

FANUC Series 16 i -LB
FANUC Series 160 i -LB

PARAMETER MANUAL

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- All specifications and designs are subject to change without notice.

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In this manual we have tried as much as possible to describe all the various matters. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities. Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

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DEFINITION OF WARNING, CAUTION, AND NOTE

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

 **WARNING**

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

 **CAUTION**

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

NOTE

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

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

PREFACE

Applicable Models

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

Product Name	Abbreviations	
FANUC Series 16 <i>i</i> -LB	Series 16 <i>i</i> -LB	16 <i>i</i> -LB
FANUC Series 160 <i>i</i> -LB	Series 160 <i>i</i> -LB	160 <i>i</i> -LB

NOTE

- 1 This manual describes the parameters that are used by the Series 16*i*/160*i*-LB only. For parameters common to other models, refer to "Series 16*i*/18*i*/160*i*/180*i*/160*is*/180*is*-MODEL B Parameter Manual" (B-63530EN).
- 2 Some functions described in this manual may not be applied to some products. For details, refer to the DESCRIPTIONS (B-63662EN).

Related manuals of Series Series 16i/160i-LB

The following table lists the manuals related to Series 16i-LB, Series 160i-LB. This manual is indicated by an asterisk (*).

Related manuals of Series Series Series 16i/160i-LB

Manual name	Specification number	
Series 16i/18i/21i/160i/180i/210i/160is/180is/210is-MODEL B DESCRIPTIONS	B-63522EN	
Series 16i/160i-LBDESCRIPTIONS	B-63662EN	
Series 16i/18i/21i/160i/180i/210i/160is/180is/210is-MODEL B CONNECTION MANUAL (HARDWARE)	B-63523EN	
Series 16i/18i/21i/160i/180i/210i/160is/180is/210is-MODEL B CONNECTION MANUAL (FUNCTION)	B-63523EN-1	
Series 16i/160i-LBCONNECTION MANUAL (FUNCTION)	B-63663EN-1	
Series 16i/160i-LBOPERATOR'S MANUAL	B-63664EN	
Series 16i/18i/21i/160i/180i/210i/160is/180is/210is-MODEL B MAINTENANCE MANUAL	B-63525EN	
Series 16i/160i-LBMAINTENANCE MANUAL	B-63665EN	
Series 16i/18i/160i/180i/160is/180is- MODEL B PARAMETER MANUAL	B-63530EN	
Series 16i/160i-LBPARAMETER MANUAL	B-63670EN	*
PROGRAMMING MANUAL		
Macro Compiler/Macro Executor PROGRAMMING MANUAL	B-61803E-1	
C Language Executor PROGRAMMING MANUAL	B-62443EN-3	
FANUC MACRO COMPILER (For Personal Computer) PROGRAMMING MANUAL	B-66102E	
PMC		
PMC Ladder Language PROGRAMMING MANUAL	B-61863E	
PMC C Language PROGRAMMING MANUAL	B-61863E-1	
Network		
I/O Link-II OPERATOR'S MANUAL	B-62714EN	
PROFIBUS-DP Board OPERATOR'S MANUAL	B-62924EN	
FAST Ethernet Board/FAST DATA SERVER OPERATOR'S MANUAL	B-63644EN	
Ethernet Board/DATA SERVER Board OPERATOR'S MANUAL	B-63354EN	
DeviceNet Board OPERATOR'S MANUAL	B-63404EN	
PC function		
Screen Display Function OPERATOR'S MANUAL	B-63164EN	

Related manuals of SERVO MOTOR $\alpha i/\beta i$ series

The following table lists the manuals related to SERVO MOTOR $\alpha i/\beta i$ series.

Manual name	Specification number
FANUC AC SERVO MOTOR αis series FANUC AC SERVO MOTOR αi series DESCRIPTIONS	B-65262EN
FANUC AC SPINDLE MOTOR αi series DESCRIPTIONS	B-65272EN
FANUC AC SERVO MOTOR βis series DESCRIPTIONS	B-65302EN
FANUC AC SPINDLE MOTOR βi series DESCRIPTIONS	B-65312EN
FANUC SERVO AMPLIFIER αi series DESCRIPTIONS	B-65282EN
FANUC SERVO AMPLIFIER βi series DESCRIPTIONS	B-65322EN
FANUC SERVO MOTOR αis series FANUC SERVO MOTOR αi series FANUC AC SPINDLE MOTOR αi series FANUC SERVO AMPLIFIER αi series MAINTENANCE MANUAL	B-65285EN
FANUC SERVO MOTOR βis series FANUC AC SPINDLE MOTOR βi series FANUC SERVO AMPLIFIER βi series MAINTENANCE MANUAL	B-65325EN
FANUC AC SERVO MOTOR αis series FANUC AC SERVO MOTOR αi series FANUC AC SERVO MOTOR βis series PARAMETER MANUAL	B-65270EN
FANUC AC SPINDLE MOTOR αi series FANUC AC SPINDLE MOTOR βi series PARAMETER MANUAL	B-65280EN

Related manuals of SERVO MOTOR α series

The following table lists the manuals related to SERVO MOTOR α series

Manual name	Specification number
FANUC AC SERVO MOTOR α series DESCRIPTIONS	B-65142E
FANUC AC SERVO MOTOR α series PARAMETER MANUAL	B-65150E
FANUC AC SPINDLE MOTOR α series DESCRIPTIONS	B-65152E
FANUC AC SPINDLE MOTOR α series PARAMETER MANUAL	B-65160E
FANUC SERVO AMPLIFIER α series DESCRIPTIONS	B-65162E
FANUC SERVO MOTOR α series MAINTENANCE MANUAL	B-65165E

Either of the following servo motors and the corresponding spindle can be connected to the CNC covered in this manual.

- FANUC SERVO MOTOR αi series
- FANUC SERVO MOTOR α series

This manual mainly assumes that the FANUC SERVO MOTOR αi series of servo motor is used. For servo motor and spindle information, refer to the manuals for the servo motor and spindle that are actually connected.

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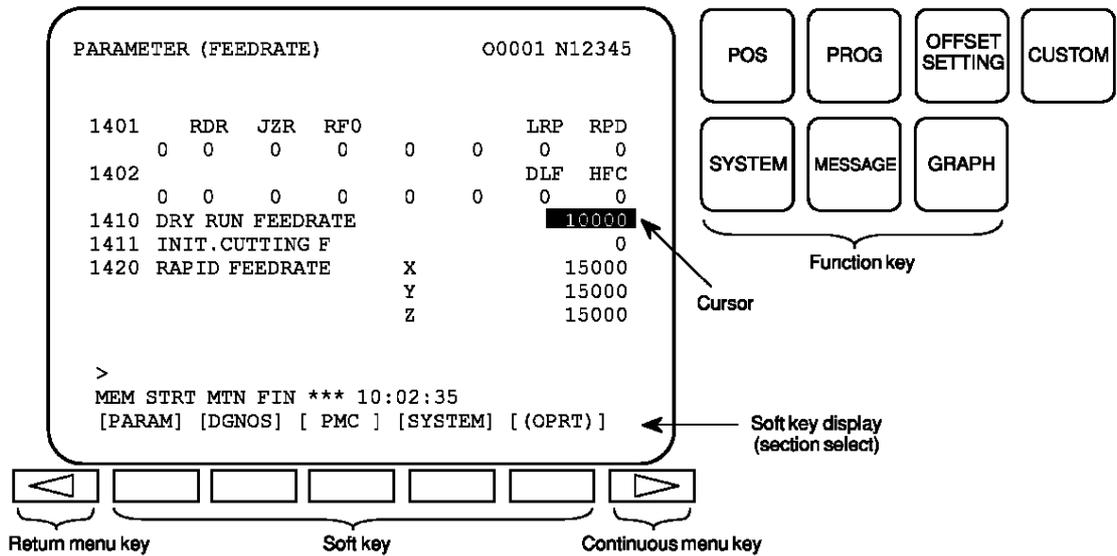
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1

DISPLAYING PARAMETERS

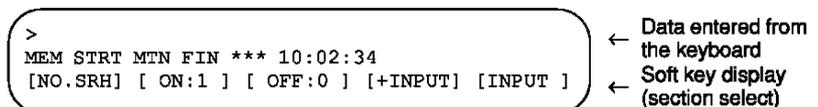
Follow the procedure below to display parameters.

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



- (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.



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  function key as many times as required, or alternatively press the  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)                00001  N00010
PARAMETER WRITE =  (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  function key as many times as required, or alternatively press the  function key once, then the [PARAM] section select soft key. (See Chapter 1 "DISPLAYING PARAMETERS.")
 - (4) Display the page containing the parameter you want to set, and position the cursor on the parameter. (See Chapter 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)		00001 N00010	
1401	RDR	JZR	RPD
	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]			

Cursor

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 indicated by 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

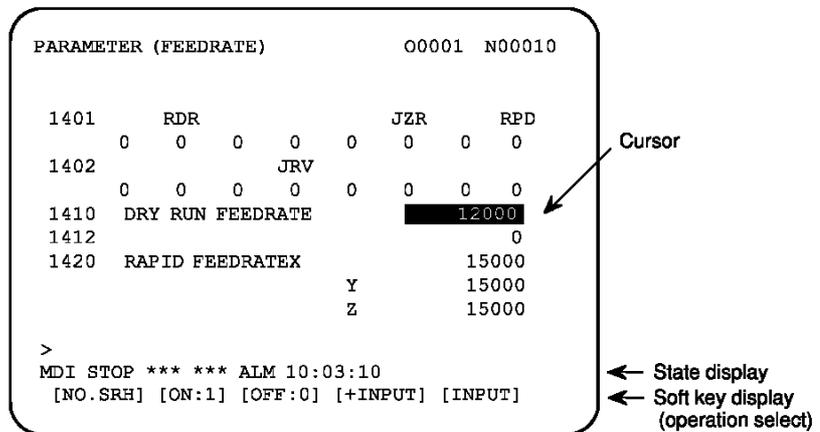
INPUTTING AND OUTPUTTING PARAMETERS THROUGH THE READER/PUNCHER INTERFACE

This section explains the parameter input/output procedures for input/output devices connected to the reader/puncher interface.

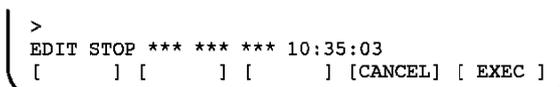
The following description assumes the input/output devices are ready for input/output. It also assumes parameters peculiar to the input/output devices, such as the baud rate and the number of stop bits, have been set in advance. (See Section 4.2 in Series 16i/18i/160i/180i/160is/180is-MODEL B PARAMETER MANUAL (B-63530EN).)

3.1 OUTPUTTING PARAMETERS THROUGH THE READER/PUNCHER INTERFACE

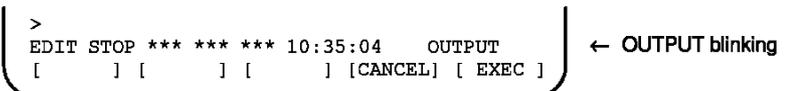
- (1) Select the EDIT mode or set to Emergency stop.
- (2) To select the parameter screen, press the  function key as many times as required, or alternatively press the  function key once, then the [PARAM] section select soft key.
- (3) Press the [(OPRT)] soft key to display operation select soft keys, 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].



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



- (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.



- (6) When parameter output terminates, "OUTPUT" stops blinking. Press the  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  function key as many times as required, or alternatively press the  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  function key as many times as required, or alternatively press the  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 -EMG- ALM 10:37:30
[      ] [ READ ] [PUNCH] [      ] [      ]
    
```

← State display
← Soft key display

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

```

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

← INPUT blinking

- (7) When parameter input terminates, "INPUT" stops blinking. Press the  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

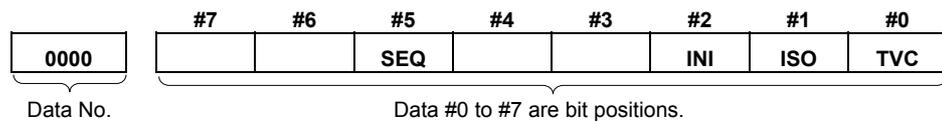
Parameters are classified by data type as follows:

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		

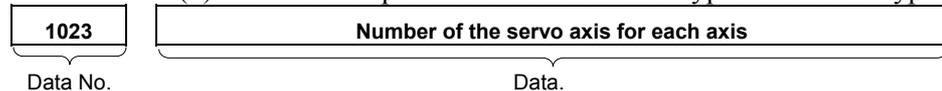
NOTE

- 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



(2) Notation of parameters other than bit type and bit axis type



NOTE

The bits left blank in Chapter 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.

4.1 SETTINGS FOR ENABLING/DISABLING FUNCTIONS

	#7	#6	#5	#4	#3	#2	#1	#0
15000			FLT	CLB	BMO	AGA	LGC	LPC

[Data type] Bit

LPC Laser power control function is:

0: Disabled.

1: Enabled.

If 0 is set, the system cannot enter the laser power control mode.

The G code and input signal to enter the laser power control mode are ignored.

LGC The in-tube pressure control gain selection of two types is:

0: Disabled.

1: Enabled. (Normal setting)

When this bit is set to 1, parameter No. 15245 is enabled.

AGA Monitoring of an assist gas no output alarm is:

0: Enabled. (Normal setting)

1: Disabled. (Maintenance)

BMO When the shutter is closed, the function to turn the beam on is:

0: Disabled. (Normal setting)

1: Enabled. (Manual operation only, maintenance)

CLB Power calibration is:

0: Disabled.

1: Enabled. (Normal setting)

FLT During power control, the filter is:

0: Disabled.

1: Enabled.

If 1 is set, the primary delay filter is applied to the output command.

This can delay the output command.

The time constant of the filter can be set in parameter No. 15094.

	#7	#6	#5	#4	#3	#2	#1	#0
15001		LHC		PC8	NGC	PES	G0B	EXA

[Data type] Bit

EXA An assist gas can be selected from:

0: Three types. (Normal setting)

1: Seven types.

G0B In a block specifying G00, the beam is:

0: Not output. (Normal setting)

1: Output.

If this bit is set to 1, when G00 is specified with the shutter being open during LSTR, the beam is output.

- PES In the machine lock or dry run state, the piercing time is:
 0: Executed. (Normal setting)
 1: Not executed.

- NGC The integral for gas pressure control is:
 0: Not preset.
 1: Preset.
 If this bit is set to 1, the value added to the integral element for gas pressure control is replaced by the setting of parameter No. 15247 when the LSTR gas pressure has been attained.

- PC8 The power calibration function of:
 0: Correction by constant power.
 1: Power is raised to eight steps. (Normal setting)

- LHC The oscillator is:
 0: Not controlled by an external signal. (Normal setting)
 1: Controlled by an external signal.

	#7	#6	#5	#4	#3	#2	#1	#0
15002		PSH						BMA

- [Data type] Bit
- BMA When the shutter is closed in automatic operation, beam output is:
 0: Disabled. (Normal setting)
 1: Enabled. (Maintenance)

- PSH Of the discharge tubes,
 0: All are used.
 1: Half are used.

	#7	#6	#5	#4	#3	#2	#1	#0
15003						GVW	HPT	TIV

- [Data type] Bit
- TIV The sign (+/-) of the gap control displacement amount is:
 0: Not inverted.
 1: Inverted.

- HPT When piercing is lengthened or reduced, a parameter setting is:
 0: Rewritten.
 1: Not rewritten.

- GVW RUN-OFF evacuation is:
 0: Disabled. (Maintenance)
 1: Enabled. (Normal setting)

	#7	#6	#5	#4	#3	#2	#1	#0
15004	CWY	ECH		EDG		SPB	STC	AGC

- [Data type] Bit
- AGC The "G32 P_;" command (with Q, T, and R not specified) is used as:
 0: A flow pattern command.
 1: A direct gas pressure control command.
 The setting of this bit is followed also when the assist gas is output by an external signal.
- STC The shutter is controlled by:
 0: A G code.
 1: An external signal.
- SPB During a skip, beam output is:
 0: Performed.
 1: Not performed.
- EDG When the assist gas is switched in edge machining, the beam is:
 0: Turned off.
 1: Not turned off.
- ECH Upon reset, the active E number is:
 0: Not cleared.
 1: Cleared.
- CWY The oscillator of the:
 0: CO₂ laser is used.
 1: CW-YAG laser is used.
 When this bit is set, the power must be turned off before operation is continued.

	#7	#6	#5	#4	#3	#2	#1	#0
15005	DLY	ITR		GNS	BPV	TTD		INB

- [Data type] Bit
- INB When a feed hold is performed, the beam output is stopped:
 0: Upon completion of distribution.
 1: After the in-position check.
- TTD A single laser power supply unit drives:
 0: A single discharge tube.
 1: Two discharge tubes.
- BPV The bypass valve:
 0: Is opened while correcting power.
 1: Is closed while correcting power.
- GNS When an assist gas direct command is specified, at the time of assist gas switching:
 0: The assist gas is interrupted. (Normal setting)
 1: The assist gas is not interrupted.

ITR Gap control interlock signal (G227#6 *TRIL) is:
 0: Disabled.
 1: Enabled.

DLY The beam output condition delay function is:
 0: Disabled.
 1: Enabled.
 The delay time is set in parameter No. 15219 or No. 15410.

	#7	#6	#5	#4	#3	#2	#1	#0
15006			PCN	PCL		PIN	TRM	NCC

[Data type] Bit

NCC The cutting condition setting screen is:
 0: Displayed.
 1: Not displayed.

TRM On the trace setting screen, the zero-point, start-point, and end-point soft keys are:
 0: Enabled.
 1: Disabled.

PIN In inch input, address P in G13 is:
 0: Metric input.
 1: Inch input.

PCL The assist gas pressure is displayed on the screen in units of:
 0: kg/cm².
 1: MPa.

PCN When power correction is not executed, the power correction coefficient is:
 0: Rewritten with 1024.
 1: Not rewritten, but remains unchanged from the previous value.

	#7	#6	#5	#4	#3	#2	#1	#0
15007			STO	XSC	ECK	ESE		

[Data type] Bit

ESE If piercing is to be executed in edge machining, it is:
 0: Executed upon the completion of distribution.
 1: Executed after a smoothing error check is performed upon the completion of distribution.

ECK In edge machining, the angle is judged with:
 0: The actual machining path.
 1: The path in the machining program.

NOTE
 This setting is ignored if bit 4 of parameter No. 15012 is set to 1.

- XSC In exact stop mode, the edge machining function is:
 0: Not executed.
 1: Executed.
- STO If an assist gas is specified with the same type and the same flow pattern:
 0: Neither the after-flow nor pre-flow is executed.
 1: Both the after-flow and pre-flow are executed.

	#7	#6	#5	#4	#3	#2	#1	#0
15008	RMP	EGE	DCW		SOC	TAL	GPC	MST

- [Data type] Bit
- MST The signs (+ and -) of the reference displacement amount indicate the following directions of tracing:
 0: + indicates approach towards the workpiece, while - indicates withdrawal from the workpiece.
 1: + indicates withdrawal from the workpiece, while - indicates approach towards the workpiece.
- GPC Gap control is performed according to:
 0: The reference displacement.
 1: The gap (distance from the nozzle to the workpiece).
- TAL If the trace check mode signal (G225#2 TRCKM) is set to 1:
 0: The gap range over alarm is disabled.
 1: The gap range over alarm and gap displacement large alarm are disabled.
- SOC When the machining condition setting function is used, the reference displacement amount of gap control is used as the reference displacement amount of piercing:
 0: Except during machining.
 1: Only during piercing.
- DCW In diagnostic display, the values of DCV, DCI, and DCW are:
 0: Not displayed.
 1: Displayed.
 This parameter is valid only for oscillators that support this display.
- EGE The automatic aging function is:
 0: Disabled.
 1: Enabled.
- RMP The step function measures:
 0: The distance of movement based on the up/down step distance only.
 1: The distance of movement considering the up/down step distance and the specified feedrate value.

	#7	#6	#5	#4	#3	#2	#1	#0
15009	TEM	BCG	BEM	AFZ	BS2	BS1	AS2	AS1

[Data type]
AS1,AS2,BS1,BS2

Bit
These parameters are related to the laser gas mixer function, which store and monitor the operating states of the mixer. The parameters are automatically set and need not be set manually.

AS2,AS1 Indicate the state of tank A.

AS2	AS1	State
0	0	Tank A is being supplied with gases.
0	1	Tank A is mixing the gases.
1	0	Tank A is supplying the mixed gas.
1	1	Tank A is being prepared for gas supply.

BS2,BS1 Indicate the state of tank B.

BS2	BS1	State
0	0	Tank B is being supplied with gases.
0	1	Tank B is mixing the gases.
1	0	Tank B is supplying the mixed gas.
1	1	Tank B is being prepared for gas supply.

AFZ In calculation for actual cutting feedrate display, the Z-axis is:
0: Not included.
1: Included.

BEM The supply pressure of the gas cylinder:
0: Is normal.
1: Has fallen.

BCG The gas cylinder:
0: Has not yet been replaced.
1: Has been replaced.

TEM The supply pressure of the tank:
0: Is normal.
1: Has fallen.

	#7	#6	#5	#4	#3	#2	#1	#0
15010	OVE		TRG					

[Data type]
TRG

Bit
The trigger pulse command control function is:
0: Disabled.
1: Enabled.

- OVE Edge machining and feedrate clamp by arc radius:
 0: Cannot be used at the same time.
 1: Can be used at the same time.

NOTE
 This parameter must be set to 1.

	#7	#6	#5	#4	#3	#2	#1	#0
15011	OPV		CSC	AOC	LVE			EDS

- [Data type] Bit
 EDS During the return distance movement in edge machining or start-up machining, the laser power, assist gas type, and assist gas pressure conditions follow:
 0: The specified values of cutting conditions.
 1: The specified values for the piercing operation of the edge machining conditions.

NOTE
 This setting takes priority over the setting of bit 3 of parameter No. 15011.

- LVE For the assist gas switching operation during edge machining:
 0: The specified assist gas setting time is used.
 1: If the gas type and gas pressure remain unchanged, the setting time is ignored.

NOTE
 This setting is ignored if bit 0 of parameter No. 15011 is set to 1.

- AOC The analog output of the assist gas pressure command is:
 0: Output to JA40 of the motherboard. (Normal setting)
 1: Output to JA6 of the analog input board.
- CSC If, in start-up machining mode, the four items S, P, Q, and F are specified at the same time in the first G01, G02, or G03 block after G24:
 0: The start-up machining operation is executed as usual, regardless of the specification of S, P, Q, and F.
 1: The start-up machining operation is canceled, and cutting is performed with the specified S, P, Q, F values.
- OPV The external piping exhaust valve:
 0: Is operated only once after the power is turned on. (Normal setting)
 1: Is always operated at RUN-ON time.

	#7	#6	#5	#4	#3	#2	#1	#0
15012	EXS			CVA				

- [Data type] Bit
- CVA The edge machine function determines angles according to:
 0: The setting of bit 3 (ECK) of parameter No. 15007.
 1: The programmed path regardless of the setting of bit 3 (ECK) of parameter No. 15007.
- EXS During execution of the edge machine function, switching to the piercing operation conditions is made:
 0: Upon completion of distribution (when bit 2 of parameter No. 15007 is set to 0) or at the end of acceleration/deceleration (when bit 2 of parameter No. 15007 is set to 1).
 1: After the in-position check for all axes.

	#7	#6	#5	#4	#3	#2	#1	#0
15013	ZCM							IVA

- [Data type] Bit
- IVA The RUN-OFF-time vacuum operation is:
 0: Performed only at the RUN-OFF time after the LSTR state has been entered. (Normal setting)
 1: Always performed at RUN-OFF time.
- ZCM When a command for a gap control axis is specified during automatic operation:
 0: The command is ignored.
 1: Alarm No. 4134 is issued.

	#7	#6	#5	#4	#3	#2	#1	#0
15014		PXZ	GAG	MAG				

- [Data type] Bit
- MAG On the aging setting screen:
 0: Only the first page is displayed, allowing the user to change only the on/off setting of the manual mode startup.
 1: All items on all pages are displayed.
- GAG At the time of the restart operation performed after alarm No. 4073 is issued during purging:
 0: No aging operation is performed.
 1: An aging operation is performed twice.
- PXZ If zero is specified as the piercing time:
 0: The laser is output for one execution cycle, and switching to the piercing gap amount is made. (Normal setting)
 1: The laser is not output, and switching to the piercing gap amount is not made.

	#7	#6	#5	#4	#3	#2	#1	#0
15015							TPS	OWU

[Data type] Bit

OWU The laser oscillator warm-up function is:

0: Disabled.

1: Enabled.

When enabling the warm-up operation, also set bit 4 of parameter No. 15000 to 1.

TPS Switching of the temperature sensor installed in the laser oscillator

0: A laser cabinet temperature sensor is installed.

1: A cooling water temperature sensor is installed.

TPS and OWU settings, warm-up operation, and temperature sensor operation

TPS	OWU	Operation
0	0	Warm-up operation function does not operate. Alarm No. 4124 "OVER COOL" is not detected. Alarm No. 4067 "LASER CABINET OH" is detected.
1	0	Warm-up operation function does not operate. Alarm No. 4124 "OVER COOL" is not detected. Alarm No. 4067 "LASER CABINET OH" is not detected.
0	1	Warm-up operation function does not operate. Alarm No. 4124 "OVER COOL" is not detected. Alarm No. 4067 "LASER CABINET OH" is detected.
1	1	Warm-up operation function operates. Alarm No. 4124 "OVER COOL" is detected. Alarm No. 4067 "LASER CABINET OH" is not detected.

4.2 DISCHARGE TUBE SELECTION

	#7	#6	#5	#4	#3	#2	#1	#0
15025	PS8	PS7	PS6	PS5	PS4	PS3	PS2	PS1
15026	PS16	PS15	PS14	PS13	PS12	PS11	PS10	PS9

[Data type] Bit
 PS1 to PS16 Discharge tube selection when half of the discharge tubes are used
 Set the bit corresponding to the discharge tube to be used to 1. Set the other bits to 0.
 The use of a half or all of the discharge tubes is set on the laser setting screen or by bit 6 (PSH) of parameter No. 15002.

NOTE

Parameter No.15026 is provided for extension of the discharge tubes. This parameter is not used at present. Set all bits to 0.

	#7	#6	#5	#4	#3	#2	#1	#0
15027	PS8	PS7	PS6	PS5	PS4	PS3	PS2	PS1
15028	PS16	PS15	PS14	PS13	PS12	PS11	PS10	PS9

[Data type] Bit
 PS1 to PS16 Discharge tube selection when all of the discharge tubes are used
 Set the bit corresponding to the discharge tube to be used to 1. Set the other bits to 0.
 The use of a half or all of the discharge tubes is set on the laser setting screen or by bit 6 (PSH) of parameter No. 15002.

NOTE

Parameter No.15028 is provided for extension of the discharge tubes. This parameter is not used at present. Set all bits to 0.

4.3 CONTOURING CONDITIONS

15040	Peak power setting
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	Set the peak power of the beam output during cutting operation (G01, G02, G03, and G12). Also when the beam is output by external signal BEMON (G222#4), this setting is used.
15041	Pulse frequency
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	5 to 2000
	Set the pulse frequency of the beam output during cutting operation (G01, G02, G03, and G12). Also when the beam is output by external signal BEMON (G222#4), this setting is used.
15042	Pulse duty ratio
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	Set the pulse duty ratio of the beam output during cutting operation (G01, G02, G03, and G12). Also when the beam is output by external signal BEMON (G222#4), this setting is used.

4.4 EDGE MACHINING CONDITIONS

15050	Edge detection angle
[Data type]	Word
[Unit of data]	deg
[Valid data range]	0 to 180
	When an angle formed by two blocks is smaller than this setting, the portion is assumed to be a corner.
15051	Piercing peak power
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	Specify the peak power of piercing at the vertex of a corner.
15052	Piercing pulse frequency
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	5 to 2000
	Specify the pulse frequency of piercing at the vertex of a corner.
15053	Piercing pulse duty ratio
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	Specify the pulse duty ratio of piercing at the vertex of a corner.
15054	Piercing time
[Data type]	2-word
[Unit of data]	msec
[Valid data range]	0 to 99999999
	Specify a piercing time at the vertex of a corner.
15055	Piercing assist gas pressure
[Data type]	Word
[Unit of data]	0.01MPa or 0.1 kg/cm ²
[Valid data range]	0 to 255
	Specify a piercing assist gas pressure at the vertex of a corner.
15056	Piercing assist gas type
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 7
	Select the gas type for piercing at the vertex of a corner.

15057 **Return distance**

[Data type] 2-word
 [Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	0.01	0.001	0.0001
Inch input	inch	0.001	0.0001	0.00001

[Valid data range] 0 to 65000
 Specify the return distance of movement from the vertex of a corner to the next block.

15058 **Return speed**

[Data type] Word
 [Unit of data] mm/min
 [Valid data range] 0 to 9999

Specify the return speed of movement from the vertex of a corner to the next block.

15059 **Return peak power**

[Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 7000

Specify the return peak power of movement from the vertex of a corner to the next block.

15060 **Return frequency**

[Data type] Word
 [Unit of data] Hz
 [Valid data range] 5 to 2000

Specify the return frequency of movement from the vertex of a corner to the next block.

15061 **Return duty ratio**

[Data type] Word
 [Unit of data] %
 [Valid data range] 0 to 100

Specify the return duty ratio of movement from the vertex of a corner to the next block.

15062 **Amount of reference displacement during edge machining**

[Data type] Word
 [Unit of data] 0.001mm
 [Valid data range] Parameters Nos. 15531 to 15532

Set the amount of reference displacement of gap control during edge machining.

4.5 HIGH-SPEED PIERCING CONDITIONS

15080	High-speed piercing power
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	Specify a high-speed piercing power.
15081	Initial frequency of high-speed piercing
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	5 to 2000
	Specify the initial frequency of high-speed piercing.
15082	Incremental value of high-speed piercing frequency
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	0 to 2000
	Specify a value by which the high-speed piercing frequency is incremented.
15083	Initial duty ratio of high-speed piercing
[Data type]	Byte
[Unit of data]	%
[Valid data range]	0 to 100
	Specify the initial duty ratio of high-speed piercing.
15084	Incremental value of high-speed piercing duty ratio
[Data type]	Byte
[Unit of data]	%
[Valid data range]	0 to 100
	Specify a value by which the high-speed piercing duty ratio is incremented.
15085	High-speed piercing step time
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Specify a high-speed piercing step time.

15086	High-speed piercing step count
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	Specify the number of high-speed piercing steps.
15087	High-speed piercing end time
[Data type]	2-word
[Unit of data]	msec
[Valid data range]	0 to 99999999
	Specify a high-speed piercing end time.

4.6 POWER CONTROL (1)

	#7	#6	#5	#4	#3	#2	#1	#0
15089	LP8	LP7	LP6	LP5	LP4	LPZ	LPY	LPX

[Data type] Bit

LP* The speed calculation of the power control function:

0: Does not use the * axis.

1: Uses the * axis.

By using the composite speed of the axes selected by this parameter, each element of laser output is calculated.

When nothing is specified, the system assumes that the first axis (LPX) and second axis (LPY) are specified.

Normally, specify the axis used for interpolation, and avoid specifying the synchronized axis of simple synchronous control, the PMC axis, the mirror axis of optical path length compensation, and so on.

15090	Minimum peak power
-------	--------------------

[Data type] Word

[Unit of data] W

[Valid data range] 0 to 7000

Minimum clamp value of peak power.

If the peak power calculated from the current feedrate is lower than the setting of this parameter, the power is clamped at this setting.

15091	Minimum pulse frequency
-------	-------------------------

[Data type] Word

[Unit of data] Hz

[Valid data range] 5 to 2000

Minimum clamp value of pulse frequency.

If the frequency calculated from the current feedrate is lower than the setting of this parameter, the frequency is clamped at this setting.

15092	Minimum pulse duty ratio
-------	--------------------------

[Data type] Word

[Unit of data] %

[Valid data range] 0 to 100

Minimum clamp value of pulse duty ratio.

If the pulse duty ratio calculated from the current feedrate is lower than the setting of this parameter, the pulse duty ratio is clamped at this setting.

15094	Power control filter time constant
--------------	---

[Data type] Word
 [Unit of data] msec
 [Valid data range] 0 to 32767

Set the time constant of the primary delay filter for delaying the output command to synchronize it with the machine feed.
 This parameter is valid if bit 5 (FLT) of parameter No. 15000 is set to 1.
 The primary delay filter is expressed by the following equation:

$$O_n = O_{n-1} + (I_n - O_{n-1}) \frac{T_s}{T_c}$$

Ts: Always 8 ms (sampling time)
 Tc: Set by this parameter (time constant)

15095	Allowable variation in power control speed
--------------	---

[Data type] Byte
 [Unit of data] mm/min or %
 [Valid data range] 0 to 255

Specify the allowable variation in power control speed.
 This parameter is effective when parameter No. 15450 is 0. To set a value equal to or greater than 256, use parameter No. 15450.
 Depending on the setting of the bit 6 (SDB) of parameter No. 15096, specify this parameter as described below:
 If SDB = 0, set a speed.
 Thus, the permissible speed fluctuation width is always the same.
 If SDB = 1, set the ratio to the velocity specified with the velocity command after a switch to power control mode (0 to 100%).

[Example] When G63P1 is issued and the system switches to power control mode:
If SUB = 0:
 If this setting is 10, the permissible velocity fluctuation width is 10 mm/min.
If SUB = 1:
 If the velocity specified with the velocity command is 200 mm/min and this setting 10, the permissible velocity fluctuation width is 200 mm/min.

15096	#7	#6	#5	#4	#3	#2	#1	#0
	EGM	SDB	FOV	SQ0		PCD	PCF	PCP

[Data type] Bit

PCP In power control, peak power control by feedrate is:
 0: Disabled.
 1: Enabled.

PCF In power control, frequency control by feedrate is:
 0: Disabled.
 1: Enabled.

- PCD In power control, duty cycle ratio control by feedrate is:
 0: Disabled.
 1: Enabled.
- SQ0 If 0 is specified as the peak power (S) or pulse duty ratio (Q), the power control function is:
 0: Performed.
 1: Stopped.
 Whether 0 is specified or not as the peak power or the pulse duty ratio is determined by the peak power setting (in parameter No. 15040) and the pulse duty ratio setting (in parameter No. 15042). Therefore, even if either of these parameters is set to 0 by using a method other than specifying address S, P, and Q in a machining program, power control is stopped.
- FOV When the feedrate override is changed in power control mode, the reference feedrate for power control is:
 0: Not changed.
 1: Changed by applying the new override value.
- SDB The method of setting a permissible velocity fluctuation width in power control mode (parameter No. 15095) is to:
 0: Directly specify the velocity (mm/min)
 1: Set the ratio to the velocity specified with the velocity command after a switch to power control mode (0 to 100%).
- EGM In edge machining mode and start-up machining mode:
 0: Power control mode is canceled.
 1: Power control is stopped only during the return distance movement in edge machining and start-up machining.
 Edge machining mode and start-up machining mode refer to the states in which E numbers specifying the respective cutting conditions for edge machining and start-up machining have been selected.

15097

Reference value for calculating the output inclination (output when feedrate F is 0)

- [Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 7000
 Set the power command value applied when feedrate F is set to 0. Based on this setting and the output value specified in power control mode, the ratio of change in output is calculated.

15098	Reference value for calculating the frequency inclination (frequency when feedrate F is 0)
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	5 to 2000
	Set the frequency applied when feedrate F is set to 0. Based on this setting and the frequency specified in power control mode, the ratio of change in frequency is calculated.
15099	Reference value for calculating the inclination of the duty ratio (duty ratio when feedrate F is 0)
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	Set the duty ratio applied when feedrate F is set to 0. Based on this setting and the duty ratio specified in power control mode, the ratio of change in duty ratio is calculated.

4.7 SETTINGS RELATED TO ASSIST GAS PRESSURE AND TIME

15100	Assist gas selection
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 7 Specify an assist gas type.
15101	Flow pattern selection
[Data type]	Word
[Unit of data]	
[Valid data range]	1 to 3 Select the flow pattern of the assist gas.
15102	Pre-flow time 1
15103	Pre-flow time 2
15104	Pre-flow time 3
[Data type]	Word
[Unit of data]	10msec
[Valid data range]	0 to 32767 Specify the pre-flow time of the assist gas.
15108	After-flow time 1
15109	After-flow time 2
15110	After-flow time 3
[Data type]	Word
[Unit of data]	10msec
[Valid data range]	0 to 32767 Specify the after-flow time of the assist gas.
15114	Pre-flow pressure 1
15115	Pre-flow pressure 2
15116	Pre-flow pressure 3
[Data type]	Word
[Unit of data]	0.01MPa or 0.1 kg/cm ²
[Valid data range]	0 to 255 Specify the pre-flow pressure of the assist gas.

15120	Machining flow pressure 1
--------------	----------------------------------

15121	Machining flow pressure 2
--------------	----------------------------------

15122	Machining flow pressure 3
--------------	----------------------------------

[Data type] Word
 [Unit of data] 0.01MPa or 0.1 kg/cm²
 [Valid data range] 0 to 255
 Specify the machining flow pressure of the assist gas.

15126	After-flow pressure 1
--------------	------------------------------

15127	After-flow pressure 2
--------------	------------------------------

15128	After-flow pressure 3
--------------	------------------------------

[Data type] Word
 [Unit of data] 0.01MPa or 0.1 kg/cm²
 [Valid data range] 0 to 255
 Specify the after-flow pressure of the assist gas.

15132	Maximum assist gas pressure
--------------	------------------------------------

[Data type] Word
 [Unit of data] 0.01MPa or 0.1 kg/cm²
 [Valid data range] 0 to 255
 Specify a gas pressure with which an analog output of 10V is obtained.

15135	Stabilization time of the assist gas pressure for cutting
--------------	--

[Data type] Word
 [Unit of data] 10msec
 [Valid data range] 0 to 32767
 Specify the stabilization time of the assist gas pressure for cutting.

15136	Assist gas pressure for cutting
--------------	--

[Data type] Word
 [Unit of data] 0.01MPa or 0.1 kg/cm²
 [Valid data range] 0 to 255
 Specify an assist gas pressure for cutting.

15137	Stabilization time of the assist gas pressure for piercing
--------------	---

[Data type] Word
 [Unit of data] 10msec
 [Valid data range] 0 to 32767
 Specify the stabilization time of the assist gas pressure for piercing.

15138	Assist gas pressure for piercing
[Data type]	Word
[Unit of data]	0.01MPa or 0.1 kg/cm ²
[Valid data range]	0 to 255 Specify an assist gas pressure for piercing.

4.8 LASER MAINTENANCE/INSPECTION TIME DISPLAY FUNCTION

15150	Laser RUN-ON period																
[Data type]	2-word																
[Unit of data]	0.1 hour																
[Valid data range]	0 to 99999999																
	The total RUN-ON time is automatically specified.																
15151	Vacuum pump operation period																
[Data type]	2-word																
[Unit of data]	0.1 hour																
[Valid data range]	0 to 99999999																
	The total operation period of the vacuum pump is automatically specified.																
15152	Shutter alarm mask time																
[Data type]	Word																
[Unit of data]	msec																
[Valid data range]	0 to 32767																
	Specify a time from when the shutter operation is specified until the alarm monitor starts.																
15153	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 12.5%; text-align: center;">#7</th> <th style="width: 12.5%; text-align: center;">#6</th> <th style="width: 12.5%; text-align: center;">#5</th> <th style="width: 12.5%; text-align: center;">#4</th> <th style="width: 12.5%; text-align: center;">#3</th> <th style="width: 12.5%; text-align: center;">#2</th> <th style="width: 12.5%; text-align: center;">#1</th> <th style="width: 12.5%; text-align: center;">#0</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;">LCK</td> </tr> </tbody> </table>	#7	#6	#5	#4	#3	#2	#1	#0								LCK
#7	#6	#5	#4	#3	#2	#1	#0										
							LCK										
[Data type]	Bit																
LCK	The automatic leak check function is:																
	0: Disabled.																
	1: Enabled.																
15154	Leak judgment time																
[Data type]	Word																
[Unit of data]	sec																
[Valid data range]	3 to 65535																
	In the automatic leak check function, set the time for which the in-discharge-tube pressure is maintained by closing the valve to make a leak check.																
	In the specified time, the in-discharge-tube pressure is measured a total of four times. If 0 to 2 is specified, the automatic leak check function is not executed.																

	#7	#6	#5	#4	#3	#2	#1	#0
15160							MDS	MNT

[Data type] Bit

MNT The laser maintenance screen is:

0: Not displayed.

1: Displayed.

Even if the screen is not displayed, the storage of compensation coefficients and the totaling of operation time are performed, so that the screen can be displayed for confirmation when needed.

MDS The laser maintenance screen is:

0: Used in user mode.

1: Used in service mode.

Input of part of data to the laser maintenance screen is inhibited to prevent wrong data from being input. (Reference of data is permitted.)

If this parameter bit is set to 1, input of all data is permitted.

Internal discharging cannot be specified on the laser adjustment screen unless this parameter bit is set to 1.

4.9 PARAMETERS RELATED TO OSCILLATOR CONTROL

15200	Power specified for power calibration when half of the discharge tubes are used
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	Specify the power to be specified to obtain a power calibration coefficient when half of the discharge tubes are used.
15201	Power specified for power calibration when all the discharge tubes are used
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	Specify the power to be specified to obtain a power calibration coefficient when all the discharge tubes are used.
15203	Power calibration limit
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	When the power calibration coefficient exceeds this setting, the output drop alarm signal (F220#6 MWRN) is output to indicate that the mirror should be cleaned or replaced.
15204	Power calibration coefficient
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	The coefficient is used to calibrate the specified power according to the actual power. This parameter is automatically specified during power calibration.
15205	Power calibration time
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Specify a power calibration time.

15206	Time constant of power sensor input filter
[Data type]	Word
[Unit of data]	msec
[Valid data range]	8 to 32767
	The time constant is used when the primary delay filter is applied to the laser power monitor value input from the power sensor. If a value smaller than 8 is set, 8 is assumed to be specified.
15207	Upper limit on power
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	When the specified power value exceeds this setting after power calibration and power feedback addition, the actual power is clamped to this setting.
15208	Laser power feedback gain
[Data type]	Word
[Unit of data]	1/1024 (1024 = 1 time)
[Valid data range]	0 to 32767
	Specify a laser power feedback gain.
15209	Power feedback amount clamp
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	The power specification is clamped to this setting in power feedback.
15210	Maximum peak power
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	When a peak power higher than this setting is specified, the actual power is clamped to this setting. (The value obtained by applying power override is clamped.)
15211	Minimum peak power
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	When a peak power lower than this setting is specified, the actual power is clamped to this setting. (The value obtained by applying power override is clamped.)

15212	Upper limit on power when the duty ratio is not clamped
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	When the duty ratio is not clamped to 50% according to parameter No. 15213 and when the specified power exceeds this setting after power calibration and power feedback addition, the actual power is clamped to this setting. When 0 is specified, the value of parameter No. 15207 is assumed.
15213	Criterion for clamping the duty ratio
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	If the value obtained by multiplying the specified peak power value by the power override value is greater than the value set in this parameter, the duty ratio is clamped at 50% (fixed value), and the specified peak power value is clamped at the value set in parameter No. 15210. When 0 is specified, the value of parameter No. 15210 is assumed.
15214	Maximum CW-YAG laser frequency
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	0 to 32767
	For the CW-YAG laser oscillator (when bit 7 of parameter No. 15004 is set to 1), the specified frequency is clamped at the value set in this parameter.
15215	Power input compensation coefficient
[Data type]	Word
[Unit of data]	
[Valid data range]	102(0.1×2^{10}) to 10240(10×2^{10})
	Specify a power input calibration coefficient. When 0 is specified, 1024 (1×2^{10}) is assumed.
15216	Time constant of power display filter
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Specify a time constant for the filter that suppresses flickering of the power display.

15217	Beam stop delay time
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Specify the period from when an in-position check is completed until the beam stops.
	This parameter is valid when bit 0 of parameter No. 15005 is set to 1.
15218	Power for clamping the duty ratio of the CW-YAG laser
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	If the CW-YAG laser is used (bit 7 of parameter No. 15004 is set to 1), and specified laser output P_c exceeds the setting of this parameter, the upper limit of the duty ratio is clamped at the value obtained by PRM No. 15218/ $P_c \times 100$ (%).
	When 0 is specified, 500 W is assumed.
15219	Beam output condition delay time
[Data type]	Byte
[Unit of data]	Beam output control cycle (8msec or 2msec)
[Valid data range]	0 to 16
	This parameter is valid when bit 7 (DLY) of parameter No. 15005 is set to 1.
	The beam output control cycle is assumed to be 2 ms if the laser high-speed control option is enabled, or 8 ms if the option is disabled.
	For high-speed and high-precision machining using the RISC board (such as AI high precision contouring control), the setting of parameter No. 15410 is used.

4.10 PARAMETERS RELATED TO DISCHARGE

15220	Maximum specifiable bias value at the start of discharge
[Data type]	Word
[Unit of data]	mV
[Valid data range]	0 to 32767
	Specify the maximum bias value that can be specified at the start of discharge.
15221	Discharge start voltage
[Data type]	Word
[Unit of data]	V
[Valid data range]	0 to 32767
	Specify a discharge start voltage. If the discharge tube voltage has not become lower than the setting of this parameter after the discharge start wait time (parameter No. 15222) since the maximum specifiable bias value (parameter No. 15220) was reached, abnormal discharge start alarm No. 4066 is issued.
15222	Discharge start wait time
[Data type]	Word
[Unit of data]	10msec
[Valid data range]	0 to 32767
	Specify a wait time from when the bias value is maximized at the start of discharge until actual discharge is confirmed.
15223	Bias value
[Data type]	Word
[Unit of data]	mV
[Valid data range]	0 to 32767
	Specify a bias value.
15224	Modulation voltage
[Data type]	Word
[Unit of data]	mV
[Valid data range]	0 to 3000
	Specify the modulation voltage. When the beam is turned off, this parameter setting is specified as the base voltage for a specified time (parameter No. 15225).

15225	Modulation time
[Data type]	Word
[Unit of data]	10msec
[Valid data range]	0 to 32767
	The time for which the specified base voltage is lowered.
15231	Power feedback mask time at change in specified power
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 65535
	When a change in specified power value is detected, power feedback control is stopped for the time set in this parameter.
15232	Allowable variation in specified power (dead zone width)
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 65535
	If a change in specified power value is smaller than the value set in this parameter, power feedback control continues on the assumption that there is no change in specified power.

NOTE

Specified power values refer to values obtained as a result of the reflection of power override; they are not values just specified in machining programs. Therefore, when a power value specified in a machining program is 1000 W and the power override is 150%, for example, the specified power value is as follows:

$$\text{Specified power value} = 1000 \times 1.5 = 1500 \text{ W}$$

4.11 PARAMETERS RELATED TO GAS PRESSURE CONTROL (1)

15240	Negative pressure for completing evacuation
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	The negative pressure is applied to evacuate the discharge tube during the laser startup sequence.
15241	In-tube pressure at the start of discharge
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	Set the in-discharge-tube gas pressure to be applied at the start of discharge.
15242	In-tube pressure during oscillation (50 Hz)
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	The discharge tube has the gas pressure during laser oscillation (50 Hz).
15243	In-tube pressure during oscillation (60 Hz)
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	The discharge tube has the gas pressure during laser oscillation (60 Hz).
15244	Gas pressure control gain
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	The feedback gain is used to maintain a constant gas pressure in the discharge tube.
15245	In-tube pressure control gain 2
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	Specify a gas pressure control gain for reference discharge. This setting is valid when bit 1 of parameter No. 15000 is set to 1.

15246	Pressure control integral gain
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	The setting is the feedback gain of an integral element for gas pressure control.
15247	Pressure control integral element preset value
[Data type]	Word
[Unit of data]	
[Valid data range]	-32768 to 32767
	The setting is the preset value of an integral element for gas pressure control. This setting is valid when bit 3 of parameter No. 15000 is set to 1.
15248	Lowest permissible gas pressure
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	When the gas pressure is low but reaches this setting, no alarm is raised. This setting is valid when bit 3 of parameter No. 15001 is set to 1.
15249	Gas pressure rise time
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 60
	Specify a gas pressure rise time in laser sequence 27.
15250	Gas pressure rise time 2
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 45
	Set the time required to change from the negative pressure for completing evacuation (parameter No. 15240) to the in-tube pressure at the start of discharge (parameter No. 15241) in laser sequence 18.
15255	Evacuation time at RUN start
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Specify an evacuation time at RUN start.

15256	RUN-OFF evacuation time
[Data type]	Word
[Unit of data]	sec
[Valid data range]	600 to 32767
	When bit 2 (GVW) of parameter No. 15003 is set to 1 and when the oscillator start signal (G222#6 RUN) goes to 0, evacuation of the specified time is executed.
15257	Abnormal vibration detection count
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	When the abnormal vibration count, detected over ten minutes, is not smaller than this setting, an alarm is raised.
15258	Time constant of filter for reducing the laser gas pressure variation
[Data type]	Word
[Unit of data]	msec
[Valid data range]	17 to 32767
	Set this parameter if the read laser gas pressure varies remarkably because of noise or for another reason.
	When the setting is 16 or lower, the filter is disabled.
15259	RUN-ON evacuation time
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Specify a RUN-ON evacuation time.
15260	Discharge valve open time for external piping
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 60
	Specify the operation time of the external piping discharge valve.
	If the set value is greater than 60 s, the time is clamped at 60 s.

4.12 HIGHLY REFLECTIVE MATERIAL ALARMS

15265	Maximum permissible output increase
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	If the return light power exceeds the setting of this parameter, alarm No. 4068 is issued.
15266	Output limit
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	When the actual power exceeds this value, an alarm No. 4068 is raised.
15268	Abnormal beam reflection alarm mask time
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Set a time for which monitoring of the abnormal beam reflection alarm (alarm No. 4068) and the abnormal beam reflection warning signal (F488#7) is masked when the beam is turned on or when the specified mean power changes.
	This parameter is used when the pulse power feedback function of the actual output estimation type is enabled (when bit 0 (PFB) of parameter No. 29000 is set to 1).
	If 0 is set in this parameter, 5000 ms is assumed.
15269	Permissible value for generating abnormal beam reflection warning signal
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	If the difference between the specified power and the actual output exceeds the setting of this parameter, the abnormal beam reflection warning signal (F488#7 BMRF) is output.
	This parameter is used when the pulse power feedback function of the actual output estimation type is enabled (when bit 0 (PFB) of parameter No. 29000 is set to 1).

4.13 LASER POWER/VOLTAGE DECREASE

15270	Normal discharge tube voltage
[Data type]	Word
[Unit of data]	V
[Valid data range]	0 to 32767
	Specify a discharge tube voltage in normal reference discharge. This parameter is automatically rewritten after the discharge start signal (G222#7 HVON) turned "ON".
15271	Permissible power decrease
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	When the difference between the specified power and actual power is not smaller than this value, an output decrease alarm No. 4076 is raised.
15272	Permissible decrease in discharge tube voltage
[Data type]	Word
[Unit of data]	V
[Valid data range]	0 to 32767
	When the difference in the discharge tube voltage between the laser being used and at laser activation is not smaller than this value, an alarm No. 4088 (voltage decrease) is raised.
15276	Laser gas replacement time
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Time after which new gas is to be injected to the internal piping system. This parameter is not used at present.

4.14 POWER TABLE SETTINGS

15280	Power table interval when half of the discharge tubes are used
15281	Power table interval when all of the discharge tubes are used

[Data type] Word
 [Unit of data]
 [Valid data range] 0 to 32767

Set the interval of table data for converting specified power (W) to a power voltage value. Set this parameter with 1 bit assumed to be equivalent to 1.22 mV.
 For the standard setting, refer to the parameter sheet attached to the laser oscillator.

15290	Value 0 when half of the discharge tubes are used
15291	Value 1 when half of the discharge tubes are used
15292	Value 2 when half of the discharge tubes are used
15293	Value 3 when half of the discharge tubes are used
15294	Value 4 when half of the discharge tubes are used
15295	Value 5 when half of the discharge tubes are used
15296	Value 6 when half of the discharge tubes are used
15297	Value 7 when half of the discharge tubes are used
15298	Value 8 when half of the discharge tubes are used

[Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 32767

Specify power settings 0 to 8 at the table intervals, in the indicated order, when half of the discharge tubes are used.
 For the standard setting, refer to the parameter sheet attached to the laser oscillator.

15300	Value 0 when all of the discharge tubes are used
15301	Value 1 when all of the discharge tubes are used
15302	Value 2 when all of the discharge tubes are used
15303	Value 3 when all of the discharge tubes are used
15304	Value 4 when all of the discharge tubes are used
15305	Value 5 when all of the discharge tubes are used
15306	Value 6 when all of the discharge tubes are used
15307	Value 7 when all of the discharge tubes are used
15308	Value 8 when all of the discharge tubes are used

[Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 32767

Specify power settings 0 to 8 at the table intervals, in the indicated order, when all of the discharge tubes are used.
 For the standard setting, refer to the parameter sheet attached to the laser oscillator.

4.15 AUTOMATIC AGING FUNCTION

15320	Laser power in normal calibration
-------	-----------------------------------

[Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 7000
 Set the power specified for obtaining the power calibration coefficient.

NOTE

When manually performing the aging operation by changing the setting, set the same value in parameters Nos. 15320 and 15201.

15321	Oscillation frequency in normal calibration
-------	---

[Data type] Word
 [Unit of data] Hz
 [Valid data range] 5 to 2000
 Set the frequency specified for obtaining the power calibration coefficient.

NOTE

When manually performing the aging operation by changing the setting, set the same value in parameters Nos. 15321 and 15332.

15322	Pulse duty ratio in normal calibration
-------	--

[Data type] Word
 [Unit of data] %
 [Valid data range] 0 to 100
 Set the pulse duty ratio specified for obtaining the power calibration coefficient.

NOTE

When manually performing the aging operation by changing the setting, set the same value in parameters Nos. 15322 and 15333.

15323	Calibration time of normal calibration
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Set the time specified for obtaining the power calibration coefficient.

NOTE

When manually performing the aging operation by changing the setting, set the same value in parameters Nos. 15323 and 15205.

15324	Gas pressure in normal calibration (50 Hz)
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	Set the in-tube pressure to be set for oscillation during power calibration. For an oscillator containing an inverter, set the same value as the setting of parameter No. 15325. (The value set when an oscillator containing no inverter is used in an area using a supply frequency of 50 Hz.)

NOTE

The gas pressure may have been changed in the field. So, input the settings of parameters Nos. 15242 and 15243 in parameters Nos. 15324 and 15325.

15325	Gas pressure in normal calibration (60 Hz)
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	Set the in-tube pressure to be set for oscillation during power calibration. For an oscillator containing an inverter, set the same value as the setting of parameter No. 15325. (The value set when an oscillator containing no inverter is used in an area using a supply frequency of 60 Hz.)

NOTE

The gas pressure may have been changed in the field. So, input the settings of parameters Nos. 15242 and 15243 in parameters Nos. 15324 and 15325.

15326	Laser power in aging
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	Set the power to be specified when aging is performed by the automatic aging function.
15327	Oscillation frequency in aging
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	5 to 2000
	Set the frequency to be specified when aging is performed by the automatic aging function.
15328	Pulse duty ratio in aging
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	Set the pulse duty ratio to be specified when aging is performed by the automatic aging function.
15329	Calibration time in aging
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Set the time to be specified per operation when aging is performed by the automatic aging function.
15330	Gas pressure in aging (50 Hz)
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	Set the in-tube pressure to be set during oscillation when aging is performed by the automatic aging function. For an oscillator containing an inverter, set the same value as the setting of parameter No. 15331. (The value set when an oscillator containing no inverter is used in an area using a supply frequency of 50 Hz.)

NOTE

The gas pressure may have been changed in the field. So, input the values obtained by subtracting 100 from the settings of parameters Nos. 15242 and 15243 in parameters Nos. 15330 and 15331, respectively.

15331	Gas pressure in aging (60 Hz)
-------	-------------------------------

[Data type] Word
 [Unit of data] (1=13Pa)
 [Valid data range] 0 to 32767
 Set the in-tube pressure to be set during oscillation when aging is performed by the automatic aging function. (The value set when an oscillator containing an inverter is used or when an oscillator containing no inverter is used in an area using a supply frequency of 60 Hz.)

NOTE

The gas pressure may have been changed in the field. So, input the values obtained by subtracting 100 from the settings of parameters Nos. 15242 and 15243 in parameters Nos. 15330 and 15331, respectively.

15332	Pulse frequency in normal calibration
-------	---------------------------------------

[Data type] Word
 [Unit of data] Hz
 [Valid data range] 5 to 2000
 Set the frequency specified for power calibration.

NOTE

When manually performing the aging operation by changing the setting, set the same value in parameters Nos. 15332 and 15321.

15333	Pulse duty ratio in normal calibration
-------	--

[Data type] Word
 [Unit of data] %
 [Valid data range] 0 to 100
 Set the pulse duty ratio specified for power calibration.

NOTE

When manually performing the aging operation by changing the setting, set the same value in parameters Nos. 15333 and 15322.

15334	Aging count
-------	-------------

[Data type] Word
 [Unit of data]
 [Valid data range] 0 to 32767 (automatically specified by the CNC)
 The number of times an aging sequence is performed. When the automatic aging function is enabled, 0 or 2 to 7 times are automatically set according to the stop time.

15335	Time data 1 at HVOFF after LSTR
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 65535 (automatically specified by the CNC) When the automatic aging is enabled, the year in which the oscillator was stopped previously is recorded.
15336	Time data 2 at HVOFF after LSTR
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 65535 (automatically specified by the CNC) When the automatic aging is enabled, the month in which the oscillator was stopped previously is recorded.
15337	Time data 3 at HVOFF after LSTR
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 65535 (automatically specified by the CNC) When the automatic aging is enabled, the date in which the oscillator was stopped previously is recorded.
15338	Time data 4 at HVOFF after LSTR
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 65535 (automatically specified by the CNC) When the automatic aging is enabled, the time at which the oscillator was stopped previously is recorded.
15339	Stop time of the oscillator that requires an aging operation
[Data type]	Word
[Unit of data]	hour
[Valid data range]	0 to 32767 (valid range: 30 to 120) Set the oscillator stop time that requires an aging operation. If the setting is smaller than 30, the internal processing assumes 60. If the setting is 121 or greater, 120 is assumed.
15340	Number of aging times in manual execution
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767 (valid range: 2 to 255) Set the number of aging times when manual execution is performed. If bit 4 (MAG) of parameter No. 15014 is set to 0, 2 is always set. If bit 4 (MAG) of parameter No. 15014 is set to 1, a value from 2 to 255 can be set.

4.16 PARAMETERS RELATED TO THE PMC-WINDOW

15350	M code for reading a comment
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 999
	Specify an M code for reading the comment of function code 140.

15360	Start address of the R area of the PMC
[Data type]	Word
[Unit of data]	
[Valid data range]	1 to 997
	Specify the start address of the R area of the PMC.

4.17 PARAMETER RELATED TO HIGH-SPEED MACHINING

15410	Beam output condition delay time (during HPCC or AI-HPCC mode)
[Data type]	Byte
[Unit of data]	Beam output control cycle (8msec or 2msec)
[Valid data range]	0 to 16
	This parameter is valid when bit 7 (DLY) of parameter No. 15005 is set to 1, and high-speed and high-precision machining using the RISC board (such as AI high precision contour control) is used.
	The beam output control cycle is set to 2 ms if the laser high-speed option is enabled, or 8 ms if the option is disabled.
	In normal mode and for high-speed and high-precision machining not using the RISC board (such as AI contour control), the setting of parameter No. 15219 is used.

4.18 POWER CONTROL (2)

15450	Allowable variation in power control speed
[Data type]	Word
[Unit of data]	mm/min
[Valid data range]	0 to 32767
	Specify the allowable variation in power control speed. If this parameter is 0, parameter No. 15095 is effective. Parameter No. 15095 and this parameter have different valid data ranges. For details of setting, see the description of parameter No. 15095.
15451	Maximum peak power
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 7000
	If the peak power calculated from the actual feedrate exceeds the setting of this parameter, the peak power is clamped at this setting. If 0 is set, this parameter is ignored.
15452	Maximum pulse frequency
[Data type]	Word
[Unit of data]	Hz
[Valid data range]	0, 5 to 2000
	If the pulse frequency calculated from the actual feedrate exceeds the setting of this parameter, the pulse frequency is clamped at this setting. If 0 is set, this parameter is ignored.
15453	Maximum pulse duty ratio
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	If the pulse duty ratio calculated from the actual feedrate exceeds the setting of this parameter, the pulse duty ratio is clamped at this setting. If 0 is set, this parameter is ignored.

4.19 SETTINGS RELATED TO GAP CONTROL

4.19.1 Settings Related to Gap Control (Detection)

15500	Detection gain coefficient
-------	----------------------------

[Data type] Word
 [Unit of data]
 [Valid data range] 0 to 65535
 Specify the gain coefficient of the displacement detector in Z-axis gap control. If 0 is set, 4096 is assumed.

NOTE

This parameter can be set on the trace setting screen.

15502	Detection zero point
-------	----------------------

[Data type] Word
 [Unit of data]
 [Valid data range] -32768 to 32767
 The zero point calibration value is used to calibrate the zero point of the displacement detector in Z-axis gap control.

NOTE

This parameter can be set on the trace setting screen.

15503	Filter time constant
-------	----------------------

[Data type] Word
 [Unit of data] msec
 [Valid data range] 0, 2 to 32767 (Must not set to 1)
 The setting is the time constant of a filter for eliminating the disturbance component from the displacement in Z-axis gap control.

15504	Displacement multiplier
-------	-------------------------

[Data type] Word
 [Unit of data]
 [Valid data range] 1 to 5
 Specify a multiply ratio for supporting a large detection amount in Z-axis gap control.

Displacement multiplier setting, maximum displacement, and resolution

Setting	Maximum displacement (mm)	Resolution (mm)
1	±2	0.001
2	±4	0.002
3	±6	0.003
4	±8	0.004
5	±10	0.005

4.19.2 Setting Related to Gap Control (Display)

	#7	#6	#5	#4	#3	#2	#1	#0
15505	TAC	TRS	TRA	EBS				

- [Data type] Bit
- EBS When the displacement is used as a reference value:
 0: It is expressed with one word.
 1: It is expressed with two words.
- TRA The trace setting screen displays the current position using:
 0: The relative coordinate system.
 1: The absolute coordinate system.
- TRS When gap control mode is not set, the gap control disable state signal (F220#0 TRERS) is output if:
 0: Gap displacement > parameter No. 15537.
 1: Gap displacement > (parameter No. 15537 + parameter No. 15539). Alternatively, gap displacement < -(parameter No. 15537).
- TAC Gap control acceleration clamping is:
 0: Effective only during approach.
 1: Always effective during gap control.

	#7	#6	#5	#4	#3	#2	#1	#0
15507					GO2			PCH

- [Data type] Bit
- PCH The G codes for gap control are:
 0: Of the normal type. (Normal setting)
 1: Not of the normal type. G13 is a G code dedicated to changing gap amounts and G14 is a G code with no function.
- GO2 The second gap control gain override signal is:
 0: Disabled.
 1: Enabled.

4.19.3 Settings Related to Gap Control (Integration)

15510	Integral time constant
-------	------------------------

- [Data type] Word
- [Unit of data] msec
- [Valid data range] 0 to 32767
- [Standard setting] 0
- The integral time constant is used for displacement integration in Z-axis gap control.

15511	Integral calibration zero width
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	0
	The setting is used as a displacement to disable integration in Z-axis gap control. The integration is not performed when (displacement specified as a reference value) ≤ (integral calibration zero width).
15512	Integral clamp value
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	0
	The setting is the integral clamp value for displacement integration in Z-axis gap control.

4.19.4 Settings Related to Gap Control (Phase Compensation)

15520	Phase compensation time constant
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
[Standard setting]	0 (A value lower than 2 is invalid.)
	This setting is the time constant for displacement phase compensation in Z-axis gap control.
15521	Phase compensation gain
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
[Standard setting]	0 (A value lower than 2 is invalid.)
	Specify a gain for displacement phase compensation in Z-axis gap control.

4.19.5 Settings Related to Gap Control (Displacement)

15530	Reference displacement
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	Parameters Nos.15531 to 15532
	The setting determines the reference distance from the tip of the quill to the workpiece to be controlled in Z-axis gap control.
<div style="border: 1px solid black; padding: 5px;"> <p>NOTE This parameter can be set on the trace setting screen.</p> </div>	
15531	Lower limit on reference displacement
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	-32768 to 32767
[Standard setting]	0
	Specify the minimum value that can be specified as the reference displacement for Z-axis gap control.
15532	Upper limit on reference displacement
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	-32768 to 32767
[Standard setting]	1000
	Specify the maximum value that can be specified as the reference displacement for Z-axis gap control.
15533	Displacement causing large displacement alarm
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	1200
	When a value specified as the reference displacement exceeds this setting in Z-axis gap control, a large displacement alarm is raised.
15534	Gap displacement on workpiece surface
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
	This setting indicates the displacement from the surface of the workpiece to the zero point in gap control.

15535	Lower limit on gap
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
	Specify the minimum value that can be specified for the gap in gap control.
15536	Upper limit on gap
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
	Specify the maximum value that can be specified for the gap in gap control.
15537	Gap control range over alarm
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	1000
	When the absolute value of the value obtained by subtracting the reference displacement from the detected displacement exceeds this setting in Z-axis gap control, an alarm is raised.
15538	Mask time of gap control range over alarm
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
[Standard setting]	1000
	When the reference displacement amount is changed, an alarm is suppressed in the transition state for the specified mask time.
15539	Calibration amount of gap control range over alarm
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	0
	The calibration amount can be added to the detected value of the approaching side to give the setting of parameter No. 15537.

4.19.6 Settings Related to Gap Control (Velocity Command)

15540	Velocity control voltage conversion coefficient of Z-axis gap control
15541	Velocity control voltage conversion coefficient of W-axis gap control
15542	Velocity control voltage conversion coefficient of X-axis gap control
15543	Velocity control voltage conversion coefficient of Y-axis gap control

[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	Use the following expression to calculate the conversion coefficient to be specified:
	$\text{Conversion coefficient} = \frac{P \times 4}{1000 \times Le} \times 2 \times 10^{-3} \times 4096$
	G : Gap control loop gain (sec ⁻¹)
	Le : Amount of machine movement per motor revolution (mm/rev)
	P : Number of pulses detected by the pulse coder per motor revolution (P/rev) (2048 for the serial A or α motor)

15544	Permissible approach acceleration
-------	-----------------------------------

[Data type]	Word
[Unit of data]	mm/min
[Valid data range]	0 to 32767
	A limit may be imposed on the gap control acceleration (speed increase per 2 msec) to prevent a servo overcurrent alarm from being raised at the start of gap control. Specify this permissible value.

15545	Displacement amount at which an acceleration limit is imposed during approach
-------	---

[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	-32768 to 32767
	A limit is imposed on the acceleration if the absolute value of the displacement amount is larger than this setting during gap control approach.

4.19.7 Settings Related to Gap Control (Approach)

15550	Approach completion detection range
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	50
	This setting is the displacement at which the completion of approach is assumed in Z-axis gap control. When the displacement stays within this approach completion detection range for the approach completion interval time or longer, the system assumes that the approach has been completed.
15551	Approach completion interval
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
[Standard setting]	500
	When a displacement in Z-axis gap control stays within the approach completion detection range for the specified time or longer, the system assumes that the approach has been completed.
15552	Approach completion detection displacement
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
[Standard setting]	50
	Specify the approach completion displacement for approach feed.
15553	Upper limit on feedrate for the approaching side
[Data type]	Word
[Unit of data]	mm/min
[Valid data range]	0 to 32767
[Standard setting]	1200
	Specify an upper limit on the feedrate in an approach.

15554	Constant for clamping Z-axis gap control speed
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	The setting is used as the constant for clamping the gap control speed. Specify the value obtained using the following expression:
	Gap control speed clamp constant = $\frac{P \times 4}{Le}$
	P : Number of pulses detected by the pulse coder per motor revolution (P/rev) (2048 for the serial A or α motor)
	Le : Amount of machine movement per motor revolution (mm/rev)

15555	Upper limit on feedrate for the withdrawing side
[Data type]	Word
[Unit of data]	mm/min
[Valid data range]	0 to 32767
[Standard setting]	1200
	Specify an upper limit on the feedrate for the withdrawing side.

15556	Constant for clamping W-axis gap control speed
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	This setting is used as the constant for clamping the gap control speed. Specify the value obtained using the following expression:
	Gap control speed clamp constant = $\frac{P \times 4}{Le}$
	P : Number of pulses detected by the pulse coder per motor revolution (P/rev) (2048 for the serial A or α motor)
	Le : Amount of machine movement per motor revolution (mm/rev)

4.19.8 Settings Related to Gap Control (Clamp Function)

15565	Gap control axis error detection value
[Data type]	2-word
[Unit of data]	Least command increment
[Valid data range]	0 to 99999999
	Set the gap control axis operation range.
	If the distance of a gap control axis operation exceeds the setting, the gap control axis error detection signal (F0224#4 TROUT) is output to the PMC.
	If 0 is set, gap control axis error detection is not performed.

15566	Gap control axis error detection value
[Data type]	2-word axis
[Unit of data]	Least command increment
[Valid data range]	0 to 99999999
	Set the gap control axis operation range for each axis.
	If the distance of a gap control axis operation exceeds the setting, the gap control axis error detection signal (F0224#4 TROUT) is output to the PMC.
	If 0 is set, gap control axis error detection is not performed.

4.20 GAP CONTROL BY MANUAL PULSE INTERRUPTS

	#7	#6	#5	#4	#3	#2	#1	#0
15570					APE	HS3	HS2	HS1

[Data type] Bit

HS1 Interrupts with the first manual pulse generator are:
 0: Not used for gap control by manual pulse interrupts.
 1: Used for gap control by manual pulse interrupts.

HS2 Interrupts with the second manual pulse generator are:
 0: Not used for gap control by manual pulse interrupts.
 1: Used for gap control by manual pulse interrupts.

HS3 Interrupts with the third manual pulse generator are:
 0: Not used for gap control by manual pulse interrupts.
 1: Used for gap control by manual pulse interrupts.

APE The acceleration control function of gap control by manual pulse interrupts is:
 0: Enabled only during approach operation. After the approach operation is completed, the function does not work.
 1: Always enabled during execution.

15572	Approach completion detection width 1
15573	Approach completion detection width 2
15574	Approach completion detection width 3

[Data type] Word

[Unit of data] 0.001mm

[Valid data range] 0 to 32767

Specify distances along axes 1 and 2 controlled under gap control by manual pulse interrupts. Completion of approach is determined by the specified distances. When a move command by manual pulse interrupt input maintains the setting or a shorter distance for at least the approach completion interval time, manual pulse gap control mode is entered on the assumption that approach is completed.

15575	Approach completion interval time 1
15576	Approach completion interval time 2
15577	Approach completion interval time 3

[Data type] Word

[Unit of data] msec

[Valid data range] 0 to 32767

If the approach completion detection width or a shorter distance is maintained for the set time or longer in gap control by manual pulse interrupts, approach completion is assumed.

15578	Allowable speed increase in gap control by manual pulse interrupts 1
15579	Allowable speed increase in gap control by manual pulse interrupts 2
15580	Allowable speed increase in gap control by manual pulse interrupts 3

[Data type] 2-word
[Unit of data] mm/min
[Valid data range] 8 to 99999999
Specify an allowable speed increase value for the unit time of each gap control axis in gap control by manual pulse interrupts.
After approach completion, this setting may be enabled or disabled, which depends on the setting of bit 3 (APE) of parameter No. 15570.

4.21 PREVENTION OF FALL INTO A HOLE ON GAP CONTROL AXIS (Z-AXIS)

	#7	#6	#5	#4	#3	#2	#1	#0
15590	FHT						NEZ	DPR

[Data type] Bit

DPR The function for preventing a fall into a hole in gap control is:
 0: Disabled.
 1: Enabled.

NEZ In conditions for canceling the function for preventing a gap control axis fall, the reference displacement is:
 0: Considered.
 1: Not considered.

FHT During feed hold, the operation for releasing gap control for all axes except the gap control axis after completion of the in-position check is:
 0: Disabled.
 1: Enabled.

15591	Z-axis machine coordinate value for preventing fall into a hole
-------	---

[Data type] 2-word

[Unit of data]

Input unit	Unit	IS-A	IS-B
Metric machine	mm	0.01	0.001
Inch machine	inch	0.001	0.0001

[Valid data range] -99999999 to +99999999

Immediately before the machine coordinate value of the gap control axis (Z-axis) under gap control becomes the setting of this parameter or smaller, the velocity command value for gap control is set to 0 to prevent a fall along the Z-axis.

15592	Release value of the function for preventing a fall into a hole on the Z-axis
-------	---

[Data type] Word

[Unit of data] 0.001mm

[Valid data range] -32768 to 32767

If the value obtained by subtracting the reference displacement from the deviation amount becomes greater than the parameter value, a rising operation along the Z-axis is enabled.

4.22 SETTINGS RELATED TO THREE- DIMENSIONAL AXIAL MOVEMENT (ANGULAR AXIS SETTING)

	#7	#6	#5	#4	#3	#2	#1	#0
15600	TDA	NFX	NCT	RNC	MIA	NPC		

- [Data type] Bit
- NPC During a stroke limit check before movement, movement in the G31 block is:
 0: Checked.
 1: Not checked.
- MIA During attitude control B, the G53 mode is:
 0: Tip fix mode.
 1: Independent axis mode. (A program containing G53 cannot execute a proximity point search and program restart.)
- RNC During movement along an angular axis in manual reference position return, the X, Y, and Z workpiece coordinates and relative coordinates are:
 0: Updated.
 1: Not updated.
- NCT When no command is specified for an intermediate point around the fourth and fifth axes in spatial circular interpolation (G12),
 0: The attitude does not change from the start point to the intermediate point.
 1: The intermediate attitude of the attitudes at the start point and the end point is specified for the intermediate point.
- NFX A non-tip-fix command is allowed in memory operation for adjusting the machine.
 0: The tip-fix operation is performed in memory operation.
 1: The non-tip-fix operation is performed in memory operation.

NOTE

When NFX is set to 1, the value (end point) specified by a program does not match the coordinates. After adjusting the machine, reset NFX to 0.

- TDA When the attitude around a rotation axis exceeds a point of software overtravel after three-dimensional conversion:
 0: Rotation in the opposite direction is performed.
 1: The software overtravel is not checked.

	#7	#6	#5	#4	#3	#2	#1	#0
15601	OFC		RAT	PCK	RDC	RFD	PA5	PA4

[Data type] Bit

PA4 The rotation around the fourth axis is:

0: Counterclockwise.

1: Clockwise.

PA5 The rotation around the fifth axis is:

0: Counterclockwise.

1: Clockwise.

RFD When only the fourth and fifth axes are specified with G01, the feedrate is:

0: That of parameter No. 15612 or No. 15613, whichever is lower.

1: The program-specified feedrate in deg/min.

RDC In three-dimensional conversion, the rotation around the fourth and fifth axes is:

0: The same as usual.

1: The rotation around the fourth axis is in the same direction as the programmed direction.

If there are two solutions, the one nearer the amount of travel before the conversion is selected. The solution for the fifth axis is determined with the solution selected for the fourth axis.

NOTE

1 This parameter must be set to 1.

2 This parameter can be used for offset type nozzles.

PCK The stroke limit check before movement is:

0: Enabled. (Normal setting)

1: Disabled.

RAT In three-dimensional conversion, the amounts of travel around the fourth and fifth axes are:

0: Always taken from the shorter path. (Normal setting)

1: Determined by bits 0 and 1 of parameter No. 1006 and bits 0 and 1 of parameter No. 1008.

OFC When movement around the fourth or fifth axis results in a great movement along the X-axis, Y-axis, or Z-axis,

0: The feedrate is not clamped.

1: The feedrate along the X-axis, Y-axis, or Z-axis is clamped to the manual rapid traverse rate.

	#7	#6	#5	#4	#3	#2	#1	#0
15602		FMX		ZTC			OSL	TGC

- [Data type] Bit
- TGC For interaction control, the rotation of the α axis is specified in a command:
 0: Using a sign different from that used for the β axis rotation command.
 1: Using the same sign as that used for the β axis rotation command.
- OSL In the stroke limit check before movement, the offset of attitude control B is:
 0: Not considered.
 1: Considered.
- ZTC The tracing axis is:
 0: Switchable by tracing axis selection signal (G225#0 ZTRM).
 1: Always the Z-axis, irrespective of tracing axis selection signal (G225#0 ZTRM).
- FMX If an offset-type nozzle is used, the cutting speed is:
 0: Not clamped.
 1: Clamped by considering the maximum speed after attitude control.

15610	Machine zero-degree position offset around the fourth axis
-------	--

15611	Machine zero-degree position offset around the fifth axis
-------	---

[Data type] 2-word
 [Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Unit of data	deg/min	0.01	0.001	0.0001

[Valid data range] 0 to 360000
 Specify the zero-degree position offsets around the fourth and fifth axes in that order.

15612	Highest speed in machining feed around the fourth axis
-------	--

15613	Highest speed in machining feed around the fifth axis
-------	---

[Data type] Word
 [Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Unit of data	deg/min	10	1	0.1

[Valid data range] 6 to 15000
 Specify the highest speeds in machining feed around the fourth and fifth axes (rotation axes). To execute interaction control, specify identical values for the fourth and fifth axes.

15615	Length of the first arm
--------------	--------------------------------

15616	Length of the second arm
--------------	---------------------------------

[Data type] 2-word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-B
Metric machine	mm	0.01	0.001	0.0001
Inch machine	inch	0.001	0.0001	0.00001

[Valid data range] 0 to 500000 (Metric machine)
0 to 196850 (Inch machine)
Specify the lengths of the first and second arms of the offset heads.

15617	Interaction gear count for the α axis
--------------	--

[Data type] Byte
[Unit of data]
[Valid data range] 0 to 127

Specify the interaction gear count for the α axis. When the gear count falls outside beyond the specified range, specify a value divided by the greatest common divisor of the gear counts of this axis and the β axis.

[Example] When the gear count of the α axis is 300 and the gear count of the β axis is 200, $300:200 = 3:2$. Specify 3 as the α axis gear count and 2 as the β axis gear count.

15618	Interaction gear count for the β axis
--------------	---

[Data type] Byte
[Unit of data]
[Valid data range] 0 to 127

Specify the interaction gear count for the β axis.
The β -axis interaction calibration amount is calculated from the α -axis interaction gear count specified in parameter No. 15617 and this setting. The calculated value is automatically specified for the β axis.

15619	Nozzle length
--------------	----------------------

[Data type] 2-word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-B
Metric machine	mm	0.01	0.001	0.0001
Inch machine	inch	0.001	0.0001	0.00001

[Valid data range] Parameter No. 15616 + parameter No. 15619 \leq 500000 (Millimeter machine)
Parameter No. 15616 + parameter No. 15619 \leq 196850 (Inch machine)
Specify a nozzle length.
When G71 is executed, the value specified with address R is specified in this parameter.

15621	Maximum speed 1 after attitude control
[Data type]	2-word axis
[Unit of data]	mm/min
[Valid data range]	0 to 240000
	Specify the maximum speed after attitude control. The speed on each axis may be overridden so as not to exceed this setting. The maximum speed check is not performed on an axis for which 0 is set.
15622	Maximum speed 2 after attitude control
[Data type]	2-word axis
[Unit of data]	mm/min
[Valid data range]	0 to 240000
	Specify the maximum speed after attitude control. The speed on each axis may be overridden so as not to exceed this setting. This parameter is effective when the attitude control B speed clamp select signal (G224#7 OTPMX2) is 1. When OTPMX2 is 0, parameter No. 15621 is effective. Parameter No. 15621 is effective to an axis for which 0 is set in this parameter.
15623	Angle at which rotation is assumed to be only plane rotation in three-dimensional conversion
[Data type]	2-word
[Unit of data]	0.001 deg
[Valid data range]	0 to 89999
	If, in three-dimensional conversion, the difference between the inclination of the plane containing three reference points (P1, P2, and P3) and that of the plane containing three target points (Q1, Q2, and Q3) is equal to or less than the angle specified in this parameter, the inclination difference is ignored and the rotation is assumed to be only rotation in the X-Y plane. If this parameter is 0, this compensation process is not executed.
15628	Backlash for the fifth-axis program command
[Data type]	Word
[Unit of data]	
[Valid data range]	-9999 to 9999
	Backlash is output when the polarity of the travel direction of nozzle arm 2 reverses. That is, backlash is output when the polarity of the fifth-axis command reverses. Before changing this parameter, move the tool along the fifth axis in the reference position return direction and cancel any existing backlash compensation.

15629**Backlash for the fifth-axis interaction command**

[Data type]	Word
[Unit of data]	Detection unit
[Valid data range]	-9999 to 9999

Backlash is output for the fifth axis when the polarity of the travel direction of the fourth axis reverses. Before changing this parameter, move the tool along the fourth axis in the reference position return direction and cancel any existing backlash compensation.

4.23 PROGRAM RESTART / PROXIMITY POINT SEARCH

	#7	#6	#5	#4	#3	#2	#1	#0
15630	NMT	NMC	NSC	PRT	NRE	NSR	PRZ	PRS

[Data type] Bit

PRS The program restart function of:

0: The standard type is used.

1: The laser type is used.

PRZ While the program restart function is being executed, a Z-axis command up to the position of restart is:

0: Not ignored.

1: Ignored.

NSR In a sequence number search, the automatic operation in progress signal (F007#7 OP) is:

0: Output.

1: Not output.

NRE When the proximity point search function attempts positioning to the end point,

0: Alarm PS4000 (No proximity point is found) is raised.

1: The positioning is allowed.

PRT When an attempt is made to execute the program restart function on a Z-axis gap control program using G13:

0: Alarm No. 4001 is raised. (Normal setting)

1: Search is possible.

If this parameter is set to 1, drive the Z-axis machine lock (G108#2 MLK3) signal on and off at the same timing as program restart signal REST2 when the program is restarted. Note that the program must be specified in absolute mode.

NSC If, with the program restart function of the laser type and the proximity point search function, a program is to resume in a spatial corner R insertion block:

0: The program restarts at the program-specified point at which a corner R is not inserted.

1: The program restarts at the end of the inserted corner R.

NMC With the proximity point search in attitude control B and the program restart function, positioning to the point of resumption is:

0: Executed for all axes at the same time.

1: Executed for the fourth and fifth axes first, then for the remaining axes. (Note: Executed in non-interpolation mode.)

NMT If, in a proximity point search, the block whose end point is near the reference position is followed by a block without movement:
 0: The system searches for the next block. (Normal setting)
 1: The system assumes the block without movement to be a proximity point.

15635	Proximity point distance of proximity point search
--------------	---

[Data type] 2-word
 [Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	0.01	0.001	0.0001
Inch input	inch	0.001	0.0001	0.00001

[Valid data range] 0 to 99999999
 Specify the proximity point distance of proximity point search.

4.24 TEACHING BOX

15638	Start address of teaching box DI area
15639	Start address of teaching box DO area

[Data type] Word
 [Unit of data]
 [Valid data range] 1 to 999
 The DI/DO area can be assigned to a desired address of the internal relay area (R area). When an address is specified in parameter No. 15638 or 15639, the area is assigned, starting from the address. This parameter is effective when bit 1 (TBX) of parameter No. 15641 is 1.

15640	Channel of teaching box
-------	-------------------------

[Data type] Byte
 [Unit of data]
 [Valid data range] 1,2
 Specify the channel to which the teaching box is connected.

	#7	#6	#5	#4	#3	#2	#1	#0
15641	TBN	TN5				TBA	TBX	TBE

[Data type] Bit

TBE As the channel of the teaching box, the right to occupy the RS-232C port is:
 0: Always held by the CNC. (Normal setting)
 1: Switchable by the signal (G226#6 TBES).

TBX The areas used to access DI/DO signals from the teaching box:
 0: Are fixed.
 1: Can be expanded.

TBA The transfer status to the expansion nonvolatile memory is:
 0: Not output. (Parameter No. 15642 is invalid.)
 1: Output. (Parameter No. 15642 is valid.)

TN5 In G and M commands, 5-digit sequence numbers are:
 0: Not used.
 1: Made usable.

TBN In N commands, comment specification is:
 0: Disabled.
 1: Enabled.
 If this parameter is set to 1, all MDI key characters except O can be input.

15642	Output address of transfer status from TB to expansion nonvolatile memory
--------------	--

[Data type] Word
 [Unit of data]
 [Valid data range] 0 to 65528
 When an R or S command is specified in the teaching box, the start address, byte count, completion code, and control bit of the data sent from the teaching box are set at the address specified in parameter No.15642.

Address specified in parameter No.15642

Start address of data	+0
Byte count	+2
Completion code	+4
Control Bit	+6

Control Bit +6

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

When MSTBA is set to 1, the R or S command is masked.
 (If an R or S command is specified while MSTBA is set to 1, an alarm completion code is output.)

15643	Number of DI sets
--------------	--------------------------

15644	Number of DO sets
--------------	--------------------------

[Data type] Byte
 [Unit of data] 1 set (1 byte)
 [Valid data range] 1 to 15 (When 0 is specified, the extension function is disabled.)
 Specify the sizes of DI and DO.
 Specify the DI size in parameter No.15643 and the DO size in parameter No.15644. Starting from the address specified in parameter No.15638 and parameter No.15639, the DI and DO areas of the specified sizes are assigned. This parameter is valid, when the bit 1 (TBX) of parameter No.15641 is set to 1.

Internal relay area	
Start address Specified in parameter No.15638	DI The size is specified in parameter No.15643.
Start address Specified in parameter No.15639	DO The size is specified in parameter No.15644.

4.25 SETTINGS RELATED TO RETRY PROCESSING FUNCTION

15650 Z-axis retraction amount

[Data type] 2-word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	0.01	0.001	0.0001
Inch input	inch	0.001	0.0001	0.00001

[Valid data range] 1 to 99999999

Specify the amount of Z-axis retraction if it occurs before inverted movement or skip starts.

15651 Amount of inverted movement

[Data type] Word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	10	1	0.1
Inch input	inch	1	0.1	0.01

[Valid data range] 1 to 8000

Specify the amount of inverted movement, which is the distance between the start and end points of the inverted movement.

15652 Resumption completion distance

[Data type] Word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	10	1	0.1
Inch input	inch	1	0.1	0.01

[Valid data range] 1 to 8000

The system assumes that the inverted movement processing ends when the amount of travel since a program is resumed after the resumed non-inverted movement up to the start point of the inverted movement ends exceeds this setting.

15653	Retry count
--------------	--------------------

[Data type] Word
 [Unit of data] Times
 [Valid data range] 0 to 100

When a program is resumed after the resumed non-inverted movement up to the start point of the inverted movement ends, an attempt is made to repeat the inverted movement processing if inverted movement signal (G007#0 RVS) is accepted before the resumption completion distance set with parameter No.15652 is reached. The number of times the processing is repeated is counted. If the number of times exceeds this setting, the inverted movement processing is stopped and skip to the next block is performed.

	#7	#6	#5	#4	#3	#2	#1	#0
15669							STH	N2S

[Data type] Bit
 N2S The piercing conditions for the resumed non-inverted movement are:
 0: As specified in the program.
 1: Determined by the values of parameters Nos. 15670 to 15682.

STH In the retry processing function:
 0: The normal specifications are followed after a skip operation.
 1: Z-axis descent, gap control, and piercing are not executed after a skip operation.

15670	Piercing power
--------------	-----------------------

[Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 7000

Specify the piercing power to be used when the retry processing function or a skip is executed.

15671	Initial frequency of piercing
--------------	--------------------------------------

[Data type] Word
 [Unit of data] Hz
 [Valid data range] 5 to 2000

Specify the initial frequency of piercing to be used when the retry processing function or a skip is executed.

15672	Incremental value of piercing frequency
--------------	--

[Data type] Word
 [Unit of data] Hz
 [Valid data range] 0 to 2000

Specify a value by which the piercing frequency is incremented when the retry processing function or a skip is executed.

15673	Initial duty ratio of piercing
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	Specify the initial duty ratio of piercing to be used when the retry processing function or a skip is executed.
15674	Incremental value of piercing duty ratio
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 100
	Specify the value by which the duty ratio of piercing is incremented when the retry processing function or a skip is executed.
15675	Piercing step time
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Specify the piercing step time to be used when the retry processing function or a skip is executed.
15676	Piercing step count
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 32767
	Specify the number of piercing steps to be used when the retry processing function or a skip is executed.
15677	Piercing end time
[Data type]	2-word
[Unit of data]	msec
[Valid data range]	0 to 99999999
	Specify the piercing end time to be used when the retry processing function or a skip is executed.
15678	Reference displacement
[Data type]	2-word
[Unit of data]	0.001mm
[Valid data range]	Parameter No.15531 to parameter No.15532
	Specify the reference displacement for piercing to be used when the retry processing function or a skip is executed. This value determines the reference distance from the tip of the quill to the workpiece to be controlled during Z-axis gap control.

15679	Assist gas selection
[Data type]	Word
[Unit of data]	
[Valid data range]	0 to 7
	Specify the assist gas type to be selected when the retry processing function or a skip is executed.
15680	Flow pattern selection
[Data type]	Word
[Unit of data]	
[Valid data range]	1 to 3
	Select the assist gas flow pattern to be used when the retry processing function or a skip is executed.
15681	Assist gas pressure stabilization time for piercing
[Data type]	Word
[Unit of data]	10msec
[Valid data range]	0 to 32767
	Specify the assist gas pressure stabilization time for piercing to be used when the retry processing function or a skip is executed.
15682	Assist gas pressure for piercing
[Data type]	Word
[Unit of data]	0.01MPa or 0.1 kg/cm ²
[Valid data range]	0 to 255
	Specify the assist gas pressure for piercing to be used when the retry processing function or a skip is executed.

4.26 OPTICAL PATH LENGTH COMPENSATION

	#7	#6	#5	#4	#3	#2	#1	#0
15700	8	7	6	5	4	Z	Y	X

[Data type] Bit
 X to 8 When a move command for the axis of mirror movement is calculated, the corresponding axis is:
 0: Not used.
 1: Used.

NOTE
 Specify 0 for the bit corresponding to an axis that is not present.

	#7	#6	#5	#4	#3	#2	#1	#0
15701	8	7	6	5	4	Z	Y	X

[Data type] Bit
 X to 8 When a move command for the axis of mirror movement is calculated, the polarity of the move command of each axis to be used for the calculation is:
 0: Negative.
 1: Positive.

NOTE
 Specify 0 for the bit corresponding to an axis that is not present.

	#7	#6	#5	#4	#3	#2	#1	#0
15702	MRO					MCO	FMS	TXC

[Data type] Bit
 TXC During gap control, the amount of travel along the gap control axis is:
 0: Included in the calculation of the U-axis move command.
 1: Not included in the calculation of the U-axis move command.

FMS Optical path length compensation is:
 0: Enabled.
 1: Disabled.

MCO The sign of the compensation amount for the reference position of the axis of mirror movement is:
 0: Plus.
 1: Minus.

MRO The optical path length compensation stop request signal is set to 1 when:
 0: An overtravel occurs on the mirror block axis.
 1: An overtravel occurs on the mirror block axis and the axis specified in parameter No. 15700.

15703	Mirror block axis selection
--------------	------------------------------------

[Data type] Byte
 [Unit of data]
 [Valid data range] 4 to 8
 Specify the axis number of an axis of mirror movement. The axis must not be the X-axis, Y-axis or Z-axis.

15704	Mirror block axis reference position calibration
--------------	---

[Data type] Word
 [Unit of data]
 [Valid data range] -32768 to 32767
 [Standard setting] 0
 Specify a distance from the origin for the position calibration of the mirror block axis so that an optimum transmission distance can be obtained.

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	10	1	0.1
Inch input	inch	1	0.1	0.01

15705	Optical path length compensation coefficient
--------------	---

[Data type] Word
 [Unit of data] 1/64
 [Valid data range] 64 to 32767
 [Standard setting] 128
 The total amount of travel along the axis specified in parameter No. 15700 divided by this coefficient is the amount of travel along the mirror block axis.

4.27 LASER GAS MIXER FUNCTION

15710	Cylinder level check wait time
[Data type]	Word
[Unit of data]	sec
[Valid data range]	0 to 32767
	Specify a wait time for checking the cylinder level.
15711	Gas mixture wait time
[Data type]	Word
[Unit of data]	min
[Valid data range]	0 to 32767
[Standard setting]	60
	Specify the time from when the tank is filled with gases until the gases are mixed and ready to be supplied.
15712	Mixer evacuation time
[Data type]	Word
[Unit of data]	min
[Valid data range]	0 to 32767
[Standard setting]	30
	Specify the evacuation time for evacuating the mixer. This value is also used as the evacuation time used for a leak check.
15713	Helium discharge time
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Specify the time allowed to discharge helium gas from the piping after the piping is filled with helium gas and before being filled with another gas.
15714	Nitrogen and CO₂ discharge time
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Specify the time allowed to discharge nitrogen or CO ₂ from the piping after the piping is filled with nitrogen or CO ₂ and before being filled with another gas.

15715	Degree of vacuum of gas pressure
[Data type]	Word
[Unit of data]	(1=13Pa)
[Valid data range]	0 to 32767
	The degree of vacuum of the laser gas pressure in the gas mixer is measured. When the laser gas pressure is below the setting, an alarm is raised.

15716	Evacuation wait time
[Data type]	Word
[Unit of data]	min
[Valid data range]	0 to 32767
	Specify an evacuation wait time. When 0 is specified, 30 is assumed.

4.28 STEP FUNCTION

15730	Distance of a single ramp-up step
--------------	--

[Data type] Word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	0.01	0.001	0.0001
Inch input	inch	0.001	0.0001	0.00001

[Valid data range] 0 to 65000
Specify the distance of a single ramp-up step during step control.

15731	Laser power of ramp-up step 1
--------------	--------------------------------------

15732	Laser power of ramp-up step 2
--------------	--------------------------------------

15733	Laser power of ramp-up step 3
--------------	--------------------------------------

15734	Laser power of ramp-up step 4
--------------	--------------------------------------

15735	Laser power of ramp-up step 5
--------------	--------------------------------------

15736	Laser power of ramp-up step 6
--------------	--------------------------------------

15737	Laser power of ramp-up step 7
--------------	--------------------------------------

15738	Laser power of ramp-up step 8
--------------	--------------------------------------

15739	Laser power of ramp-up step 9
--------------	--------------------------------------

15740	Laser power of ramp-up step 10
--------------	---------------------------------------

[Data type] Word
[Unit of data] W
[Valid data range] 0 to 7000
Specify the laser powers of the ramp-up steps during step control.

15745	Distance of a single ramp-down step
--------------	--

[Data type] Word
[Unit of data]

Input unit	Unit	IS-A	IS-B	IS-C
Metric input	mm	0.01	0.001	0.0001
Inch input	inch	0.001	0.0001	0.00001

[Valid data range] 0 to 65000
Specify the distance of a single ramp-down step during step control.

15746	Laser power of ramp-down step 1
15747	Laser power of ramp-down step 2
15748	Laser power of ramp-down step 3
15749	Laser power of ramp-down step 4
15750	Laser power of ramp-down step 5
15751	Laser power of ramp-down step 6
15752	Laser power of ramp-down step 7
15753	Laser power of ramp-down step 8
15754	Laser power of ramp-down step 9
15755	Laser power of ramp-down step 10

[Data type] Word
 [Unit of data] W
 [Valid data range] 0 to 7000
 Specify the laser powers of the ramp-down steps during step control.

4.29 STEP FORWARD/BACK FUNCTION

15770	Feedrate of step forward/back
--------------	--------------------------------------

[Data type] 2-word
 [Unit of data]
 [Valid data range]

Input unit	Unit of data	Valid data range	
		IS-A, IS-B	IS-C
Metric machine	1mm/min	0 to 240000	0 to 100000
Inch machine	0.1inch/min	0 to 96000	0 to 48000

Specify the feedrate to be used when the step forward/back function is specified from the teaching box.

15771	Wait time after which C command processing will be executed
--------------	--

[Data type] Word
 [Unit of data] 16msec
 [Valid data range] 0 to 10

Specify the wait time after which the teaching box C command will be executed.

	#7	#6	#5	#4	#3	#2	#1	#0
15775				STS	TIE	MCL	MEN	NST

[Data type] Bit

NST Step forward/back complies with:
 0: New specification (bits 1 (MEN), 2 (MCL), and 3 (TIE) of parameter No. 15775 are valid).
 1: Old specification.

MEN In the step forward/back function, M codes are:
 0: Not output.
 1: Output.

MCL In the step forward/back function, macro and subprogram calls are:
 0: Disabled.
 1: Enabled.

TIE In the step forward/back function, spatial corner R is:
 0: Enabled.
 1: Disabled.

STS After feed hold during step forward/back, T and U commands perform the following:
 0: The next block is read and executed.
 1: Only a start is made.

4.30 PARAMETERS RELATED TO GAS PRESSURE CONTROL (2)

	#7	#6	#5	#4	#3	#2	#1	#0
15800								TPC

[Data type] Bit
 TPC The turbo blower constant-power drive control function is:
 0: Disabled. (Normal setting)
 1: Enabled.

15801	Maximum in-tube pressure when the turbo blower constant-power drive control function is enabled
-------	--

[Data type] Word
 [Unit of data] (1=13Pa)
 [Valid data range] 1 to 32767
 Maximum in-laser-tube pressure. If the in-laser-tube pressure calculated from the specified laser power value exceeds the setting of this parameter, the pressure is clamped to the setting.

15802	Laser power that yields the maximum in-tube pressure when the turbo blower constant-power drive control function is enabled
-------	--

[Data type] Word
 [Unit of data] W
 [Valid data range] 1 to 32767
 Laser power that yields the in-laser-tube pressure equal to the setting of parameter No. 15801. This parameter and parameter No. 15801 are used to determine the proportional constant for the in-laser-tube gas pressure and the laser power.

15803	In-tube pressure compensation coefficient when the turbo blower constant-power drive control function is enabled
-------	---

[Data type] Word
 [Unit of data] 1/1024
 [Valid data range] 0 to 32767
 Compensation coefficient by which the in-laser-tube pressure is to be multiplied. A parameter setting of 1024 corresponds to a compensation coefficient of 1.0.

15804	Maximum open time of the exhaust valve for controlling the in-tube pressure during oscillation
-------	---

[Data type] Word
 [Unit of data] msec
 [Valid data range] 0 to 3000
 Specify the maximum open time of the exhaust valve PCV.

4.31 GAP CONTROL B, GAP CONTROL AXIS HIGH-SPEED APPROACH, AND AUTOMATIC GAP CONTROL AXIS RETRACTION/RETURN FUNCTIONS

	#7	#6	#5	#4	#3	#2	#1	#0
15840	NKS	PEX	ITL	LPP		GDS	PPN	TRB

[Data type] Bit
 TRB Gap control function B is:
 0: Disabled.
 1: Enabled.

NOTE

When using the gap axis high-speed approach function and the automatic gap control axis retraction/return function, set this parameter to 1.

PPN The automatic gap axis retraction/return function is:
 0: Disabled.
 1: Enabled.

NOTE

When using this function, enable the gap control B function (set bit 0 (TRB) of parameter No. 15840 to 1).

GDS Method of specifying the start of deceleration of the gap axis high-speed approach function
 0: Deceleration starts when the gap deviation is smaller than the deviation for starting deceleration (parameter No. 15848).
 1: Deceleration starts when deceleration start signal *APDEC is set to 0.

When using the automatic gap control axis retraction/return function, set this parameter to 1.

LPP When a lowering operation along the Z-axis is performed by the high-speed approach function:
 0: The pierce point position signal is not used.
 1: The pierce point position signal is used to stop the operation at the pierce point position.

When using the automatic gap control axis retraction/return function, set this parameter to 1.

ITL If function end position stop signal (G488#6 NPDS) is 0, the automatic gap control axis retraction/return function ends when:
 0: The function end position on the Z-axis is achieved.
 1: The gap amount shows the approach completion state after the function end position on the Z-axis is achieved.

- PEX If the positioning distance is shorter than the setting of parameter No. 15844 when the automatic gap control axis retraction/return function is about to operate, the automatic gap control axis retraction/return function in-progress signal (F488#6 PPEX) is:
 0: Not set to 1.
 1: Set to 1.
- NKS In the automatic gap control axis retraction/return function, when the position set in parameter No. 15843 is achieved by a rise along the Z-axis:
 0: Lowering operation starts after the end of positioning of the contour axis that is used as the reference axis for operation.
 1: Lowering operation starts before the end of positioning of the contour axis that is used as the reference axis for operation.

15842	Z-axis rise distance
--------------	-----------------------------

- [Data type] 2-word
 [Unit of data] 0.001mm
 [Valid data range] 0 to 99999999
 Set the distance of a rising operation along the Z-axis starting from the X- and Y-axis movement start position that is performed at the time of gap axis (Z-axis) retraction in the automatic gap control axis retraction/return function. After the rising operation along the Z-axis has been made by the distance set in this parameter, the Z-axis operation starts deceleration then stops.

15843	Z-axis rise limit position
--------------	-----------------------------------

- [Data type] 2-word
 [Unit of data] 0.001mm
 [Valid data range] 0 to ±99999999
 Set the machine coordinate value of the limit position of the rising operation performed along the Z-axis in the automatic gap control axis retraction/return function.
 When this position is achieved, the Z-axis operation starts deceleration, and when the speed becomes 0, the operation stops.
 If 0 is set, the Z-axis rise limit function by this parameter is disabled.
 Set a position in this parameter so that it is lower than the OT detection position on the positive side of the Z-axis.

15844	Positioning amount for suppressing automatic gap control axis retraction/return
--------------	--

- [Data type] 2-word
 [Unit of data] 0.001mm
 [Valid data range] 0 to 99999999
 If the X- or Y-axis positioning distance that is used as the reference distance for the operation of the automatic gap control axis retraction/return function is not longer than the setting of this parameter, the automatic gap control axis retraction/return function does not operate.

15845	Approach speed
[Data type]	Word axis
[Unit of data]	mm/min
[Valid data range]	0 to 65535
	Set the approach speed of high-speed approach operation. If 0 is set, the high-speed approach function does not operate. If a too large value is set in this parameter, sufficient deceleration may fail, which can cause a collision with the workpiece. So, when changing the parameter setting, set a value carefully.
15846	Acceleration time constant
[Data type]	Word axis
[Unit of data]	msec
[Valid data range]	0 to 32767
	Set the time from the start of the high-speed approach operation until the approach speed is reached.
15847	Deceleration time constant
[Data type]	Word axis
[Unit of data]	msec
[Valid data range]	0 to 32767
	Set the time that it takes to decelerate the approach speed until stop occurs. If a too large value is set in this parameter, sufficient deceleration may fail, which can cause a collision with the workpiece. So, when changing the parameter setting, set a value carefully.
15848	Deviation for ending high-speed approach operation
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
	Set the deviation for switching from the high-speed approach operation to the normal approach operation, which is controlled at a speed changing in proportion to the deviation. If the deviation is smaller than the setting of this parameter, deceleration starts from the speed of the high-speed approach toward the normal approach speed. This parameter is used if bit 2 (GDS) of parameter No. 15840 is set to 0. If bit 2 (GDS) of parameter No. 15840 is set to 0, and this parameter is set to 0, the gap control axis high-speed approach function does not operate. If this parameter is set to a too small value, sufficient deceleration may fail, which can cause a collision with the workpiece. So, when changing the parameter setting, set a value carefully.

15850	Amount of movement per motor rotation
[Data type]	2-word axis
[Unit of data]	0.001mm
[Valid data range]	0 to 99999999
	Set the amount of axis movement per rotation of the motor installed for each axis.
	Set this parameter when an axis used for gap control B is driven by a rotary motor.
	This parameter is not used by other than the gap control B function. So, this parameter need not be set for axes not used by the gap control B function.
15851	Magnification of interpolation circuit
[Data type]	2-word axis
[Unit of data]	Times
[Valid data range]	0 to 99999999
	Set the magnification of the interpolation circuit in the separate detector of each axis.
	Set this parameter for an axis that is used by gap control B and is driven by a linear motor.
	This parameter is not used by other than the gap control B function. So, this parameter need not be set for axes not used by the gap control B function.
15852	Separate detector wave length
[Data type]	2-word axis
[Unit of data]	0.001 μ m (0.000001mm)
[Valid data range]	0 to 99999999
	Set the wave length of the separate detector of each axis.
	Set this parameter for an axis that is used by gap control B and is driven by a linear motor.
	This parameter is not used by other than the gap control B function. So, this parameter need not be set for axes not used by the gap control B function.
15853	Gap control gain
[Data type]	Word axis
[Unit of data]	sec ⁻¹
[Valid data range]	0 to 32767
[Standard setting]	30
	Set the gap control gain for determining the follow-up performance of the gap axis in the gap control B function.
	The follow-up speed is obtained by multiplying the deviation sent from the detector by the gap control gain.

15854	Gap control gain during approach
[Data type]	Word axis
[Unit of data]	sec ⁻¹
[Valid data range]	0 to 32767
[Standard setting]	30
	Set the gap control gain during approach operation in the gap control B function. If this parameter is not set, parameter No. 15853 (gap control gain) is used.
15855	Permissible approach acceleration value
[Data type]	Word axis
[Unit of data]	0.1m/min
[Valid data range]	0 to 32767
	The gap control acceleration is limited to prevent a servo overcurrent alarm from being issued at the start of the gap control B function. This parameter sets the permissible value of acceleration.
15856	Displacement for limiting acceleration during approach
[Data type]	Word axis
[Unit of data]	0.001mm
[Valid data range]	0 to 32767
	If the absolute value of the displacement is greater than the setting of this parameter during approach operation in the gap control B function, the gap control acceleration is limited.
15857	Upper limit of feedrate on proximate side
[Data type]	Word axis
[Unit of data]	mm/min
[Valid data range]	0 to 65535
	Set the upper limit of the feedrate on the proximate side in the gap control B function.
15858	Upper limit of feedrate on far side
[Data type]	Word axis
[Unit of data]	mm/min
[Valid data range]	0 to 65535
	Set the upper limit of the feedrate on the far side in the gap control B function.

15861	Percentage of remaining positioning distance for starting Z-axis lowering operation
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 2,000
	Set the percentage of the X- or Y-axis remaining positioning distance that is used as the reference for the operation of the automatic gap control axis retraction/return function to the amount of movement for positioning that is required for the Z-axis rising operation. When this percentage is achieved, the lowering operation starts. If 0 is set, 70 is assumed. A value greater than 2,000 is assumed to be 2,000.
15865	Position for starting X- and Y-axis movements
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 65535
	Set the position on the Z-axis at which X- and Y-axis movements start by using a relative distance from the Z-axis position at which the automatic gap control axis retraction/return function starts. If 0 is set, 30,000 is assumed for operation. Custom macro system variable #6048 is assigned to this parameter.
15866	Deceleration start position
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 65535
	Set the position at which deceleration starts from the lowering speed to attain the gap control speed when a lowering operation is performed after the rising operation along the Z-axis by the automatic gap control axis retraction/return function. This position is set as a relative distance from the Z-axis position at which the automatic gap control axis retraction/return function starts. If 0 is set, 30,000 is assumed for operation. Custom macro system variable #6049 is assigned to this parameter.
15867	Function end position
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	0 to 65535
	Set the position at which the operation is regarded as ending when a lowering operation is performed after the rising operation along the Z-axis by the automatic gap control axis retraction/return function. This position is set as a relative distance from the Z-axis position at which the automatic gap control axis retraction/return function starts. If 0 is set, 0 is assumed for operation. Custom macro system variable #6050 is assigned to this parameter.

4.32 BEAM OUTPUT FUNCTION DURING APPROACH

15870	Gap deviation for starting beam output
[Data type]	Word
[Unit of data]	0.001mm
[Valid data range]	-32768 to 32767
	When the deviation output from the gap sensor reaches this setting after the start of the Z-axis approach operation by the gap control function, beam output starts.
	Set a value within the detection stroke range of the gap sensor used.
	The value set in this parameter must be smaller than the setting of parameter No. 15848.
	Custom macro system variable #6051 is assigned to this parameter.

NOTE

Do not change this setting while the beam output function is being performed during the Z-axis approach operation.

15871	Adjustment ratio of gap control axis speed
[Data type]	Word
[Unit of data]	%
[Valid data range]	0 to 65535 (Valid data range: 0 to 255)
[Standard setting]	100
	Set the ratio for adjusting the gap control axis speed calculated by the CNC when the beam is output during the approach operation for the gap control axis.
	If 0 is set, 100 is assumed.
	If 0 or 100 is set, no weight is provided.
	A value from 0 to 255 can be set.
	A value greater than 255 is assumed to be 255.
	Custom macro system variable #6052 is assigned to this parameter.
	<ul style="list-style-type: none"> • If bit 7 of parameter No. 15873 is set to 0 This parameter can provide a weight for the gap control axis speed from the start of beam output calculated by the CNC until the end. If the approach operation ends earlier than the beam output, set 100 in this parameter first, then adjust the setting by decreasing the setting gradually in steps of 5. • If bit 7 of parameter No. 15873 is set to 1 This parameter can provide a weight for the ratio for decreasing the speed calculated based on the gap control axis speed used at the start of beam output. If the Z-axis position touches the surface of the workpiece, set 100 in this parameter first, then adjust the setting by increasing the setting gradually in steps of 5.

NOTE

If a value is set by using the variable number, do not set a negative value.

15872	Gap control axis control extension time
--------------	--

[Data type] Word
 [Unit of data] msec
 [Valid data range] 0 to 65535
 [Standard setting] 0

If bit 7 of parameter No. 15873 is set to 0, the Z-axis is controlled so that the approach operation is completed within the specified beam output time. Setting of this parameter allows the approach operation to end earlier than the end of beam output.

If the value set in this parameter is not shorter than the beam output time, alarm No. 4032 is issued.

Custom macro system variable #6053 is assigned to this parameter.

NOTE
 If a value is set by using the variable number, do not set a negative value.

	#7	#6	#5	#4	#3	#2	#1	#0
15873	AZC							

[Data type] Bit
 AZC After the start of beam output, the approach operation for the gap control axis is performed as follows:

- 0: The approach operation is completed within the beam output time.
- 1: The approach speed is controlled based on the approach speed set at the start of beam output.

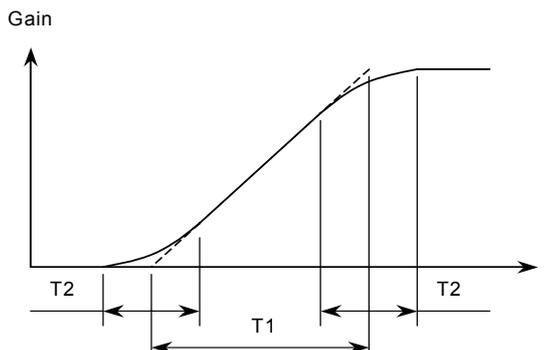
4.33 ACTUAL OUTPUT ESTIMATION TYPE PULSE POWER FEEDBACK

	#7	#6	#5	#4	#3	#2	#1	#0
29000						PTC	PTB	PFB

- [Data type] Bit
- PFB The actual output estimation type pulse power feedback control is:
 0: Disabled.
 1: Enabled. (Normal setting)
- PTB On the actual output estimation data table screen, data input is:
 0: Disabled.
 1: Enabled.
 If 0 is set in this parameter, the cursor does not appear on the screen, disabling data input.
- PTC On the time constant measurement screen, time constant measurement is:
 0: Disabled.
 1: Enabled.
 If 0 is set in this parameter, a time constant measurement is not made even when the [EXEC] soft key is pressed. The measurement, however, can be started using an external signal.

29001	Time constant 1 (T1) of bell-shaped filter for power feedback gain
-------	--

- [Data type] Word
- [Unit of data] msec
- [Valid data range] 0 to 32767
- A bell-shaped filter can be applied to the power feedback gain. The power feedback gain is reset to 0 as a specified output value changes, then it is increased in a bell-shaped manner, and after the time of the time constant set in this parameter elapses, the power feedback gain reaches the value set in parameter No. 15208. A bell-shaped filter is set by setting two time constants: One time constant is time constant 1 for the linear portion (parameter No. 29001), and the other is time constant T2 for the rounded portions (parameter No. 29002). If 0 is set in this parameter, the bell-shaped filter is not used.



29002	Time constant 2 (T2) of bell-shaped filter for power feedback gain
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Set the time constant for the rounded portions of the bell-shaped filter.
29003	Peak power at power sensor time constant measurement
[Data type]	Word
[Unit of data]	W
[Valid data range]	0 to 32767
	Set the peak power applied when the time constant of the power sensor is measured.
	Normally, set the rated output of the oscillator.
29004	Beam output time at power sensor time constant measurement
[Data type]	Word
[Unit of data]	msec
[Valid data range]	0 to 32767
	Set the time for which the beam is to be output when the time constant of the power sensor is measured.

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Revision Record

FANUC Series 16i/160i-LB PARAMETER MANUAL (B-63670EN)

02	Jul., 2005	<p>Addition of following items:</p> <ul style="list-style-type: none"> • Parameter related to high-speed machining • Settings related to gap control (clamp function) • Prevention of fall into a hole on gap control axis (Z-axis) • Gap control b, gap control axis high-speed approach, and automatic gap control axis retraction/return functions • Beam output function during approach • Actual output estimation type pulse power feedback <p>Addition of following parameters</p> <p>Correction of errors</p>							
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