4.5.3 Operation Procedure

The host operates and executes registered direct commands by means of the procedure explained below.

(1) Select AUTO mode. (MD1 = 1, MD2 = 0, MD4 = 0 [2.3.4 (1)])
(2) Change the status of automatic operation start signal ST [2.3.10 (1)] from 1 to 0. When the level of the ST signal falls, buffering operation starts. (It is also possible to start operation when the ST signal level rises by parameter setting (bit 7 (STON) of parameter No. 3)).

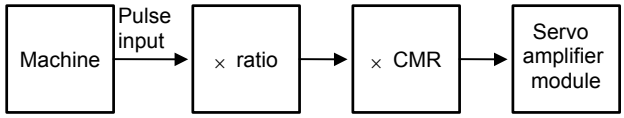
NOTE
1 After the last block has been executed, operation is halted. To perform operation again from the first block, cause a reset to locate the first block, then start operation by using the ST signal. A reset causes the top of the registered blocks to be located.
2 During buffering, switching the ST signal state from 0 to 1 causes a single-block stop. To restart operation, change the ST signal state from 1 to 0.
3 During the execution of buffering operation, switching the INPF signal from "0" to "1" causes a single-block stop, deleting all registered blocks.
4 If, in the halt state, an attempt is made to start operation with the ST signal with the INPF signal changed from "0" to "1", alarm 254 is issued.
5 If, during the execution of a skip command block, the skip signal (HDI) is input, the currently executed block is skipped to proceed to the next block.

5 EXTERNAL PULSE INPUT FUNCTION

5.1 OVERIVIEW

This function enables movement in sync with external pulses generated from the machine.
Input external pulses to connector JA34.

5.2 DETAILED DESCRIPTION



(1) Input external pulses to connector JA34. The A-phase (PA, *PA) and B-phase (PB, *PB) signals are used for an input waveform as well as for a position coder output waveform. The C-phase signal is not required.
(2) The ratio of the amount of travel along an axis to an external pulse can be set with parameters. The ratio is expressed as M/N (where, M = parameter magnification 1 (parameter No. 0062), N = parameter magnification 2 (parameter No. 0063)).
(3) When the A-phase signal is 90° ahead of the B-phase signal, movement is performed in the positive direction.
When the A-phase signal lags 90° behind the B-phase signal, movement is performed in the negative direction.
(4) Parameter setting (bit 6 (EXPLS) of parameter No. 0003) determines whether to enable axis movement by external pulses.
(5) For axis movement by external pulses, interlock and overtravel detection are valid.
(6) The acceleration/deceleration type used for axis movement by external pulses is the same as that for jog feed. (Set bit 1 (JOGE) of parameter No. 0002.)
(7) Select manual handle mode. This mode is selected when signal output is performed from the host to a servo amplifier module (MD1 = 0, MD2 = 0, MD4 = 1 [2.3.4 (1)].
(8) If the feedrate for axis movement by external pulses exceeds the upper limit for a specified feedrate, as set in parameter No. 43, a choice of the following responses can be made by parameter setting (bit 6 (EPEXA) and bit 7 (EPEXB) of parameter No. 0001):
   (a) The feedrate is clamped to the upper limit, and the excess pulses are accumulated.
   If the number of accumulated pulses exceeds 99999999, the excess pulses are discarded.
   (b) The feedrate is clamped to the upper limit, and the excess pulses are discarded.
   (c) Alarm 291 is issued, and movement is decelerated and stopped.

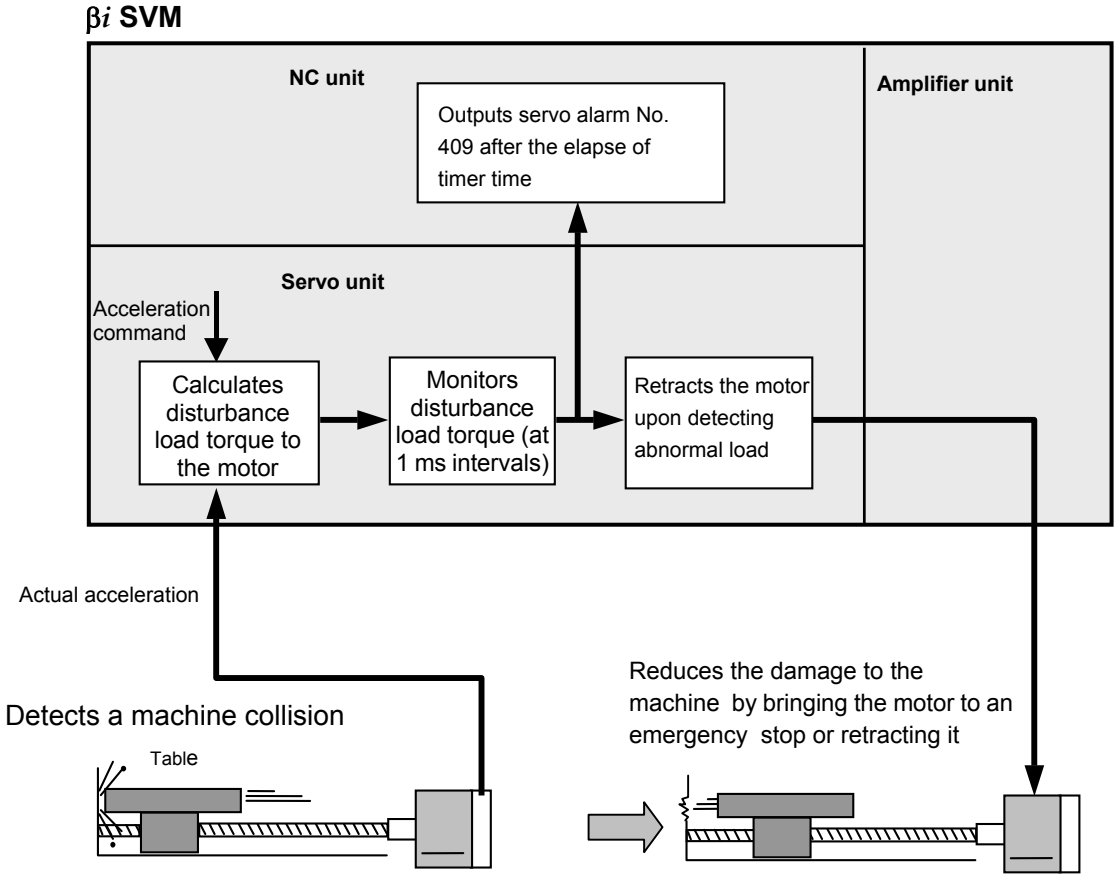
NOTE
This function does not operate unless the motor has been activated. When this function is used, therefore, clamping/unclamping using the unclamp command signal (UCPC2) and the clamp/unclamp state output signal (UCPS2) (when bit 1 (NCLP of parameter No. 003 is "0") cannot be used. Perform clamping/unclamping, using the servo off signal (SVFX).

6 UNEXPECTED DISTURBANCE TORQUE DETECTION FUNCTION

Optional function

6.1 OVERVIEW

In the event of a machine collision, for example, the servo motor receives higher load torque than in normal feed.
This function estimates the load torque to be received by this motor, and upon detecting an abnormal value, brings the servo motor to an emergency stop or retract the motor in the direction opposite to the advance direction, thereby reducing damage to the machine.



6.2 SERIES AND EDITIONS OF APPLICABLE SERVO SOFTWARE

Software programs of the following series and editions are required:

(β*i* SVM control software)

Series 88A6/01(A) and subsequent editions

(Power Mate CNC manager)

Series 8A01/01(A) and subsequent editions

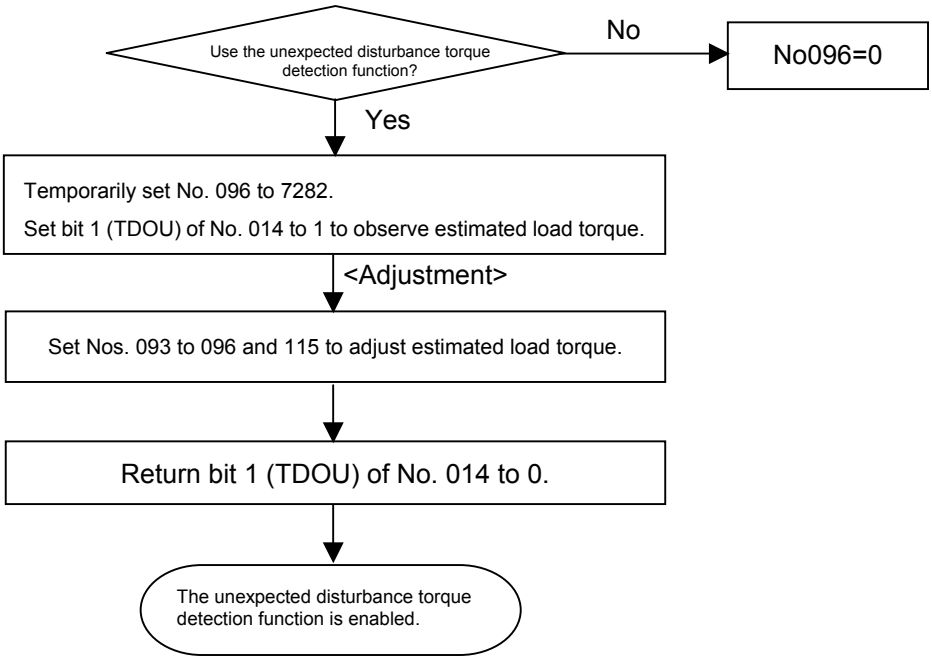
(CNC software)

FS16*i* -MA	Series B0F4/03 and subsequent editions
FS16*i* -TA	Series B1F4/02 and subsequent editions
FS18*i* -MA	Series BDF4/03 and subsequent editions
FS18*i* -TA	Series BEF4/02 and subsequent editions
FS21*i* -MA	Series DDF4/03 and subsequent editions
FS21*i* -TA	Series DEF4/02 and subsequent editions
FS16*i*-MB	Series B0H1/08 and subsequent editions
FS16*i* -TB	Series B1H1/09 and subsequent editions
FS18*i* -MB	Series BDH1/08 and subsequent editions
FS18*i* -MB5	Series BDH5/01 and subsequent editions
FS18*i* -TB	Series BEH1/09 and subsequent editions
FS21*i* -MB	Series DDH1/08 and subsequent editions
FS21*i* -TB	Series DEH1/09 and subsequent editions
Power Mate *i* -D	Series 88E0/15 and subsequent editions
Power Mate *i* -H	Series 88F1/09 and subsequent editions
Power Mate *i* -H	Series 88F2/01 and subsequent editions
FS30*i* -A	Series G001/22 and subsequent editions
	Series G011/22 and subsequent editions
	Series G021/22 and subsequent editions
	Series G002/01 and subsequent editions
	Series G012/01 and subsequent editions
	Series G032/01 and subsequent editions
FS31*i* -A	Series G101/01 and subsequent editions
	Series G121/01 and subsequent editions
FS31*i* –A5	Series G111/01 and subsequent editions
	Series G131/01 and subsequent editions
FS32*i* –A	Series G201/01 and subsequent editions

6.3 SETUP METHOD

6.3.1 Overview

To use the unexpected disturbance torque detection function, set appropriate parameters beforehand, using the procedure below.



6.3.2 Details of the Setup Method

<1> Confirm that the unexpected disturbance torque detection function is usable.
Confirm that the unexpected disturbance torque detection function is usable, using diagnosis (DGN) No. 034#1 (ABTDTC) and the signal Xx+1#3 (OPTENB).

<2> Temporarily set an alarm threshold
For adjustment, set parameter No. 096 to 7282 because no alarms will be detected and no estimated load torque will be calculated if the alarm threshold of abnormal load detection is 0.

<3> Observe the estimated load torque.
Set bit 1 (TDOU) of parameter No. 014 to 1 to output the estimated load torque to DATA1 on the check board and the acceleration command to DATA0.

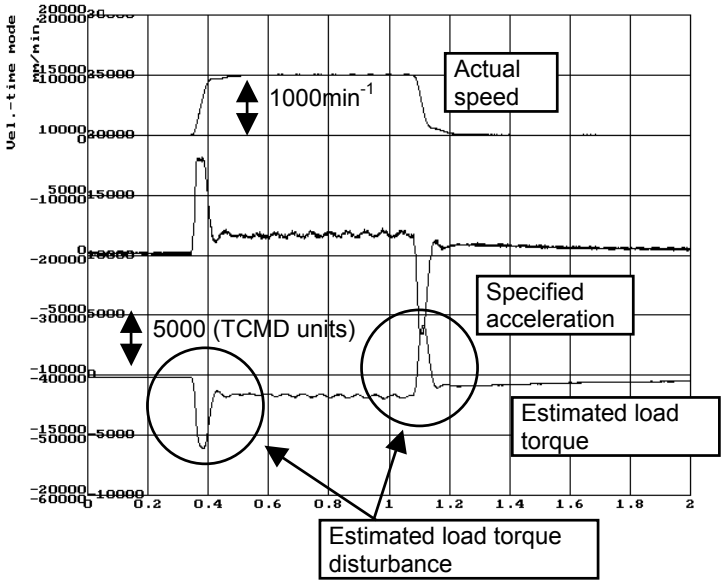


Fig. 6.3.2 (a) Before Adjustment

Fig. 6.3.2 (a) shows the actual speed, specified acceleration, and estimated load torque at a rapid traverse rate of 1000min^{-1}. Because the estimated load torque has not been adjusted, the estimated load torque is disturbed during acceleration and during a constant speed. The estimated load torque disturbance is corrected by adjusting the model constant and setting dynamic friction compensation, to be described later.

<4> Adjust the model constant (parameter No. 115)
Parameter No. 115, model constant, represents the "torque constant/inertia". To perform estimation correctly, this parameter must be adjusted properly. Fig. 6.3.2 (b) shows results obtained after parameter No. 115 is set to a proper value in accordance with the machine inertia.

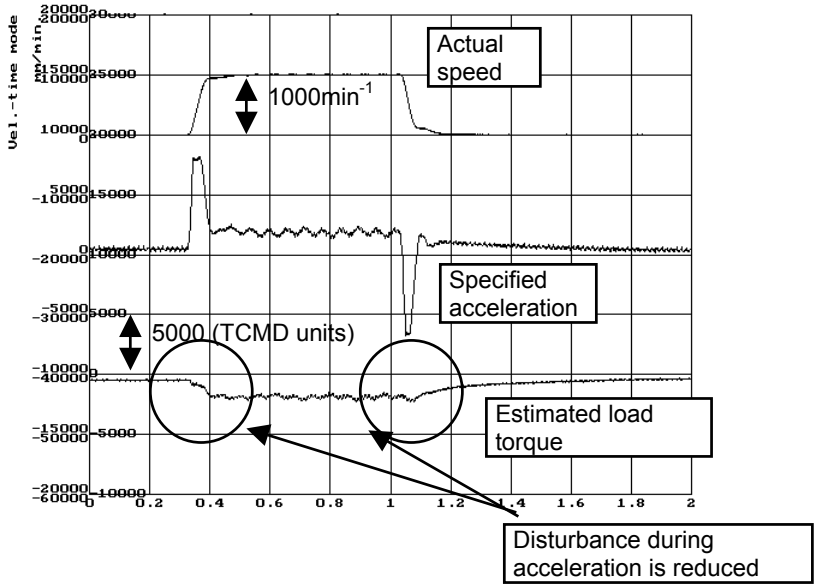


Fig. 6.3.2 (b) After Adjusting the Model Constant

<5> Adjust dynamic friction compensation (parameter No. 94)
Parameter No. 094, dynamic friction compensation, removes the effect of dynamic friction. Measure the estimated load torque at 1000 min^{-1} and set the measurement in parameter No. 094 in torque command units (with the maximum current value of the amplifier being assumed 7282).
Because in Fig. 6.3.2 (b), the estimated load torque at 1000min^{-1} is about 1800 during a constant speed, set parameter No. 094 to 1800.
The results obtained after this parameter is applied are shown in Fig. 6.3.2 (c); the estimated load torque at 1000min^{-1} is 0.

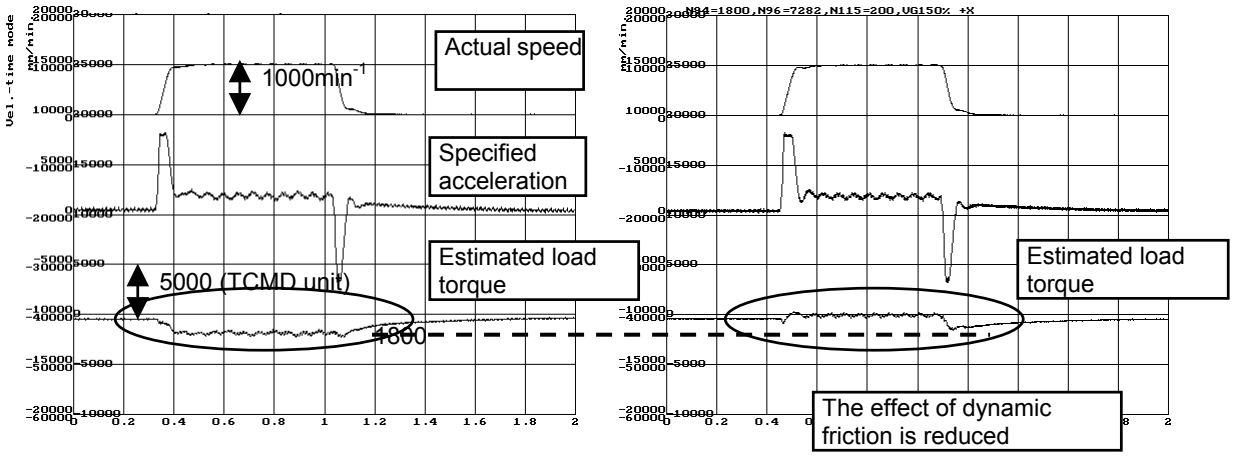


Fig. 6.3.2 (c) Adjustment of Dynamic Friction Compensation

<6> Adjust the torque offset (parameter No. 93)
For axes to which a constant force is applied constantly, such as the vertical axis, set parameter No. 093, torque offset, to remove the effect. In the case of Fig. 6.3.2 (d), it is seen that the offset of the estimated load torque is -3000; set 3000, with the opposite sign, in parameter No. 093. As a result, waveform similar to that in Fig. 6.3.2 (c) is obtained.

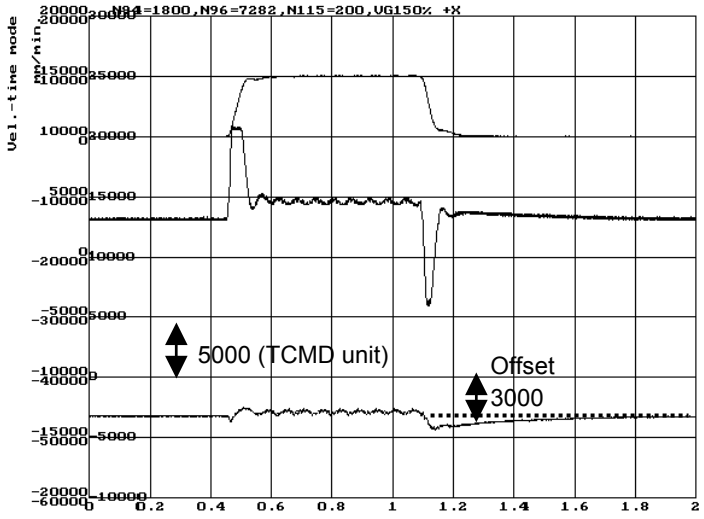


Fig. 6.3.2 (d) Torque Offset

<7> Adjust the retraction amount (parameter No. 95)
Set the retraction amount to be assumed if an abnormal load is detected. The tool moves in the direction opposite to the advance direction by the specified distance from the position at which the alarm is detected. If the setting of parameter No. 095, retraction amount, is 0, the tool stops at the position at which the alarm is detected.

<8> Adjust the alarm threshold (parameter No. 96)
Finally, set parameter No. 096, alarm threshold. As the threshold, set a value about 120 to 150% larger than that at which the estimated load torque is maximized.
In the example in Fig. 6.3.2 (e), a value of about 2000 is shown during rapid acceleration/deceleration and, therefore, set a value of about 2400 to 3000 in parameter No. 096. Fig. 6.3.2 (f) shows a collision example (when the unexpected disturbance torque detection function is disabled). Because the estimated load torque is 5000 at the collision, the unexpected disturbance torque detection function operates.

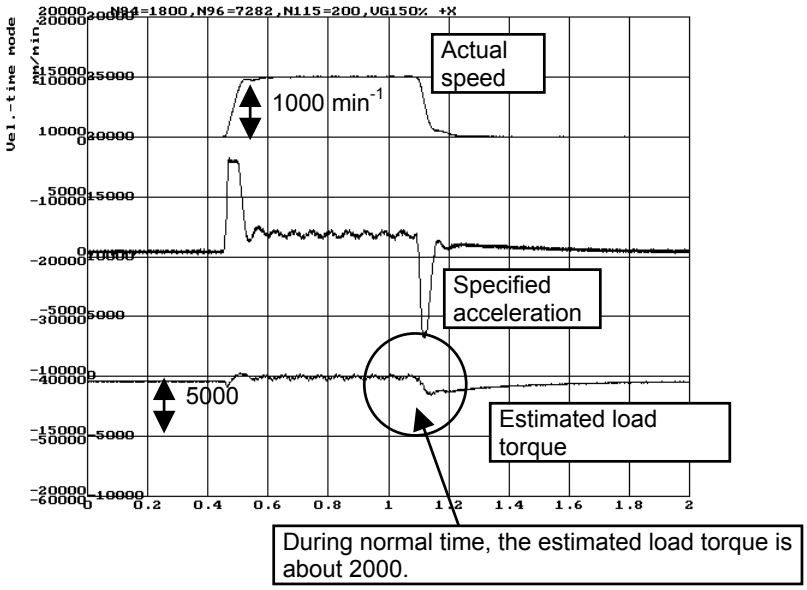


Fig 6.3.2 (e) Normal Time

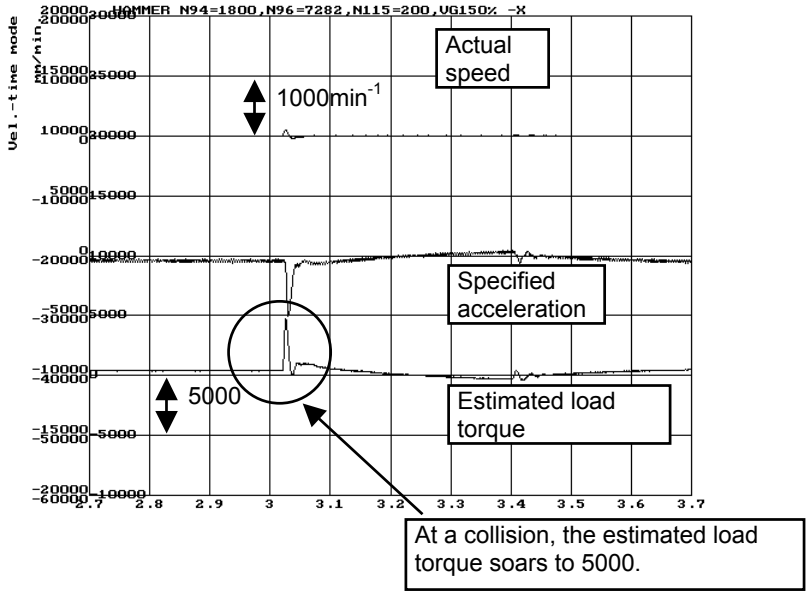


Fig. 6.3.2 (f) At a Collision

6.4 Signal

	7	6	5	4	3	2	1	0	BIT
Xx+1					OPTENB				

Function enable signal OPTENB

[Classification] Input signal <Xx+1#3> (common to both the peripheral equipment control and direct command interfaces)

[Function] The servo amplifier module notifies that the function is enabled (usable).

The function is as follows:

- Unexpected disturbance torque detection function (software option function)

[Input condition] The signal becomes 1 when:

1. The function is usable.

The signal becomes 0 when:

1. The function is under preparation, immediately after the power is turned on.
2. The function is not ordered.

> ⚠ **CAUTION**
> The unexpected disturbance torque detection function is disabled until this signal becomes "1". Be sure to start axis movement after confirming hat this signal has become "1".

6.5 Parameter

No	
130	Unexpected disturbance torque detection alarm timer

[Size] 2-byte
[Unit of data] msec
[Valid data range] 0 to 32767 (200 msec if 0 is set)
Set the time from when an unexpected disturbance torque is detected to when a servo alarm is issued. A fraction smaller than 8 msec is rounded up.
Example) Setting of 30: assumed to be 32 msec

No	#7	#6	#5	#4	#3	#2	#1	#0
014							TDOU	

[Size] 1 byte/bit type
TDOU Output to the check board
0 : The torque command is output to the check board.
1 : The estimated load torque is output to the check board.
The estimated load torque is output to DATA1, and the specified acceleration to DATA0. For both, the value weight is in TCMD unit (maximum current value being 4.4 V).

NOTE
To output the estimated load torque to the check board, set bit 0 of parameter No. 014 to 0.

No	
115	Model constant

[Size] 2-byte
[Valid data range] 0 to 32767
The model constant is a motor-specific value. Usually, it is fixed as a standard parameter. However, it should be tuned so as to obtain the estimated load torque correctly.

NOTE
Load torque estimation takes the load inertia ratio into consideration. Changing the load inertia ratio causes the optimum value for the model constant to change. Determine the load inertia ratio, as the first step of the servo adjustment procedure.
If changing the setting of the load inertia ratio after determining the model constant, set a new model constant, using the following formula:

$$\text{(New model constant)} = \text{Parameter No. 115} \times \frac{\text{Load inertia ratio after adjustment}+256}{\text{Load inertia ratio before adjustment}+256}$$

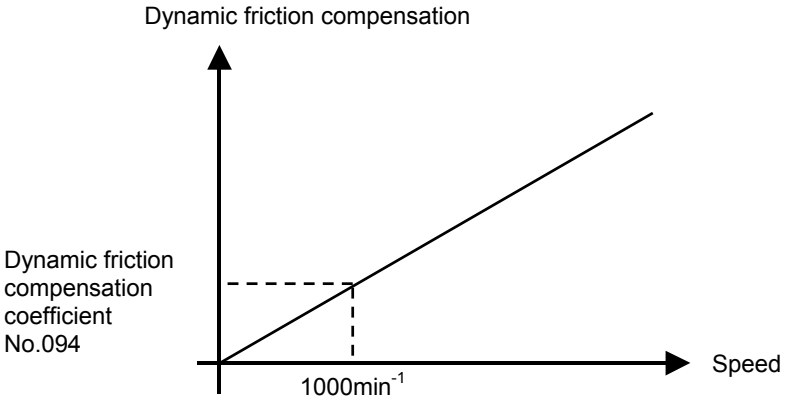
Load inertia ratio: Parameter No. 100

No	
093	Estimated load torque: torque offset compensation

[Size] 2-byte
[Unit of data] Torque command unit
[Valid data range] -7282 to 7282 (7282 is the maximum current value of the amplifier)
The setting is added to an estimated load torque, thereby eliminating an effect of stationary torque including gravity.

No	
094	Estimated load torque: dynamic friction compensation coefficient

[Size] 2-byte
[Unit of data] Torque command unit
[Valid data range] 0 to 7282 (7282 is the maximum current value of the amplifier)
[Setting value] An estimated load torque at 1000 min^{-1} is measured and set.
The compensation proportional to the speed is added to the estimated load torque, thereby eliminating an effect of dynamic friction.



Set the compensation at 1000min^{-1} in torque command units to compensate the value proportionate to the speed as dynamic friction.

No	
095	Unexpected disturbance torque detection: retract distance

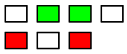
[Size] 2-byte
[Unit of data] Detection unit
[Valid data range] 0 to 65535
[Setting value] Set approximately 3 mm.

NOTE
Even if this parameter is set, if the movement is at a speed lower than the that described below, retraction is not performed but the tool stops at the position at which an abnormal load is detected.
Let the value of the retraction parameter to be A,
If the speed is equal to or less than A/8 x detection unit x 1000 [mm/min]: Stop at the detection point
If the speed is equal to or greater than A/8 x detection unit x 1000 [mm/min]: Stop after retraction

No	
096	Unexpected disturbance torque detection: alarm threshold value

[Size] 2-byte
[Unit of data] Torque command unit
[Valid data range] 0 to 7282 (7282 is the maximum current value of the amplifier)
Set a limit (threshold) value at which an unexpected disturbance torque detection alarm is issued. If the setting is 0, processing for unexpected disturbance torque detection is disabled, and alarm detection and calculation of an estimated load torque are not performed.
First set bit 1 (TDOU) of parameter No. 014 to 1 (bit 0 of parameter No.014 must be 0), and observe load torque. Then, set parameter No. 096 to a value greater than the maximum torque value.

6.6 ALARM

Number	LED indication	Description	Action
409		An abnormal load is detected.	Look for the mechanical cause of the abnormal load. If there is no mechanical cause, increase the check amount of the parameter (No. 096).

6.7 DIAGNOSIS

(DGN number)	7	6	5	4	3	2	1	0
034							ABTDTC	

ABTDTC Unexpected disturbance torque detection function is:
0 : Disabled.
1 : Enabled.

7 QUICK STOP FUNCTION

7.1 OVERVIEW

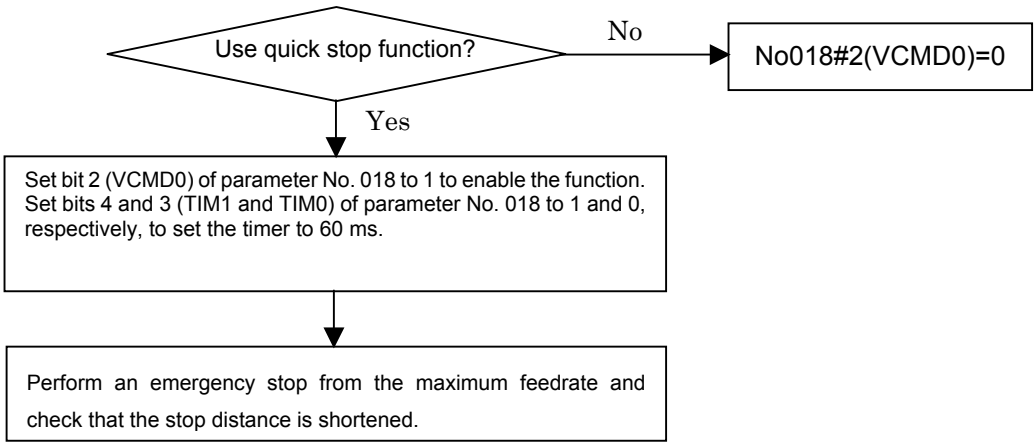
This function enables the motor to stop with a shorter distance than with a normal DB stop, by performing a stop operation in a controlled manner when a directly input emergency stop signal is input. To perform a stop operation in a controlled manner, it is necessary to set the delay time from the time the pressing of the emergency stop switch is recognized until the magnetic contactor of the amplifier is actually shut down. The βi SVM allows setting of 60 and 100 ms through appropriate parameter setting.

7.2 SERIES AND EDITIONS OF APPLICABLE SERVO SOFTWARE

Software of the following series and edition is necessary:
(control software)
Series 88A6 /01(A) and subsequent editions

7.3 SETTING METHOD

To use the quick stop function, set appropriate parameters with the procedure given below.



7.4 PARAMETER

No	#7	#6	#5	#4	#3	#2	#1	#0
018				TIM1	TIM0	VCMD0		

[Size] 1 byte/bit type

VCMD0(#2) Quick stop function is:
0 : Disabled.
1 : Enabled.

TIM1,0(#4,#3) Setting of the MCC off timer
The delay time from the time an emergency stop signal is input until MCC is turned off can be selected with a combination of TIM1 and TIM0. If VCMD0 is 0, the setting is invalid.
Usually set it to 60 ms. If a sufficult effect cannot be obtained, set it to 100 ms.

Delay time	TIM1	TIM0
0ms	0	0
60ms	1	0
100ms	1	1

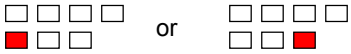
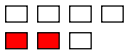
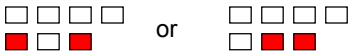
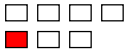
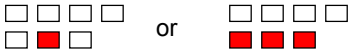
NOTE
1 It is not possible to set a delay time of 100 ms or greater by mounting an additional external timer.
2 Do not turn an emergency stop OFF/ON instantaneously.
3 The timer on the amplifier operates in conjunction with connector CX30 or with *ESP on CXA19B. It does not operate only with an emergency stop signal on the FANUC I/O Link between the host and a servo amplifier module.

III. TROUBLESHOOTING

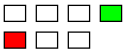
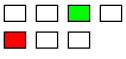
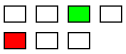
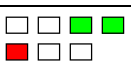
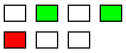
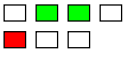
1 OVERVIEW

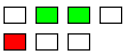
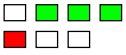
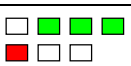
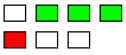
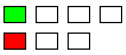
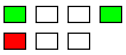
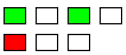
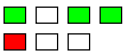
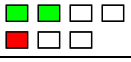
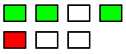
This part describes the troubleshooting procedure. Read the section related to your current trouble to locate it and take an appropriate action.
First, check the LEDs on the servo amplifier modules or the alarm number (displayed on the host controller), examine the cause, and take an appropriate action.

2 ALARM NUMBERS AND BRIEF DESCRIPTIONS

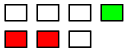
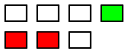
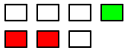
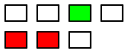
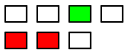
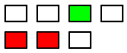
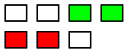
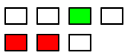
Number	Alarm type	LED type (Classification by Red LED)
000 to 299	Program or setting alarm	
300 to 399	Pulse coder alarm	
400 to 499	Servo alarm	
500 to 599	Overtravel alarm	 Same as PS alarm
-	System alarm or I/O Link alarm	

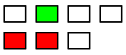
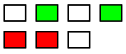
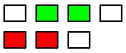
Program or setting alarms (PS alarms)

No.	LED display	Description	Countermeasure
000		A parameter that requires power-down has been specified.	Turn the power off, then back on.
011		The specified feedrate is zero.	Check the feedrate parameter specified with a function code.
013		The specified feedrate (maximum feedrate) is zero.	Check the value of parameter No.043, which indicates the maximum feedrate that can be specified.
070		More than 32 blocks have been registered for a buffering operation.	Reduce the number of registered blocks to 32.
090		Reference position setting cannot be executed normally.	Move the tool in the direction of reference position return in jog mode at a speed that causes the servo position error to exceed 128. Then, specify another reference position setting.
093		(1) A first to third reference position return cannot be executed because the reference position has not yet been established. (2) The reference position external setting was executed without Absolute pulse coder.	(1) Set the reference position. (2) Absolute pulse coder must be used.

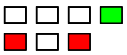
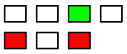
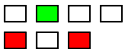
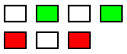
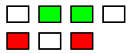
No.	LED display	Description	Countermeasure
224		The reference position has not yet been established. This occurs only when the ZRTN bit of parameter No.001 is set to 0.	Set the reference position.
250		Input data 1 or command is invalid.	Check input data 1, specified with a function code.
251		Input data 2 is invalid.	Check input data 2, specified with a function code.
254		A function code or mode is invalid.	Check the command code, specified with a function code. Check the mode.
255		Operation cannot be activated because an invalid mode is specified or because block execution is in progress.	Check the mode. Check whether a block is being executed.
290		The interface switch signal (DRC) was switched during block execution.	Switch the signal after block execution stops.
291		The speed of an axial movement specified by an external pulse has exceeded the upper limit. This occurs only when the EPEXA bit of parameter No.001 is set to 1.	Check the speed specified by the external pulse. Check the magnification of the external pulse (parameters No.062 and 063).
292		A checksum error for the nonvolatile memory was detected.	Parameters are cleared. Set the parameters again. If this alarm subsequently recurs, replace the unit.
293		Software version between FROM on CPU and EPROM is same.	Remove the EPROM.
294		CRC check alarm of EPROM was detected.	Remove the EPROM.

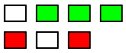
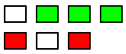
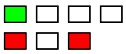
Pulse coder alarms

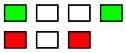
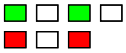
No.	LED display	Description	Countermeasure
300		A communication error (DTER) for the serial pulse coder was detected.	Check the continuity of the signal cable. If the cable is normal, the pulse coder or servo amplifier module may be defective. This error can also be caused by external noise. See the chapter on noise reduction in "Descriptions."
301		A communication error (CRCER) for the serial pulse coder was detected.	Check the continuity of the signal cable. If the cable is normal, the pulse coder or servo amplifier module may be defective. This error can also be caused by external noise. See the chapter on noise reduction in "Descriptions."
302		A communication error (STBER) for the serial pulse coder was detected.	Check the continuity of the signal cable. If the cable is normal, the pulse coder or servo amplifier module may be defective. This error can also be caused by external noise. See the chapter on noise reduction in "Descriptions."
303		An LED disconnection (LDAL) was detected in the serial pulse coder.	Turn the power off. If this alarm recurs when the power is reapplied, replace the motor.
304		A mispulse alarm (PMAL) for the serial pulse coder was detected.	Turn the power off. If this alarm recurs when the power is reapplied, replace the motor.
305		A miscount alarm (CMAL) for the serial pulse coder was detected.	Turn the power off. If the alarm recurs when the power is re-applied, replace the motor. Even if the alarm does not recur, restart the operation from reference position return.
306		The motor has overheated (OHAL).	This alarm is issued when the motor has overheated, causing the thermostat to trip. Possible causes include an excessively high ambient temperature and excessively strict operating conditions. Check the actual cause. If it occurs again when the motor is cooled, the motor or servo amplifier may have failed. Replace the faulty motor or servo amplifier.
308		A soft phase alarm (SPHAL) was detected.	Turn the power off. This alarm may be caused by noise.

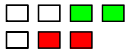
No.	LED display	Description	Countermeasure
319		When the absolute pulse coder is used, the motor has not yet rotated through more than one turn after the first power-up.	Cause the motor to rotate through more than one turn in jog feed mode, then turn the power off then back on.
350		The battery voltage of the absolute pulse coder is low.	Replace the battery. Restart the operation from reference position return.
351		The battery voltage of the absolute pulse coder is low. (warning)	Replace the battery.

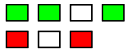
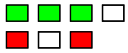
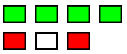
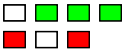
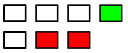
Servo alarms

No.	LED display	Description	Countermeasure
400		The servo motor has overheated. (estimated value)	The motor operation condition may be too severe. Check the operation condition.
401		DRDY(Drive Ready signal) becomes 0. The servo amplifier is not ready.	
404		The regenerative discharge unit has overheated.	This alarm is issued when the average regenerative discharge energy is too high (when the acceleration/deceleration frequency is too high, for example).
		(1) When the separate regenerative discharge resistor is not used. For the SVM1-4*i* and SVM1-20*i*, check whether the CXA20 connector is short-circuited by using a dummy connector. For the SVM1-40*i* and SVM1-80*i*, check whether the CXA20 and CZ6 connectors are short-circuited by using dummy connectors. (2) The average regenerative discharge energy may be too high. Decrease the acceleration/deceleration frequency. (3) The separate regenerative discharge unit may not be connected properly. Check the connection. (4) The thermostat of the separate regenerative discharge unit may be defective. Disconnect the separate regenerative discharge unit, then check the thermostat. If the thermostat is open even through the separate regenerative discharge unit is cool, replace the separate regenerative discharge unit. (5) The resistor of the separate regenerative discharge unit may be defective. Disconnect the separate regenerative discharge unit, then check the resistance. If it does not fall in the range of the predetermined resistance "20%, replace the separate regenerative discharge unit. (6) If from (1) to (5) are not the cause of the alarm, replace the servo amplifier module.	
405		Reference position return could not be executed correctly.	Re-execute reference position return.
		If a value in the range of 4 to 96 is set for parameter No. 032 (CMR), an alarm may be issued. In this case, prevent an alarm from being issued by setting N405(bit4 of parameter No. 001) to "1".	
409		Unexpected disturbance torque has been detected.	Look for the mechanical cause of the abnormal load. If no mechanical cause is found, specify a larger value for the parameter.

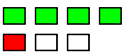
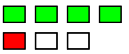
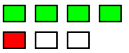
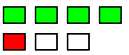
No.	LED display	Description	Countermeasure
410		The servo position error in the stop state is larger than the value specified in parameter No.110.	Determine the mechanical cause of the large position error. If no mechanical cause is found, specify a larger value for the parameter.
411		The servo position error during movement is larger than the value specified in parameter No.182.	Determine the mechanical cause of the large position error. If no mechanical cause is found, apply any of the following countermeasures: • Specify a larger value for the parameter. • Specify a lower feed rate. • Increase the time constants.
412		Over Current Alarm has been issued.	This alarm is issued when an excessively large current flows in the main circuit.
		(1) Check whether the motor ID number is correctly set in parameter No.125. (2) Check whether the standard values (see Appendix B) are specified in the current control parameters for servo control. Correct current control is possible only when the standard values are specified for the following parameters: No.70, 71, 72, 78, 79, 84, 85, 86, 87, 88, 89, 90, 99, 118, 119 (3) Disconnect the power line from the servo amplifier module connector. - Then, release the emergency stop state. If the over-current alarm continues to be issued, replace the servo amplifier module. - If no over-current alarm is issued, go to (4). (4) Check the insulation between the ground and each of U, V, and W. - If the insulation is satisfactory, go to (5). If a short-circuit is detected, disconnect the power line from the motor connector. Then, check the insulation between the ground and each of U, V, and W of the motor. - If a short-circuit is found between the ground and U, V, or W of the motor, replace the motor. - If the insulation is satisfactory, replace the power line. (5) Connect the power line. Observe the waveform of the motor current (IR, IS) while the motor is accelerating or decelerating. See the description of the checking of the motor current in Appendix E, "Servo Check Board". - If the motor current (IR, IS) does not exhibit a normal sine wave, replace the servo amplifier module. (6) Check if the motor current (IR, IS) waveforms include noise. - When noise is included, take an action such as making a connection to shield ground. - When noise is not included, replace the servo amplifier module. If (1) to (6) above are not the cause of the alarm, the pulse coder, command cable or internal hardware of the CNC may be defective.	

No.	LED display	Description	Countermeasure
413		DC Link Over Voltage Alarm has been issued.	This alarm is issued when the DC voltage of the main circuit power is too high.
		(1) When SVM1-4*i* or SVM1-20*i* is used, and a separate regenerative discharge unit is not used, check the specification to see if regenerative energy per one time does not exceed the allowable regenerative energy of the servo amplifier module. (2) For the SVM1-40*i* and the SVM1-80*i*, when the separate regenerative discharge resistor is not used, check whether the CZ6 connector is short-circuited with a dummy connector. (3) The supply voltage for dynamic power may exceed the rated value. Check the voltage. If the voltage is too high, reduce the voltage to an appropriate level. (4) The regenerative discharge unit may not be properly connected. Check the connection. (5) The resistance of the separate regenerative discharge unit may be abnormal. Disconnect the separate regenerative discharge unit, then check the resistance. If the resistance is not within ±20% of the predetermined resistance, replace the separate regenerative discharge unit. If from (1) to (5) are not the cause of the alarm, replace the servo amplifier unit.	
414		DC Link Low Voltage Alarm has been issued.	This alarm is issued when the DC voltage of the main circuit power is too low.
		(1) 190 ms or longer may pass from the time when both the *ESP of the built-in DI and the *ESP of the I/O link interface signal are canceled until the external magnetic contactor inserted into the input for motive power turns on(including the operating time of the magnetic contactor). The magnetic contactor must turn on within 100 ms. (2) The external circuit breaker may be turned off. Check the circuit breaker. (3) The supply voltage for dynamic power is lower than the rated value. Check the voltage. If the voltage is too low, increase it to an appropriate level. (4) The external magnetic contactor may not be connected properly. Check the connection. If from (1) to (4) are not the cause of the alarm, replace the servo amplifier unit.	

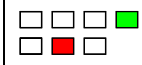
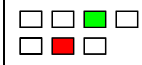
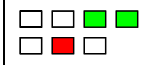
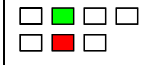
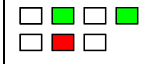
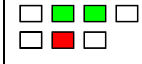
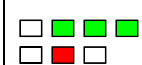
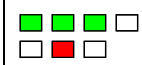
No.	LED display	Description	Countermeasure
416		Inverter IPM Alarm has been issued.	(1) Check whether the cooling fan is not stopped. (2) Check whether the motor is used within related current. (3) Check whether the temperature in locker is higher. Check the fin or filter in locker. (4) Check whether the temperature is higher around the servo amplifier module. (5) Disconnect the power line from the servo amplifier module connector. Then, release the emergency stop state. - If the IPM alarm continues to be issued, replace the servo amplifier module. - If no IPM alarm is issued, go to (6). (6) Disconnect the power line from the servo amplifier module connector. Then, check the insulation between the ground and each of U, V, and W. - If the insulation is satisfactory replace the servo amplifier module. - If the insulation is not satisfactory, go to (7). (7) Disconnect the power line from the servo motor. Then check the insulation. - If the insulation of servo motor is not satisfactory, replace the servo motor - If the insulation of power line is not satisfactory, replace the servo amplifier module.
417		A parameter has been specified incorrectly.	Check the following parameters: - When the both No.030 and No.125 are set for motor ID number, this alarm is issued.it is necessary to set motor ID number on No.125 and to set 0 on No.030. - No.031: the parameter for direction of rotate is not selected in “111” or “–111”. - No.106: Is the denominator of the number of pulses per single revolution of the motor 0? - No.107: Is this parameter too large? - No.179: Is this parameter out of range (8388607 lower or equal)? - Is No.107 (position gain)/No.105 or No.179 (number of pulses per single revolution of the motor) less than 0.488? - No.180: Is the specified reference counter capacity 0 or a negative value?

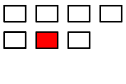
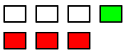
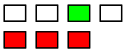
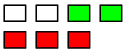
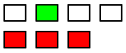
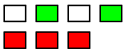
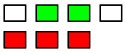
No.	LED display	Description	Countermeasure
423		The specified speed exceeds 32767000 detection units per second.	Re-examine the CMR and speed settings.
425		The fan for internal agitation has stopped. This alarm is issued when the fan motor built into the servo amplifier module has failed. The fan motor is consumable. For the explanation about its replacement procedure, see Part IV "Maintenance of Servo Amplifier Unit." (1) Check that the fan is not clogged with foreign matter. (2) Check that the power connector of the fan is connected properly. (3) Replace the fan or servo amplifier module.	
446		The external pulse input line is disconnected.	Connect the external pulse input signal correctly.
447		The velocity deviation is too high (velocity control)	Check the actual velocity. See the settings of parameter No.136.
449		No.080 is not corrected. (This parameter is out of range from 0 to 8010)	Set No.080 correctly (from 0 to 8010).
601		The fan for cooling the external radiator fin has stopped. This alarm is issued when the fan motor for inverter radiator has failed. The fan motor is consumable. For an explanation of the replacement procedure, see Part IV, "Maintenance of Servo Amplifier Unit." (1) Check that the fan is not clogged with foreign matter. (2) Check that the power connector of the fan is connected properly. (3) Replace the fan or servo amplifier module.	

Overtravel alarms

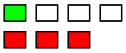
No.	LED display	Description	Countermeasure
500		The positive stroke limit has been exceeded.	Check whether *+OT and *-OT are connected correctly. Check whether a correct move command is specified. Move the tool in the opposite direction in jog mode, then perform a reset.
501		The negative stroke limit has been exceeded.	
510		The positive soft stroke limit has been exceeded.	Check whether appropriate values have been specified for parameters No.142 and 143. Check whether a valid move command is specified. Move the tool in the opposite direction in jog mode, then perform a reset.
511		The negative soft stroke limit has been exceeded.	

System alarms

No.	LED display	Description	Countermeasure
–		An error was detected in the RAM write/read test at power-up. (External SRAM)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A watchdog alarm 1 was issued.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A watchdog alarm 2 was issued.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A watchdog alarm 3 was issued.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		The logic supply was less than 5V.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		The low voltage of the 24-VDC control supply was detected.	Check the 24-VDC control supply voltage. If the voltage is low, increase the voltage to an appropriate level.
–		An error was detected in the data collation check for the nonvolatile memory.	Turn the power off then back on. Then, re-enter the parameters. If this alarm recurs, replace the servo amplifier module.
–		A data transfer alarm for the nonvolatile memory has been issued.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A CRC check alarm for the FROM that is built into the CPU is issued.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (Synchronous deviation alarm)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (Dead-band 0 alarm)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (Timer for skip position measurement)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		Loading of a software on the FROM that is built into the CPU is incomplete. An error was detected in the RAM write/read test at power-up. (Internal RAM) An error was detected in the control circuit.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.

No.	LED display	Description	Countermeasure
–		An error was detected in the control circuit.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (General illegal instruction)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (Slot illegal instruction)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (CPU address error)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		A alarm for the servo amplifier module is issued. (DTC address error)	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		Stuck overflow occurred.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.
–		Stuck underflow occurred.	Turn the power off then back on. If this alarm recurs, replace the servo amplifier module.

I/O link alarm

No.	LED display	Description	Countermeasure
–		A FANUC I/O Link error occurred. Some unit connected to the line was turned off.	Turn off the power to all units connected to the line. Then, turn on the slave devices, followed by the master device.

No LED display

No.	LED display	Description	Countermeasure
–	No indicators lit	The control circuit is not operating normally.	(1) Check the 24-VDC control supply voltage. If the voltage is low, increase the voltage to an appropriate level. (2) Check whether a fuse in the servo amplifier module has blown. If a blown fuse is found, replace it, following the procedure described in Part IV "Maintenance of Servo Amplifier Unit." If (1) and (2) are not the cause, replace the servo amplifier.

3 ACTION AGAINST NOISE

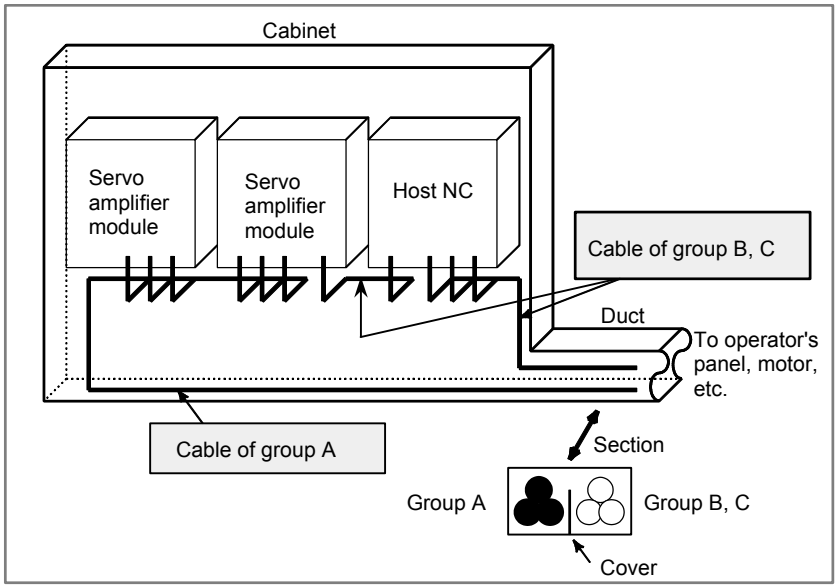
The servo amplifier module has been steadily reduced in size using surface-mount and custom LSI technologies for electronic components. The servo amplifier module also is designed to be protected from external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and noise has many uncertain factors. It is important to prevent both noise from being generated and generated noise from being introduced into the servo amplifier module. This precaution improves the stability of the servo amplifier module machine tool system.
The servo amplifier module component units are often installed close to the parts generating noise in the power magnetics cabinet. Possible noise sources into the servo amplifier module are capacitive coupling, electromagnetic induction, and ground loops.
When designing the power magnetics cabinet, guard against noise in the machine as described in the following section.

- Separating signal lines

The cables used for the machine are classified as listed in the following table:
Process the cables in each group as described in the action column.

Group	Signal line	Action
A	Primary AC power line	Bind the cables in group A separately (Note 1) from groups B and C, or cover group A with an electromagnetic shield (Note 2). Connect spark killers or diodes with the solenoid and relay.
	Secondary AC power line	
	AC/DC power lines (containing the power lines for the servo motors)	
	AC/DC solenoid	
	AC/DC relay	
B	DC solenoid (24VDC)	Connect diodes with DC solenoid and relay. Bind the cables in group B separately from group A, or cover group B with an electromagnetic shield. Separate group B as far from Group C as possible. It is more desirable to cover group B with the shield.
	DC relay (24VDC)	
	DC power line	
C	Cable between the host and servo amplifier module	Bind the cables in group C separately from group A, or cover group C with an electromagnetic shield. Separate group C as far from Group B as possible. Be sure to perform shield processing.
	Cable for position and velocity feedback	
	External pulse input	
	Other cables to be covered with the shield	

NOTE
1 The groups must be 100mm or more apart from one another when binding the cables in each group.
2 The electromagnetic shield refers to shielding between groups with grounded steel plates.



- Ground

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

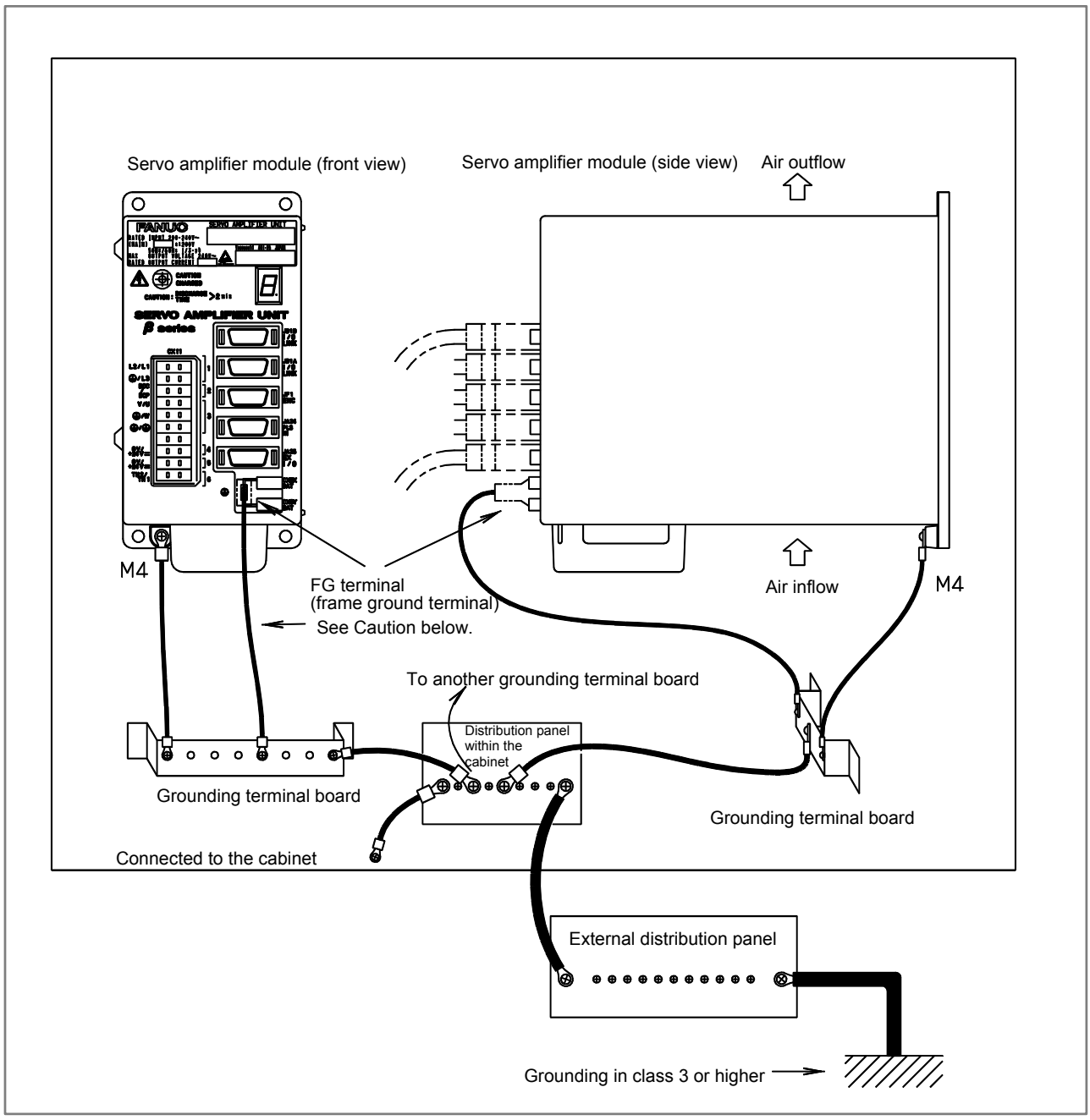
- The signal ground supplies the reference voltage (0V) of the electrical signal system.
- The frame ground system is used for safety, and suppressing external and internal noises. In the frame ground system, the frames, cases of the units, panels, and shields for the interface cables between the units are connected.
- The protective earth (PE) is designed so that the protective grounds provided between the units are connected to ground at one point from a system point of view.

3.1 NOTES ON CONNECTING THE GROUND SYSTEMS

- The grounding resistance of the protective earth shall be 100 ohms or less (class D grounding).
- The protective earth (PE) cable must have enough cross-sectional area to safety carry the accidental current flow into the protective earth (PE) when an accident such as a short circuit occurs. (Generally, it must have the cross-sectional area of the AC power cable or more.)
- Use the cable containing the AC power wire and the protective earth (PE) wire so that power is supplied with the ground wire connected.

- Connecting the frame ground of the servo amplifier module

Connect the 0 V line of the electronic circuit in the servo amplifier module with the ground plate of the cabinet via the frame ground (FG) terminal.
The SG terminal is located on the printed circuit board at the rear of the control unit.



⚠ CAUTION

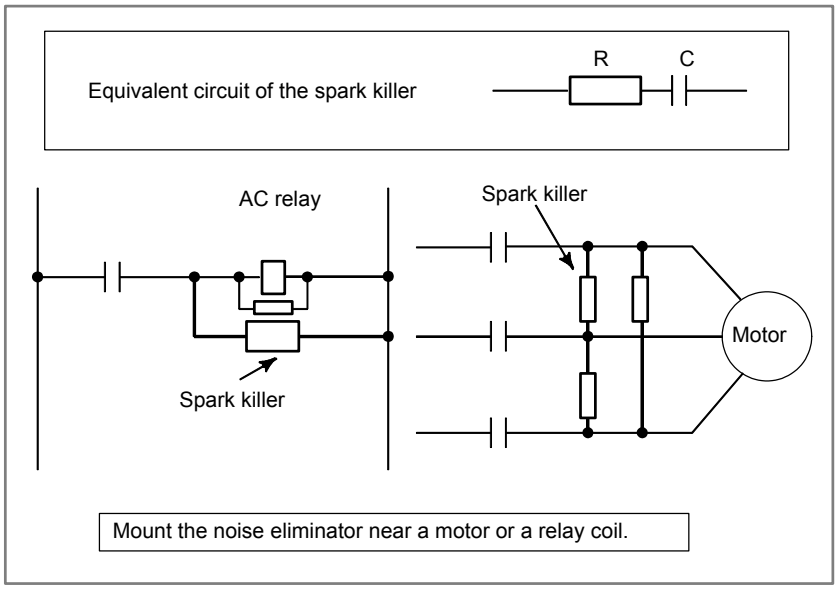
Use the Faston terminals (A02B-0166-K330) for connection using the frame ground. Also connect to the grounding terminal board using 100 to 300 mm stranded wire with a cross-section of 2 mm^2 or more. Otherwise, the servo amplifier unit will be susceptible to noise.

- Noise suppressor

The AC/DC solenoid and relay are used in the power magnetics cabinet. A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage induced through the cable causes the electronic circuits to be disturbed.

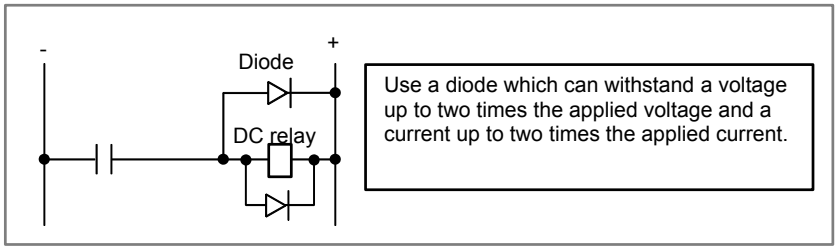
3.2 NOTES ON SELECTING THE SPARK KILLER

- Use a spark killer consisting of a resistor and capacitor in series. This type of spark killer is called a CR spark killer.(Use it under AC)
  (A varistor is useful in clamping the peak voltage of the pulse voltage, but cannot suppress the sudden rise of the pulse voltage. FANUC therefore recommends a CR spark killer.)
- The reference capacitance and resistance of the spark killer shall conform to the following based on the current (I (A)) and DC resistance of the stationary coil:
  - ❑ Resistance (R) : Equivalent DC resistance of the coil
  - ❑ Capacitance (C) : $\frac{I^2}{10}$ to $\frac{I^2}{20}$ (μF)
    where I : Current at stationary state of the coil



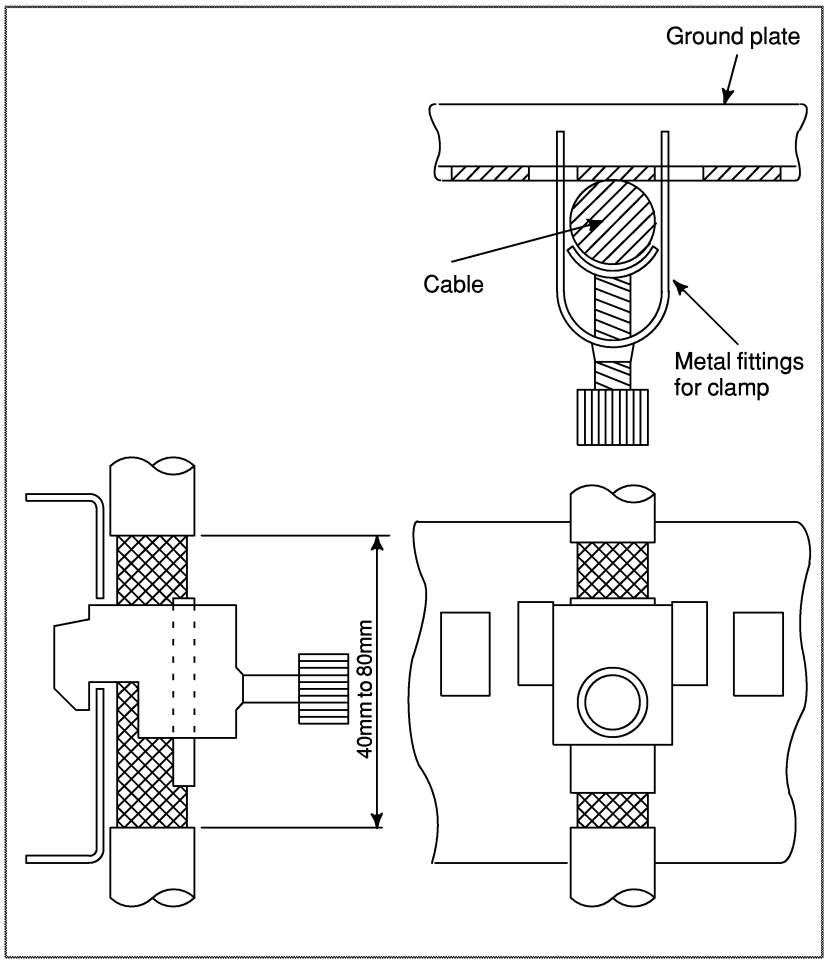
NOTE
Use a CR-type noise eliminator. Varistor-type noise eliminators clamp the peak pulse voltage but cannot suppress a sharp rising edge.

- Diode is used for direct-current circuits



- Cable clamp and shield processing

The servo amplifier module cables that require shielding should be clamped by the method shown below. This cable clamp treatment is for both cable support and proper grounding of the shield. To insure stable CNC system operation, follow this cable clamp method.
Partially peel out the sheath and expose the shield. Push and clamp by the plate metal fittings for clamp at the part. The ground plate must be made by the machine tool builder, and set as follows :



Cable clamp (1)

IV. MAINTENANCE OF SERVO AMPLIFIER MODULES

1 HOW TO REPLACE THE FUSES AND PRINTED CIRCUIT BOARDS

> ⚠ **WARNING**
> Before replacing fuses or printed-circuit boards, make sure that the recharge-under-way LED (red) is off.

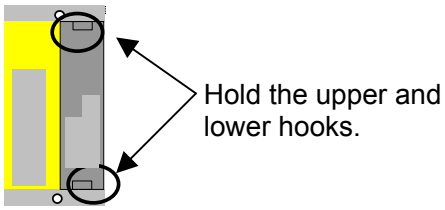
Before replacing fuses or printed circuit boards of servo amplifier modules, see the table given below to find which section or subsection in this manual provides information about the related replacement procedure.

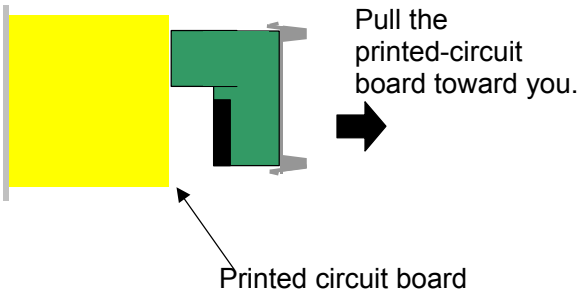
> **NOTE**
> 1 If a fuse blows, it is likely that there is a short-circuit in the power supply for a device (such as a sensor) connected to the servo amplifier module.
> After checking that all devices connected to the servo amplifier are normal, replace the fuse.
> If you do not remove the cause, it is very much likely that the fuse will blow again.
> 2 Do not use any fuse not supplied from FANUC.
> 3 Before replacing a fuse, check a marking on it with that on the printed-circuit board. Be careful not to mount a fuse with an incorrect rating.

1.1 HOW TO REPLACE THE FUSES AND PRINTED CIRCUIT BOARDS

A printed-circuit board can be removed and inserted from the front of the servo amplifier.

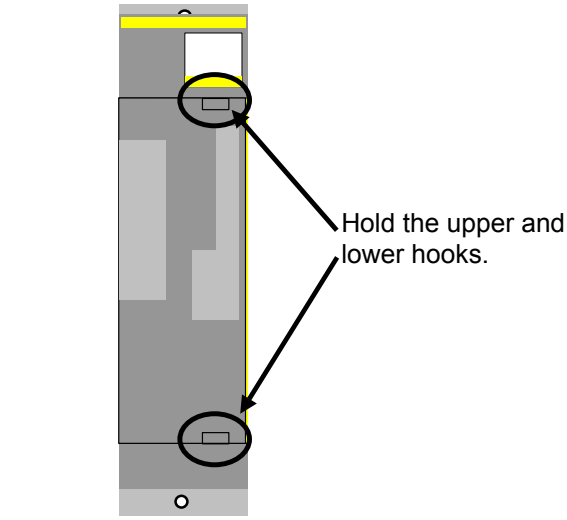
SVM1-4*i*, SVM1-20*i*

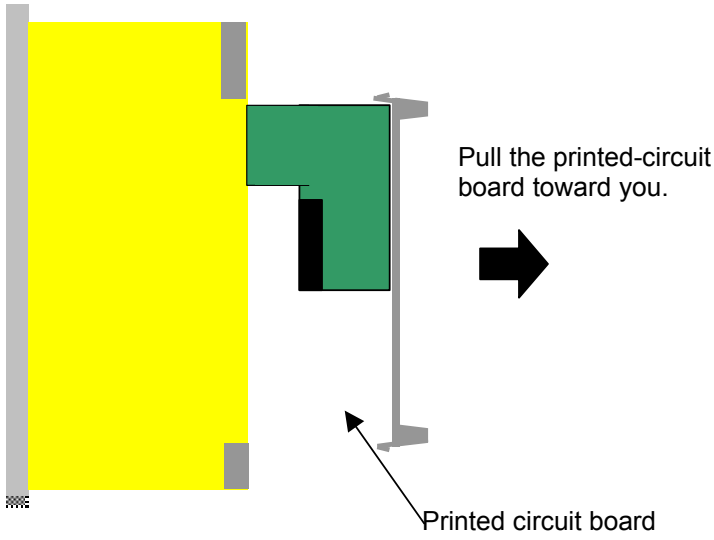




To insert the printed-circuit board, reverse the above procedure.
Ensure that the upper and lower hooks snap into the housing.
If the printed-circuit board is not inserted completely, the housing remains lifted. Pull out the printed-circuit board and insert it again.

SVM1-40*i*, SVM1-80*i*





To insert the printed-circuit board, reverse the above procedure.
Ensure that the upper and lower hooks snap into the housing.
If the printed-circuit board is not inserted completely, the housing remains lifted. Pull out the printed-circuit board and insert it again.

1.1.1 Ordering Number of Printed Circuit Board

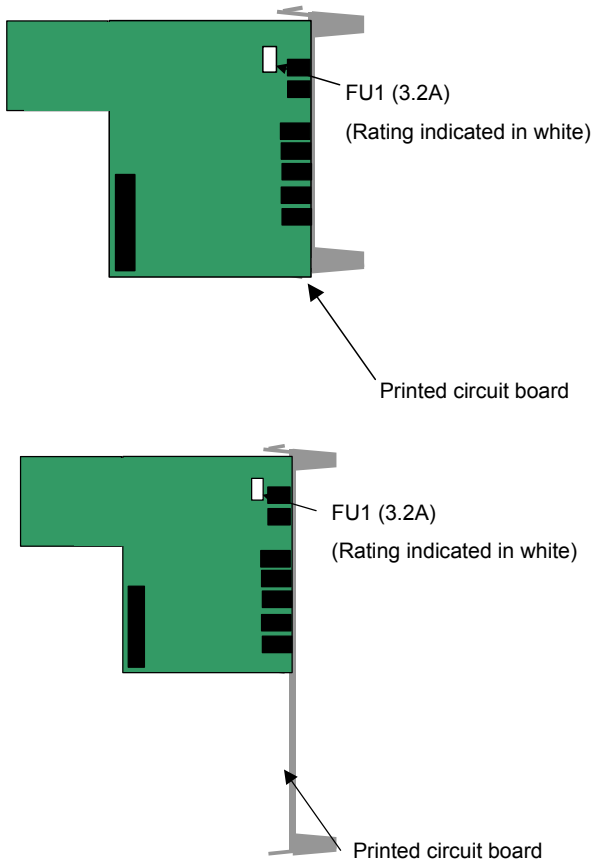
SVM

Model	Ordering number
SVM1-4*i* to 20*i*	A20B-8101-0200
SVM1-40*i* to 80*i*	

1.1.2 Fuse Locations

There is one fuse on the SVM printed-circuit board.

(1) A20B-8101-0200



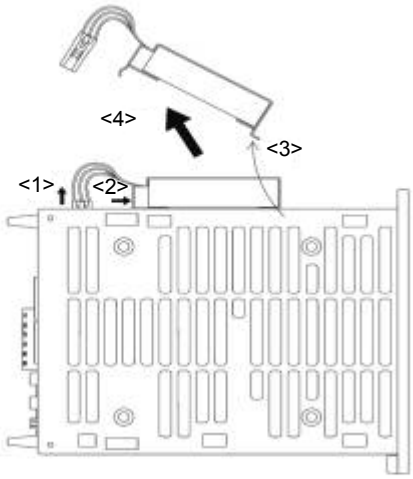
Fuse specification

Symbol	Ordering number
FU1	A60L-0001-0290#LM32C

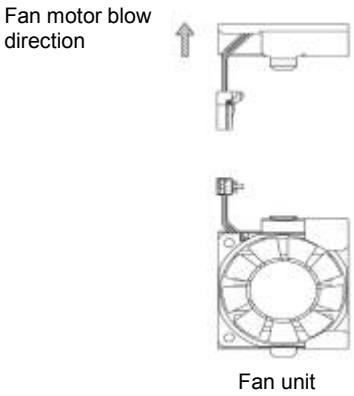
1.2 HOW TO REPLACE THE FAN MOTOR

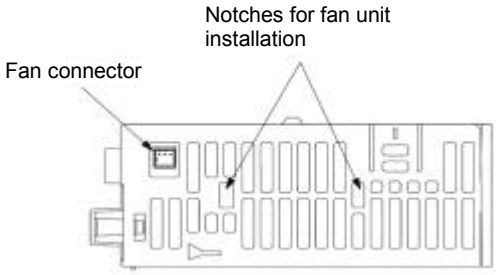
1.2.1 For Fan Motors for Internal Agitation for SVM1-4*i* and SVM1-20*i*

<1> Pull out the fan connector upward.
<2> Push the front of the fan unit to disengage the lug.
<3> Disengage the rear of the fan unit.
<4> Lift the fan unit in a slant direction.



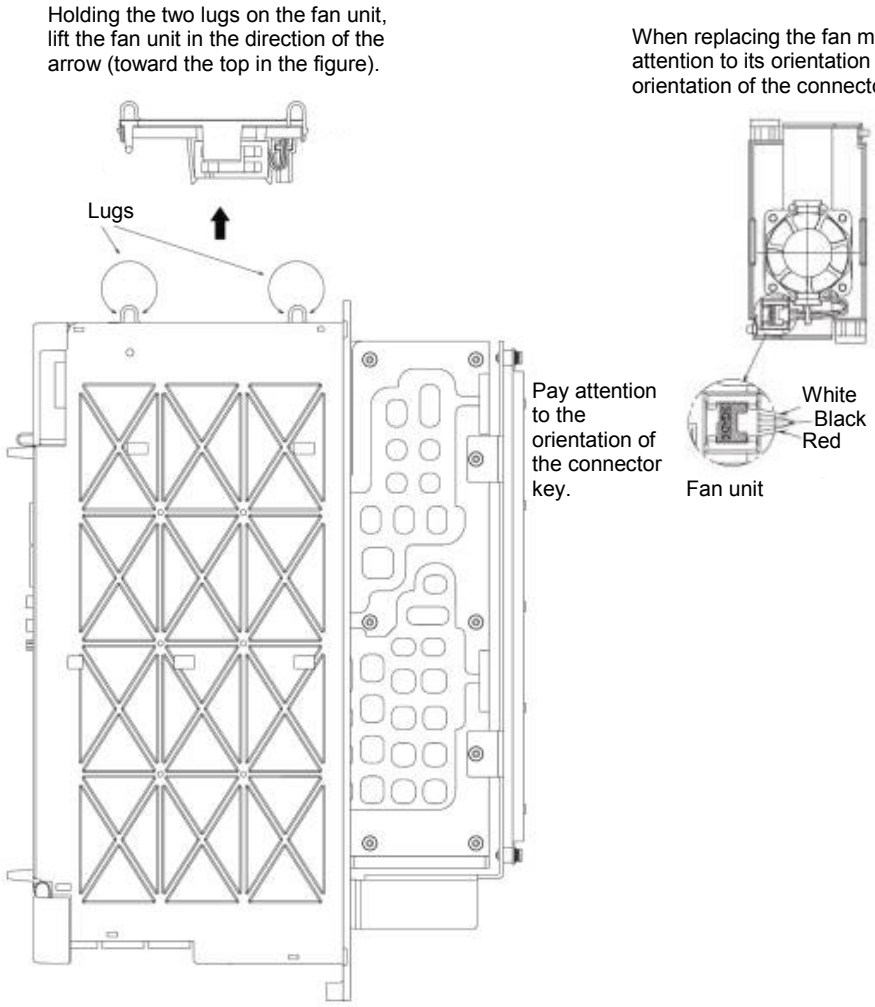
When replacing the fan motor, pay attention to its orientation and the cable drawing position.





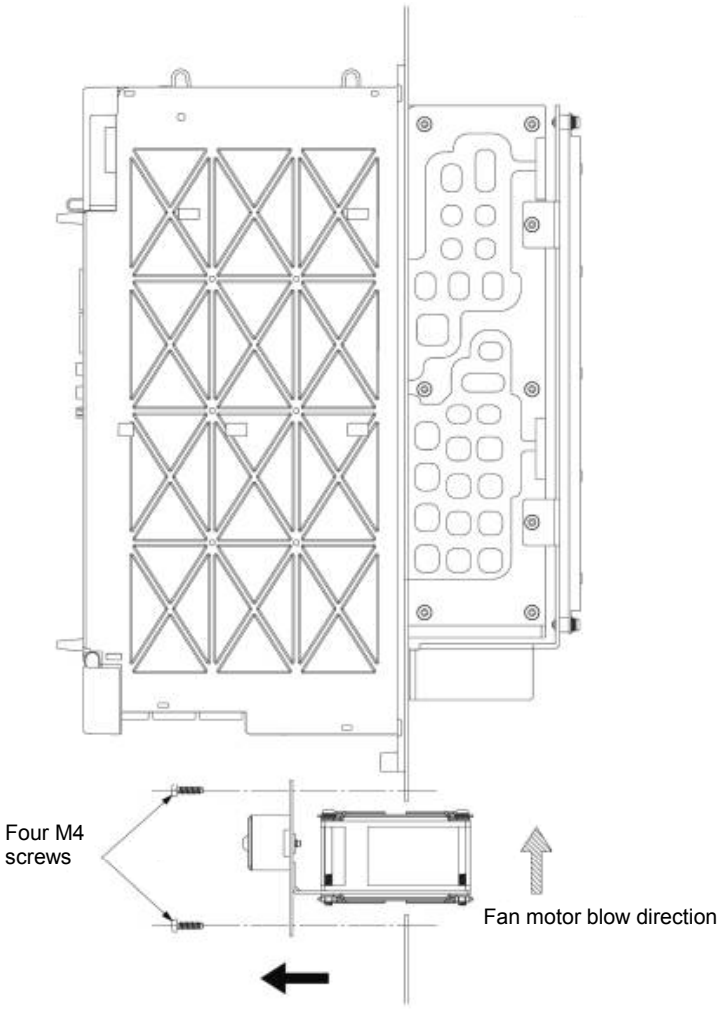
1.2.2 For Fan Motors for Internal Agitation for SVM1-40*i* and SVM1-80*i*

<1> Remove the four sheet metal fixing screws and then pull out the fan unit.



1.2.3 External-Fan Motor

<1> Holding the two lugs on the fan unit, lift the fan unit in the direction of the arrow (upward in the figure).



V. SERVO MOTOR MAINTENANCE

1 SERVO MOTOR MAINTENANCE

Generally, β*i*s series AC servo motors have no parts that wear off or that must be replaced periodically, unlike DC servo motors, which have brushes that must be replaced periodically.
However, you should perform periodic maintenance for servo motors so as to keep their initial performance as long as possible and to prevent breakdowns. AC servo motors have precision sensors. Their incorrect use or damage caused during transportation or assembling can result in breakdowns or accidents. We recommend that you inspect the servo motors periodically according to the descriptions given below.

1.1 RECEIVING AND KEEPING AC SERVO MOTORS

When you receive an AC servo motor, make sure that:

- The motor is exactly the one you ordered, in terms of model, shaft, and sensor specifications.
- No damage has been caused on the motor.

Because FANUC inspects servo motors strictly before shipment, you do not, in principle, have to inspect them when you receive them.
The servo motors should be kept indoors as a rule. The storage temperature range is -20 to +60°C. Do not place or install AC servo motors in the place where:

- It is extremely humid and dew is prone to form,
- There is a steep change in temperature,
- There is constant vibration, which may cause damage to the shaft bearings, or
- There is lots of dust and trash.

1.2 DAILY INSPECTION OF AC SERVO MOTORS

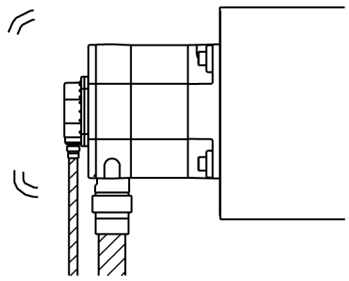
Before starting operation, or periodically (once a week or month), you should inspect the AC servo motors in terms of the following:

(1) Vibration and noise

Check the motor for abnormal vibration (by the hand) and noise (by the ear) when the motor is:

- Not rotating
- Rotating at low speed
- Accelerating or decelerating

If you find anything unusual, contact your FANUC service staff.

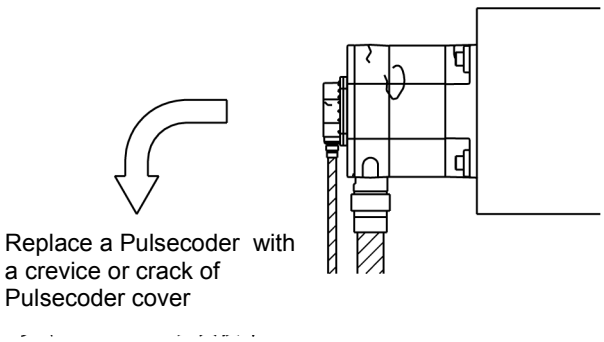


(2) Damage on the outside

Check the Pulsecoder cover (red plastic) for crevices and the motor surface (black coating) for scratches and cracks.

If you find a crevice in the Pulsecoder cover, you should replace it. For how to replace, see the description about the Pulsecoder in Section 1.4. If you are not sure about replacement, contact you FANUC service staff.

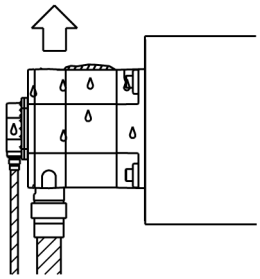
If there is a scratch or crack on the motor surface, the user should repair it by himself as required. If coating has come off, dry the portion of interest (or the entire surface) and coat it with paint for machines such as urethane paint.



(3) Stains and smudges

Check the motor surface and bolt holes for oil or coolant.
Wipe off oil and coolant on the motor surface periodically. Oil or coolant can damage the coating by chemical reaction, possibly leading to a failure.
Also check how such a liquid leaks onto the motor, and repair if needed.

Wipe off oil and coolant on the motor surface periodically.

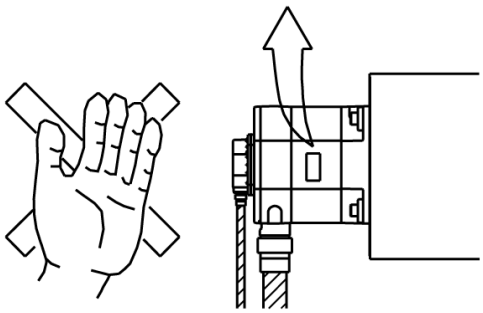


(4) Overheating

Check to see if the motor is too hot during normal operation.
Attach a thermolabel on the motor surface and check it visually to see if the motor becomes too hot during normal operation.

> ⚠ **CAUTION**
> Temperature on the motor surface can exceed 80°C under some conditions. Never touch it by the hand.

Attach a thermolabel and check it visually.



1.3 PERIODIC INSPECTION OF AC SERVO MOTORS

We recommend that you inspect the AC servo motors for the following items at least once a year.

(1) Observation of torque command (TCMD) and speed command (VCMD) waveforms

Observe normal voltage waveforms with an oscilloscope, and keep notes of them. During periodic inspection, check the current waveforms with the records.

The waveforms vary according to the operating conditions such as load and cutting speed. Note that you should make comparisons under the same condition (for example, during fast traverse to the reference position or low-speed cutting).

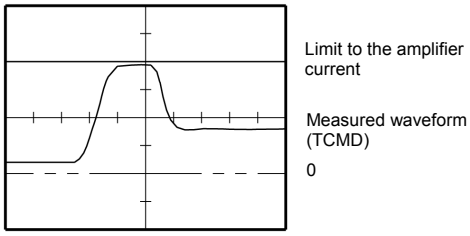
For a description of the measurement method, see Appendix E, "SERVO CHECK BOARD".

(2) Diagnosis by waveforms

Check the measured waveforms to see whether:

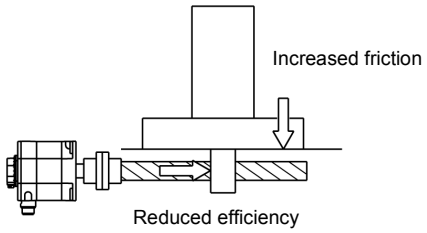
<1> The peak current is within the limit to the current in the amplifier during rapid traverse, acceleration, or deceleration.(TCMD)

The limit to the amplifier current is listed below. A voltage of 4.44 V is indicated when the current flowing through the amplifier is equal to the current limit for the amplifier (common to all models).



⇒ The motor used to accelerate/decelerate with the amplifier current within the limit (the acceleration/deceleration torque used to be sufficient), but something is wrong now. If this is the case, the probable causes are:

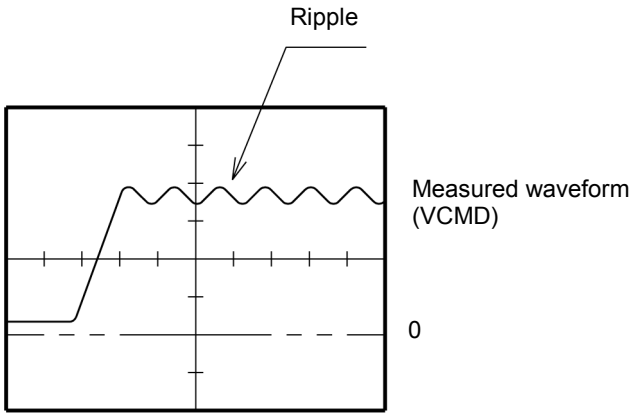
- The load conditions in the machine have changed because of changed friction or reduced machine efficiency after long period of use.
- Motor failure



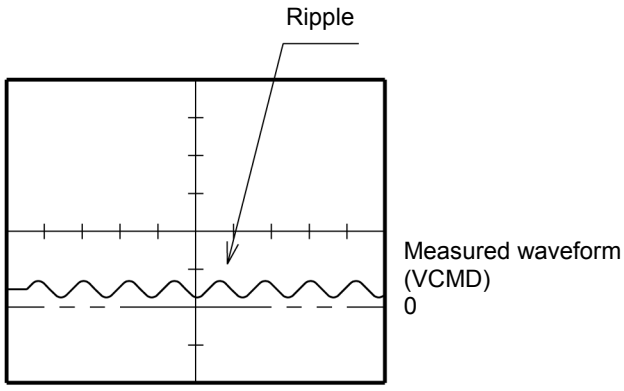
[Table 1]

Models	Current value
β0.2/5000*i*s, β0.3/5000*i*s	4Ap
β0.4/5000*i*s, β0.5/5000*i*s, β1/5000*i*s, β2/4000*i*s, β4/4000*i*s, β8/3000*i*s	20Ap
β12/3000*i*s, β22/2000*i*s	40Ap

<2> The waveform has ripple during constant-speed feeding (VCMD).



<3> The current waveform has ripple or jumps when the motor is not rotating (VCMD).



If you find anything unusual in relation to the above items <1> to <3>, contact your FANUC service staff.

(3) Winding and insulation resistances.

Measure heck its winding and insulation resistances.

Note that extremely severe inspections (such as dielectric strength tests) of a motor may damage its windings. For the winding resistances of motors, refer to FANUC AC SERVO MOTOR β*i*s series Descriptions (B-65302EN), or ask FANUC. For insulation resistances, see the following table.

MOTOR INSULATION RESISTANCE MEASUREMENT

Measure an insulation resistance between each winding and motor frame using an insulation resistance meter (500 VDC). Judge the measurements according to the following table.

Insulation resistance	Judgment
100MΩ or higher	Acceptable
10 to 100 MΩ	The winding has begun deteriorating. There is no problem with the performance at present. Be sure to perform periodic inspection.
1 to 10 MΩ	The winding has considerably deteriorated. Special care is in need. Be sure to perform periodic inspection.
Lower than 1 MΩ	Unacceptable. Replace the motor.

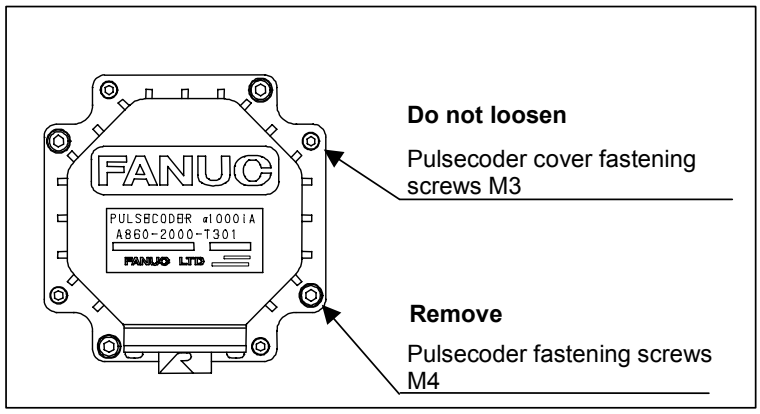
NOTE

If the insulation resistance steeply drops within a short period of time, it is likely that liquid such as coolant may have entered from the outside. Check the drip-proof environment again (by referring to Section 2.1, "USE ENVIRONMENT FOR SERVO MOTORS," in Chapter I in "FANUC AC SERVO MOTOR β*i*s series Descriptions (B-65302EN)).

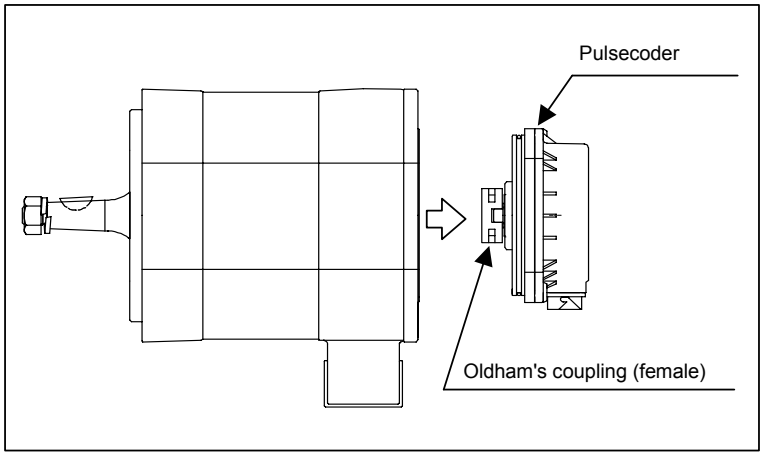
1.4 REPLACING THE PULSECODER

This section explains how to replace the Pulsecoder and motor cover, assuming that the Pulsecoder has broken down and is in need of immediate replacement.
When replacing the Pulsecoder and motor cover, be careful not to give a shock to the Pulsecoder or motor, because they are precision devices prone to a breakdown. Also keep them from dust and cutting chips.

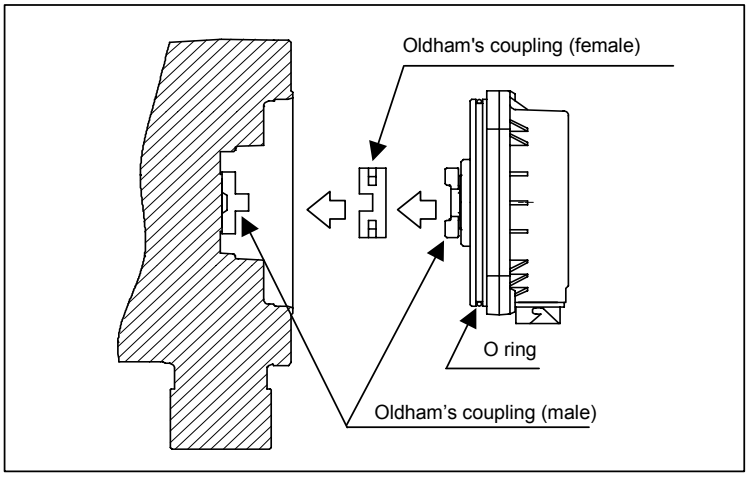
<1> Remove the four M4 hexagonal socket head bolts that fasten the Pulsecoder. Do not loosen the M3 bolts near each M4 bolt.



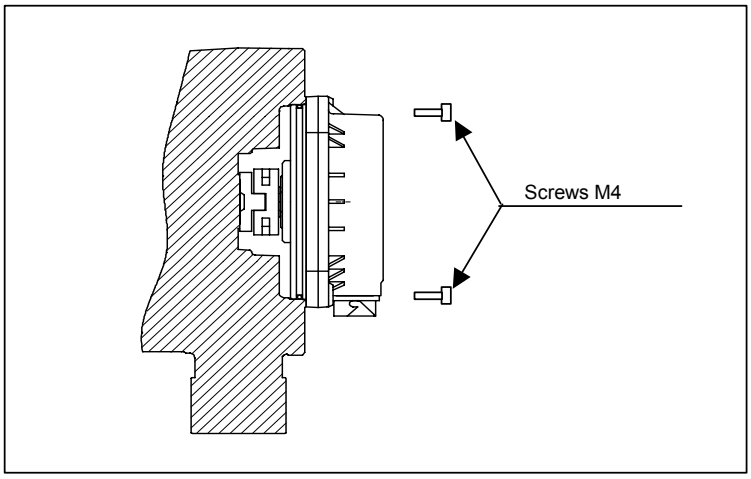
<2> Remove the Pulsecoder and Oldham's coupling.



<3> Set a new Pulsecoder and a new Oldham's coupling in the motor. Place the Oldham's coupling with the correct orientation, and engage the teeth.
Push in the Pulsecoder until the O ring on the Pulsecoder settles in between the motor pocket and Pulsecoder pocket. Be careful not allow the O ring to be caught between other parts.



<4> Fasten the Pulsecoder with the four M4 hexagonal socket head bolts.



1.5 SPECIFICATION NUMBERS OF REPLACEMENT PARTS

The following lists the ordering specification numbers for maintenance:

(1) Ordering specifications of Pulsecoders
A860-2020-T301: β128*i*A

(2) Oldham's coupling
A290-0501-V535

APPENDIX

A SERVO AMPLIFIER MODULE FRONT VIEW

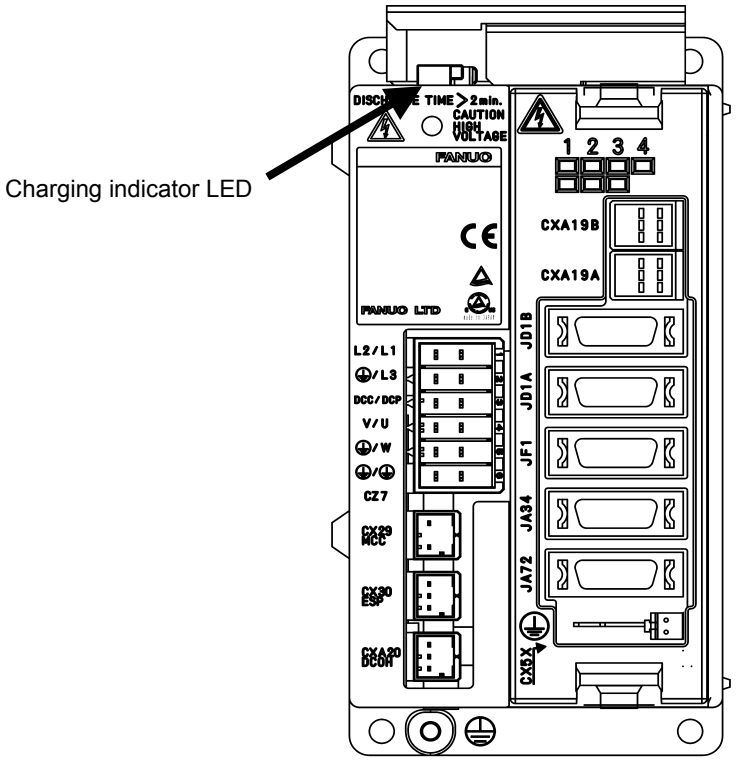


Fig. A(a) SVM-4*i*, SVM-20*i*

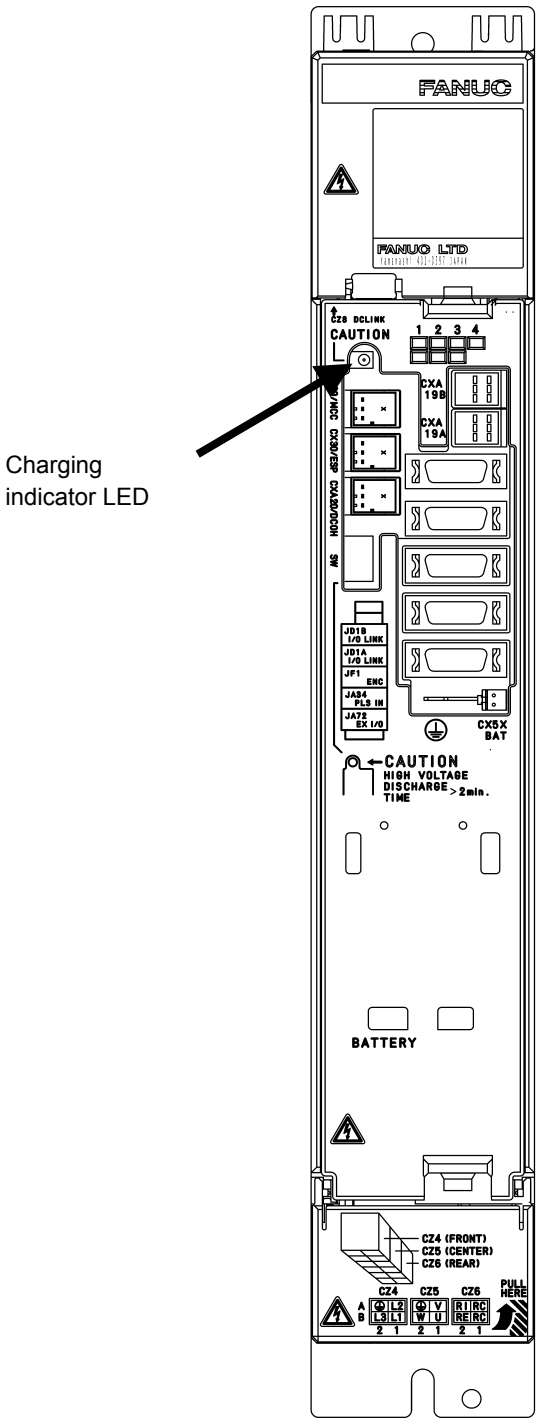


Fig. A(b) SVU-40*i*, SVU-80*i*

B PARAMETER LIST

Table B (a) Parameter list (in order of classification)

Classification	Parameter number	Reference item
Controlled-axis parameter	000	B.1
Coordinate system and stroke limit parameters	001, 068, 140 to 145, 147, 154 to 165, 170	B.2
Feedrate parameters	021, 040, 041, 043 to 050, 054, 061, 066, 067	B.3
Acceleration/deceleration parameters	002, 055 to 060	B.4
Input/output signal parameters	003 to 005, 007, 020, 022 to 025, 029, 062, 063, 148 to 152,166 to 169	B.5
Servo parameters	010 to 014, 016 to 019, 030 to 032, 070 to 075, 078 to 096, 099 to 112, 115, 116, 118, 119, 125, 130, 135 to 138, 179 to 182	B.6

Table B (a) Parameter list (in order of parameter number)

Any parameter with its number column shaded is automatically set by setting bit 0 of parameter No. 012 to 0, then turning the power off and then back on.

<table>
<tr><th>No.</th><th>Description</th><th>Related item</th></tr>
<tr><td>000</td><td>Controlled-axis</td><td>Appendix B.1</td></tr>
<tr><td></td><td>#1 ROTX : Linear axis (0)/Rotation axis (1)
#2 RAB2X : Specification of the sign of the absolute command-based rotation direction of the rotation axis is disabled (0)/enabled (1).
#6 RABX : The absolute command-based rotation direction of the rotation axis is a direction in which the distance to a desired point within one revolution is smaller (0)/a direction determined according to a command-specified sign (1).
#7 ROAX : The roll-over function of the rotation axis is disabled (0)/enabled (1).</td><td></td></tr>
<tr><td>001</td><td>Coordinate system and stroke limit</td><td>Appendix B.2</td></tr>
<tr><td></td><td>#1 ZRTN : If a reference position is not set up, an alarm is issued (0)/not issued (1).
#2 HOT : The overtravel direct input signals are disabled (0)/enabled (1).
#3 SSL1 : Stored stroke limit 1 is invalid (0)/valid (1).
#4 N405 : If reference position return cannot be executed correctly, servo alarm No. 405 is issued (0)/not issued (1).
#6 EPEXA
#7 EPEXB : If input external pulses exceed the upper limit for feedrate commands:
<table>
<tr><th>EPEXB</th><th>EPEXA</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>The feedrate is clamped (pulses at excessive rates are accumulated).</td></tr>
<tr><td>0</td><td>1</td><td>Alarm No. 291</td></tr>
<tr><td>1</td><td>0</td><td>The feedrate is clamped (pulses at excessive rates are discarded).</td></tr>
<tr><td>1</td><td>1</td><td>Alarm No. 291</td></tr>
</table></td><td></td></tr>
<tr><td>002</td><td>Acceleration/deceleration control</td><td>Appendix B.4</td></tr>
<tr><td></td><td>#0 RPDE : The acceleration/deceleration type for rapid traverse is linear or bell-shaped (0)/exponential (1).
#1 JOGE : The acceleration/deceleration type for jog or cutting feed is linear or bell-shaped (0)/exponential (1).
#3 CIPC : Switching between effective areas for in-position check is disabled (0)/enabled (1).
#6 RVF2 : For a rapid traverse override, a feedrate is specified in 4 steps of 100%, 50%, 25%, F0 (0)/100%, F1, F2, F0 (1).
#7 CSMZ : The SMZX signal is disabled (0)/enabled (1).</td><td></td></tr>
<tr><td>003</td><td>Input/output signals</td><td>Appendix B.5</td></tr>
<tr><td></td><td>#1 NCLP : Clamping/unclamping is used (0)/not used (1).
#2 IGCP : A clamp/unclamp state is checked (0)/ not checked (1).
#5 WAT2 : For a wait command, an ID code cannot be specified (0)/can be specified (1).
#6 EXPLS : The external pulse function is disabled (0)/enabled (1).
#7 STON : The ST signal is detected on the falling edge (0)/rising edge (1).</td><td></td></tr>
<tr><td>004</td><td>Input/output signals</td><td>Appendix B.5</td></tr>
<tr><td></td><td>#2 ZRNO : Input of a reference position establishment signal is disabled (0)/enabled (1).
#3 NEPRM : Writing to EEPROM is performed (0)/not performed (1).</td><td></td></tr>
</table>

No.	Description	Related item
005	Input/output signals	Appendix B.5
	#0 JNCL : When JOG operation stops, clamping is performed (0)/not performed (1). #1 CLPSVF : The time from clamping to servo-off is set as the time from the point the UCPC2 signal turns off (0)/the time from the point the UCPS2 signal turns off (1). #2 REFDRC : The direction of high-speed reference position return of the rotation axis depends on the sign of the result of subtracting the current position from the reference position (0)/the setting of bit 5 (ZMIX) of parameter No.010 (1). #4 IOH : Manual handle feed over the I/O Link is disabled (0)/enabled (1). #5 MP : Setting of a magnification in 4 steps with the MP1/MP2 signal for manual handle feed is disabled (0)/enabled (1). #6 LDM : Output of the motor current value to response data is disabled (0)/enabled (1). #7 ABSPS : Reading of response data is not synchronized with the host (0)/synchronized with the host (1).	
007	Input/output signals	Appendix B.5
	#0 ABSV : When coordinates are read, allowance for delays including an acceleration/deceleration delay and servo delay is not made (0)/made (1). #1 PSSV : For area signals, allowance for delays including an acceleration/deceleration delay and servo delay is not made (0)/made (1). #2 NZRPO: If a reference position is not established, a turret/magazine number or point number is not output (0)/output (1). #4 VCTLB : The velocity control type for peripheral equipment control is type A (0)/type B(1). #5 ATCR2 : A turret/magazine number is not always output to response data (0)/always output to response data (1).	
010	Servo	Appendix B.6
	#0 IINP : When the torque is limited, an in-position check is not made (0)/made (1). #1 IALM : When the torque is limited, a check for an excessive error is not made (0)/made (1). #2 IEBL : The torque limit function is disabled (0)/enabled (1). #5 ZMIX : The initial direction of reference position return and backlash is positive (0)/negative (1). #6 ECMR : CMR expansion is disabled (0)/enabled (1). #7 SVFP : During servo-off, follow-up is not performed (0)/performed (1).	
011	Servo	Appendix B.6
	#0 ABSX : The reference position of the absolute-position detector has not been established (0)/has been established (1). #1 SZRN : Scale return is disabled (0)/enabled (1). #2 DZRN : Reference position return with dogs is disabled (0)/enabled (1). #6 MVZPFR : When the reference position on a rotation axis is updated, allowance for a fraction is not made (0)/made (1). #7 APCX : An absolute-position detector is not provided (0)/provided (1).	
012	Servo	Appendix B.6
	#1 DGPR : Automatic motor settings are made (0)/not made (1).	

<table>
<tr><th>No.</th><th>Description</th><th>Related item</th></tr>
<tr><td>013</td><td>Servo</td><td>Appendix B.6</td></tr>
<tr><td></td><td>#0 VCM1
#1 VCM2 : The scale of VCMD output to the check board
<table>
<tr><th>VCM2</th><th>VCM1</th><th>Scale</th></tr>
<tr><td>0</td><td>0</td><td>5 V corresponds to 3750 min^{-1}.</td></tr>
<tr><td>0</td><td>1</td><td>5 V corresponds to 234 min^{-1}.</td></tr>
<tr><td>1</td><td>0</td><td>5 V corresponds to 14.6 min^{-1}.</td></tr>
<tr><td>1</td><td>1</td><td>5 V corresponds to 0.92 min^{-1}.</td></tr>
</table>
#4 TSA1
#5 TSA2 : The scale of TSA output to the check board
<table>
<tr><th>TSA2</th><th>TSA1</th><th>Scale</th></tr>
<tr><td>0</td><td>0</td><td>5 V corresponds to 3750 min^{-1}.</td></tr>
<tr><td>0</td><td>1</td><td>5 V corresponds to 234 min^{-1}.</td></tr>
<tr><td>1</td><td>0</td><td>5 V corresponds to 14.6 min^{-1}.</td></tr>
<tr><td>1</td><td>1</td><td>5 V corresponds to 0.92 min^{-1}.</td></tr>
</table></td><td></td></tr>
<tr><td>014</td><td>Servo</td><td>Appendix B.6</td></tr>
<tr><td></td><td>#0 IRS : Items output to DATA0 and DATA1 of the check board are changed to VCMD, TCMD (0)/IR, IS (1).
Bit 1 (TDOU) of parameter No.014 must be set to 0.
#1 TDOU : Items output to DATA0 and DATA1 of the check board are changed to VCMD, TCMD (0)/specified acceleration, estimated load torque (1).
Bit 0 (IRS) of parameter No.014 must be set to 0.</td><td></td></tr>
<tr><td>016</td><td>Servo</td><td>Appendix B.6</td></tr>
<tr><td></td><td>#0 PIIP : The velocity loop is subjected to PI control (0)/IP control (1).
#1 LVMD : Low-velocity integration is disabled (0)/enabled (1).
#4 FFVL :
#5 FFAL :
<table>
<tr><th>FFVL</th><th>FFAL</th><th>Description</th></tr>
<tr><td>1</td><td>1</td><td>The feed-forward function is enabled.</td></tr>
<tr><td>0</td><td>*</td><td>The feed-forward function is disabled.</td></tr>
<tr><td>1</td><td>0</td><td>The feed-forward function is disabled.</td></tr>
</table></td><td></td></tr>
<tr><td>017</td><td>Servo</td><td>Appendix B.6</td></tr>
<tr><td></td><td>#0 HENB : The skip function is disabled (0)/enabled (1).
#1 HEDG : A skip signal is detected on the rising edge (0)/falling edge (1).
#2 SPCO : If no skip signal is input and the end point is reached, skip measurement data is not updated (0)/contains end point data (1).</td><td></td></tr>
<tr><td>018</td><td>Servo</td><td>Appendix B.6</td></tr>
<tr><td></td><td>#2 VCMD0: The function for quick stop at emergency stop is disabled (0)/enabled (1).
#3 TIM0
#4 TIM1 : MCC off timer settings
<table>
<tr><th>TIM1</th><th>TIM0</th><th>MCC off timer</th></tr>
<tr><td>0</td><td>0</td><td>0 ms</td></tr>
<tr><td>1</td><td>0</td><td>60 ms</td></tr>
<tr><td>1</td><td>1</td><td>100 ms</td></tr>
</table></td><td></td></tr>
<tr><td>019</td><td>Servo</td><td>Appendix B.6</td></tr>
<tr><td></td><td>#2 ACLIM : Current compensation function 11 is disabled (0)/enabled (1).
#3 SQLIM : Current compensation function 12 is disabled (0)/enabled (1).</td><td></td></tr>
<tr><td>020</td><td>Response data specification</td><td>Appendix B.5</td></tr>
<tr><td>021</td><td>Feedrate command weight N</td><td>Appendix B.3</td></tr>
<tr><td>022</td><td>ECF and EBSY signal minimum output time</td><td>Appendix B.5</td></tr>
<tr><td>023</td><td>PMM allocation rate assumed when reading continuous data with a direct command</td><td>Appendix B.5</td></tr>
</table>

No.	Description	Related item
024	Axis name (1st character)	Appendix B.5
025	Axis name (2nd character)	Appendix B.5
029	Internal variable (ignore this parameter)	Appendix B.5
030	Set 0. Set the motor type number in parameter No. 125.	
031	Direction of motor rotation (DIRCTL)	Appendix B.6
032	Command multiplier (CMR)	Appendix B.6
036	Always set 0.	
037	Always set 0.	
038	Always set 0.	
039	Always set 0.	
040	Rapid traverse rate	Appendix B.3
041	Jog feedrate	Appendix B.3
043	Feedrate upper limit	Appendix B.3
044	Feedrate specified for feedrate code 1	Appendix B.3
045	Feedrate specified for feedrate code 2	Appendix B.3
046	Feedrate specified for feedrate code 3	Appendix B.3
047	Feedrate specified for feedrate code 4	Appendix B.3
048	Feedrate specified for feedrate code 5	Appendix B.3
049	Feedrate specified for feedrate code 6	Appendix B.3
050	Feedrate specified for feedrate code 7	Appendix B.3
054	FL rate for a reference position return	Appendix B.3
055	Linear/bell-shaped/exponential acceleration/deceleration time constant T1 for rapid traverse	Appendix B.4
056	Rapid traverse bell-shaped acceleration/deceleration time constant T2	Appendix B.4
057	Linear/bell-shaped/exponential acceleration/deceleration time constant T1 for jog or cutting feed	Appendix B.4
058	Bell-shaped acceleration/deceleration time constant T2 for jog or cutting feed	Appendix B.4
059	Exponential acceleration/deceleration FL rate for jog or cutting feed	Appendix B.4
060	FL rate for rapid traverse exponential acceleration/deceleration	Appendix B.4
061	F0 rate for rapid traverse override	Appendix B.3
062	External pulse input-based axis movement amount ratio setting 1 (M)	Appendix B.5
063	External pulse input-based axis movement amount ratio setting 2 (N)	Appendix B.5
066	F1 rate for rapid traverse override	Appendix B.3
067	F2 rate for rapid traverse override	Appendix B.3
068	Number of magazines/turrets	Appendix B.2
070	Current loop gain (PK1)	Appendix B.6
071	Current loop gain (PK2)	Appendix B.6
072	Current loop gain (PK3)	Appendix B.6
073	Velocity loop gain (PK1V)	Appendix B.6
074	Velocity loop gain (PK2V)	Appendix B.6
075	Velocity loop gain (PK4V)	Appendix B.6
078	Current compensation 1 (PVPA)	Appendix B.6
079	Current compensation 2 (PALPH)	Appendix B.6
080	Current limit value (TQLIM)	Appendix B.6
081	Overload protection coefficient (POVC1)	Appendix B.6
082	Overload protection coefficient (POVC2)	Appendix B.6
083	Overload protection coefficient (POVCLM)	Appendix B.6
084	Current compensation 3 (AALPH)	Appendix B.6
085	Actual current limit (DBLIM)	Appendix B.6
086	Current compensation 4 (MGSTCM)	Appendix B.6
087	Current compensation 5 (DETQLM)	Appendix B.6

No.	Description	Related item
088	Current compensation 6 (NINTCT)	Appendix B.6
089	Current compensation 7 (MFWKCE)	Appendix B.6
090	Current compensation 8 (MFWKBL)	Appendix B.6
091	VCMD polyline speed (P_VCLN)	Appendix B.6
092	Low-speed integration threshold speed (P_LVIN)	Appendix B.6
093	Estimated load torque: torque offset (TCPRLD)	Appendix B.6, Ⅱ6
094	Estimated load torque: dynamic friction compensation (FRCCMP)	Appendix B.6, Ⅱ6
095	Unexpected disturbance torque detection: retract distance (ABVOF)	Appendix B.6, Ⅱ6
096	Unexpected disturbance torque detection: alarm threshold (ABTSH)	Appendix B.6, Ⅱ6
099	Current compensation 9 (EMFCMP)	Appendix B.6
100	Load inertia ratio (LDINT)	Appendix B.6
101	Acceleration feedback (PK2VAUX)	Appendix B.6
102	Torque command filter (FILTER)	Appendix B.6
103	Feed-forward coefficient (FALPH)	Appendix B.6
104	Velocity feed-forward coefficient (VFFLT)	Appendix B.6
105	Numerator for the number of pulses per motor revolution (SDMR1)	Appendix B.6
106	Denominator for the number of pulses per motor revolution (SDMR2)	Appendix B.6
107	Position loop gain (LPGINX)	Appendix B.6
108	Servo motor torque limit	Appendix B.6
109	Backlash amount (BKLCMP)	Appendix B.6
110	Positional deviation limit value at a stop	Appendix B.6
111	In-position width	Appendix B.6
112	Torque constant	
115	Model constant	
116	Velocity loop gain override during velocity control	Appendix B.6
118	Current compensation 10 (PHDLY1)	Appendix B.6
119	Current compensation 10 (PHDLY2)	Appendix B.6
125	Motor type number	Appendix B.6
130	Unexpected disturbance torque detection alarm timer	Appendix B.6, Ⅱ6
135	Linear acceleration/deceleration time constant for velocity control	Appendix B.6
136	Velocity deviation check limit during velocity control	Appendix B.6
137	Effective area for in-position check during cutting feed	Appendix B.6
138	Expanded CMR	Appendix B.6
140	Machine coordinate for the reference position	Appendix B.2
141	Amount of movement per rotation axis revolution	Appendix B.2
142	Positive machine coordinate for stored stroke limit 1	Appendix B.2
143	Negative machine coordinate for stored stroke limit 1	Appendix B.2
144	Machine coordinate for the second reference position	Appendix B.2
145	Machine coordinate for the third reference position	Appendix B.2
147	Workpiece coordinate for the reference position	Appendix B.2
148	Servo positional deviation monitor amount	Appendix B.5
149	Remaining travel limit for outputting the remaining travel in-range signal (DEN2)	Appendix B.5
150	Coordinates (minimum) for point 1 in the operation range of the area signals	Appendix B.5
151	Coordinates for point 2 in the operation range of the area signals	Appendix B.5
152	Coordinates for point 3 in the operation range of the area signals	Appendix B.5
154	Position for point number 1	Appendix B.2
155	Position for point number 2	Appendix B.2
156	Position for point number 3	Appendix B.2
157	Position for point number 4	Appendix B.2
158	Position for point number 5	Appendix B.2
159	Position for point number 6	Appendix B.2

No.	Description	Related item
160	Position for point number 7	Appendix B.2
161	Position for point number 8	Appendix B.2
162	Position for point number 9	Appendix B.2
163	Position for point number 10	Appendix B.2
164	Position for point number 11	Appendix B.2
165	Position for point number 12	Appendix B.2
166	Operation completion signal output time	Appendix B.5
167	Time between servo-on and unclamping	Appendix B.5
168	Time between clamping and servo-off	Appendix B.5
169	Time allowed before the next sequence is executed without clamping/unclamping	Appendix B.5
170	Index point tolerance	Appendix B.2
179	Numerator for the number of pulses per motor revolution (SDMR1, 32768 or greater)	Appendix B.6
180	Reference counter capacity	Appendix B.6
181	Grid shift amount	Appendix B.6
182	Positional deviation limit value during movement	Appendix B.6

⚠ CAUTION
You must not change any parameters during operation.

NOTE
1 The increment system in the current CNCs corresponds to the user-specified unit in this servo amplifier module. For example, when an amount of movement is specified in any of the current CNCs, the weight for a specified value of 1 is determined by parameter switching. In increment system B, the weight for a specified value of 1 is 1 μ. This servo amplifier module does not perform parameter switching, but requires the user to determine the weight for a specified value of 1.
2 Do not change the value of a parameter not included in the parameter list because that parameter may be used for an internal variable. For example, parameter No. 029 is used for an internal variable. Even if this parameter has a nonzero value, ignore the parameter without changing the value.

B.1 CONTROLLED-AXIS PARAMETERS

No	#7	#6	#5	#4	#3	#2	#1	#0
000	ROAX	RABX				RAB2X	ROTX	

[Size] 1 byte (bit type)
[Standard value] 0

ROTX Specifies whether the controlled axis is a linear or rotation axis, as follows:
0 : Linear axis
1 : Rotation axis

NOTE
For velocity control, set a rotation axis.

RAB2X Specifies whether the specification of the sign of the absolute command-based rotation direction of the rotation axis is valid, as follows:
0 : Invalid
1 : Valid

NOTE
For details, see Section 3.6.2, "Rotation axis rotation direction sign specification function."

RABX Specifies the absolute command-based rotation direction of the rotation axis for movement within one revolution, as follows:
1 : Direction of the smallest distance to a desired point
0 : Direction determined according to a command-specified sign

NOTE
This parameter is valid only when ROAX = 1.

ROAX Specifies whether the roll-over function of the rotation axis is valid, as follows:
0 : Invalid
1 : Valid

NOTE
For velocity control, enable the roll-over function of the rotation axis.

B.2 COORDINATE SYSTEM AND STROKE LIMIT PARAMETERS

No	#7	#6	#5	#4	#3	#2	#1	#0
001	EPEXB	EPEXA		N405	SSL1	HOT	ZRTN	

[Size] 1 byte (bit type)
[Standard value] 0

ZRTN Specifies whether an alarm is to be issued if a reference position is not set up, as follows:
0 : An alarm is issued.
1 : An alarm is not issued.

HOT Specifies whether the overtravel direct input signals (*+OT and *-OT) are valid, as follows:
0 : Invalid
1 : Valid

SSL1 Specifies whether stored stroke limit 1 is valid, as follows:
0 : Invalid
1 : Valid

NOTE
This parameter is invalid until reference position return is completed.

N405 Specifies whether a servo alarm is to be issued if reference position cannot be executed correctly, as follows:
0 : A servo alarm is issued. (No. 405)
1 : A servo alarm is not issued.

NOTE
If a value in the range of 4 to 96 is set for parameter No. 032 (CMR), servo alarm No. 405 may be issued during reference position return. In this case, prevent the alarm from being issued by setting N405 to "1".

EPEXA, EPEXB Specify the operation that is to occur if the axis movement rate determined according to external pulses exceeds the feedrate upper limit specified in parameter No. 043.

EPEXB	EPEXA	Description
0	0	The feedrate is clamped to the parameter-specified value, and the excessive pulses are treated as accumulated pulses. If the number of accumulated pulses exceeds 99999999, the excessive pulses are discarded.
0	1	Alarm 291 is issued, leading to deceleration and stop.
1	0	The feedrate is clamped to the parameter-specified value, and the excessive pulses are discarded.
1	1	Alarm 291 is issued, leading to deceleration and stop.

No	
068	Number of magazines/turrets

[Size] 2-byte
[Valid data range] 1 to 9999
[Standard value] 0
[Description] Sets up the number of magazines/turrets.

No	
140	Machine coordinate of the reference position

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to ±99999999
[Standard value] 0
[Description] Sets up the machine coordinate for the reference position.
When setting of the reference position, either without dogs or externally, is completed, the machine coordinate is preset to the value specified in the parameter.

No	
141	Amount of movement per rotation axis revolution

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to 99999999
[Standard value] 0
[Description] Specifies an amount of movement per revolution for the rotation axis. If 0 is specified, the amount of movement is assumed to be 36000.

> ⚠ **CAUTION**
> The amount of motor revolution corresponding to the amount of movement per rotation axis revolution must be 2500 revolutions or less. If the amount of motor revolution corresponding to the amount of movement per rotation axis revolution exceeds 2500 revolutions, reduce the amount of motor revolution to 2500 or below, by reducing the gear reduction ratio or by other means.

No	
142	Positive machine coordinate for stored stroke limit 1

No	
143	Negative machine coordinate for stored stroke limit 1

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to ±99999999
[Standard value] 99999999 (positive machine coordinate),
-99999999 (negative machine coordinate)
[Description] Sets up the positive and negative machine coordinates for stored stroke limit 1. Areas outside the specified ranges are forbidden areas.

No	
144	Machine coordinate for the second reference position

No	
145	Machine coordinate for the third reference position

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to ±99999999
[Standard value] 0
[Description] Sets up the machine coordinates for the second and third reference positions.

No	
147	Workpiece coordinate for the reference position

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to ±99999999
[Standard value] 0
[Description] Sets up the workpiece coordinate for the reference position. When setting the reference position, either without dogs or externally, is completed, the workpiece coordinate of the reference position is preset to the value specified in the parameter. This parameter is fixed to 0 for the rotation axis.

No	
154	Position for point number 1
:	:
165	Position for point number 12

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to ±99999999
[Standard value] 0
[Description] Specify positions for point numbers 1 to 12 for point positioning.

No	
170	Index point tolerance

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to 99999999
[Standard value] 0
[Description] When the 1-pitch rotation of ATC/turret control is specified, the index point is preserved if the machine deviates from the index point during clamping/ unclamping, as long as the absolute value for the movement amount is equal to or less than this value. For example, when the machine is to move from index point 1 to 2, it can move to the position of point 2 even if it has deviated from the position of point 1 in the direction opposite from the direction of movement, as long as the movement amount is within the value specified in this parameter.
In ATC/turret control, this parameter is also used to specify a tolerable magazine range when a turret/magazine number is always output to response data.

NOTE
When bit 5 of parameter No.007 is 1 (a turret/magazine number is always output to response data), set a tolerable magazine range in this parameter.

B.3 FEEDRATE PARAMETERS

No	
021	Feedrate command weight N

[Size] 1 byte
[Unit of data]
[Valid data range] 0 to 8
[Standard value] 3
[Description] Sets up a weight for feedrate parameter Nos. 040, 041, 043 to 050, 054, 059 to 061. Supposing 3 is specified, the feedrate is assumed to be a parameter-specified feedrate multiplied by 10^3 (= 1000).

No	
040	Rapid traverse rate

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 4000
[Description] Specifies a rapid traverse rate. (N is specified in parameter No. 021.)

No	
041	Jog feedrate

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (4 user-specified units/MIN or greater)
[Standard value] 2000
[Description] Specifies the feedrate for job feed when the feedrate override value is 100%. (N is specified in parameter No. 021.)

No	
043	Feedrate upper limit

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535
[Standard value] 4000
[Description] Specifies the upper limit for the feedrate to be specified. If an attempt is made to specify a value larger than the upper limit, the actual feedrate is clamped to the upper limit. (N is specified in parameter No. 021.)

No	
044	Feedrate specified for feedrate code 1
045	Feedrate specified for feedrate code 2
046	Feedrate specified for feedrate code 3
047	Feedrate specified for feedrate code 4
048	Feedrate specified for feedrate code 5
049	Feedrate specified for feedrate code 6
050	Feedrate specified for feedrate code 7

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (4 user-specified units/MIN or greater)
[Standard value] 2000
[Description] Specify the feedrates corresponding to feedrate codes 1 to 7 for command data 1 for a function code command. (N is specified in parameter No. 021.)

No	
054	FL rate for a reference position return

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 100
[Description] Specifies a rate of movement to the next grid point during setting of the reference position. (N is specified in parameter No. 021.)

No	
061	F0 rate for rapid traverse override

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 10
[Description] Specifies the F0 rate for rapid traverse override. (N is specified in parameter No. 021.)

No	
066	F1 rate for rapid traverse override

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 10
[Description] Specifies the F1 rate for rapid traverse override. (N is specified in parameter No. 021.)

NOTE
This parameter is valid when bit 6 (RVF2) of parameter No. 002 is 1.

No	
067	F2 rate for rapid traverse override

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 10
[Description] Specifies the F2 rate for rapid traverse override. (N is specified in parameter No. 021.)

NOTE
This parameter is valid when bit 6 (RVF2) of parameter No. 002 is 1.

B.4 ACCELERATION/DECELERATION CONTROL PARAMETERS

No	#7	#6	#5	#4	#3	#2	#1	#0
002	CSMZ	RVF2			CIPC		JOGE	RPDE

[Size] 1 byte (bit type)
[Standard value] 0

NOTE
In the explanation below, cutting feed means a feed type that is neither rapid traverse nor jog feed.

RPDE Specifies the acceleration/deceleration type for rapid traverse, as follows:
0 : Linear or bell-shaped acceleration/deceleration

NOTE
Bell-shaped acceleration/deceleration is selected if rapid traverse bell-shaped acceleration/deceleration time constant T2 is specified.

1 : Exponential acceleration/deceleration

JOGE Specifies the acceleration/deceleration type for jog or cutting feed, as follows:
0 : Linear or bell-shaped acceleration/deceleration

NOTE
Bell-shaped acceleration/deceleration is selected if jog or cutting feed rapid traverse bell-shaped acceleration/deceleration time constant T2 is specified.

1 : Exponential acceleration/deceleration

CIPC Specifies whether to enable switching between effective areas for in-position check, regardless of whether a direct command specifies rapid traverse or cutting feed for the next block, as follows:
0 : Disabled.
1 : Enabled.

RVF2 For a rapid traverse override, a feedrate is specified in 4 steps of:
0 : 100%, 50%, 25%, F0.
1 : 100%, F1, F2, F0.
The table below lists override values determined by the rapid traverse override signals ROV1 and ROV2.

ROV2	ROV1	Override value	
		RVF2=0	RVF2=1
0	0	100%	100%
0	1	50%	F1
1	0	25%	F2
1	1	F0	F0

NOTE
For F0, F1, and F2, set actual feedrates in parameters No. 061, No. 066, and No. 067, respectively.

CSMZ Specifies whether to enable the output signal SMZX (Yy+7#5) of a direct command, as follows:
0 : Disabled.
1 : Enabled.

No	
055	Rapid traverse linear acceleration/deceleration time constant or rapid traverse bell-shaped acceleration/deceleration time constant T1
	Rapid traverse exponential acceleration/deceleration time constant

[Size] 2-byte
[Unit of data] msec
[Valid data range] 0 to 4000
[Standard value] 100
[Description] Specifies a rapid traverse acceleration/deceleration time constant. The acceleration/deceleration time constant to be used is determined depending on whether bit 0 of parameter No. 002 (RPDE) and rapid traverse bell-shaped acceleration/deceleration time constant T2 are set.

No	
056	Rapid traverse bell-shaped acceleration/deceleration time constant T2

[Size] 2-byte
[Unit of data] msec
[Valid data range] 0 to 512
[Standard value] 100
[Description] Specifies rapid traverse bell-shaped acceleration/deceleration time constant T2.

No	
057	Linear acceleration/deceleration time constant or bell-shaped acceleration/deceleration time constant T1 for jog feed or feed based on feedrate codes 1 to 7
	Exponential acceleration/deceleration time constant for jog feed or feed based on feedrate codes 1 to 7

[Size] 2-byte
[Unit of data] msec
[Valid data range] 0 to 4000
[Standard value] 100
[Description] Specifies an acceleration/deceleration time constant for jog feed or feed based on feedrate codes 1 to 7. The acceleration/deceleration time constant to be used is determined depending on whether bit 1 of parameter No. 002 (JOGE) and bell-shaped acceleration/deceleration time constant T2 for jog feed or feed based on feedrate codes 1 to 7 are set.

No	
058	Bell-shaped acceleration/deceleration time constant T2 for jog feed or feed based on feedrate codes 1 to 7

[Size] 2-byte
[Unit of data] msec
[Valid data range] 0 to 512
[Standard value] 100
[Description] Specifies bell-shaped acceleration/deceleration time constant T2 for jog feed or feed based on feedrate codes 1 to 7.

No	
059	Exponential acceleration/deceleration FL rate for jog feed or feed based on feedrate codes 1 to 7

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 10
[Description] Specifies the exponential acceleration/deceleration time constant FL rate for jog feed or feed based on feedrate codes 1 to 7. (N is specified in parameter No. 021.)

No	
060	FL rate for rapid traverse exponential acceleration/deceleration

[Size] 2-byte
[Unit of data] 10^N User-specified unit/MIN
[Valid data range] 1 to 65535 (7500 user-specified units/MIN or greater)
[Standard value] 10
[Description] Specifies the FL rate for rapid traverse exponential acceleration/deceleration. (N is specified in parameter No. 021.)

B.5 INPUT/OUTPUT SIGNALS PARAMETERS

No	#7	#6	#5	#4	#3	#2	#1	#0
003	STON	EXPLS	WAT2			IGCP	NCLP	

[Size] 1 byte (bit type)
[Standard value] 1 only for NCLP

NCLP Specifies whether to use clamping/unclamping, as follows:
0 : Clamping/unclamping is used.
1 : Clamping/unclamping is not used.

IGCP Specifies whether to check a clamp/unclamp state (UCPS2) before proceeding to the next sequence, as follows:
0 : A clamp/unclamp state is checked.
1 : A clamp/unclamp state is not checked.

WAT2 Indicates whether an ID code can be specified for a wait function, as follows:
0 : An ID code cannot be specified.
1 : An ID code can be specified.

EXPLS Indicates whether an axis movement function based on external pulses (pulses from a manual pulse generator) is valid, as follows:
0 : Invalid.
1 : Valid.

STON Specifies whether an automatic operation is started at the rising (off to on) or falling (on to off) edge of the automatic operation start (ST) signal, as follows:
0 : Falling edge (on to off)
1 : Rising edge (off to on)

No	#7	#6	#5	#4	#3	#2	#1	#0
004					NEPRM	ZRNO		

[Size] 1 byte (bit type)
[Standard value] 0

ZRNO Specifies whether to enable input of a reference position establishment signal, as follows:
0 : Disabled.
1 : Enabled.

NEPRM Specifies whether to perform writing to the EEPROM (memory for storing parameter settings) when rewriting parameters using peripheral device control or a direct command, as follows:
0 : Writing is performed.
1 : Writing is not performed.

⚠ CAUTION

1 There is a limit to the number of writes to the EEPROM (memory for storing parameter settings) (tens of thousands of writes). For this reason, set NEPR to 1 if parameters are to be rewritten frequently using peripheral device control or a direct command.

2 Those parameters that were rewritten to values different from their initial values when NEPRM was "1" must not be rewritten when NEPRM is "0." Otherwise, an EEPROM parity mismatch occurs, with the result that a parity error occurs and standard settings are loaded when the power is turned OFF and then ON again.
If parameters are rewritten from the MDI using the power mate CNC manager (PMM), writing to the EEPROM is performed regardless of the value of NEPRM. Consequently, a parity error also occurs if those parameters that were rewritten using the ladder when NEPRM was "1" are rewritten from the MDI.
(Example)
A parity error occurs and standard settings are loaded if the following is performed:

"3" is set for parameter No. 020 at power on.
↓
a) Set "1" for parameter No. 020 using the ladder when NEPRM is "1."
↓
b) Set "2" for parameter No. 020 using the ladder when NEPRM is "0."

Alternatively,

c) Set "2" for parameter No. 020 from the MDI using the PMM.
↓

Turn the power OFF and then ON again.
↓

Standard settings are loaded.

* If b) or c) is not performed, a parity error is not issued.

No	#7	#6	#5	#4	#3	#2	#1	#0
005	ABSPS	LDM	MP	IOH		REFDRC	CLPSVF	JNCL

[Size] 1 byte (bit type)
[Standard value] 0

JNCL Specifies whether to use clamping when JOG operation stops, as follows:
0 : Clamping is performed.
1 : Clamping is not performed. (The unclamp state is preserved.)

CLPSVF The time from clamping to servo off (parameter No. 168) is:
0 : Time from the point the unclamping instruction signal (UCPC2) turns off
1 : Time from the point the clamping/unclamp state output signal (UCPS2) turns off.

REFDRC The direction of the high-speed origin return of the rotation axis depends on:
0 : Sign of the result of subtracting the current position from the reference position.
1 : Setting of ZMIX (bit 5 of parameter No. 010).

IOH Specifies whether to enable manual handle feed over the I/O Link, as follows:
0 : Disabled.
1 : Enabled.

NOTE
When this parameter is set to 1, bit 6 (EXPLS) of parameter No. 003 must be set to 0.

MP Specifies whether to enable setting of a magnification in 4 steps with the MP1/MP2 signal for input manual handle pulses for manual handle feed, as follows:
0 : Disabled.
1 : Enabled.

LDM Specifies whether the output of the motor current value is valid to the response data (Xx+3 to Xx+6), as follows:
0 : Invalid.
1 : Valid.

ABSPS Specifies whether the host and a servo amplifier module are to be synchronized with each other in the response data read function, as follows:
0 : Not synchronized.
1 : Synchronized. (This makes it possible for the host to read the correct position even during axis movement.)

NOTE
1 For details, see Part II, Section 3.8, "Upgrading the Response Data Read Function."
2 When bit 5 of parameter No.007 is 1 (a turret/magazine number is always output to response data), set this parameter to 1.

No	#7	#6	#5	#4	#3	#2	#1	#0
007			ATCR2	VCTLB		NZRPO	PSSV	ABSV

[Size] 1 byte (bit type)
[Standard value] 0

ABSV Specifies whether to make allowance for delays including an acceleration/deceleration delay and servo delay when coordinates are read from the host to the servo amplifier module, as follows:
0 : Positions where allowance for delays is not made are read.
1 : Positions where allowance for delays is made (actual motor positions) are read.

NOTE
1 This parameter is valid when coordinates are read as described below.
(1) Machine coordinates or workpiece coordinates are output to response data for peripheral equipment control.
(2) A direct command is used to specify any of the following:
- Reading of absolute positions (function code 0x30)
- Reading of machine positions (function code 0x31)
- Reading of absolute positions or machine positions using a continuous data read command (function code 0x41)

2 Due to a delay, for example, in data exchange over the FANUC I/O Link, coordinate positions that are read have a maximum delay of 30 to 40 msec.

PSSV Specifies whether to make allowance for delays including an acceleration/deceleration delay and servo delay when area signals are input, as follows:
0 : Area signals are input at positions where allowance for delays is not made.
1 : Area signals are input at positions where allowance for delays is made (actual motor positions).

NZRPO Specifies whether to output a turret/magazine number or point number when ATC/turret control or point positioning control is performed, if a reference position is not established, as follows:

0 : Not output.
1 : Output.

> ⚠ **CAUTION**
> When an incremental pulse coder is used with bit 2 (NZRPO) of parameter No. 007 set to 1, be sure to set a coordinate system to establish a relationship between the machine and absolute coordinates, before performing ATC operation or point positioning. If ATC operation or point positioning is performed before a coordinate system is set, positioning to correct machine positions may not occur. A turret/magazine number or point number that is then output may not be correct.
> This affects all types of positioning, not only ATC operation and point positioning.

> **NOTE**
> 1 This parameter is valid when parameter No. 020 is set to 1.
> 2 This parameter is also valid when bit 5 of parameter No. 007 is 1 (a turret/magazine number is always output to response data).

VCTLB Specifies the velocity control type for peripheral equipment control, as follows:

0 : Type A (the torque limit value cannot be specified).
1 : Type B (the torque limit value can be specified).

ATCR2 Specifies when to output a turret/magazine number, as follows:

0 : A turret/magazine number is output when ATC/turret control is performed. (Conventional method)
1 : A turret/magazine number is always output. (New method)

> ⚠ **CAUTION**
> In the new method, even if a function code for other than ATC/turret control (function code 2) is specified, the turret/magazine number and MINP, +MOR, and -MOR signals corresponding to the current position are always output to response data. Note that, for example, if point positioning is performed, a point number and the MINP, +MOR, and -MOR signals corresponding to the point number are not output to response data.

NOTE

1 To enable the new method, the following conditions must also be satisfied.
   - Set parameters as described below to enable ATC/turret control (function code 2).
     Select a rotation axis (bit 1 of parameter No.000 is 1).
     Enable the roll-over function (bit 7 of parameter No.000 is 1).
     Set the number of magazines/turrets (parameter No. 068).
     Set an index point tolerance (parameter No. 170).
   - Set parameter No.020 to 1 (an ATC and point number are output to response data).
   - Set bit 7 of parameter No.005 to 1 (the host and a servo amplifier module are synchronized with each other in the response data read function).

2 In the new method, response data must be read in a synchronous manner. The response data retained is thus based on a position when the logic of ABSWT (XX+1#0) is reversed, and the data is not updated until the next time the ABSWT logic is reversed.

No	
020	Response data specification (PHOUT)

[Size] 1 byte
[Standard value] 3

PHOUT Specifies whether or what to output as response data (Xx+3 to Xx+6), as follows:

0 : Nothing is output.
1 : An ATC and point No. are output if an ATC cycle and point positioning are involved.
2 : Machine coordinates are output in real time.
3 : Workpiece coordinates are output in real time.
4 : The motor current value is output. The motor current value is 6554, which is the maximum current value for the amplifier.
5 : Measurement data (workpiece coordinates) obtained when a skip signal is input is output.
6 : An actual feedrate is output in real time.
[Unit of data] 10^NUser-specified unit/MIN (N:Parameter No. 021)
7 : An actual speed is output in real time.
[Unit of data] min^{-1}
8 : A torque command is output in real time. The maximum value of a torque command is 6554.
The least significant bit is a signal indicating whether the torque limit is reached.
Least significant bit =
0: The torque limit is not reached.
1: The torque limit is reached.

NOTE
1 An ATC and point number are not output until a reference position is established. When bit 2 (NZRPO) of parameter No. 007 is set to 1, however, an ATC and point number are output even if a reference position is not established.
2 If the motor current value is output as response data, set LDM (bit 6 of parameter No. 005) to "1" and set "4" for parameter No. 020.
3 When bit 5 of parameter No. 007 is 1 (a turret/magazine number is always output to response data), set this parameter to 1.
4 The value of an actual speed is output with a sign. While the motor is being stopped, the motor current may drift, causing the sign to be unstable.

No	
022	ECF and EBSY signal minimum output time

[Size] 1 byte
[Unit of data] 8msec
[Valid data range] 0 to 127
[Standard value] 5
[Description] Specifies the minimum output time for the ECF and EBSY signals (direct command interface control flag 2). This is valid when the power mate CNC manager is used.

No	
023	PMM allocation rate assumed when reading continuous data with a direct command

[Size] 1 byte
[Valid data range] 0 to 100
[Standard value] 50
Do not change the parameter from its standard value.

No	
024	Axis name (1st character)

No	
025	Axis name (2nd character)

[Size] 1 byte
[Valid data range] 0, 32 (" " space)
48 ("0") to 57 ("9")
65 ("A") to 90 ("Z")
[Description] Set an axis name using two characters (parameters No. 024 and No. 025).
If a setting is out of range, " " (space) is displayed.
When parameter No. 024 is set to 0, an axis name is 1, regardless of the setting of parameter No. 025.

Setting	Displayed character
0	Space
32	Space
48	0
49	1
50	2
51	3
52	4
53	5
54	6
55	7

Setting	Displayed character
56	8
57	9
65	A
66	B
67	C
68	D
69	E
70	F
71	G
72	H

Setting	Displayed character
73	I
74	J
75	K
76	L
77	M
78	N
79	O
80	P
81	Q
82	R

Setting	Displayed character
83	S
84	T
85	U
86	V
87	W
88	X
89	Y
90	Z

Example)
To set **X3** as an axis name:
Set parameter No. 024 to 88 and parameter No. 025 to 51.

No	
029	Internal variable

[Size] 1 byte
Do not change the value of the parameter.

NOTE
1 Even if this parameter has a nonzero value, ignore the parameter without changing the value.
2 There is no problem even if this parameter is rewritten when all parameters are written at once.

No	
062	External pulse input-based axis movement amount ratio setting 1 (M)
063	External pulse input-based axis movement amount ratio setting 2 (N)

[Size] 2-byte
[Valid data range] 1 to 32767
[Standard value] 1
[Description] Specify a ratio M/N for an axis movement amount based on an external pulse input.

No	
148	Servo positional deviation monitor amount

[Size] 4-byte
[Unit of data] Detection unit
[Valid data range] 0 to 99999999
[Standard value] 99999999
[Description] Specifies the servo positional deviation monitor amount. The SVERX signal becomes 1 when the servo positional deviation amount becomes larger than the value specified in this parameter.

No	
149	Remaining travel limit for outputting the remaining travel in-range signal (DEN2)

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to 99999999
[Standard value] 0
[Description] Specifies the absolute value of a remaining travel value used as a limit to output the remaining travel in-range signal (DEN2).

No	
150	Coordinates (minimum) for point 1 in the operation range of the area signals
151	Coordinates for point 2 in the operation range of the area signals
152	Coordinates for point 3 in the operation range of the area signals

[Size] 4-byte
[Unit of data] User-specified unit
[Valid data range] 0 to ±99999999
[Standard value] 0
[Description] Specify the points for the output range of the area signals using machine coordinates. Area signals PSG1 and PSG2 are output according to the result of comparison between the machine coordinate and a parameter-specified value. The output conditions are listed below. ABSMT represents the current machine coordinate.

Condition	PSG2	PSG1
ABSMT < point 1	0	0
Point 1 ≤ ABSMT < point 2	0	1
Point 2 ≤ ABSMT < point 3	1	0
Point 3 ≤ ABSMT	1	1

NOTE
When bit 1 (PSSV) of parameter No. 007 is 1, area signals can be input at actual motor position where allowance for delays including an acceleration/deceleration delay and motor delay is made.

No	
166	Operation completion signal output time

[Size] 4-byte
[Unit of data] 8msec
[Valid data range] 0 to 99999999
[Standard value] 5
[Description] Specifies the output time for operation completion signals OPC1 to OPC4.

NOTE
If 0 is set, no operation completion signal is not output.

No	
167	**Time between servo-on and unclamping**

[Size] 4-byte
[Unit of data] 8msec
[Valid data range] 0 to 99999999
[Standard value] 0
[Description] Specifies a time interval from the time the servo system is switched on until the machine is unclamped if clamping/unclamping is used.

No	
168	**Time between clamping and servo-off**

[Size] 4-byte
[Unit of data] 8msec
[Valid data range] 0 to 99999999
[Standard value] 0
[Description] Specifies a time interval from the time the machine is clamped until the servo system is switched off if clamping/unclamping is used.

No	
169	**Time allowed before the next sequence is executed without clamping/unclamping**

[Size] 4-byte
[Unit of data] 8msec
[Valid data range] 0 to 99999999
[Standard value] 0
[Description] Specifies a time interval from the time the clamp/unclamp command (UCPC2) is issued until the next sequence is started, if the clamp/unclamp state signal (UCPS2) is not to be checked. Whether to check the clamp/unclamp state signal (UCPS2) is specified using bit 2 of parameter No. 003 (IGCP).

B.6 SERVO PARAMETERS

No	#7	#6	#5	#4	#3	#2	#1	#0
010	SVFP	ECMR	ZMIX			IEBL	IALM	IINP

[Size] 1 byte (bit type)
[Standard value] 1 for SVFP only

IINP Specifies whether to make in-position check when the torque is limited, as follows:
0 : In-position check is not made.
1 : In-position check is made.

NOTE
This parameter is valid, when parameter No.0108 is not 0 and IEBL = 1.

IALM Specifies whether to check for a stop- and movement-time excessive error when the torque is limited, as follows:
0 : An error check is not made.
1 : An error check is made.

NOTE
This parameter is valid, when parameter No.0108 is not 0 and IEBL = 1.

IEBL Specifies whether to enable the torque limit function, as follows:
0 : Disable
1 : Enable

ZMIX Specifies the initial direction of backlash and grid movement in a reference position return without dogs, as follows:
0 : Positive direction
1 : Negative direction

ECMR Specifies whether to enable expansion of the setting range for the command multiplier, as follows:
0 : Disabled. (The setting of parameter No. 032 is valid for the command multiplier.)
1 : Enabled. (The setting of parameter No. 138 is valid for the command multiplier.)

SVFP Specifies whether to perform follow-up, as follows:
0 : Follow-up is not performed.
1 : Follow-up is performed.

No	#7	#6	#5	#4	#3	#2	#1	#0
011	APCX	MVZPFR				DZRN	SZRN	ABSX

[Size] 1 byte (bit type)
[Standard value] 1 only for APCX

ABSX Indicates whether the absolute position detector has been associated with the machine position, as follows:
0 : Has not been associated
1 : Has been associated

SZRN Specifies the type of positioning to a grid to be performed for a manual reference position return if the feed axis and direction selection signal (+X, -X, or I/O link signal from the host) is 1 for reference position return without dogs, as follows:
0 : Positioning to a grid is performed only once.
1 : Positioning to a grid is performed each time the feed axis and direction selection signal becomes 1.

DZRN Specifies whether the reference position return function with dogs is valid, as follows:
0 : Invalid. (The reference position return function without dogs is selected.)
1 : Valid

> ⚠ **CAUTION**
> When DZRN = 1, the high-speed interlock signal (*RILK) is invalid.

MVZPFR On a rotation axis where the absolute-position detector is used, when the reference position is updated and the value of the amount of movement has a fractional part:
0 : The reference position is updated, making allowance for the fractional part.
1 : The reference position is updated, without making allowance for the fractional part.

> **NOTE**
> Set this parameter to 1 only when a rotation axis uses the absolute-position detector, and a positional error may occur, as described in the notes on parameter No. 032. Otherwise, this parameter must be set to 0.

LIMITATIONS

When this parameter is used, the limits below are imposed on the settings of the amount of movement per rotation axis revolution (parameter No. 141), command multiplier (CMR) (parameter No. 032), and denominator for the number of pulses per motor revolution (SDMR2) (parameter No. 106). If any of the limits is exceeded, this parameter cannot be used.

Amount of movement per rotation axis revolution (parameter No. 141) × K
× Denominator for the number of pulses per motor revolution (parameter No. 106) ≤ 247 - 1
where

$$K = \frac{\text{User-specified unit}}{\text{Detection unit}}$$

- When K ≥ 1, CMR = 2 × K (1 ≤ K ≤ 48).
  (When expanded CMR (parameter No. 138) is used, however, 1 ≤ K ≤ 200.)
- When K < 1, CMR = 1/K + 100 (1/2 ≤ K ≤ 1/27).
  If K ≥ 1, the above conditional expression applies.
  If K < 1, the conditional expression does not require the K term, and is set as follows.
  Amount of movement per rotation axis revolution (parameter No. 141)
  × Denominator for the number of pulses per motor revolution (parameter No.106) ≤ 247 - 1

APCX Indicates whether a detector for an absolute pulse coder is available.
0 : Unavailable
1 : Available

No	#7	#6	#5	#4	#3	#2	#1	#0
012							DGPR	

[Size] 1 byte (bit type)
[Standard value] 0

DGPR Specifies whether to set motor-specific servo parameters when the power is switched on.
0 : Set.
1 : Do not set.

After a motor type (parameter No. 30) is specified, resetting this bit to 0 automatically sets up the standard values for the motor when the power is turned on. At the same time, the bit is set to 1 again.

No	#7	#6	#5	#4	#3	#2	#1	#0
013			TSA2	TSA1			VCM2	VCM1

[Size] 1 byte (bit type)
[Standard value] 0

When bits 0 and 1 of parameter No. 14 are 0 and 0, the following signals are output to the servo check board.

DATA0 VCMD (velocity command)
DATA1 TCMD (torque command)
DATA2 TSA (actual speed)

These parameters determine the scale of data on DATA0 and DATA2, as listed below:

VCM2	VCM1	DATA0
0	0	For VCMD, 5 V corresponds to 3750 min^{-1}.
0	1	For VCMD, 5 V corresponds to 234 min^{-1}.
1	0	For VCMD, 5 V corresponds to 14.6 min^{-1}.
1	1	For VCMD, 5 V corresponds to 0.92 min^{-1}.

TSA2	TSA1	DATA2
0	0	For TSA, 5 V corresponds to 3750 min^{-1}.
0	1	For TSA, 5 V corresponds to 234 min^{-1}.
1	0	For TSA, 5 V corresponds to 14.6 min^{-1}.
1	1	For TSA, 5 V corresponds to 0.92 min^{-1}.

No	#7	#6	#5	#4	#3	#2	#1	#0
014							TDOU	IRS

[Size] 1 byte (bit type)
[Standard value] 0

IRS Setting this bit to 1 causes the following current to flow in check board DATA0 and DATA1.
Bit 1 of parameter No. 014 must be set to 0.

DATA0 R-phase actual current (4 V corresponds the maximum current.)
DATA1 S-phase actual current (4 V corresponds the maximum current.)

TDOU Setting this bit to 1 causes a specified acceleration and an estimated load torque to be output to DATA0 and DATA1 of the check board.
Bit 0 of parameter No. 014 must be set to 0.

DATA0 Specified acceleration
DATA1 Estimated load torque

No	#7	#6	#5	#4	#3	#2	#1	#0
016			FFAL	FFVL			LVMD	PIIP

[Size] 1 byte (bit type)
[Standard value] 0

PIIP
0 : Specifies that the velocity loop be subject to PI control.
1 : Specifies that the velocity loop be subject to IP control.

LVMD
0 : Disables the low-velocity integration function.
1 : Enables the low-velocity integration function.

FFVL, FFAL
Specify whether to enable the feed-forward function.
The feed-forward function is enabled only when FFVL and FFAL are 1.

FFVL	FFAL	Description
1	1	The feed-forward function is enabled.
0	*	The feed-forward function is disabled regardless of whether FFAL is 1.
1	0	The feed-forward function is disabled.

No	#7	#6	#5	#4	#3	#2	#1	#0
017						SPCO	HEDG	HENB

[Size] 1 byte (bit type)
[Standard value] 0

HENB
Specifies whether to use the skip function.
0 : The skip function is not used.
1 : The skip function is used.

HEDG
When a skip signal is used with the skip function:
0 : The skip signal is handled as an input signal on the rising edge (0 → 1).
1 : The skip signal is handled as an input signal on the falling edge(1 → 0).

SPCO
During execution of the skip function, if a skip signal (HDI) is not input and the end point is reached:
0 : The data on the last skip measurement is retained.
1 : Specified coordinates of the end point are recorded as skip measurement data.

No	
030	Set 0. Set the motor type number in parameter No. 125.

Set parameter No. 030 to 0, and set the motor type number in parameter No. 125.