 : An M code specifying the rigid tapping mode is specified prior to the issue of the G84 (or G74) command. (See parameter No.5210).

1 : An M code specifying the rigid tapping mode is not used. (G84 cannot be used as a G code for the tapping cycle; G74 cannot be used for the reverse tapping cycle.)

VGR Any gear ratio between spindle and position coder in rigid tapping

0 : Not used (The gear ratio is set in parameter No.3706.)

1 : Used (The gear ratio is set by parameters Nos. 5221 through 5224 and 5231 through 5234.)

> **NOTE**
> For serial spindles, set this parameter to 0 when using the DMR function for position coder signals on the spindle side.

CRG Rigid mode when a rigid mode cancel command is specified (G80, G01 group G code, reset, etc.)

0 : Canceled after rigid tapping signal RGTAP is set to "0".

1 : Canceled before rigid tapping signal RGTAP is set to "0".

SIG When gears are changed for rigid tapping, the use of SIND <G032 and G033> is

0 : Not permitted.

1 : Permitted.

DOV Override during extraction in rigid tapping

0 : Invalidated

1 : Validated (The override value is set in parameter No.5211.)

PCP Rigid tapping

0 : Used as a high–speed peck tapping cycle

1 : Not used as a high–speed peck tapping cycle

FHD Feed hold and single block in rigid tapping

0 : Invalidated

1 : Validated

SRS To select a spindle used for rigid tapping in multi–spindle control:

0 : The spindle selection signals SWS1 and SWS2 (bits 0 and 1 of G027) are used. (These signals are used also for multi–spindle control.)

1 : The rigid tapping spindle selection signals RGTSP1 and RGTSP2 (bits 4 and 5 of G061) are used. (These signals are provided expressly for rigid tapping.)

	#7	#6	#5	#4	#3	#2	#1	#0
5201				OV3	OVU	TDR		
				OV3	OVU	TDR		NIZ

[Data type] Bit

NIZ Smoothing in rigid tapping is:
- 0 : Not performed.
- 1 : Performed.

TDR Cutting time constant in rigid tapping
- 0 : Uses a same parameter during cutting and extraction (Parameter Nos. 5261 through 5264)
- 1 : Not use a same parameter during cutting and extraction
  Parameter Nos. 5261 to 5264: Time constant during cutting
  Parameter Nos. 5271 to 5274: Time constant during extraction

OVU The increment unit of the override parameter (No.5211) for tool rigid tapping extraction is:
- 0 : 1%
- 1 : 10%

OV3 The spindle speed for tool extraction is specified by program. Overriding based on this spindle speed is:
- 0 : Disabled.
- 1 : Enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
5202								ORI

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

ORI When rigid tapping is started:
- 0 : Spindle orientation is not performed.
- 1 : Spindle orientation is performed.

> **NOTE**
> This parameter can be used only for a serial spindle.

	#7	#6	#5	#4	#3	#2	#1	#0
5204							SPR	DGN
								DGN

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

DGN On the diagnosis screen:

0 : A rigid tapping synchronization error is displayed. (Nos. 455 to 457)

1 : An error difference between the spindle and tapping axis is displayed. (Nos. 452 and 453)

SPR In rigid tapping, the parameters are:

0 : Not changed on a spindle–by–spindle basis.
1 : Changed on a spindle–by–spindle basis.

> **NOTE**
> 1 When switching between the rigid tapping parameters on a spindle–by–spindle basis in rigid tapping using the second and third serial spindles, set this parameter to 1. The following parameters are supported for each spindle:
>
> | First spindle (4–stage gear) | Second spindle (2–stage gear) | Third spindle (2–stage gear) |
> |---|---|---|
> | No.5214 | No.5215 | No.5216 |
> | No.5221 to No.5224 | No.5225, No.5226 | No.5227, No.5228 |
> | No.5231 to No.5234 | No.5235, No.5236 | No.5237, No.5238 |
> | No.5241 to No.5244 | No.5245, No.5246 | No.5247, No.5248 |
> | No.5261 to No.5264 | No.5265, No.5266 | No.5267, No.5268 |
> | No.5271 to No.5274 | No.5335, No.5336 | No.5337, No.5338 |
> | No.5280 | No.5341 | No.5344 |
> | No.5281 to No.5284 | No.5242, No.5243 | No.5345, No.5346 |
> | No.5300, No.5301 | No.5302, No.5303 | No.5304, No.5305 |
> | No.5310 to No.5314 | No.5350 to No.5353 | No.5354 to No.5357 |
> | No.5321 to No.5324 | No.5325, No.5326 | No.5327, No5328 |
>
> 2 For rigid tapping using the second and third serial spindles, the multispindle control option is required.

5210	Rigid tapping mode specification M code

[Data type] Byte

[Valid data range] 0 to 255

This parameter sets an M code that specifies the rigid tapping mode. To set an M code larger than 255, set it to parameter No.5212.

> **NOTE**
> 1 The M code is judged to be 29 (M29) when "0" is set.
> 2 To use an M code whose number is greater than 255,
>   Specify the code number with parameter No.5212.

5211	Override value during rigid tapping extraction

[Data type] Byte

[Unit of data] 1 % or 10 %

[Valid data range] 0 to 200

The parameter sets the override value during rigid tapping extraction.

> **NOTE**
> The override value is valid when DOV in parameter No.5200
> #4 is "1".
> When OVU (bit 3 of parameter No.5201) is 1, the unit of set data
> is 10%. An override of up to 200% can be applied to extraction.

5212	M code that specifies a rigid tapping mode

[Data type] 2–word

[Unit of data] Integer

[Valid data range] 0 to 65535

This parameter sets the M code that specifies the rigid tapping mode.

The M code that specifies the rigid tapping mode is usually set by parameter 5210. To use an M code whose number is greater than 255, specify the code number with parameter 5212.

> **NOTE**
> If the setting of this parameter is 0, the M code specifying the
> rigid tapping mode is determined by the setting of parameter
> 5210. Otherwise, it is determined by the setting of parameter
> 5212. The setting of parameter 5212 must always be within
> the above valid range.

5213	Return or clearance in peck tapping cycle

[Data type] Word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	0.01	0.001	0.0001	mm
Input in incluse	0.001	0.0001	0.00001	inch

[Valid data range] 0 to 32767

This parameter sets the return or clearance in the peck tapping cycle.
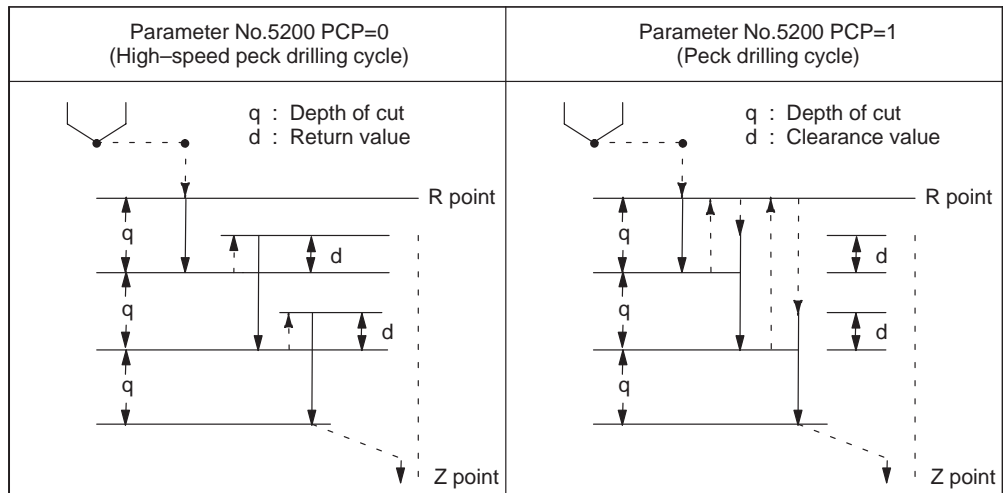
Fig. 4.20 (a) High–speed peck drilling and peck drilling cycles

5214	Setting of an allowable rigid tapping synchronization error range

5215	Setting of an allowable rigid tapping synchronization error range for the second spindle

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 0 to 32767

Each of these parameters is used to set an allowable synchronization error range between a spindle used for rigid tapping and the tapping axis.

If the value set with each parameter is exceeded, servo alarm No.411 (excessive error during movement) for the tapping axis is issued. When 0 is set, a synchronization error check is not made.

> **NOTE**
> When rigid tapping is performed using the second and third spindles
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5214 is applied to the second and third spindles, as well as to the first spindle.
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameter No.5215 and No.5216 are applied to the second and third spindles, respectively.

5221	Number of spindle gear teeth (first–stage gear)

5222	Number of spindle gear teeth (second–stage gear)

5223	Number of spindle gear teeth (third–stage gear)

5224	Number of spindle gear teeth (fourth–stage gear)

5225	Number of second spindle gear teeth (first–stage gear)

5226	Number of second spindle gear teeth (second–stage gear)

[Data type] Word

[Valid data range] 1 to 32767

When an arbitrary gear ratio is used in rigid tapping, each of these parameters sets the number of teeth of each spindle gear.

> **NOTE**
> 1 These parameters are enabled when the VGR parameter (bit 1 of parameter No.5200) is set to 1.
> 2 When a position coder is attached to the spindle, set the same value for all of parameters No.5221 through No.5224.
> 3 When the DMR function of the position coder signal is used with a serial spindle, set the VGR parameter (bit 1 of parameter No.5200) to 0, and set these parameters to 0.
> 4 When rigid tapping is performed using the second and third spindles
>   - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameters No.5221 and No.5222 are applied to the second and third spindles, as well as to the first spindle.
>   - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5225 and No.5226 are applied to the second spindle, while the settings of parameters No.5227 and No.5228 are applied to the third spindle.

5231	Number of position coder gear teeth (first–stage gear)

5232	Number of position coder gear teeth (second–stage gear)

5233	Number of position coder gear teeth (third–stage gear)

5234	Number of position coder gear teeth (fourth–stage gear)

5235	Number of position coder gear teeth for the second spindle (first–stage gear)

5236	Number of position coder gear teeth for the second spindle (second–stage gear)

[Data type] Word

[Valid data range] 1 to 32767

When an arbitrary gear ratio is used in rigid tapping, each of these parameters sets the number of teeth of each position coder gear.

NOTE

1 These parameters are enabled when the VGR parameter (bit 1 of parameter No.5200) is set to 1.
 When a position coder is attached to the spindle, set the same value for all of parameters No.5231 through No.5234. When a spindle motor with a built–in position coder is used, a position coder with a resolution of 2048 pulses/rev may be used. In such a case, set the actual number of teeth, multiplied by 2 (for conversion to 4096 pulses/rev).

2 When the DMR function of the position coder signal is used with a serial spindle, set the VGR parameter (bit 1 of parameter No.5200) to 0, and set these parameters to 0.

3 When rigid tapping is performed using the second and third spindles
 • When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameters No.5231 and No.5232 are applied to the second and third spindles, as well as to the first spindle.
 • When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5235 and No.5236 are applied to the second spindle, while the settings of parameters No.5237 and No.5238 are applied to the third spindle.

5241	Maximum spindle speed in rigid tapping (first–stage gear)

5242	Maximum spindle speed in rigid tapping (second–stage gear)

5243	Maximum spindle speed in rigid tapping (third–stage gear)

5244	Maximum spindle speed in rigid tapping (fourth–stage gear)

5245	Maximum spindle speed in rigid tapping using the second spindle (first–stage gear)

5246	Maximum spindle speed in rigid tapping using the second spindle (second–stage gear)

[Data type] 2–word

[Unit of data] rpm

[Valid data range] Spindle position coder gear ratio
1:1 0 to 7400
1:2 0 to 9999
1:4 0 to 9999
1:8 0 to 9999

Each of these parameters is used to set a maximum spindle speed for each gear in rigid tapping.

NOTE

1 For the M series, set the same value for both parameter No.5241 and parameter No.5243 for a one–stage gear system. For a two–stage gear system, set the same value for parameter No.5242 and parameter No.5243. Otherwise, P/S alarm No.200 will be issued.

2 When rigid tapping is performed using the second and third spindles
- When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameters No.5241 and No.5242 are applied to the second and third spindles, as well as to the first spindle.
- When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5245 and No.5246 are applied to the second spindle, while the settings of parameters No.5247 and No.5248 are applied to the third spindle.

5261	Linear acceleration/deceleration time constant for the spindle and tapping axis (first–stage gear)

5262	Linear acceleration/deceleration time constant for the spindle and tapping axis (second–stage gear)

5263	Linear acceleration/deceleration time constant for the spindle and tapping axis (third–stage gear)

5264	Linear acceleration/deceleration time constant for the spindle and tapping axis (fourth–stage gear)

5265	Linear acceleration/deceleration time constant for the second spindle and tapping axis (first–stage gear)

5266	Linear acceleration/deceleration time constant for the second spindle and tapping axis (second–stage gear)

[Data type] Word

[Unit of data] ms

[Valid data range] 0 to 4000

Each of these parameters is used to set a linear acceleration/deceleration time constant for the spindle of each gear and the tapping axis in rigid tapping.

Set the period required to reach each maximum spindle speed (parameters No.5241 through No.5248). The set time constant, multiplied by the ratio of a specified S value to a maximum spindle speed, is actually used as a time constant.

NOTE

When rigid tapping is performed using the second and third spindles

- When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameters No.5261 and No.5262 are applied to the second and third spindles, as well as to the first spindle.
- When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5265 and No.5266 are applied to the second spindle, while the settings of parameters No.5267 and No.5268 are applied to the third spindle.

5271	Time constant for the spindle and tapping axis in extraction operation (first–stage gear)

5272	Time constant for the spindle and tapping axis in extraction operation (second–stage gear)

5273	Time constant for the spindle and tapping axis in extraction operation (third–stage gear)

5274	Time constant for the spindle and tapping axis in extraction operation (fourth–stage gear)

[Data type] Word

[Unit of data] ms

[Valid data range] 0 to 4000

Each of these parameters is used to set a linear acceleration/deceleration time constant for the spindle of each gear and tapping axis in extraction operation during rigid tapping.

NOTE
1 These parameters are enabled when the TDR parameter (bit 2 of parameter No.5201) is set to 1.
2 When rigid tapping is performed using the second and third spindles
   - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameters No.5271 and No.5272 are applied to the second and third spindles, as well as to the first spindle.
   - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5335 and No.5336 are applied to the second spindle, while the settings of parameters No.5337 and No.5338 are applied to the third spindle.

5280	Position control loop gain for the spindle and tapping axis in rigid tapping (common to all gears)

5281	Position control loop gain for the spindle and tapping axis in rigid tapping (first–stage gear)

5282	Position control loop gain for the spindle and tapping axis in rigid tapping (second–stage gear)

5283	Position control loop gain for the spindle and tapping axis in rigid tapping (third–stage gear)

5284	Position control loop gain for the spindle and tapping axis in rigid tapping (fourth–stage gear)

> **NOTE**
> Once these parameters have been set, the power must be turned off then back on for the settings to become effective.

[Data type] Word

[Unit of data] 0.01 s^{-1}

[Valid data range] 1 to 9999

Each of these parameters is used to set a position control loop gain for the spindle and tapping axis in rigid tapping. These parameters significantly affect the precision of threading. Optimize these parameters as well as the loop gain multipliers by conducting a cutting test.

> **NOTE**
> 1 To use a varied loop gain on a gear–by–gear basis, set parameter No.5280 to 0, and set a loop gain for each gear in parameters No.5281 through No.5284. The specification of a loop gain on a gear–by–gear basis is disabled if parameter No.5280 is set to a value other than 0. In such a case, the value set in parameter No.5280 is used as a loop gain that is common to all the gears.
> 2 When rigid tapping is performed using the second and third spindles
>   • When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5280 or the settings of parameters No.5281 and No.5282 are applied to the second and third spindles, as well as to the first spindle.
>   • When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5341 through No.5343 are applied to the second spindle, while the settings of parameters No.5344 through No.5346 are applied to the third spindle.

5291	Spindle loop gain multiplier in the rigid tapping mode (for gear 1)

5292	Spindle loop gain multiplier in the rigid tapping mode (for gear 2)

5293	Spindle loop gain multiplier in the rigid tapping mode (for gear 3)

5294	Spindle loop gain multioplier in the rigid tapping mode (for gear4)

[Data type] Word type

[Unit of data]

[Valid data range] 0 to 32767

Set the spindle loop gain multipliers for gears 1 to 4 in the rigid tapping mode. The thread precision depends on the multipliers. Find the most appropriate multipliers by conducting the cutting test and assign them to the parameters.

> **NOTE**
> These parameters are used for analog spindles.

Loop gain multiplier = $2048 \times E/L \times \alpha \times 1000$

where;

E : Voltage in the velocity command at 1000 rpm

L : Rotation angle of the spindle per one rotation of the spindle motor

α : Unit used for the detection

Examples

When the spindle motor, spindle, and position coder are connected as shown left, let the variables be as follows:

E = 1.667 (V) (A motor speed of 6000 rpm corresponds to 10 V.)
L = 360°   (One rotation of the spindle corresponds to one rotation of the spindle motor.)
α = La/4096
   = 720°/4096
   = 0.17578
La = 720°   (= 360° × 2. One rotation of the position coder corresponds to two rotations of the spindle.)
4096 =   The number of detected pulses per rotation of the position coder
Gear ratio between the spindle and the position coder
   1:1 . . . . 0.08789 degrees
   1:2 . . . . 0.17578 degrees
   1:4 . . . . 0.35156 degrees
   1:8 . . . . 0.70313 degrees
According to above ratio the loop gain multiplier is calculated as $2048 \times 1.667/360 \times 0.17578 \times 1000 = 1667$

* When the position coder which is built in a spindle motor sends 512 pulses per rotation, the unit used for the detection, α, is La/2048.

Fig.4.20 (b) Connection among the spindle motor, spindle, and position coder

5300	Tapping axis in–position width in rigid tapping

5301	Spindle in–position width in rigid tapping

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 0 to 32767

These parameters are used to set tapping axis and spindle in–position widths in rigid tapping.

> **NOTE**
> 1 If an excessively large value is specified, the threading precision will deteriorate.
> 2 When rigid tapping is performed using the second and third spindles
>   • When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameter No.5300 and No.5301 are applied to the second and third spindles, as well as to the first spindle.
>   • When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5302 and No.5303 are applied to the second spindle, while the settings of parameters No.5304 and No.5305 are applied to the third spindle.

5302	Tapping axis in–position width in rigid tapping using the second spindle

5303	Spindle in–position width in rigid tapping using the second spindle

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 0 to 32767

These parameters are used to set spindle and tapping axis in–position widths in rigid tapping using the second spindle.

> **NOTE**
> These parameters are enabled when the SPR parameter (bit 1 of parameter No.5204) is set to 1.

5310	Positional deviation limit imposed during tapping axis movement in rigid tapping

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter is used to set a positional deviation limit during tapping axis movement in rigid tapping. A value that falls outside the valid data range, described above, can be specified in parameter No.5314.

NOTE
1 When a high–resolution detector is used, the unit must be multiplied by 10.
2 When rigid tapping is performed using the second and third spindles
   - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5310 (or No.5314) is applied to the second and third spindles, as well as to the first spindle.
   - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5350 and No.5354 are applied to the second spindle and third spindle, respectively.

5311	Limit value of spindle positioning deviation during movement in rigid tapping.

[Data type] Word type

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter sets the limit value of a spindle positioning deviation during movement in rigidtapping.

Limit value = $S \times 360 \times 100 \times 1.5 / (60 \times G \times \alpha)$

where

S : Maximum spindle speed in rigid tapping
(Setting value of parameter Nos. 5241 and greater)
G : Loop gain of rigid tapping axis
(Setting value of parameter Nos. 5280 and greater)
α : Detection unit

(Calculation example)

S = 3600
G = 3000
L = 360 degrees (One spindle rotation per spindle motor rotation)
α = La/4096
= 720 degrees/4096
= 0.17578 degrees
La = 720 degrees
(One position coder rotation requires two spindle rotations
(= 360 degrees × 2)).
4096 = Detection pulse per position coder rotation

$$\text{Setting value} = \frac{3600 \times 360 \times 100 \times 1.5}{60 \times 3000 \times 0.17578}$$

= 6144

Fig.4.20 (c) Connection among spindle motor, spindle and position coder

> **NOTE**
> 1 The detection unit is α = La/2048 when the position coder built–in spindle motor uses a position coder of 512 pulses per revolution.
> 2 When rigid tapping is performed using the second and third spindles
>   - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5311 is applied to the second and third spindles, as well as to the first spindle.
>   - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5351 and No.5355 are applied to the second spindle and third spindle, respectively.

| 5312 | Positional deviation limit imposed while the tapping axis is stopped in rigid tapping |

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter is used to set a positional deviation limit imposed while the tapping axis is stopped in rigid tapping.

> **NOTE**
> When rigid tapping is performed using the second and third spindles
>   - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5312 is applied to the second and third spindles, as well as to the first spindle.
>   - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5352 and No.5356 are applied to the second spindle and third spindle, respectively.

| 5313 | Positional deviation limit imposed while the spindle is stopped in rigid tapping |

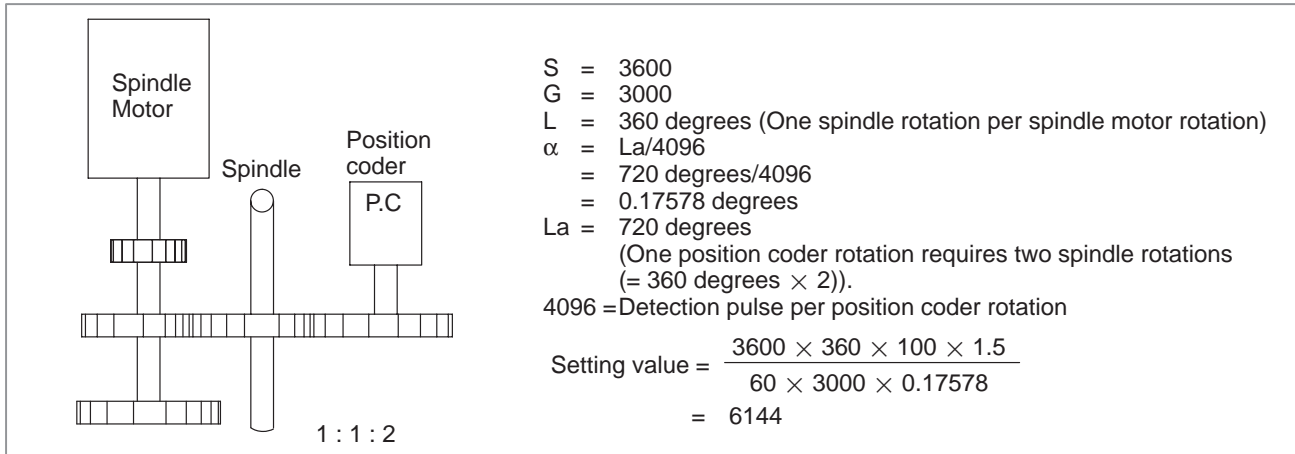**[Data type]** Word

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter is used to set a positional deviation limit imposed while the spindle is stopped in rigid tapping.

> **NOTE**
> When rigid tapping is performed using the second and third spindles
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5313 is applied to the second and third spindles, as well as to the first spindle.
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5353 and No.5357 are applied to the second spindle and third spindle, respectively.

| 5314 | Positional deviation limit imposed during tapping axis movement in rigid tapping |

[Data type] 2–word

[Unit of data] Detection unit

[Valid data range] 0 to 99999999

Usually, parameter No.5310 is used to set a positional deviation limit imposed during tapping axis movement in rigid tapping. However, parameter No.5314 can be used to set a value greater than the valid data range of parameter No.5310 because of the resolution of the detector being used.

> **NOTE**
> 1 When parameter No.5314 is set to 0, the setting of parameter No.5310 is used. When parameter No.5314 is set to a value other than 0, parameter No.5310 is disabled; in this case, the setting of parameter No.5314 is used.
> 2 When rigid tapping is performed using the second and third spindles
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the setting of parameter No.5314 (or No.5310) is applied to the second and third spindles, as well as to the first spindle.
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5350 and No.5354 are applied to the second spindle and third spindle, respectively.

5321	Spindle backlash in rigid tapping (first–stage gear)
	Spindle backlash in rigid tapping

5322	Spindle backlash in rigid tapping (second–stage gear)

5323	Spindle backlash in rigid tapping (third–stage gear)

5324	Spindle backlash in rigid tapping (fourth–stage gear)

5325	Spindle backlash in rigid tapping using the second spindle (first–stage gear)
	Spindle backlash in rigid tapping using the second spindle

5326	Spindle backlash in rigid tapping using the second spindle (second–stage gear)

[Data type] Byte

[Unit of data] Detection unit

[Valid data range] 0 to 127

Each of these parameters is used to set a spindle backlash.

> **NOTE**
> When rigid tapping is performed using the second and third spindles
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 1, the settings of parameters No.5325 and No.5326 are applied to the second spindle, while the settings of parameters No.5227 and No.5228 are applied to the third spindle.
> - When the SPR parameter (bit 1 of parameter No.5204) is set to 0, the settings of parameters No.5321 and No.5322 are applied to the second spindle and third spindle, as well as to the first spindle.

5335	Time constant for the spindle and tapping axis in second spindle extraction operation (first–stage gear)

5336	Time constant for the spindle and tapping axis in second spindle extraction operation (second–stage gear)

[Data type] Word

[Unit of data] ms

[Valid data range] 0 to 4000

Each of these parameters is used to set a linear acceleration/deceleration time constant for the spindle and tapping axis in extraction operation during rigid tapping on a gear–by–gear basis.

> **NOTE**
> This parameter is enabled when both the TDR parameter (bit 2 of parameter No.5201) and the SPR parameter (bit 1 of parameter No.5204) are set to 1.

5341	Position control loop gain for the spindle and tapping axis in rigid tapping using the second spindle (common to all the gears)

5342	Position control loop gain for the spindle and tapping axis in rigid tapping using the second spindle (first–stage gear)

5343	Position control loop gain for the spindle and tapping axis in rigid tapping using the second spindle (second–stage gear)

> **NOTE**
> After these parameters have been set, the power must be turned off then back on for the settings to become effective.

[Data type] Word

[Unit of data] $0.01\ \mathrm{s}^{-1}$

[Valid data range] 1 to 9999

Each of these parameters is used to set a position control loop gain for the spindle and tapping axis in rigid tapping using the second spindle.

> **NOTE**
> 1 To use a varied loop gain on a gear–by–gear basis, set parameter No.5341 to 0, and set a loop gain for each gear in parameters No.5342 and No.5343.
> 2 This parameter is enabled when the SPR parameter (bit 1 of parameter No.5204) is set to 1.

5350	Positional deviation limit imposed during tapping axis movement in rigid tapping using the second spindle

[Data type] 2–word

[Unit of data] Detection unit

[Valid data range] 1 to 99999999

This parameter sets a positional deviation limit imposed during tapping axis movement in rigid tapping using the second spindle.

> **NOTE**
> This parameter is enabled when the SPR parameter (bit 1 of parameter No.5204) is set to 1.

5351	Positional deviation limit imposed during spindle movement in rigid tapping using the second spindle

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter is used to set a positional deviation limit imposed during spindle movement in rigid tapping using the second spindle.

> **NOTE**
> This parameter is enabled when the SPR parameter (bit 1 of parameter No.5204) is set to 1.

5352	Positional deviation limit imposed while the tapping axis is stopped in rigid tapping using the second spindle

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter is used to set a positional deviation limit imposed while the tapping axis is stopped in rigid tapping using the second spindle.

> **NOTE**
> This parameter is enabled when the SPR parameter (bit 1 of parameter No.5204) is set to 1.

5353	Positional deviation limit imposed while the spindle is stopped in rigid tapping using the second spindle

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 1 to 32767

This parameter is used to set a positional deviation limit imposed while the spindle is stopped in rigid tapping using the second spindle.

> **NOTE**
> This parameter is enabled when the SPR parameter (bit 1 of parameter No.5204) is set to 1.

5381	Override value for rigid tapping return

[Data type] Byte

[Units of data] 1% or 10%

[Valid data range] 0 to 200

Set the override value to be applied during rigid tapping return.

> **NOTE**
> This parameter is valid when bit 4 (DOV) of parameter No. 5200 is set to 1. If bit 3 (OVU) of parameter No. 5201 is set to 1, 10% is set as the units of data. Thus, an override of up to 2000% can be applied during extraction.

5382	Amount of return for rigid tapping return

[Data type] 2–word

[Unit of data] Input increments

[Valid data range] 0 to 99999999

During rigid tapping return for the machining return and restart function, the tool can be pulled out, along the tapping axis, going beyond the stored rigid tapping start position by the amount specified with this parameter.

4.21
PARAMETERS OF SCALING/COORDINATE ROTATION

	#7	#6	#5	#4	#3	#2	#1	#0
5400	SCR	XSC						RIN

[Data type] Bit type

RIN Coordinate rotation angle command (R)

0 : Specified by an absolute method
1 : Specified by G90 or G91

XSC Axis scaling and programmable mirror image

0 : Invalidated (The scaling magnification is specified by P.)
1 : Validated

SCR Scaling magnification unit

0 : 0.00001 times (1/100,000)
1 : 0.001 times

	#7	#6	#5	#4	#3	#2	#1	#0
5401								SCLx

[Data type] Bit axis

SCLx Scaling for every axis

0 : Invalidated
1 : Validated

5410	Angular displacement used when no angular displacement is specified for coordinate system rotation

[Data type] 2–word

[Unit of data] 0.001 degrees

[Valid data range] –360000 to 360000

This parameter sets the angular displacement for coordinate system rotation. When the angular displacement for coordinate system rotation is not specified with address R in the block where G68 is specified, the setting of this parameter is used as the angular displacement for coordinate system rotation.

5411	Magnification used when scaling magnification is not specified

Setting entry is acceptable.

[Data type] Word

[Unit of data] 0.001 or 0.00001 times (Selected using SCR, #7 of parameter No.5400)

[Valid data range] 1 to 999999

This parameter sets the scaling magnification. This setting value is used when a scaling magnification (P) is not specified in the program.

> **NOTE**
> Parameter No.5421 becomes valid when scaling for every axis is valid. (XSC, #6 of parameter No.5400 is "1".)

5421	Scaling magnification for every axis

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] 0.001 or 0.00001 times (Selected using SCR, #7 of parameter No.5400)

[Valid data range] –999999 to –1, 1 to 999999

This parameter sets the scaling magnification for every axis.

4.22
PARAMETERS OF UNI–DIRECTIONAL POSITIONING

	#7	#6	#5	#4	#3	#2	#1	#0
5431							PDI	MDL
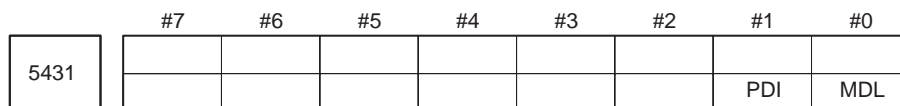
[Data type] Bit

MDL Specifies whether the G code for single direction positioning (G60) is included in one–shot G codes (00 group) or modal G codes (01 group)

0: One–shot G codes (00 group)
1: Modal G codes (01 group)

PDI When the tool is stopped before or after a specified end point with the unidirectional positioning function:

0 : No in–position check is performed.
1 : An in–position check is performed.
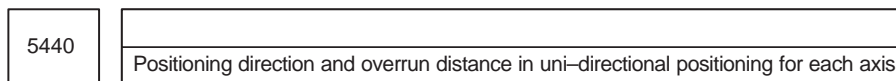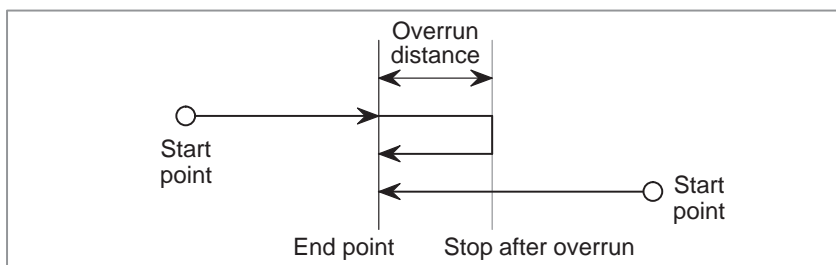
5440	Positioning direction and overrun distance in uni–directional positioning for each axis

[Data type] Word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –16383 to +16383

This parameter sets the positioning direction and overrun distance in uni–directional positioning (G60) for each axis. The positioning direction is specified using a setting data sign, and the overrun distance using a value set here.

Overrun distance > 0: The positioning direction is positive (+).
Overrun distance < 0: The positioning direction is negative ($-$).
Overrun distance = 0: Uni–directional positioning is not performed.
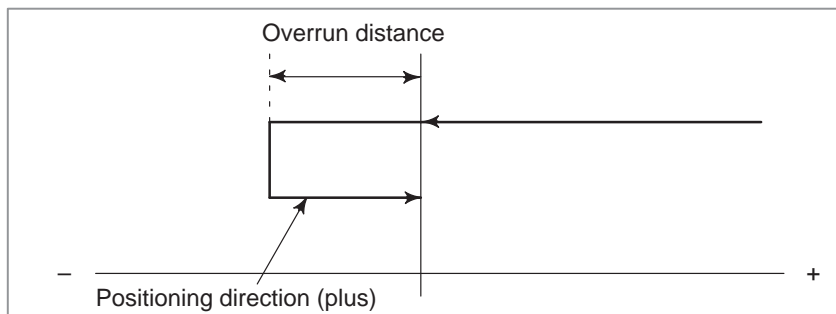
Fig. 4.22 Positioning direction and overrun distance

4.23
PARAMETERS OF
POLAR COORDINATE
INTERPOLATION

	#7	#6	#5	#4	#3	#2	#1	#0
5450							AFC	

[Data type] Bit type

AFC In polar coordinate interpolation mode, automatic override operation and automatic feedrate clamp operation are:

0 : Not performed.
1 : Performed.

> **NOTE**
> In polar coordinate interpolation mode, the feedrate component for a rotational axis increases as the tool moves closer to the center of a workpiece. Near the center of a workpiece, the maximum cutting feedrate (parameter No.5462) may be exceeded, causing servo alarm No.411 to be issued. The automatic feedrate override function and automatic feedrate clamp function automatically control the feedrate to prevent the feedrate component on a rotation axis from exceeding a specified maximum cutting feedrate.

5460	Axis (linear axis) specification for polar coordinate interpolation

5461	Axis (rotary axis) specification for polar coordinate interpolation

[Data type] Byte

[Valid data range] 1, 2, 3, ... control axes count

These parameters set control axis numbers of linear and rotary axes to execute polar interpolation.

5462	Maximum cutting feedrate during polar coordinate interpolation

[Data type] 2–word

[Unit of data]

[Valid data range]

Increment system	Unit of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	1 mm/min	0, 6 to 240000	0, 6 to 100000
Inch machine	0.1 inch/min	0, 6 to 96000	0, 6 to 48000
Rotation axis	1 deg/min	0, 6 to 240000	0, 6 to 100000

This parameter sets the upper limit of the cutting feedrate that is effective during polar coordinate interpolation. If a feedrate greater than the maximum feedrate is specified during polar coordinate interpolation, it is clamped to the feedrate specified by the parameter. When the setting is 0, the feedrate during polar coordinate interpolation is clamped to the maximum cutting feedrate usually specified with parameter 1422.

5463	Allowable automatic override percentage in polar coordinate interpolation

[Data type] Byte type

[Unit of data] %

[Valid data range] 0 to 100

This parameter sets an allowable percentage to find an allowable feedrate on a rotation axis in polar coordinate interpolation mode. A maximum cutting feedrate (parameter No.5462), multiplied by the allowable percentage set with this parameter represents an allowable feedrate.

(Allowable feedrate on rotation axis) = (maximum cutting feedrate) $\times$ (allowable percentage)

In polar coordinate interpolation mode, the feedrate component on a rotation axis increases as the tool moves closer to the center of a workpiece. Near the center of a workpiece, the maximum allowable feedrate (parameter No.5462) may be exceeded. To prevent the feedrate component on a rotation axis from exceeding the maximum allowable feedrate in polar coordinate interpolation mode, the following override is automatically applied to the feedrate (automatic override):

$$\textbf{(Override)} = \frac{\textbf{(Allowable feedrate on rotation axis)}}{\textbf{(Feedrate component on rotation axis)}} \times \textbf{100 (\%)}$$

If the overridden feedrate component for a rotation axis still exceeds the allowable feedrate, the feedrate is clamped to prevent the feedrate component on a rotation axis from exceeding a maximum cutting feedrate (automatic feedrate clamp).

> **NOTE**
> When 0 is set in this parameter, a specification of 90% is assumed. When a value of 100 or greater is set with this parameter, a specification of 100% is assumed. Before the automatic override function and automatic feedrate clamp function can be used, bit 1 (AFC) of parameter No.5450 must be set to 1.

4.24
PARAMETERS OF
NORMAL DIRECTION
CONTROL

5480	Number of the axis for controlling the normal direction

[Data type] Byte

[Valid data range] 1 to the maximum control axis number

This parameter sets the control axis number of the axis for controlling the normal direction.

5481	Rotation feedrate of normal direction control axis

[Data type] Word

[Unit of data] 1 deg/min

[Valid data range] 1 to 15000

This parameter sets the feedrate of a normal direction control axis that is inserted at the start point of a block during normal direction control.

5482	Limit value that ignores the rotation insertion of normal direction control axis

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] 1 to 99999999

The rotation block of a normal direction control axis is not inserted when the rotation insertion angle calculated during normal direction control does not exceed this setting value. The ignored rotation angle is added to the next rotation insertion angle. The block insertion is then judged.

> **NOTE**
> 1 No rotation block is inserted when 360 or more degrees are set.
> 2 If 180 or more degrees are set, a rotation block is inserted only when the circular interpolation is 180 or more degrees.

5483	Limit value of movement that is executed at the normal direction angle of a preceding block

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter input	0.01	0.001	0.0001	mm
Inch input	0.001	0.0001	0.00001	inch

[Valid data range] 1 to 99999999

This parameter sets the limit value of movement at the normal direction angle of a preceding block.

For straight line
Block N2 is machined with the tool being normal to block N1 when the movement of N2 in the figure on the left does not exceed the set value.
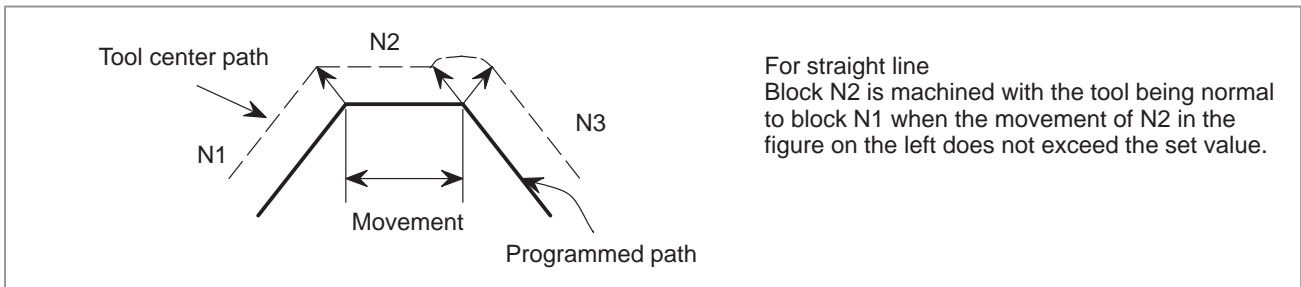
Fig.4.24 (a) When the block moves along a straight line

For arc
Arc N2 is machined with the tool being normal to block N1 when the arc diameter of N2 in the figure on the left does not exceed the setting value. A normal direction axis is not controlled to move in the normal direction according to the arc movement.
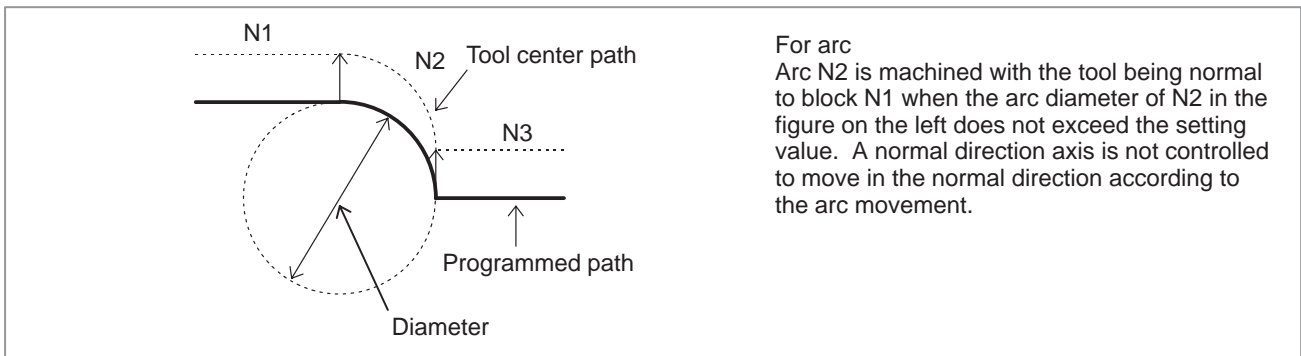
Fig.4.24 (b) When the block moves along on arc

4.25
PARAMETERS OF INDEXING INDEX TABLE

	#7	#6	#5	#4	#3	#2	#1	#0
5500								
	IDX	SIM		G90	INC	ABS	REL	DDP

[Data type] Bit type

DDP Selection of decimal–point input method of index table indexing axis

0 : Conventional method (Example IS–B: B1; = 0.001 deg)

1 : Pocket calculator method (Example IS–B: B1; = 1.000 deg)

REL Relative position display of index table indexing axis

0 : Not rounded by 360 degrees

1 : Rounded by 360 degrees

ABS Displaying absolute coordinate value of index table indexing axis

0 : Not rounded by 360 degrees

The index table indexing axis rotates 720 degrees (two rotations) when G90 B720.0; is specified from the 0–degree position. It rotates in reverse direction 720 degrees (two rotations) when G90 B0.; is specified. The absolute coordinate value then becomes 0 degree.

1 : Rounded by 360 degrees

The index table indexing axis is positioned in 40 degrees when G90 B400.0; is specified from the 0–degree position. The index table indexing axis does not rotate by two or more turns when this parameter is set to 1. It also does not move when G90 B720.0; is specified from the 0–degree position.

INC Rotation in the G90 mode when negative–direction rotation command M code (parameter No.5511) is not set

0 : Not set to the shorter way around the circumference

1 : Set to the shorter way around the circumference (Set ABS, #2 of parameter No.5500, to 1.)

G90 Index table indexing command

0 : Judged to be an absolute/increment command according to the G90/G91 mode

1 : Judged to be an absolute command

SIM When the same block includes a command for an index table indexing axis and a command for another controlled axis:

0 : A P/S alarm (No.136) is issued.

1 : The commands are executed. (In a block other than G00, G28, and G30, however, a P/S alarm (No.136) is issued.)

IDX Index table indexing sequence

0 : Type A

1 : Type B

5511	Negative–direction rotation command M code

[Data type] Byte

[Valid data range] 0 to 255

0 : Not use an M code that sets the index table rotation to the negative direction. The rotation direction is specified using a command and parameter (INC, #3 of parameter No.5500).

1 to 255:
Sets an M code that sets the index table rotation to the negative direction. The rotation is set to the negative direction only when an M code set here is specified in the same block as an index table indexing command. If the M code is not specified in the same block, the rotation is always set to the positive direction.

NOTE
Set ABS, #2 of parameter No.5500, to 1.

5512	Unit of index table indexing angle

[Data type] 2–word

[Unit of data]

Input increment	IS–A	IS–B	IS–C	Unit
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] 0 to 360000

This parameter sets the unit of index table indexing angle. A P/S alarm generated when movement other than integer multiple of the setting value is specified.

NOTE
If zero is specified as the setting value, any command can be specified irrespective of the unit of angle.

4.26 PARAMETERS OF CUSTOM MACROS

	#7	#6	#5	#4	#3	#2	#1	#0
6000			SBM	HGO			MGO	G67
			SBM	HGO	V15		MGO	G67

[Data type] Bit type

G67 If the macro continuous–state call cancel command (G67) is specified when the macro continuous–state call mode (G66) is not set:

0 : P/S alarm No.122 is issued.
1 : The specification of G67 is ignored.

MGO When a GOTO statement for specifying custom macro control is executed, a high–speed branch to 20 sequence numbers executed from the start of the program is:

0 : A high–speed branch is not caused to n sequence numbers from the start of the executed program.
1 : A high–speed branch is caused to n sequence numbers from the start of the program.
(The number of sequence numbers, n, is set in parameter No.6092.)

V15 As system variable numbers for tool offset:

0 : The standard system variable numbers for the Series 16 are used.
1 : The same system variable numbers as those used for the Series 15 are used.

The tables below indicate the system variables for tool offset numbers 1 to 999. The values for tool offset numbers 1 to 200 can be read from or assigned to the system variables in parentheses.

(1) Tool offset memory A

	System parameter number	
	V15 = 0	V15 = 1
Wear offset value	#10001 to #10999 (#2001 to #2200)	#10001 to #10999 (#2001 to #2200)

(2) Tool offset memory B

	System parameter number	
	V15 = 0	V15 = 1
Geomentry offset value	#11001 to #11999 (#2201 to #2400)	#10001 to #10999 (#2001 to #2200)
Wear offset value	#10001 to #10999 (#2001 to #2200)	#11001 to #11999 (#2201 to #2400)

(3) Tool offset memory C

		System parameter number	
		V15 = 0	V15 = 1
H–Code	Geomentry offset value	#11001 to #11999 (#2201 to #2400)	#10001 to #10999 (#2001 to #2200)
	Wear offset value	#10001 to #10999 (#2001 to #2200)	#11001 to #11999 (#2201 to #2400)
D–Code	Geomentry offset value	#13001 to #13999	#12001 to #12999
	Wear offset value	#12001 to #12999	#13001 to #13999

HGO When a GOTO statement for specifying custom macro control is executed:

　　0 : A high–speed branch is not caused to 30 sequence numbers, immediately following the point of execution.

　　1 : A high–speed branch is caused to 30 sequence numbers, immediately before the point of execution.

SBM Custom macro statement

　　0: Not stop the single block

　　1: Stops the single block

> **NOTE**
> When parameter No.3404 #0 NOP = 1, it becomes invalid.

	#7	#6	#5	#4	#3	#2	#1	#0
6001	CLV	CCV	TCS	CRO	PV5		PRT	

[Data type] Bit

PRT Reading zero when data is output using a DPRINT command

　　0 : Outputs a space

　　1 : Outputs no data

PV5 Custom macro common variables:

　　0 : Nos. 500 to 599 are output.

　　1 : Nos. 100 to 199 and Nos. 500 to 599 are output.

CRO ISO code in BPRWT or DPRNT commond

　　0 : Outputs only LF after data is output

　　1 : Outputs LF and CR after data is output

TCS Custom macro (subprogram)

　　0 : Not called using a T code

　　1 : Called using a T code

CCV Custom macro's common variables Nos. 100 through 149 (to 199)

　　0: Cleared to "vacant" by reset

　　1: Not cleared by reset

CLV Custom macro's local variables Nos. 1 through 33

　　0: Cleared to "vacant" by reset

　　1: Not cleared by reset

	#7	#6	#5	#4	#3	#2	#1	#0
6003	MUS	MCY	MSB	MPR	TSE	MIN	MSK	

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

MSK Absolute coordinates at that time during custom macro interrupt

　　0 : Not set to the skip coordinates (system variables #5061 and later)

　　1 : Set to the skip coordinates (system variables #5601 and later)

MIN Custom macro interrupt

0 : Performed by interrupting an in–execution block (Custom macro interrupt type I)

1 : Performed after an in–execution block is completed (Custom macro interrupt type II)

TSE Custom macro interrupt signal UINT

0 : Edge trigger method (Rising edge)

1 : Status trigger method

MPR Custom macro interrupt valid/invalid M code

0 : M96/M97

1 : M code set using parameters (Nos. 6033 and 6034)

MSB Interrupt program

0 : Uses a dedicated local variable (Macro–type interrupt)

1 : Uses the same local variable as in the main program (Subprogram– type interrupt)

MCY Custom macro interrupt

0 : Not performed during cycle operation

1 : Performed during cycle operation

MUS Interrupt–type custom macro

0 : Not used

1 : Used

		#7	#6	#5	#4	#3	#2	#1	#0
6004							VHD		NAT
									NAT

[Data type] Bit

NAT Specification of the results of custom macro functions ATAN and ASIN

0 : The result of ATAN is 0 to 360.0.
The result of ASIN is 270.0 to 0 to 90.0.

1 : The result of ATAN is –180 to 0 to 180.0.
The result of ASIN is –90.0 to 0 to 90.0.

VHD With system variables #5121 through #5128

0 : Tool position offset values (geometry offset values) are read.

1 : The amount of interrupt shift caused by a manual handle interrupt is read.

	#7	#6	#5	#4	#3	#2	#1	#0
6010	*7	*6	*5	*4	*3	*2	*1	*0

	#7	#6	#5	#4	#3	#2	#1	#0
6011	=7	=6	=5	=4	=3	=2	=1	=0

	#7	#6	#5	#4	#3	#2	#1	#0
6012	#7	#6	#5	#4	#3	#2	#1	#0

	#7	#6	#5	#4	#3	#2	#1	#0
6013	[7	[6	[5	[4	[3	[2	[1	[0

	#7	#6	#5	#4	#3	#2	#1	#0
6014	]7	]6	]5	]4	]3	]2	]1	]0

[Data type] Bit type

These parameters are used to input/output macro statements.
The numeral of a suffix indicates the bit position in a code.
*0 to *7 : Set the hole pattern of an EIA code indicating *.
=0 to =7 : Set the hole pattern of an EIA code indicating =.
#0 to #7 : Set the hole pattern of an EIA code indicating #.
[0 to [7 : Set the hole pattern of an EIA code indicating [.
] 0 to] 7 : Set the hole pattern of an EIA code indicating].

0 : Corresponding bit is 0
1 : Corresponding bit is 1.

6030	M code that calls the program entered in file

[Data type] Byte

[Valid data range] 0, and 1 to 255

This parameter sets an M code that calls the program entered in a file.

> **NOTE**
> The M code is judged to be M198 when zero is specified as the setting value.

6033	M code that validates a custom macro interrupt
6034	M code that invalidates a custom macro interrupt

[Data type] Byte type

[Valid data range] 0 to 255

These parameters set the custom macro interrupt valid/invalid M codes.

> **NOTE**
> These parameters can be used when MPR, #4 of parameter No.6003, is 1. M96 is used as a valid M code and M97 is used as an invalid M code when MPR is 0, irrespective of the state of this parameter.

6050	G code that calls the custom macro of program number 9010

6051	G code that calls the custom macro of program number 9011

6052	G code that calls the custom macro of program number 9012

6053	G code that calls the custom macro of program number 9013

6054	G code that calls the custom macro of program number 9014

6055	G code that calls the custom macro of program number 9015

6056	G code that calls the custom macro of program number 9016

6057	G code that calls the custom macro of program number 9017

6058	G code that calls the custom macro of program number 9018

6059	G code that calls the custom macro of program number 9019

[Data type] Word type

[Valid data range] 1 to 9999

These parameters set the G codes that call the custom macros of program numbers 9010 through 9019.

> **NOTE**
> Setting value 0 is invalid. No custom macro can be called by G00.

6071	M code that calls the subprogram of program number 9001

6072	M code that calls the subprogram of program number 9002

6073	M code that calls the subprogram of program number 9003

6074	M code that calls the subprogram of program number 9004

6075	M code that calls the subprogram of program number 9005

6076	M code that calls the subprogram of program number 9006

6077	M code that calls the subprogram of program number 9007

6078	M code that calls the subprogram of program number 9008

6079	M code that calls the subprogram of program number 9009

[Data type] 2–word type

[Valid data range] 1 to 99999999

These parameters set the M codes that call the subprograms of program numbers 9001 through 9009.

> **NOTE**
> Setting value 0 is invalid. No custom macro can be called by M00.

6080	M code that calls the custom macro of program number 9020

6081	M code that calls the custom macro of program number 9021

6082	M code that calls the custom macro of program number 9022

6083	M code that calls the custom macro of program number 9023

6084	M code that calls the custom macro of program number 9024

6085	M code that calls the custom macro of program number 9025

6086	M code that calls the custom macro of program number 9026

6087	M code that calls the custom macro of program number 9027

6088	M code that calls the custom macro of program number 9028

6089	M code that calls the custom macro of program number 9029

[Data type] 2–word type

[Valid data range] 1 to 99999999

These parameters set the M codes that call the custom macros of program numbers 9020 through 9029.

> **NOTE**
> Setting value 0 is invalid. No custom macro can be called by M00.

6090	ASCII code that calls the subprogram of program number 9004

6091	ASCII code that calls the subprogram of program number 9005

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte type

[Valid data range] 65 (A:41H) to 90 (Z:5AH)

These parameters set the ASCII codes that call subprograms in decimal.
Addresses that can be used are as follows:
T series : A, B, F, H, I, K, M, P, Q, R, S, T
M series: A, B, D, F, H, I, J, K, L, M, P, Q, R, S, T, X, Y, Z

> **NOTE**
> Set 0 when no subprogram is called

4.27
PARAMETERS OF
PATTERN DATA
INPUT

6101	First variable number displayed on pattern data screen 1
6102	First variable number displayed on pattern data screen 2
6103	First variable number displayed on pattern data screen 3
6104	First variable number displayed on pattern data screen 4
6105	First variable number displayed on pattern data screen 5
6106	First variable number displayed on pattern data screen 6
6107	First variable number displayed on pattern data screen 7
6108	First variable number displayed on pattern data screen 8
6109	First variable number displayed on pattern data screen 9
6110	First variable number displayed on pattern data screen 10

[Data type] Word type

[Valid data range] 0, 100 to 199, 500 to 999

These parameters specify the first variable number displayed on the pattern data screen selected from the pattern menu screen. When 0 is set, 500 is assumed.

4.28
PARAMETERS OF SKIP FUNCTION

	#7	#6	#5	#4	#3	#2	#1	#0
6200	SKF	SRE	SLS	HSS	MIT		SK0	GSK
	SKF	SRE		HSS			SK0	

[Data type] Bit type

GSK In skip cutting (G31), the skip signal SKIPP (bit 6 of G006) is:

0 : Not used as a skip signal.
1 : Used as a skip signal.

SK0 This parameter specifies whether the skip signal is made valid under the state of the skip signal SKIP (bit 7 of X004) and the multistage skip signals (bits 0 to 7 of X004) (for the T series only).

0 : Skip signal is valid when these signals are 1.
1 : Skip signal is valid when these signals are 0.

MIT In skip cutting (G31), the tool compensation measurement value direct input B signals +MIT1, –MIT1, +MIT2, and =MIT2 (bit 2 to 5 of X004) are :

0 : Not used as skip signals.
1 : Used as skip signals.

HSS 0 : The skip function does not use high-speed skip signals.

1 : The skip function uses high-speed skip signals.

SLS 0 The multi–step skip function does not use high-speed skip signals while skip signals are input.

1 : The multi–step skip function uses high-speed skip signals while skip signals are input.

SRE When a high-speed skip signal is used:

0 : The signal is considered to be input at the rising edge ($0 \rightarrow 1$).
1 : The signal is considered to be input at the falling edge ($1 \rightarrow 0$).

SKF Dry run, override, and automatic acceleration/deceleration for G31 skip command

0 : Disabled
1 : Enabled

	#7	#6	#5	#4	#3	#2	#1	#0
6201				IGX	TSA	TSE	SEB	SEA
				IGX	TSA	TSE	SEB	SEA

[Data type] Bit

SEA When a high speed skip signal goes on while the skip function is used, acceleration/deceleration and servo delay are:

0 : Ignored.
1 : Considered and compensated (type A).

SEB When a high speed skip signal goes on while the skip function is used, acceleration/deceleration and servo delay are:

0 : Ignored.
1 : Considered and compensated (type B).

> **NOTE**
> There are two types of compensation: Types A and B. With the skip function, the current position is stored in the CNC according to the skip signal. However, the current position stored in the CNC contains servo delay. The machine position is therefore deviated by the servo delay. The deviation can be obtained from the position deviation of the servo and the error generated due to feedrate acceleration/deceleration performed by the CNC. If the deviation can be compensated, it is not necessary to include the servo delay in measurement errors. The deviation can be compensated with the following two types by the parameter as follows:
> (1) Type A: The deviation is the value calculated from the cutting time constant and servo time constant (loop gain).
> (2) Type B: The deviation is the error due to acceleration/deceleration and the position deviation when the skip signal goes on.

TSE When the torque limit skip function (G31 P99/98) is used, the skip position held in a system variable is:

0 : Position that is offset considering the delay (positional deviation) incurred by the servo system.

1 : Position that does not reflect the delay incurred by the servo system.

> **NOTE**
> The torque limit skip function stores the current position in the CNC when the torque limit arrival signal is turned on. However, the current position in the CNC includes a servo system delay, so that the position is shifted from the machine position by an amount corresponding to the servo system delay. The value of this shift can be determined from the servo system positional deviation. When TSE is set to 0, a skip position is determined by subtracting the positional deviation from the current position. When TSE is set to 1, the current position (including the servo system delay) is used as the skip position, without considering any shift or position deviation.

TSA When the torque limit skip function (G31 P99/98) is used, torque limit arrival monitoring is performed for:

0 : All axes.

1 : Only those axes that are specified in the block containing the G31 command.

IGX When the high-speed skip function is used, SKIP (bit 7 of X004), SKIPP (bit 6 of G006), and +MIT1 to –MIT2 (bits 2 to 5 of X004) are:

0 : Enabled as skip signals.

1 : Disabled as skip signals.

> **NOTE**
> 1 SKIPP (bit 6 of G006) and +MIT1 to –MIT2 (bits 2 to 5 of X004) are enabled only when bit 0 (GSK) of parameter No.6200 is set to 1 and bit 3 (MIT) of parameter No.6200 is set to 1. Note also that these signals are enabled only for the T series.
> 2 The skip signals for the multistage skip function (SKIP, SKIP2 to SKIP8) can also be disabled.

	#7	#6	#5	#4	#3	#2	#1	#0
6202	1S8	1S7	1S6	1S5	1S4	1S3	1S2	1S1
								LS1

	#7	#6	#5	#4	#3	#2	#1	#0
6203	2S8	2S7	2S6	2S5	2S4	2S3	2S2	2S1

	#7	#6	#5	#4	#3	#2	#1	#0
6204	3S8	3S7	3S6	3S5	3S4	3S3	3S2	3S1

	#7	#6	#5	#4	#3	#2	#1	#0
6205	4S8	4S7	4S6	4S5	4S4	4S3	4S2	4S1

	#7	#6	#5	#4	#3	#2	#1	#0
6206	DS8	DS7	DS6	DS5	DS4	DS3	DS2	DS1

[Data type] Bit type

1S1 Specify which high-speed skip signal is enabled when the G31 skip command is issued. The bits correspond to the following signals:

1S1 — HDI0

1S1 to 1S8, 2S1 to 2S8, 3S1 to 3S8, 4S1 to 4S8, DS1 to DS8

Specify which skip signal is enabled when the skip command (G31, or G31P1 to G31P4) and the dwell command (G04, G04Q1 to G04Q4) are issued with the multi–step skip function.

The following table shows the correspondence between the bits, input signals, and commands.

The setting of the bits have the following meaning :

0 : The skip signal corresponding to the bit is disabled.
1 : The skip signal corresponding to the bit is enabled.

High–speed skip function		Multi–step skip function					
Command / Input signal	G31	Command / Input signal	G31 G31P1 G04Q1	G31P2 G04Q2	G31P2 G04Q2	G31P4 G04Q4	G04
HD1	1S1	SKIP/HDI0	1S1	2S1	3S1	4S1	DS1
		SKIP2	1S2	2S2	3S2	4S2	DS2
		SKIP3	1S3	2S3	3S3	4S3	DS3
		SKIP4	1S4	2S4	3S4	4S4	DS4
		SKIP5	1S5	2S5	3S5	4S5	DS5
		SKIP6	1S6	2S6	3S6	4S6	DS6
		SKIP7	1S7	2S7	3S7	4S7	DS7
		SKIP8	1S8	2S8	3S8	4S8	DS8

> **NOTE**
> HDI0 are high-speed skip signals.

4.29 PARAMETERS OF AUTOMATIC TOOL COMPENSATION (T SERIES) AND AUTOMATIC TOOL LENGTH COMPENSATION (M SERIES)

6240	#7	#6	#5	#4	#3	#2	#1	#0
								AE0
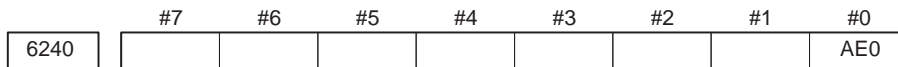
[Data type] Bit type

AE0 Measurement position arrival is assumed when the automatic tool compensation signals XAE and ZAE (bits 0 and 1 of X004) (T system) or the automatic tool length measurement signals XAE, YAE, and ZAE (bits 0, 1, and 2 of X004) (M system) are:

0 : 1
1 : 0

6241	Feedrate during measurement of automatic tool compensation
	Feedrate during measurement of automatic tool length compensation

[Data type] Word type

Increment system	Unit of data	Valid data range	
		IS−A, IS−B	IS−C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800

This parameter sets the feedrate during measurement of automatic tool compensation (T series) and automatic tool length compensation (M series).

6251	γ value on X axis during automatic tool compensation
	γ value during automatic tool length automatic compensation

6252	γ value on Z axis during automatic tool compensation

[Data type] 2–word type

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch

[Valid data range] 1 to 99999999

These parameters set the ε value during automatic tool compensation (T series) or tool length automatic compensation (M series).

> **NOTE**
> Set a radius value irrespective of whether the diameter programming or the radius programming is specified.

6254	ε value on X axis during automatic tool compensation
	ε value during automatic tool length automatic compensation

6255	ε value on Z axis during automatic tool compensation

[Data type] 2–word type

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch

[Valid data range] 1 to 99999999

These parameters set the ε value during automatic tool compensation (T series) or automatic tool length offset (M series).

> **NOTE**
> Set a radius value irrespective of whether the diameter programming or the radius programming is specified.

4.30 PARAMETERS OF EXTERNAL DATA INPUT/OUTPUT

	#7	#6	#5	#4	#3	#2	#1	#0
6300				ESR				

[Data type] Bit type

ESR External program number search

0 : Disabled
1 : Enabled

4.31
PARAMETERS OF
GRAPHIC DISPLAY

4.31.1
Parameters of Graphic Display/Dynamic Graphic Display

6500	#7	#6	#5	#4	#3	#2	#1	#0
		NZM			DPA			
			DPO					

[Data type] Bit

DPA Current position display on the graphic display screen

0 : Displays the actual position to ensure tool nose radius compensation
1 : Displays the programmed position

DPO Current position on the solid drawing (machining profile drawing) or tool path drawing screen

0 : Not appear
1 : Appears

NZM 0 : The screen image is not enlarged by specifying the center of the screen and magnification. (Screen image enlargement by a conventional method is enabled.)

1 : The screen image is enlarged by specifying the center of the screen and magnification. (Screen image enlargement by the conventional method is disabled.)

6501	#7	#6	#5	#4	#3	#2	#1	#0
			CSR					
			CSR					ORG

[Data type] Bit

ORG Movement when coordinate system is altered during drawing

0 : Draws in the same coordinate system
1 : Draws in the new coordinate system (only for the path drawing)

CSR While the screen image is enlarged, the shape of the graphic cursor is:
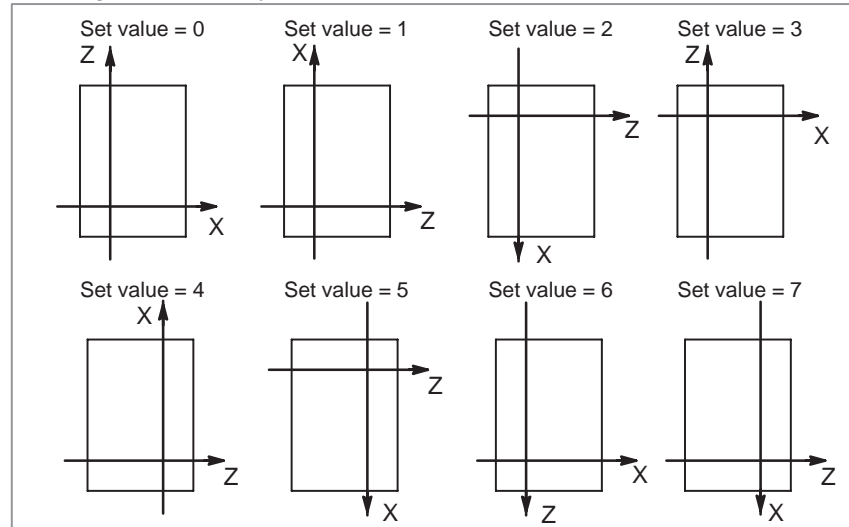
0 : A square. (■)
1 : An X. (X)

6510	Drawing coordinate system

[Data type] Byte

[Valid data range] 0 to 7

This parameter specifies the drawing coordinate system for the graphic function.

The following show the relationship between the set values and the drawing coordinate systems.

4.31.2
Parameters of Graphic Color

6561	Standard color data for graphic color number 1
6562	Standard color data for graphic color number 2
6563	Standard color data for graphic color number 3
6564	Standard color data for graphic color number 4
6565	Standard color data for graphic color number 5
6566	Standard color data for graphic color number 6
6567	Standard color data for graphic color number 7
6568	Standard color data for graphic color number 8
6569	Standard color data for graphic color number 9
6570	Standard color data for graphic color number 10
6571	Standard color data for graphic color number 11
6572	Standard color data for graphic color number 12
6573	Standard color data for graphic color number 13
6574	Standard color data for graphic color number 14
6575	Standard color data for graphic color number 15

6581	Standard color data for character color number 1
6582	Standard color data for character color number 2
6583	Standard color data for character color number 3
6584	Standard color data for character color number 4
6585	Standard color data for character color number 5
6586	Standard color data for character color number 6
6587	Standard color data for character color number 7
6588	Standard color data for character color number 8
6589	Standard color data for character color number 9
6590	Standard color data for character color number 10
6591	Standard color data for character color number 11
6592	Standard color data for character color number 12
6593	Standard color data for character color number 13
6594	Standard color data for character color number 14
6595	Standard color data for character color number 15

[Data type] 2–word

[Unit of data] rr gg bb: 6–digit number (rr: Red gg: Green bb: Blue)
When a number of less than six digits is set, the system assumes that 0 has been specified for the unspecified higher digit(s).

[Valid data range] Data of each color: 00 to 15 (same value as the tone level data on the color setting screen)
When a value of more than 15 is set, the system assumes that 15 has been specified.

Example: Set 10203 in this parameter when the color tone levels are as follows:
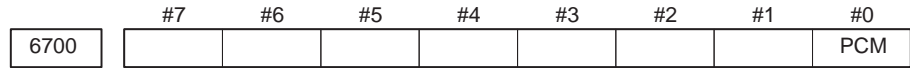Red: 1   Green: 2   Blue: 3

NOTE

To set the color of the VGA display, use the color setting screen. Note that the color changes when the settings of parameters No.6561 through No.6595 are modified.

4.32
PARAMETERS OF DISPLAYING OPERATION TIME AND NUMBER OF PARTS

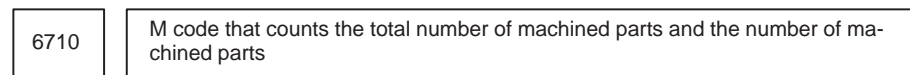|	#7	#6	#5	#4	#3	#2	#1	#0
6700								PCM

[Data type] Bit

PCM M code that counts the total number of machined parts and the number of machined parts

0 : M02, or M30, or an M code specified by parameter No.6710
1 : Only M code specified by parameter No.6710

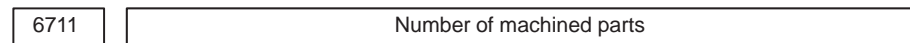| 6710	M code that counts the total number of machined parts and the number of machined parts

[Data type] Byte

[Valid data range] 0 to 255 except 98 and 99

The total number of machined parts and the number of machined parts are counted (+1) when the M code set is executed.

> **NOTE**
> Set value 0 is invalid (the number of parts is not counted for M00). Data 98 and 99 cannot be set.

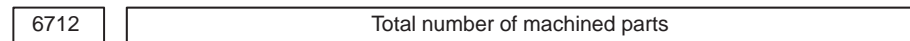| 6711	Number of machined parts

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One piece

[Valid data range] 0 to 99999999

The number of machined parts is counted (+1) together with the total number of machined parts when the M02, M30, or a M code specified by parameter No.6710 is executed.

6712	Total number of machined parts

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One piece

[Valid data range] 0 to 99999999

This parameter sets the total number of machined parts.

The total number of machined parts is counted (+1) when M02, M30, or an M code specified by parameter No.6710 is executed.

6713	Number of required parts

Setting entry is acceptable.

[Data type] Word

[Unit of data] One piece

[Valid data range] 0 to 9999

This parameter sets the number of required machined parts.

Required parts finish signal PRTSF is output to PMC when the number of machined parts reaches the number of required parts. The number of parts is regarded as infinity when the number of required parts is zero. The PRTSF signal is then not output.

6750	Integrated value of power–on period

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One minute

[Valid data range] 0 to 99999999

This parameter displays the integrated value of power–on period.

6751	Operation time (integrated value of time during automatic operation) I

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One ms

[Valid data range] 0 to 60000

6752	Operation time (integrated value of time during automatic operation) II

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One minute

[Valid data range] 0 to 99999999

This parameter displays the integrated value of time during automatic operation (neither stop nor hold time included).

6753	Integrated value of cutting time I

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One ms

[Valid data range] 1 to 60000

6754	Integrated value of cutting time II

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One minute

[Valid data range] 0 to 99999999

This parameter displays the integrated value of a cutting time that is performed in cutting feed such as linear interpolation (G01) and circular interpolation (G02 or G03).

6755	Integrated value of general–purpose integrating meter drive signal (TMRON) ON time I

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One ms

[Valid data range] 0 to 60000

6756	Integrated value of general–purpose integrating meter drive signal (TMRON) ON time II

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One minute

[Valid data range] 0 to 99999999

This parameter displays the integrated value of a time while input signal TMRON from PMC is on.

6757	Operation time (integrated value of one automatic operation time) I

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One ms

[Valid data range] 0 to 60000

6758	Operation time (integrated value of one automatic operation time) II

Setting entry is acceptable.

[Data type] 2–word

[Unit of data] One minute

[Valid data range] 0 to 99999999

This parameter displays the one automatic operation drive time (neither stop nor hold state included). The operation time is automatically preset to 0 during the power–on sequence and the cycle start from the reset state.

4.33
PARAMETERS OF TOOL LIFE MANAGEMENT

6800	#7	#6	#5	#4	#3	#2	#1	#0
			SNG	GRS	SIG	LTM	GS2	GS1
	M6T	IGI	SNG	GRS	SIG	LTM	GS2	GS1

[Data type] Bit

GS1, GS2   This parameter sets the combination of the number of tool life groups which can be entered, and the number of tools which can be entered per group as shown in the table below.

GS2	GS1	M series		T series	
		Group count	**Tool count**	**Group count**	**Tool count**
0	0	1 to 16 1 to 64	1 to 16 1 to 32	1 to 16 1 to 16	1 to 16 1 to 32
0	1	1 to 32 1 to 28	1 to 8 1 to 16	1 to 32 1 to 32	1 to 8 1 to 16
1	0	1 to 64 1 to 256	1 to 4 1 to 8	1 to 64 1 to 64	1 to 4 1 to 8
1	1	1 to 128 1 to 512	1 to 2 1 to 4	1 to 16 1 to 128	1 to 16 1 to 4

The values on the lower row in the table apply when for the M series, the 512–tool–life–management–group option is provided, and for the T series, the 128–tool–life–management–group option is provided.

LTM   Tool life

0 : Specified by the number of times
1 : Specified by time

SIG   Group number is

0 : Not input using the tool group signal during tool skip (The current group is specified.)
1 : Input using the tool group signal during tool skip

GRS   Tool exchange reset signal

0 : Clears only the execution data of a specified group
1 : Clears the execution data of all entered groups

SNG   Input of the tool skip signal when a tool that is not considered tool life management is selected.

0 : Skips the tool of the group used last or of the specified group (using SIG, #3 of parameter No.6800).
1 : Ignores a tool skip signal

IGI   Tool back number

0 : Not ignored
1 : Ignored

M6T   T code in the same block as M06

0 : Judged as a back number
1 : Judged as a next tool group command

	#7	#6	#5	#4	#3	#2	#1	#0
6801		EXG	E1S				TSM	
	M6E	EXT	E1S		EMD	LFV		CUT

[Data type] Bit

CUT The tool life management using cutting distance is

   0 : Not performed (Usually set this parameter to 0).

   1 : Performed

TSM When a tool takes several tool numbers, life is counted in tool life management:

   0 : For each of the same tool numbers.

   1 : For each tool.

LFV Specifies whether life count override is enabled or disabled when the extended tool life management function is used.

   0 : Disabled

   1 : Enabled

EMD An asterisk (*) indicating that a tool has been expired is displayed,

   0 : When the next tool is selected

   1 : When the tool life is expired

E1S When the life of a tool is measured in time–based units:

   0 : The life is counted every four seconds.

   1 : The life is counted every second.

> **NOTE**
> This parameter is valid when bit 2 (LTM) of parameter No.6800 is set to 1.

EXT Specifies whether the extended tool life management function is used.

   0 : Not used

   1 : Used

EXG Tool life management data registration by G10 (T system) is:

   0 : Performed after the data for all tool groups has been cleared.

   1 : Performed by adding/changing or deleting the data for a specified group.

> **NOTE**
> When EXG = 1, address P in the block including G10 can be used to specify whether data is to be added/changed or deleted (P1: add/change, P2: delete). When P is not specified, the data for all tool groups is cleared before the tool life management data is registered.

M6E When a T code is specified in the same block as M06

   0 : The T code is processed as a return number or as a group number selected next. Either is set by parameter M6T No.6800#7.

   1 : The tool group life is counted immediately.

	#7	#6	#5	#4	#3	#2	#1	#0
6802								T99

[Data type] Bit

T99 If a tool group whose life has expired is found to exist when M99 is executed in the main program:

0 : The tool change signal is not output.
1 : The tool change signal is output.

	#7	#6	#5	#4	#3	#2	#1	#0
6803							LFE	LGR
							LFE	

> **NOTE**
> After this parameter has been set, the power must be turned off then on again for the setting to become effective.

[Data type] Bit

LGR When the tool life management function is used, a tool life type is:

0 : Chosen based on the LTM parameter (bit 2 of parameter No.6800) for all groups.
1 : Set to either count or duration on a group–by–group basis.

When LGR is set to 1, the specification of address Q is added to the G10 (tool life management data setting) command format. As shown in the example below, specify the tool life of each group as either a count or a duration. If address Q is omitted for a group, the specification of the LTM parameter (bit 2 of parameter No.6800) applies to the group.

Example: When the LTM parameter (bit 2 of parameter No.6800) is set to 0

G10 L3 ;
P1 L10 Q1 ; (Q1: The life of group 1 is specified as a count.)
   :
P2 L20 Q2 ; (Q2: The life of group 2 is specified as a duration.)
   :
P3 L20 ;
   (Omission of Q: The life of group 3 is specified as a count.)
   :
G11 ;
M30 ;
%

LFE When a tool life is specified by count:

0 : A count value from 0 to 9999 can be specified.
1 : A count value from 0 to 65535 can be specified.

6810	Tool life management ignored number

[Data type] Word

[Valid data range] 0 to 9999

This parameter sets the tool life management ignored number.

When the set value is subtracted from a T code, a remainder is used as the tool group number of tool life management when a value exceeding the set value is specified in the T code.

6811	Tool life count restart M code

[Data type] Byte

[Valid data range] 0 to 255 (not including 01, 02, 30, 98, and 99)
When zero is specified, it is ignored.

When the life is specified by the number of times, the tool exchange signal is output when a tool life count restart M code is specified if tool life of at least one tool group is expired. A tool in life is selected in the specified group when a T code command (tool group command) is specified after the tool life count restart M code is specified. A tool life counter is then incremented by one.

When the life is specified by time, a tool in life is selected in the specified group when a T code command (tool group command) is specified after the tool life count restart M code is specified.

6844	Remaining tool life (use count)

[Data type] Word

[Unit of data] Count

[Valid data range] 0 to 9999

This parameter sets a remaining tool life (use count) used to output the tool life arrival notice signal when the tool life is specified as a use count.

> **NOTE**
> 1 When the remaining life (use count) of a selected tool reaches the value specified with parameter No.6844, tool life arrival notice signal TLCHB is output to the PMC.
> 2 If a value greater than the life of a tool is specified with parameter No.6844, the tool life arrival notice signal is not output.

6845	Remaining tool life (use duration)

[Data type] 2–word

[Unit of data] Minutes

[Valid data range] 0 to 4300

This parameter sets the remaining tool life (use duration), used to output the tool life arrival notice signal when the tool life is specified as a use duration.

> **NOTE**
> 1 When the remaining life (use duration) of a selected tool reaches the value specified in parameter No.6845, tool life arrival notice signal TLCHB is output to the PMC. The tool life management function allows the user to specify a tool life either as a use duration or use count for each tool group. For a group whose life is specified as a use count, parameter No.6844 is used. For a group whose life is specified as a use time, parameter No.6845 is used.
> 2 If a value greater than the life of a tool is specified with parameter No.6845, the tool life arrival notice signal is not output.

4.34
PARAMETERS OF POSITION SWITCH FUNCTIONS

	#7	#6	#5	#4	#3	#2	#1	#0
6901								IGP

[Data type] Bit type

IGP During follow–up for the absolute position detector, position switch signals are:

0 : Output

1 : Not output

6910	Axis corresponding to the first position switch

6911	Axis corresponding to the second position switch

6912	Axis corresponding to the third position switch

6913	Axis corresponding to the fourth position switch

6914	Axis corresponding to the fifth position switch

6915	Axis corresponding to the sixth position switch

6916	Axis corresponding to the seventh position switch

6917	Axis corresponding to the eighth position switch

6918	Axis corresponding to the ninth position switch

6919	Axis corresponding to the tenth position switch

[Data type] Byte

[Valid data range] 1, 2, 3, . . . , control axis count

These parameters specify the control–axes numbers corresponding to the first through tenth position switch functions. A corresponding position switch signal is output to PMC when the machine coordinate value of a corresponding axis is within the range that is set using a parameter.

> **NOTE**
> Set 0 for those position switch numbers that are not to be used.

6930	Maximum operation range of the first position switch

6931	Maximum operation range of the second position switch

6932	Maximum operation range of the third position switch

6933	Maximum operation range of the fourth position switch

6934	Maximum operation range of the fifth position switch

6935	Maximum operation range of the sixth position switch

6936	Maximum operation range of the seventh position switch

6937	Maximum operation range of the eighth position switch

6938	Maximum operation range of the ninth position switch

6939	Maximum operation range of the tenth position switch

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

These parameters set the maximum operation range of the first through tenth position switches.

6950	Minimum operation range of the first position switch

6951	Minimum operation range of the second position switch

6952	Minimum operation range of the third position switch

6953	Minimum operation range of the fourth position switch

6954	Minimum operation range of the fifth position switch

6955	Minimum operation range of the sixth position switch

6956	Minimum operation range of the seventh position switch

6957	Minimum operation range of the eighth position switch

6958	Minimum operation range of the ninth position switch

6959	Minimum operation range of the tenth position switch

[Data type] 2–word

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Metric input	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] –99999999 to 99999999

These parameters set the minimum operation range of the first through tenth position switches.

4.35
PARAMETERS OF
MANUAL
OPERATION
AND AUTOMATIC
OPERATION

7001	#7	#6	#5	#4	#3	#2	#1	#0
								MIN

[Data type] Bit

MIN The manual intervention and return function is:

0 : Disabled.

1 : Enabled.

4.36
PARAMETERS OF MANUAL HANDLE FEED, HANDLE INTERRUPTION AND HANDLE FEED IN TOOL AXIAL DIRECTION

	#7	#6	#5	#4	#3	#2	#1	#0
7100					HCL	IHD	THD	JHD

[Data type] Bit

JHD Manual handle feed in JOG feed mode or incremental feed in the manual handle feed

0 : Invalid
1 : Valid

	When JHD:=0		When JHD:=1	
	JOG feed mode	**Manual handle feed mode**	**JOG feed mode**	**Manual handle feed mode**
JOG feed	○	×	○	×
Manual handle feed	×	○	○	○
Incremental feed	×	×	×	○

THD Manual pulse generator in TEACH IN JOG mode

0 : Invalid
1 : Valid

IHD The travel increment for manual handle interrupt is:

0 : Output unit, and acceleration/deceleration after interpolation is disabled.
1 : Input unit, and acceleration/deceleration after interpolation is enabled.

HCL The clearing of handle interruption amount display by soft key [CAN] operation is:

0 : Disabled.
1 : Enabled.

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

[Data type] Bit axis

HNGx Axis movement direction for rotation direction of manual pulse generator

0 : Same in direction
1 : Reverse in direction

7110	Number of manual pulse generators used

[Data type] Byte

[Valid data range] 1, 2, or 3

This parameter sets the number of manual pulse generators.

7113	Manual handle feed magnification m

[Data type] Word

[Unit of data] One time

[Valid data range] 1 to 127

This parameter sets the magnification when manual handle feed movement selection signal MP2 is set to 1.

7114	Manual handle feed magnification n

[Data type] Word

[Unit of data] One time

[Valid data range] 1 to 1000

This parameter sets the magnification when manual handle feed movement selection signals MP1 and MP2 are set to 1.

Movement selection signal		Movement (Manual handle feed)
MP2	**MP1**	
0	0	Least input increment × 1
0	1	Least input increment × 10
1	0	Least input increment × m
0	1	Least input increment × n

7117	Allowable number of pulses that can be accumulated during manual handle feed

[Data type] 2–Word

[Unit of data] Pulses

[Valid data range] 0 to 99999999

If manual handle feed is specified such that the rapid traverse rate will be exceeded momentarily, those pulses received from the manual pulse generator that exceed the rapid traverse rate are accumulated rather than canceled. This parameter sets the maximum number of pulses which can be accumulated in such a case.

NOTE

If the specification of manual handle feed is such that the rapid traverse rate will be exceeded, for example, when the manual pulse generator is rotated at high speed with a large magnification such as $\times 100$, the axial feedrate is clamped at the rapid traverse rate and those pulses received from the manual pulse generator that exceed the rapid traverse rate are ignored. In such a case, therefore, the scale on the manual pulse generator may differ from the actual amount of travel. If such a difference is not acceptable, this parameter can be set to temporarily accumulate the excess pulses in the CNC, rather than ignoring them, up to the specified maximum (pulses in excess of the set maximum are ignored). The accumulated pulses are output and converted to a move command once the feedrate falls below the rapid traverse rate by reducing the rotational speed of the manual pulse generator or stopping its rotation altogether. Note, however, that if the maximum number of pulses to be accumulated is too large, stopping the rotation of the manual pulse generator does not stop feeding until the tool moves by an amount corresponding to the pulses accumulated in the CNC.

4.37
PARAMETERS OF REFERENCE POSITION SETTING WITH MECHANICAL STOPPER

7181	First withdrawal distance in reference position setting with mechanical stopper

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch

[Valid data range] –99999999 to 99999999

When the reference position setting with mechanical stopper is used, this parameter sets a distance an axis, along which withdrawal is performed after the mechanical stopper is hit (distance from the mechanical stopper to the withdrawal point).

> **NOTE**
> Set the same direction as that set in bit 5 (ZMIx) of parameter No. 1006. Cycle operation cannot be started if the opposite direction is set.

7182	Second withdrawal distance in reference position setting with mechanical stopper

[Data type] 2–word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Unit
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch

[Valid data range] –99999999 to 99999999

When the reference position setting with mechanical stopper is used, this parameter sets a distance an axis, along which withdrawal is performed after the mechanical stopper is hit (distance from the mechanical stopper to the withdrawal point).

> **NOTE**
> Set the same direction as that set in bit 5 (ZMIx) of parameter No. 1006. Cycle operation cannot be started if the opposite direction is set.

7183	First butting feedrate in reference position setting with mechanical stopper

[Data type] Word axis

[Unit of data and valid range]

Increment system	Unit of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	1 mm/min	30 to 15000	30 to 12000
Inch machine	0.1 inch/min	30 to 6000	30 to 4800

When the reference position setting with mechanical stopper is used, this parameter sets the feedrate first used to hit the stopper on an axis.

7184	Second butting feedrate in reference position setting with mechanical stopper

[Data type] Word axis

[Unit of data and valid range]

Increment system	Unit of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	1 mm/min	30 to 15000	30 to 12000
Inch machine	0.1 inch/min	30 to 6000	30 to 4800

When the reference position setting with mechanical stopper is used, this parameter sets the feedrate used to hit the stopper on an axis for a second time.

7185	Withdrawal feedrate (common to the first and second butting operations) in reference position setting with mechanical stopper

[Data type] Word axis

[Unit of data and valid range]

Increment system	Unit of data	Valid data range	
		IS–A, IS–B	IS–C
Millimeter machine	1 mm/min	30 to 15000	30 to 12000
Inch machine	0.1 inch/min	30 to 6000	30 to 4800

When the reference position setting with mechanical stopper is used, this parameter sets the feedrate used for withdrawal along an axis after the mechanical stopper has been hit.

7186	Torque limit value in reference position setting with mechanical stopper

[Data type] Byte axes

[Unit of data] %

[Valid data range] 0 to 100

This parameter sets a torque limit value in reference position setting with mechanical stopper

---

NOTE
When 0 is set in this parameter, 100% is assumed.

4.38
PARAMETERS OF SOFTWARE OPERATOR'S PANEL

	#7	#6	#5	#4	#3	#2	#1	#0
7200		OP7	OP6	OP5	OP4	OP3	OP2	OP1

[Data type] Bit

OP1 Mode selection on software operator's panel

0 : Not performed
1 : Performed

OP2 JOG feed axis select and JOG rapid traverse buttons on software operator's panel

0 : Not performed
1 : Performed

OP3 Manual pulse generator's axis select and manual pulse generator's magnification switches on software operator's panel

0 : Not performed
1 : Performed

OP4 JOG speed override and rapid traverse override switches on software operator's panel

0 : Not performed
1 : Performed

OP5 Optional block skip, single block, machine lock, and dry run switches on software operator's panel

0 : Not performed
1 : Performed

OP6 Protect key on software operator's panel

0 : Not performed
1 : Performed

OP7 Feed hold on software operator's panel

0 : Not performed
1 : Performed

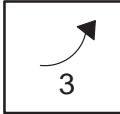|	#7	#6	#5	#4	#3	#2	#1	#0
7201								JPC

[Data type] Bit
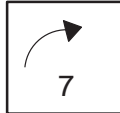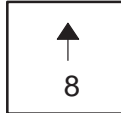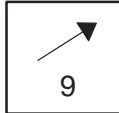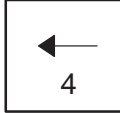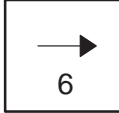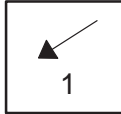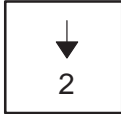
JPC For the name of a general–purpose switch function on the software operator's panel, the use of full–size characters is:

0 : Not allowed.
1 : Allowed.

7210	Job–movement axis and its direction on software operator's panel [↑]
7211	Job–movement axis and its direction on software operator's panel [↓]
7212	Job–movement axis and its direction on software operator's panel [→]
7213	Job–movement axis and its direction on software operator's panel [←]
7214	Job–movement axis and its direction on software operator's panel [↙]
7215	Job–movement axis and its direction on software operator's panel [↗]
7216	Job–movement axis and its direction on software operator's panel [↘]
7217	Job–movement axis and its direction on software operator's panel [↱]

[Data type] Byte

[Valid data range] 0 to 8

On software operator's panel, set a feed axis corresponding to an arrow key on the MDI panel when jog feed is performed.

Set value	Feed axis and direction
0	Not moved
1	First axis, positive direction
2	First axis, negative direction
3	Second axis, positive direction
4	Second axis, negative direction
5	Third axis, positive direction
6	Third axis, negative direction
7	Fourth axis, positive direction
8	Fourth axis, negative direction

Arrow keys on the MDI panel

Example

Under X, Y, and Z axis configuration, to set arrow keys to feed the axes in the direction specified as follows, set the parameters to the values given below. [8 ↑] to the positive direction of the Z axis, [2 ↓] to the negative direction of the Z axis, [6 →] to the positive direction of the X axis [4←] to the negative direction of the X axis, [1↙] to the positive direction of the Y axis, [9↗] to the negative direction of the Y axis

Parameter No.7210 = 5 (Z axis, positive direction)
Parameter No.7211 = 6 (Z axis, negative direction)
Parameter No.7212 = 1 (X axis, positive direction)
Parameter No.7213 = 2 (X axis, negative direction)
Parameter No.7214 = 3 (Y axis, positive direction)
Parameter No.7215 = 4 (Y axis, negative direction)
Parameter No.7216 = 0 (Not used)
Parameter No.7217 = 0 (Not used)

7220	Name of general–purpose switch on software operator's panel

7283	Name of general–purpose switch on software operator's panel
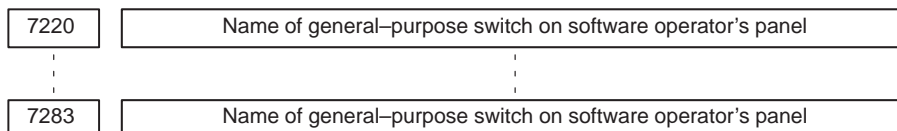
[Data type] Byte

Example

These parameters set the names of the general–purpose switches (SIGNAL 1 through SIGNAL 8) on the software operator's panel as described below.

```
OPERATOR'S PANEL      O1234 N5678

   SIGNAL1    :  OFF    ON
   SIGNAL2    :  OFF    ON
   SIGNAL3    :  OFF    ON
   SIGNAL4    :  OFF    ON
   SIGNAL5    :  OFF    ON
   SIGNAL6    :  OFF    ON
   SIGNAL7    :  OFF    ON
   SIGNAL8    :  OFF    ON
```

These names are set using character codes that are displayed in parameter Nos. 7220 to 7283.

Parameter No.7220:
    Sets the character code (083) corresponding to S of SIGNAL 1.
Parameter No.7221:
    Sets the character code (073) corresponding to I of SIGNAL 1.
Parameter No.7222:
    Sets the character code (071) corresponding to G of SIGNAL 1.
Parameter No.7223:
    Sets the character code (078) corresponding to N of SIGNAL 1.
Parameter No.7224:
    Sets the character code (065) corresponding to A of SIGNAL 1.
Parameter No.7225:
    Sets the character code (076) corresponding to L of SIGNAL 1.
Parameter No.7226:
    Sets the character code (032) corresponding to (space) of SIGNAL 1.
Parameter No.7227:
    Sets the character code (049) corresponding to 1 of SIGNAL 1.
Parameter Nos. 7228 to 7235:
    Set the character codes of SIGNAL 2 shown in the figure above.
Parameter Nos. 7236 to 7243:
    Set the character codes of SIGNAL 3 shown in the figure above.
Parameter Nos. 7244 to 7251:
    Set the character codes of SIGNAL 4 shown in the figure above.
Parameter Nos. 7252 to 7259:
    Set the character codes of SIGNAL 5 shown in the figure above.
Parameter Nos. 7260 to 7267:
    Set the character codes of SIGNAL 6 shown in the figure above.
Parameter Nos. 7268 to 7275:
    Set the character codes of SIGNAL 7 shown in the figure above.
Parameter Nos. 7276 to 7283:
    Set the character codes of SIGNAL 8 shown in the figure above.

> **NOTE**
> The character codes are shown in Appendix 1 CHARACTER CODE LIST.

7284	Name of general–purpose switch on software operator's panel (extended)
7285	Name of general–purpose switch on software operator's panel (extended)
7286	Name of general–purpose switch on software operator's panel (extended)
:	:
7299	Name of general–purpose switch on software operator's panel (extended)

7352	Name of general–purpose switch on software operator's panel (extended)
7353	Name of general–purpose switch on software operator's panel (extended)
7354	Name of general–purpose switch on software operator's panel (extended)
:	:
7399	Name of general–purpose switch on software operator's panel (extended)

[Data type] Byte

Set the names of the general–purpose switches (SIGNAL 9 to SIGNAL 16) on the software operator's panel, as described below.

```
OPERATOR'S PANEL      O1234 N5678

   SIGNAL1     :   OFF      ON
   SIGNAL2     :   OFF      ON
   SIGNAL3     :   OFF      ON
   SIGNAL4     :   OFF      ON
   SIGNAL5     :   OFF      ON
   SIGNAL6     :   OFF      ON
   SIGNAL7     :   OFF      ON
   SIGNAL8     :   OFF      ON
```

These names are set using the character codes displayed in parameters No.7284 through No.7299, and parameters No.7352 through No.7399.

Parameter No.7284:
    Set the character code (083) corresponding to S of SIGNAL 9.
Parameter No.7285:
    Set the character code (073) corresponding to I of SIGNAL 9.
Parameter No.7286:
    Set the character code (071) corresponding to G of SIGNAL 9.
Parameter No.7287:
    Set the character code (078) corresponding to N of SIGNAL 9.
Parameter No.7288:
    Set the character code (065) corresponding to A of SIGNAL 9.
Parameter No.7289:
    Set the character code (076) corresponding to L of SIGNAL 9.
Parameter No.7290:
    Set the character code (032) corresponding to (space) of SIGNAL 9.
Parameter No.7291:
    Set the character code (057) corresponding to 1 of SIGNAL 9.

Similarly, set character codes as shown below.

Parameter No.7292 to No.7299:	Set character codes for SIGNAL 10, shown above.
Parameter No.7352 to No.7359:	Set character codes for SIGNAL 11, shown above.
Parameter No.7360 to No.7367:	Set character codes for SIGNAL 12, shown above.
Parameter No.7368 to No.7375:	Set character codes for SIGNAL 13, shown above.
Parameter No.7376 to No.7383:	Set character codes for SIGNAL 14, shown above.
Parameter No.7384 to No.7391:	Set character codes for SIGNAL 15, shown above.
Parameter No.7392 to No.7399:	Set character codes for SIGNAL 16, shown above.

> **NOTE**
> The character codes are shown in the character code correspondence table in Appendix A.

4.39
PARAMETERS OF
PROGRAM RESTART

7300	#7	#6	#5	#4	#3	#2	#1	#0
	MOU	MOA						
	MOU	MOA						

[Data type] Bit

MOA In program restart operation, before movement to a machining restart point after restart block search:

0 : The last M, S, T, and B codes are output.
1 : All M codes and the last S, T, and B codes are output.

> **NOTE**
> This parameter is enabled when the MOU parameter is set to 1.

MOU In program restart operation, before movement to a machining restart point after restart block search:

0 : The M, S, T, and B codes are not output.
1 : The last M, S, T, and B codes are output.

7310	Movement sequence to program restart position

Setting entry is accepted.

[Data type] Byte

[Valid data range] 1 to No.of controlled axes

This parameter sets the axis sequence when the machine moves to the restart point by dry run after a program is restarted.

[Example]
The machine moves to the restart point in the order of the fourth, first, second, and third axes one at a time when the first axis = 2, the second axis = 3, the third axis = 4, and the fourth axis = 1 are set.

4.40
PARAMETERS OF HIGH–SPEED MACHINING (HIGH–SPEED CYCLE MACHINING/HIGH–SPEED REMOTE BUFFER)

	#7	#6	#5	#4	#3	#2	#1	#0
7501	IPC	IT2	IT1	IT0				
	IPC	IT2	IT1	IT0				

[Data type] Bit

IT0, IT1, IT2

IT2	IT1	IT0	Interpolation of G05 data (ms)
0	0	0	8
0	0	1	2
0	1	0	4
0	1	1	1
1	0	0	16

IPC

0 : The system does not monitor whether a distribution process is stopped while high–speed machining (G05) is performed with high–speed remote buffer A or B or in a high–speed cycle.

1 : The system monitors whether a distribution process is stopped while high–speed machining (G05) is performed with high–speed remote buffer A or B or in a high–speed cycle.
(P/S alarms 179 and 000 are simultaneously issued if the distribution process is stopped. In this case, the power must be turned off then on again.)
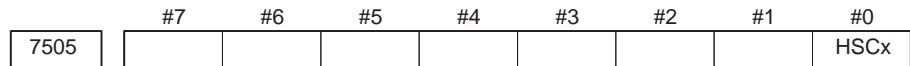

NOTE

The distribution process stops, when the host cannot send data with the high–speed remotebuffer by the specified time.

	#7	#6	#5	#4	#3	#2	#1	#0
7502								SUP

[Data type] Bit axis

SUP In high–speed remote buffering and high–speed machining:

0 : Acceleration/deceleration control is not applied.
1 : Acceleration/deceleration control is applied.

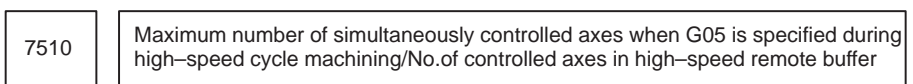|	#7	#6	#5	#4	#3	#2	#1	#0
7505								HSCx

> **NOTE**
> After setting this parameter, the power must be tuned off then on again.

[Data type] Bit axis

HSCx Specifies whether each axis is used for high–speed distribution in a high–speed cycle or with ahigh–speed remote buffer.

0 : Not used for high–speed distribution.

1 : Used for high–speed distribution

7510	Maximum number of simultaneously controlled axes when G05 is specified during high–speed cycle machining/No.of controlled axes in high–speed remote buffer

[Data type] Word

[Valid data range] 1 to 4

This parameter sets the maximum number of simultaneous conrtol axes when G05 is specified during high–speed cycle machining or sets the number of control axes in a high–speed remote buffer.

4.41
PARAMETERS OF
POLYGON TURNING

	#7	#6	#5	#4	#3	#2	#1	#0
7600	PLZ							

[Data type] Bit

PLZ Synchronous axis using G28 command

0: Returns to the reference position in the same sequence as the manual reference position return.

1: Returns to the reference position by positioning at a rapid traverse.
The synchronous axis returns to the reference position in the same sequence as the manual reference position return when no return–to–reference position is performed after the power is turned on.

7610	Control axis number of tool rotation axis for polygon turning

[Data type] Byte

[Valid data range] 1, 2, 3, . . . number of control axes

This parameter sets the control axis number of a rotation tool axis used for polygon turning.

7620	Movement of tool rotation axis per revolution

[Data type] 2–word

Increment system	IS–A	IS–B	IS–C	Unit
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] 1 to 9999999

This parameter sets the movement of a tool rotation axis per revolution.

7621	Maximum allowable speed for the tool rotation axis (polygon synchronization axis)

[Data type] Word

[Unit of data] rpm

[Valid data range] For polygonal turning using servo motors:

$$\frac{0 \text{ to } 1.2 \quad \times 10^8}{\text{set value of the parameter No.7620}}$$

For polygon turning with two spindles:

Set a value between 0 and 32767, but which does not exceed the maximum allowable speed, as determined by the performance of the second spindle and other mechanical factors.

This parameter sets the maximum allowable speed of the tool rotation axis (polygon synchronization axis).
If the speed of the tool rotation axis (polygon synchronization axis) exceeds the specified maximum allowable speed during polygon turning, the speed is clamped at the maximum allowable speed. When the speed is clamped at a maximum allowable speed, however, synchronization between the spindle and tool rotation axis (polygon synchronization axis) is lost. And, when the speed is clamped, P/S alarm No.5018 is issued.

4.42
PARAMETERS OF AXIS CONTROL BY PMC

	#7	#6	#5	#4	#3	#2	#1	#0
8001	SKE	AUX	NCC		RDE	OVE		MLE

[Data type] Bit

MLE Whether all axis machine lock signal MLK is valid for PMC–controlled axes

0 : Valid
1 : Invalid

> **NOTE**
> Each–axis machine lock signals MLK1 to MLK8 are always valid, regardless of the setting of this parameter.

OVE Signals related to dry run and override used in PMC axis control

0 : Same signals as those used for the CNC
(1) Feedrate override signals *FV0 to *FV7
(2) Override cancellation signal OVC
(3) Rapid traverse override signals ROV1 and ROV2
(4) Dry run signal DRN
(5) Rapid traverse selection signal RT
1 : Signals specific to the PMC
(1) Feedrate override signals *FV0E to *FV7E
(2) Override cancellation signal OVCE
(3) Rapid traverse override signals ROV1E and ROV2E
(4) Dry run signal DRNE
(5) Rapid traverse selection signal RTE

RDE Whether dry run is valid for rapid traverse in PMC axis control

0 : Invalid
1 : Valid

NCC When a travel command is issued for a PMC–controlled axis (selected by a controlled–axis selection signal) according to the program:

0 : P/S alarm 139 is issued while the PMC controls the axis with an axis control command. While the PMC does not control the axis, a CNC command is enabled.
1 : P/S alarm 139 is issued unconditionally.

AUX The number of bytes for the code of an auxiliary function (12H) command to be output is

0 : 1 (0 to 255)
1 : 2 (0 to 65535)

SKE Skip signal during axis control by the PMC

0 : Uses the same signal SKIP (X004#7) as CNC.
1 : Uses dedicated axis control signal ESKIP (X004#6) used by the PMC.

	#7	#6	#5	#4	#3	#2	#1	#0
8002	FR2	FR1	PF2	PF1	F10	SUE	DWE	RPD

[Data type] Bit

RPD Rapid traverse rate for PMC–controlled axes

0 : Feedrate specified with parameter No.1420
1 : Feedrate specified with the feedrate data in an axis control command

DWE Minimum time which can be specified in a dwell command in PMC axis control when the increment system is IS–C

0 : 1 ms
1 : 0.1 ms

SUE Whether acceleration/deceleration is performed for an axis that is synchronized with external pulses, for external pulse synchronization commands in PMC axis control

0 : Performed (exponential acceleration/deceleration)
1 : Not performed

F10 Least increment for the feedrate for cutting feed (per minute) in PMC axis control

F10	Millimeter input	Inch input
0	1 mm/min	0.01 inch/min
1	10 mm/min	0.1 inch/min

PF1, PF2 Set the the feedrate unit of feed per minute in PMC axis control

PF2	PF1	Feedrate unit
0	0	1/1
0	1	1/10
1	0	1/100
1	1	1/1000

FR1, FR2 Set the feedrate unit for feed per rotation for an axis controlled by the PMC.

FR2	FR1	Millimeter input	Inch input
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
8004	NDI	NCI	DSL				NMT	CMV
		NCI	DSL	G8R	G8C		NMT	CMV

CMV When a move command and auxiliary function are specified from the CNC, and the system is awaiting the auxiliary function completion signal after completion of the specified axis movement:

0 : An alarm (No.130) is issued when an axis control command is issued from the PMC for the same axis.
1 : An axis control command, when issued from the PMC for the same axis, is executed.

NMT When a command is specified from the CNC for the axis on which the tool is moving according to axis control specification from the PMC:

0 : P/S alarm No.130 is issued.
1 : The command is executed without issuing an alarm, provided the command does not involve a movement on the axis.

G8C Look–ahead control for the axes controlled by the PMC is:

0 : Disabled.
1 : Enabled.

> **NOTE**
> This parameter is valid for an axis for which bit 7 (NAHx) of parameter No.1819 is set to 0.

G8R Look–ahead control over axes controlled by the PMC is:

0 : Enabled for cutting feed (disabled for rapid traverse).
1 : Enabled for both cutting feed and rapid traverse.

> **NOTE**
> This parameter is valid for an axis for which bit 7 (NAHx) of parameter No.1819 is set to 0.

DSL If the selection of an axis is changed when PMC axis selection is disabled:

0 : P/S alarm No.139 is issued.
1 : The change is valid, and no alarm is issued for an unspecified system.

NCI In axis control by the PMC, a position check at the time of deceleration is:

0 : Performed.
1 : Not performed.

NDI For PMC axis control, when diameter programming is specified for a PMC–controlled axis:

0 : The amount of travel and feedrate are each specified with a radius.
1 : The amount of travel and feedrate are each specified with a diameter.

> **NOTE**
> NDI is valid for an axis for which diameter programming is specified (bit 3 (DIAx) of parameter No. 1006 is set to 1) when bit 1 (CDI) of parameter No. 8005 is set to 0.

		#7	#6	#5	#4	#3	#2	#1	#0
8005		MFD				DRR	R10	CDI	EDC
		MFD				DRR	R10		EDC

[Data type] Bit

EDC In PMC–based axis control, an external deceleration signal is:

0 : Disabled.
1 : Enabled.

— 247 —

CDI For PMC axis control, when diameter programming is specified for a PMC–controlled axis:

0 : The amount of travel and feedrate are each specified with a radius.

1 : The amount of travel is specified with a diameter while the feedrate is specified with a radius.

> **NOTE**
> 1 This parameter is valid when bit 3 (DIA) of parameter No.1006 is set to 1.
> 2 When CDI is set to 1, bit 7 (NDI) of parameter No.8004 is disabled.

R10 When the RPD parameter (bit 0 of parameter No.8002) is set to 1, the unit for specifying a rapid traverse rate for the PMC axis is:

0 : 1 mm/min.

1 : 10 mm/min.

DRR For cutting feed per rotation in PMC axis control, the dry run function is:

0 : Disabled.

1 : Enabled.

MFD Output by each auxiliary function of the PMC axis control function is:

0 : Disabled.

1 : Enabled.

8010	Selection of the DI/DO group for each axis controlled by the PMC

[Data type] Byte axis

[Valid data range] 1 to 4

Specify the DI/DO group to be used to specify a command for each PMC–controlled axis.

Value	Description
1	DI/DO group A (G142 to G153) is used.
2	DI/DO group B (G154 to G165) is used.
3	DI/DO group C (G166 to G177) is used.
4	DI/DO group D (G178 to G189) is used.

8022	Upper–limit rate of feed per revolution during PMC axis control

[Data type] Word

[Unit of data]

[Valid data range]

Increment system	Unit data	Valid data range	
		IS–B	IS–C
Millimeter machine	1 mm/min	6 to 15000	6 to 12000
Inch machine	0.1 inch/min	6 to 6000	6 to 4800
Rotation axis	1 deg/min	6 to 15000	6 to 12000

This parameter sets the upper limit rate of feed per revolution during PMC axis control.

> **NOTE**
> The upper limit specified for the first axis is valid for all axes.
> The specifications for the second and subsequent axes are
> ignored.

8028	Linear acceleration/deceleration time constant for speed commands for PMC axis control

[Data type] Word axis

[Unit of data] ms/1000 rpm

[Valid data range] 0 to 32767

This parameter sets the time required for the servo motor rotation speed to increase or decrease by 1000 rpm, for each axis, as a linear acceleration/deceleration time constant for speed commands for PMC axis control.

> **NOTE**
> If this parameter is set to 0, acceleration/deceleration control is not applied.

4.43
PARAMETERS OF ANGULAR AXIS CONTROL

	#7	#6	#5	#4	#3	#2	#1	#0
8200						AZR		AAC

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

AAC 0 : Does not perform angular axis control.
     1 : Performs inclined axis control.

AZR 0 : The machine tool is moved along the Cartesian axis during manual reference position return along the slanted axis under angular axis control.
     1 : The machine tool is not moved along the Cartesian axis during manual reference position return along the slanted axis under angular axis control.

8210	Inclination angle for angular axis control

[Data type] 2 words

[Unit of data] 0.001 degree

[Valid data range] 20000 to 60000

+X Program coordinate system

+X (angular axis):
Actual movement coordinate system

θ

+Z (orthogonal axis)

θ : Inclination angle
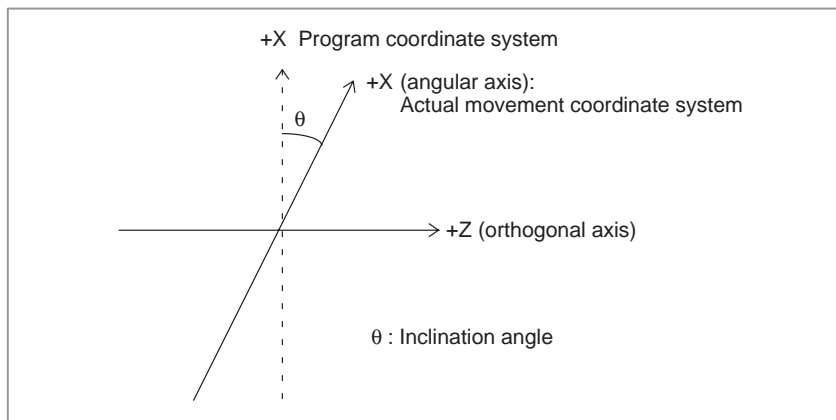
4.44
PARAMETERS OF
B–AXIS CONTROL

	#7	#6	#5	#4	#3	#2	#1	#0
8240	MST	ABS	SOV	TEM	REF			

[Data type] Bit

REF Reference position return operation by G28:

0 : Always uses deceleration dogs in the same way as a manual reference position return operation.

1 : Uses deceleration dogs when a reference position has not yet been set, but is performed by rapid traverse when a reference position has already been set (in the same way as an ordinary G28 command).

TEM When an offset movement is made in a block containing a T code:

0 : M code and MF are output before a movement along an axis.

1 : M code and MF are output after a movement along an axis.

SOV A G110 block:

0 : Overlaps the next block.

1 : Does not overlap the next block.

ABS The B–axis command is:

0 : An incremental command.

1 : An absolute command.

MST When an M code for starting a movement along the B–axis is specified:

0 : Operation is started after a ready notice using the FIN signal is received.

1 : Operation is started without waiting for a ready notice.

	#7	#6	#5	#4	#3	#2	#1	#0
8241						MDF	MDG	FXC

[Data type] Bit

FXC In canned cycle G84:

0 : The spindle is rotated clockwise or counterclockwise after M05 is output.

1 : The spindle is rotated clockwise or counterclockwise without first outputting M05.

MDG The initial continuous–state value for starting B–axis operation command registration is:

0 : G00 mode (rapid traverse).

1 : G01 mode (cutting feed).

MDF The initial continuous–state value for starting B–axis operation command registration is:

0 : G98 (feed per minute).

1 : G99 (feed per rotation).

8250	Axis number used for B–axis control

[Data type] Byte

[Valid data range] 1 to number of controlled axes (in one–system control)

This parameter sets which axis is to be used for B–axis control.

Example of setting:

For one–system control

When the fourth axis is controlled as the B–axis, set 4 in this parameter. Furthermore, specify a DI/DO number to be used for the fourth axis in parameter No.8010.

8251	M code (G101) for specifying the start of first program operation

8252	M code (G102) for specifying the start of second program operation

8253	M code (G103) for specifying the start of third program operation

[Data type] 2–word

[Valid data range] 6 to 99999999

These parameters set M codes for starting previously registered B–axis operation programs. M codes (such as M30, M98, and M99), already used for other purposes, cannot be set.

8257	T code number for tool offset cancellation

[Data type] Byte

[Valid data range] 0 to 90

This parameter sets a T code number for tool offset cancellation. When a T code from (setting + 1) to (setting + 9) is specified, tool offset is specified.
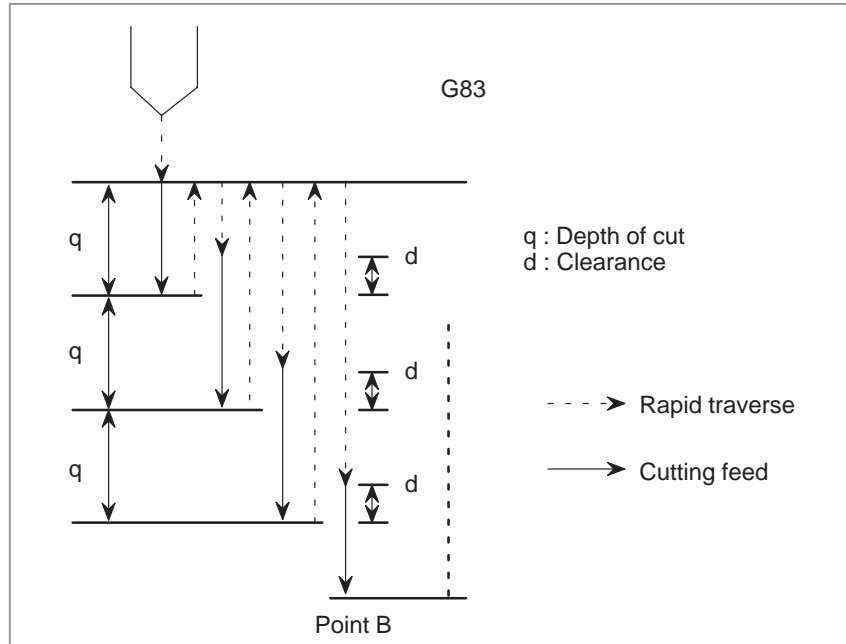
8258	Clearance, used in canned cycle G83, for the B–axis

[Data type] 2–word

[Valid data range] 0 to 99999999

[Unit of data]

Increment system	IS–B	IS–C	Unit
Millimeter input	0.001	0.0001	mm
Inch input	0.0001	0.00001	inch

This parameter sets the clearance used for peck drilling cycle G83.

4.45
PARAMETERS OF SIMPLE SYNCHRONOUS CONTROL

8301	#7	#6	#5	#4	#3	#2	#1	#0
	SOF							

[Data type] Bit

SOF The synchronization funciton in simple synchronous control (one pair) is:
0 : Not used.
1 : Used.

8302	#7	#6	#5	#4	#3	#2	#1	#0
							ATS	ATE

NOTE
When this parameter is set, the power must be turned off before operation is continued.

[Data type] Bit

ATE Automatic setting of grid positioning for simplified synchronous control one pair is:
0 : Disabled
1 : Enabled

ATS Automatic setting of grid positioning for simplified synchronous control one pair is:
0 : Not started
1 : Started

NOTE
1 When the bits are set to 1, parameter No.8316 and bit 4 (APZx) of parameter No.1815 for the master and slave axes are set to 0.
2 These bits are automatically set to 0 once grid positioning has been completed.

8303	#7	#6	#5	#4	#3	#2	#1	#0
	SOFx						ATSx	ATEx

NOTE
After this parameter has been set, the power must be turned off then on again for the setting to become effective.

[Data type] Bit axis

ATEx In simple synchronous control, automatic setting for grid positioning is:
0 : Disabled.
1 : Enabled.

ATSx In simple synchronous control, automatic setting for grid positioning is:
0 : Not started.
1 : Started.

> **NOTE**
> When starting automatic setting for grid positioning, set ATSx to 1. Upon the completion of setting, ATSx is automatically set to 0.

SOFx In simple synchronous control, the synchronization function is:

0 : Not used.

1 : Used.

8311	Axis number of master axis in synchronous control

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] Byte axis

<For the T Series>

Select a master axis and slave axis in simple synchronous control. Set a master axis number with a slave axis. For the parameters for the first axis through the fourth axis of parameter No.8311, set the following:

Units digit of the parameter for the first axis –>
    Set the axis number of a master axis for the first axis.
Tens digit of the parameter for the first axis –>
    Set the axis number of a master axis for the second axis.
Units digit of the parameter for the second axis –>
    Set the axis number of a master axis for the third axis.
Tens digit of the parameter for the second axis –>
    Set the axis number of a master axis for the fourth axis.
Units digit of the parameter for the third axis –>
    Set 0.
Tens digit of the parameter for the third axis –>
    Set 0.
Units digit of the parameter for the fourth axis –>
    Set 0.
Tens digit of the parameter for the fourth axis –>
    Set 0.

Number	Tens digit	Units digit
First axis	Second axis	First axis
Second axis	Fourth axis	Third axis

Note that the axis number settings are as follows:
0 –> First axis, 1 –> Second axis, 2 –> Third axis, 3 –> Fourth axis

> **NOTE**
> For an axis for which 0 is set, the first axis serves as the master axis. So, when the control signal for the axis is set to 1, the first axis serves as a master axis, and synchronous control is exercised.

<For the M Series>

[Valid data range] 0, 1 to Number of controlled axes

Select a master axis and slave axis in simple synchronous control. Set a master axis number with the slave axis side. The axis number settings are: 1 –> First axis, 2 –> Second axis, 3 –> Third axis, 4 –> Fourth axis. Up to two pairs can be specified.

Example1: Simple synchronous control is exercised with one pair.
When using the first axis (X–axis) as the master axis, and the third axis (Z–axis) as the slave axis, set parameter No.8311 as follows:

Parameter No. 8311   X (first axis) = 0
Y (second axis) = 0
Z (third axis) = 1
A (fourth axis) = 0

Example2: Simple synchronous control is exercised with three pairs.
Assume that the following three pairs are to be used:
The master axis is the first axis, while a slave axis is the sixth axis.
The master axis is the second axis, while a slave axis is the fifth axis.
The master axis is the third axis, while a slave axis is the fourth axis.
For this specification, set this parameter as follows:

Parameter No.8311   X (First axis)   = 0
Y (Second axis)   = 0
Z (Third axis)   = 2
(Fourth axis)   = 1

NOTE

The axis number of a master axis must always be smaller than the corresponding slave axis number. Multiple slave axes cannot be assigned to a master axis.

8312	Enabling/disabling mirror image in synchronous control

[Data type] Byte axis

[Valid data range] –127 to +128

This parameter sets the mirror image function. When 100 or a greater value is set with this parameter, the mirror image function is applied to synchronous control. Set this parameter to the slave axis.

Example

To establish reversed synchronization when using the third axis as the master axis and the fourth axis as the slave axis, set parameter No.8311 and parameter No.8312 as follows:

Parameter No.8311 (first axis) = 0
Parameter No.8311 (second axis) = 20
Parameter No.8311 (third axis) = 0
Parameter No.8311 (fourth axis) = 0
Parameter No.8312 (first axis) = 0
Parameter No.8312 (second axis) = 0
Parameter No.8312 (third axis) = 0
Parameter No.8312 (fourth axis) = 100

8313	Limit of the difference between the amount of positioning deviation of the master and slave axes (Synchronous control one pair)

[Data type] Word

[Unit of data] Detection unit

[Valid data range] 0 to 32767

Set the limit of the difference between the amount of positioning deviation of the master and slave (fourth) axes. If the difference between them exceeds the limit assigned to the parameter, the P/S alarm (No.213) is activated.

8314	Maximum error in synchronization error check

[Data type] Word axis

[Unit of data]

Increment system	IS–A	IS–B	IS–C	Units
Millimeter machine	0.01	0.001	0.0001	mm
Inch machine	0.001	0.0001	0.00001	inch
Rotation axis	0.01	0.001	0.0001	deg

[Valid data range] 0 to 32767

The machine coordinates on a master axis and slave axis are monitored. If a difference (synchronization error) which is greater than the value specified in this parameter is detected, a servo alarm (No.407) is generated, and the machine is stopped.

Set this parameter with a master axis. When 0 is set in this parameter, no synchronization error check is made.

8315	Maximum compensation value for synchronization (Synchronous control one pair)

NOTE
When this parameter is set, the power must be turned off before operation is continued.

[Data type] Word axis

[Unit of data] Unit used for the detection

[Valid data range] 0 to 32767

This parameter sets the maximum compensation value for synchronization. When a compensation value greater than the value set in this parameter is used, servo alarm No.407 is issued.

8316	Difference between reference counters for master and slave axes (Synchronous control one pair)

> **NOTE**
> When this parameter is set, the power must be turned off before operation is continued.

[Data type] 2–word

[Data unit] Detection unit

[Valid data range] –99999999 to 99999999

This parameter indicates the difference between the values in the reference counter for the master axis and that for the slave axis.

> **NOTE**
> Once grid positioning has been completed, the difference between the reference counters is automatically set in this parameter. At this time, bit 1 (ATS) of parameter No.8302 is set to 0.

8317	Torque difference alarm detection time (Synchronous control one pair)

[Data type] Word

[Data unit] ms

[Valid data range] 0 to 4000 (When 0 is set, 512 ms is assumed.)

This parameter specifies the period between the servo preparation completion signal (SA <F000 bit 6>) being set to 1 and the check of the torque difference alarm being started, for the torque difference alarm detection function.

The set value is rounded up to the nearest a multiple of 16 ms.

[Example] When 100 is specified, 112 ms is assumed.

8323	Maximum allowable difference between master axis and slave axis positional deviations

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

This parameter sets the maximum allowable difference between the master axis and slave axis position deviations. If a positional deviation difference exceeds the value specified in this parameter, an alarm (No.213) is issued.

Set this parameter with a master axis. If 0 is specified in this parameter, no position deviation difference check is made.

8325	Maximum compensation value for synchronization

[Data type] Word axis

[Unit of data] Detection unit

[Valid data range] 0 to 32767

This parameter sets the maximum compensation value for synchronization. If a compensation value exceeds the value specified with this parameter, a servo alarm (No.407) is issued.

Specify a master axis for this parameter. To enable this parameter, set the SOFx parameter (bit 7 of parameter No.8303) to 1.

8326	Difference between master axis and slave axis reference counters

[Data type] 2–word axis

[Unit of data] Detection unit

[Valid data range] –99999999 to 99999999

The difference between the master axis reference counter and slave axis reference counter (master axis and slave axis grid shift) is automatically set when automatic setting for grid positioning is performed. Then, the difference is transferred together with an ordinary grid shift value to the servo system when the power is turned on.

This parameter is set with a master axis.

8327	Torque difference alarm detection timer

[Data type] Word axis

[Unit of data] ms

[Valid data range] 0 to 4000

This parameter sets a time from the servo preparation completion signal, SA (F000#6), being set to 1 until torque difference alarm detection is started in simple synchronous control. A fraction of less than 16 msec is rounded up.

Example: Setting = 100: The specification of 112 msec is assumed.

Set this parameter with a master axis. If 0 is set in this parameter, the specification of 512 msec is assumed.

4.46
PARAMETERS OF
CHECK
TERMINATION

8341	Program number subject to check termination

[Data type] Word

[Valid data range] 0 to 9999

This parameter sets the program number, including a sequence number, subject to sequence number check termination. Parameter No.8342 is used to set a sequence number subject to check termination.

> **NOTE**
> A program number can also be set on the setting screen. If a program number is set on the setting screen, the value of the parameter is changed accordingly.

8342	Sequence number subject to check termination

[Data type] 2–word

[Valid data range] 0 to 9999

This parameter sets the sequence number subject to sequence number check termination.
If the block containing the sequence number set with this parameter is executed while the program set with parameter No.8341 is being executed, a single block stop occurs after the block is executed. At this time, the setting is automatically set to –1. Upon power–up, the setting is automatically set to 0.

> **NOTE**
> A sequence number can also be set by using the setting screen. If a sequence number is set on the setting screen, the value of the parameter is changed accordingly.

4.47
OTHER
PARAMETERS

8701	#7	#6	#5	#4	#3	#2	#1	#0
						WPR	PLD	

[Data type] Bit

PLD When the P–code loader function is used (macro compiler/executor):

0 : AM is initialized and the entire contents of RAM are rewritten.
1 : RAM is not initialized, being overwritten instead

WPR The function that allows parameters that are rewritten using the PMC window to be enabled during automatic operation is:

0 : Disabled.
1 : Enabled.

8760	Program number for data registration (data input/output function using the I/O link)

[Data type] Word

[Valid data range] 0 to 9999

When the data input/output function using the I/O link is used, this parameter sets the program numbers of the programs to be used for registering data (parameters, macro variables, and diagnostic data) from Power Mates.

For a Power Mate in group n, the following program numbers are used:
For parameters: Setting $+ n \times 10 + 0$
For macro variables: Setting $+ n \times 10 + 1$
For diagnostic data: Setting $+ n \times 10 + 2$

Example: When 8000 is set

8000: Parameters of group 0 (I/O channel = 20)
8001: Macro variables of group 0 (I/O channel = 20)
8002: Diagnostic data of group 0 (I/O channel = 20)
8010: Parameters of group 1 (I/O channel = 21)
8011: Macro variables of group 1 (I/O channel = 21)
8012: Diagnostic data of group 1 (I/O channel = 21)
8020: Parameters of group 2 (I/O channel = 22)
8021: Macro variables of group 2 (I/O channel = 22)
8022: Diagnostic data of group 2 (I/O channel = 22)

8150: Parameters of group 15 (I/O channel = 35)
8151: Macro variables of group 15 (I/O channel = 35)
8152: Diagnostic data of group 15 (I/O channel = 35)

> **NOTE**
> 1 When 0 is set, the input/output of parameters, macro variables, and diagnostic data cannot be performed, but program input/output processing is performed.
> 2 To input/output data to and from the Power Mate, the I/O CHANNEL setting data must also be set.

8790	Timing for executing an auxiliary macro

[Data type] Word

[Unit of data]

This parameter sets the timing for executing a macro executor auxiliary macro while NC programs, offset data, and so forth are being read or punched out.

When as many characters as the number specified with this parameter are read or punched out, an auxiliary macro is executed once. When 0 is set in this parameter, no auxiliary macro is executed during read or punch processing.

	#7	#6	#5	#4	#3	#2	#1	#0
8801								

[Data type] Bit

Bit parameter 1 for machine tool builder

	#7	#6	#5	#4	#3	#2	#1	#0
8802								

[Data type] Bit

Bit parameter 2 for machine tool builder

> **NOTE**
> These parameters are used only by the machine tool builder. Refer to the relevant manual supplied by the machine tool builder for details.

8811	2–word parameter 1 for machine tool builder
8812	2–word parameter 2 for machine tool builder
8813	2–word parameter 3 for machine tool builder

[Data type] 2–word

[Valid data range] –99999999 to 99999999

> **NOTE**
> These parameters are used only by the machine tool builder. Refer to the relevant manual supplied by the machine tool builder for details.

4.48 PARAMETERS OF MAINTENANCE

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

[Data type] Bit

FAN A fan motor error is:

0 : Detected. (When the fan motor error is detected, an overheating alarm occurs.)

1 : Not detected. (Use inhibited)

8911	Ratio of the items on the periodic maintenance screen to the respective lives

[Data type] Byte

[Unit of data] 1%

[Valid data range] 0 to 100

On the periodic maintenance screen, if the remaining time of an item falls to a value less than the percentage of the life specified in this parameter, the remaining time is displayed in red as a warming.

APPENDIX

A　CHARACTER CODE LIST

Character	Code	Comment	Character	Code	Comment
A	065		6	054	
B	066		7	055	
C	067		8	056	
D	068		9	057	
E	069			032	Space
F	070		!	033	Exclamation mark
G	071		”	034	Quotation marks
H	072		#	035	Shape
I	073		$	036	Dollar mark
J	074		%	037	Percent
K	075		&	038	Ampersand
L	076		'	039	Apostrophe
M	077		(	040	Left parenthesis
N	078		)	041	Right parenthesis
O	079		*	042	Asterisk
P	080		+	043	Positive sign
Q	081		,	044	Comma
R	082		–	045	Negative sign
S	083		.	046	Period
T	084		/	047	Slash
U	085		:	058	Colon
V	086		;	059	Semicolon
W	087		<	060	Left angle bracket
X	088		=	061	Equal sign
Y	089		>	062	Right angle bracket
Z	090		?	063	Question mark
0	048		@	064	Commercial at mark
1	049		[	091	Left square bracket
2	050		¥	092	Yen mark
3	051		]	093	Right square bracket
4	052		^	094	
5	053			095	Underline

Index

Revision Record

FANUC Series 21i/210i – MODEL A PARAMETER MANUAL (B–63090EN)

Edition	Date	Contents	Edition	Date	Contents
01	May, '97				