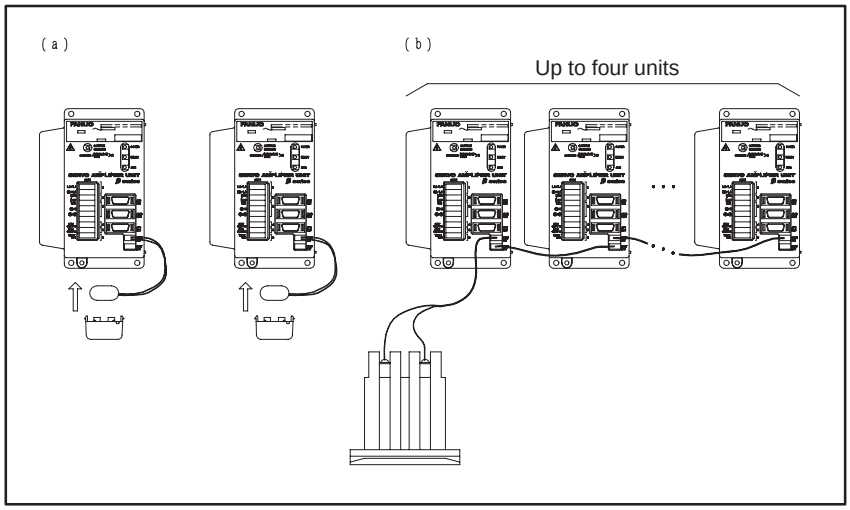
1 REPLACING BATTERY OF THE ABSOLUTE PULSE CODER

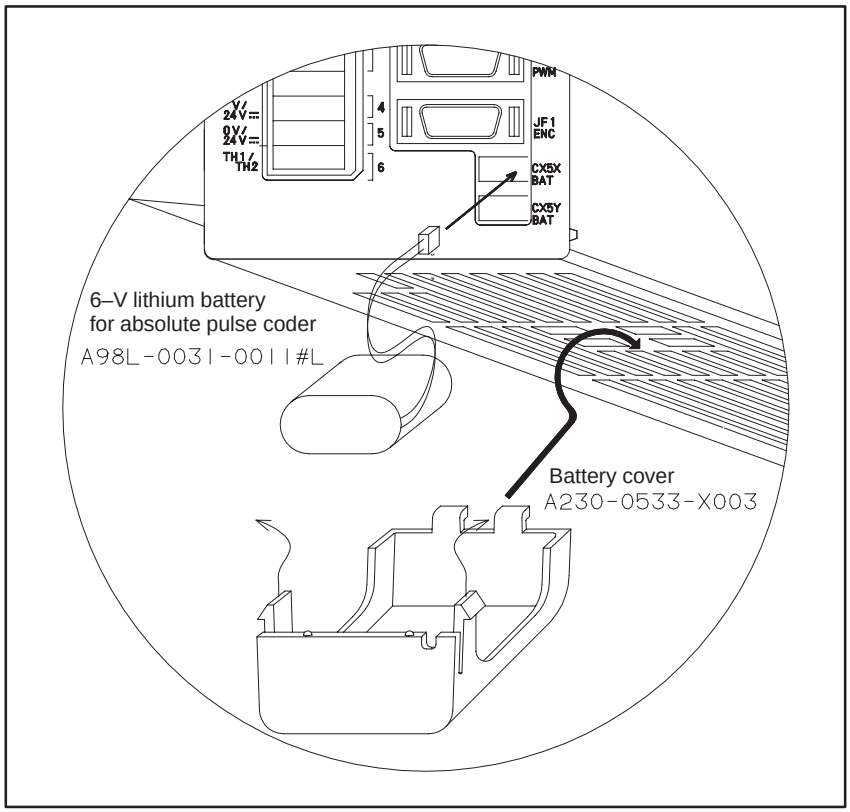
When an absolute pulse coder is used, a battery is provided for the absolute pulse coder. When the voltage of this battery falls, alarm 350 or 351 is issued. If alarm 351 is issued, replace the battery immediately. If the battery voltage falls further, the absolute position of the pulse coder cannot be stored. If the servo unit is turned on in this state, alarm 350 is issued. If this alarm is issued, replace the battery, then perform reference position return.

The battery is connected in either of the two ways shown below:



(a) 6–V lithium battery

1. Have a new 6–V lithium battery (order code: A98L–0031–0011#L) on hand.
2. Turn the servo unit (machine) on. (The battery must not be replaced while the power to the servo unit is off.) To prevent inadvertent operation of the machine while the battery is being replaced, take appropriate precautions. For example, place the unit in the emergency stop state.
3. Remove the battery cover under the servo unit by grasping its left and right sides.
4. Remove the connector from the battery.
5. Replace the battery, then re–attach the connector.
6. Mount the battery cover.
7. Turn the servo unit (machine) off.



CAUTION

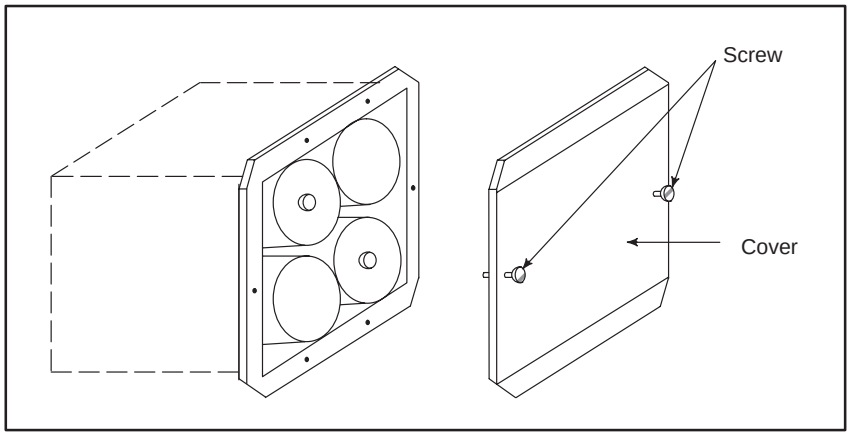
1 Replace the battery only while the power to the servo unit is on. If the battery is replaced while the power is off, all of the absolute position settings will be lost.

2 Ensure that the replacement battery is of the correct type. Otherwise, explosion or ignition will occur. Always use the specified battery (code: A98L–0031–0011#L).

3 The battery has a life of about one year. Even if a low–voltage alarm is not issued, replace the battery regularly at yearly intervals.

(b) Alkaline battery (D–size)

1. Have four D–size alkaline batteries on hand.
2. Turn the servo unit (machine) on. Replace the battery while the power to the servo unit is on. To prevent in advertent operation of the machine while the battery is being replaced, take appropriate precautions. For example, place the unit in the emergency stop state.
3. Loosen the screws on the battery case. Remove the cover.
4. Replace the dry cells in the case.
   Orient the batteries as shown below. Pay careful attention to the polarity of the dry cells.



5. Attach the cover.
6. Turn the servo unit (machine) off.

CAUTION

1 Replace the batteries only while the power to the servo unit is on. If the batteries are replaced while the power is off, all the absolute position settings will be lost.

2 The batteries have a life of about one year. Even if a low–voltage alarm is not issued, replace the battery regularly at yearly intervals.

V. MAINTENANCE OF SERVO MOTOR

1 MAINTENANCE OF SERVO MOTOR

The β–series servo motors generally do not require periodic maintenance because the motors have no wearing components, such as the brushes of a DC motor. However, incorrect operation or damage during transportation or installation may result in a failure or problem. To prevent such a failure or problem, and to ensure that the servo motor remains in peak condition for as long as possible, periodic checks are necessary.

1.1 ACCEPTANCE INSPECTION AND SERVO MOTOR STORAGE

Upon taking delivery of a servo motor, check the following points:

- Is the motor of the correct specification? (model, shaft, detector, etc.)
- Has the motor been damaged in transit?
- Can the shaft be rotated normally by hand?
- Does the brake operate normally?
- As all the screws securely tightened?

Usually, store the motor indoors, in a location where the temperature falls within the range of –20°C to +60°C.

Avoid storing the motor in the following locations:

- Location where the temperature is very high or where condensation is likely
- Location where the temperature varies widely
- Location subjected to constant vibration (Vibration may damage the bearings.)
- Location subject to much dust

FANUC servo motors are rigorously tested before delivery and do not normally require an acceptance inspection.

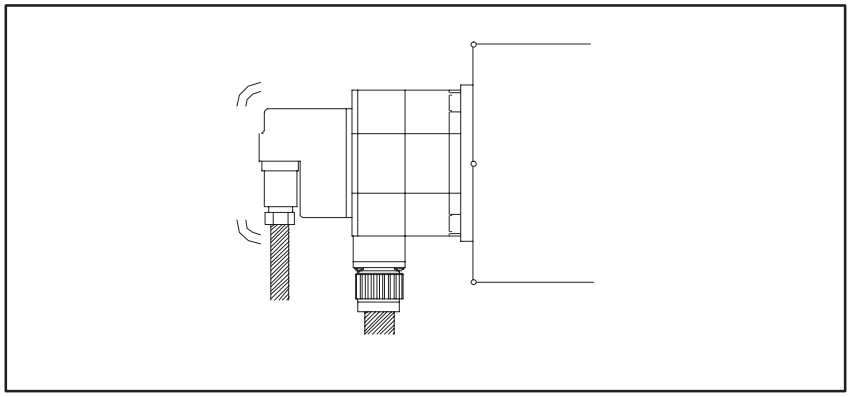
1.2 ROUTINE CHECK OF SERVO MOTOR

Make the following checks before starting operation, or once a week or month.

(1) Vibration or abnormal noise
Check the servo motor for abnormal vibration or noise in the following statuses:

- While stopped
- During low–speed operation
- During acceleration or deceleration

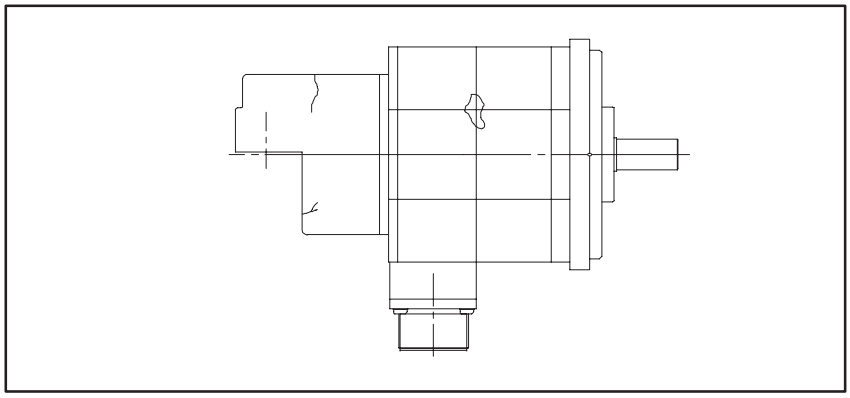
If any abnormal vibration or sound is detected, contact a FANUC service station.



(2) External damage

Check the motor cover (red plastic cover) for cracks and the motor surface (black–coated) for any abnormalities.

If any cracks are found, perform repair immediately. Alternatively, replace the motor. If you have any questions about the replacement, contact a FANUC service station.

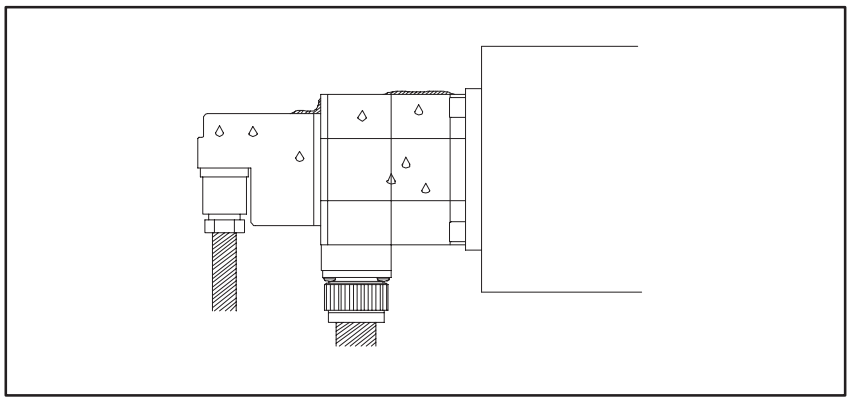


(3) Dirt

Check the motor surface, screw indentations, and other places for oil or coolant build–up.

Oil or coolant fouling on the surface causes a chemical reaction that affects the coating, ultimately resulting in failure. Wipe away the oil and coolant regularly.

If extensive fouling is noted, determine how the oil or coolant is reaching the motor. Take appropriate action to protect the motor from the oil or coolant. For example, fit a cover.



(4) Insulation resistance check
Measure the insulation resistance between the motor winding and motor frame, using a megohmmeter (500 VDC). Determine whether the insulation resistance is satisfactory according to the standards listed below:

Insulation resistance	Judgment
100MΩ or higher	The insulation is satisfactory.
10 to 100MΩ	The insulation has started to degrade. The degradation has not yet adversely affected the performance. Before starting operation, however, always check the insulation for further degradation. Alternatively, replace the motor.
1 to 10MΩ	The insulation has degraded substantially. Extreme care is necessary. Before starting the operation, always check the insulation for further degradation. Alternatively, replace the motor.
Up to 1 MΩ	The insulation is unacceptable. Replace the motor.

(5) Observation of torque command (TCMD) waveform and velocity command (VCMD) waveform

Using an oscilloscope, display a normal voltage waveform. Compare the normal waveform with that observed at the periodic check.

The waveform varies with the load, feedrate, and other conditions. Compare the waveforms observed under identical conditions (rapid traverse at a reference position return, low–speed feed, for example).

For details of the observation, see Appendix E, ”Servo Check Board.”

(6) Heat check
Check whether the motor has overheated during operation. Check the temperature of the motor surface by using a thermolabel or some other means.

WARNING
The motor surface may reach temperatures as high as 80°C under some operating conditions. Do not touch the motor.

1.3 PERIODIC CHECK OF SERVO MOTOR

Make the following checks about once a year.

(1) Observation of torque command (TCMD) waveform and velocity command (VCMD) waveform

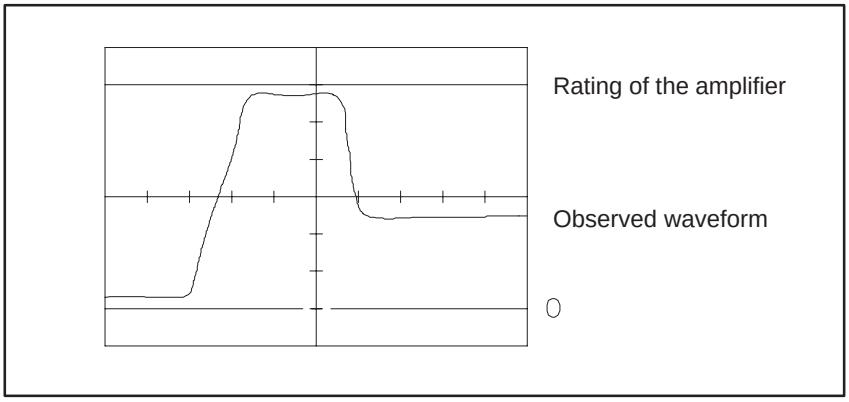
Using an oscilloscope, display a normal voltage waveform. Compare the normal waveform with that observed at a periodic check.

The waveform varies with the load, feedrate, and other conditions. Compare the waveforms observed under identical conditions (rapid traverse at reference position return, low–speed feed, for example).

For details of the observation, see Appendix E, ”Servo Check Board.”

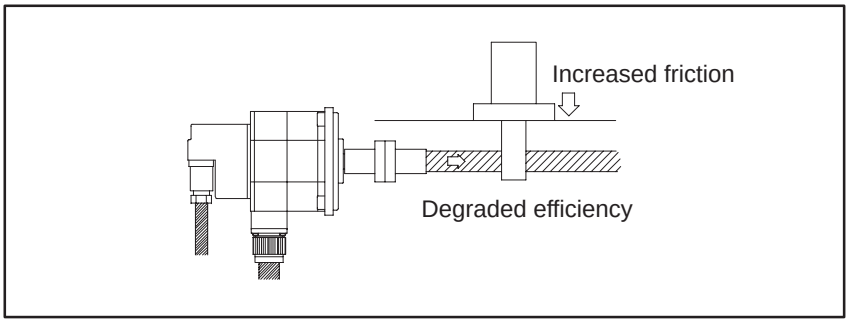
(2) Waveform diagnosis
Check the observed waveform for the following points:

1. Check whether the peak current at rapid traverse acceleration/deceleration exceeds the rating of the amplifier.
If the peak current exceeds the normal value, the load conditions of the machine may have been changed, or the motor may be defective.



A change in the load conditions of the mechanical system may be caused by the following:

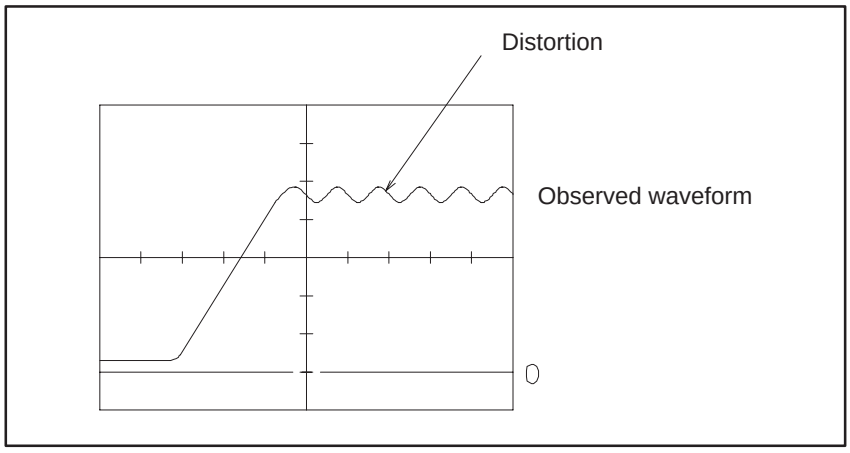
- The internal friction of the machine has changed over time.
- The machine efficiency has been degraded, requiring more power.



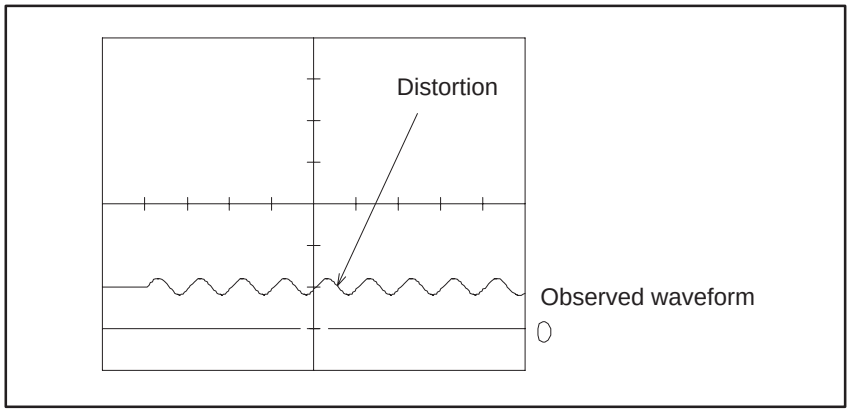
The amplifier ratings are as follows:

β 0.5/3000, β 1/3000, β 2/3000, α1/3000, α 2/2000, α 2/3000	12Apeak
β 3/3000, β 6/2000, αC3/2000, α C6/2000, α C12/2000	20Apeak

2. Check whether the waveform is distorted during constant–speed feed.



3. Check whether the current waveform is distorted in the stop state.



If any abnormality is found when 1, 2, or 3 is checked, contact a FANUC service station.

1.4 ORDER CODES OF REPLACEMENT COMPONENTS

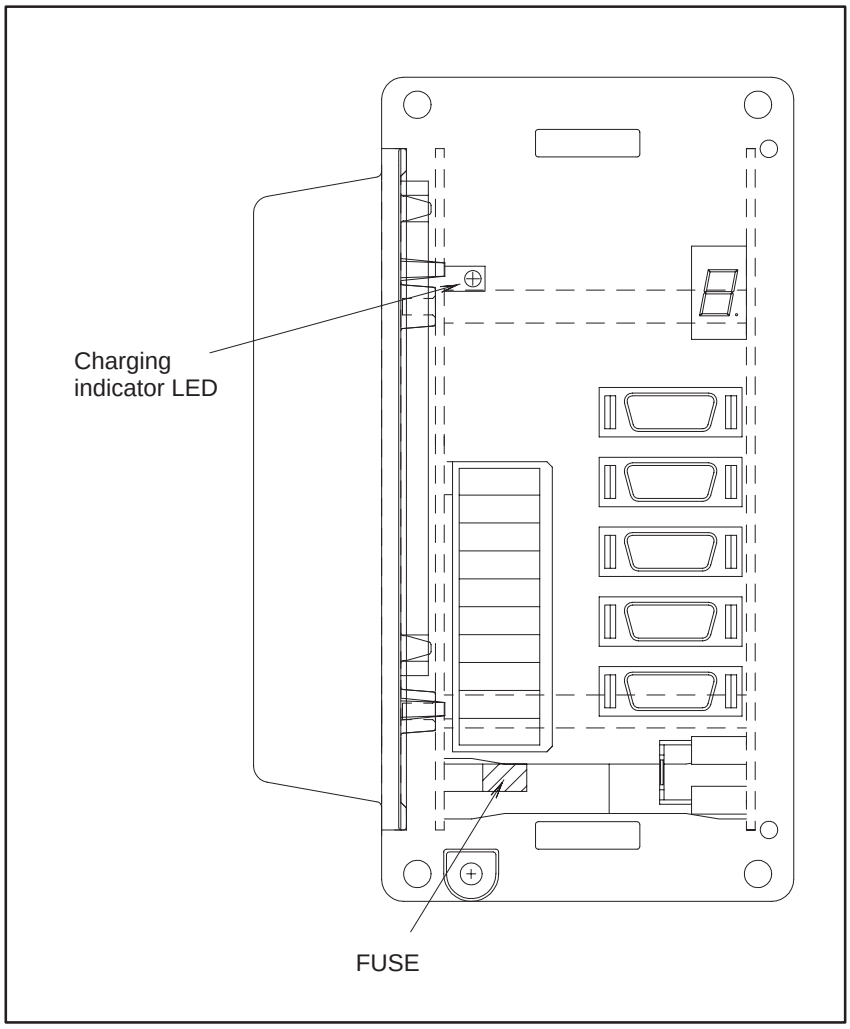
The order codes for maintenance parts are listed below:

(1) Oil seal (NOK Corporation)

Motor model		Oil seal code (manufacturer code)
β 0.5/3000		A98L–0001–0135/C0514E5 (AC0514E5 SC type)
β 1/3000 α 1/3000 α 2/3000	β 2/300 α 2/2000	A98L–0001–0135/C0616E2 (AC0616E2 SC type)
β 3/3000 α C3/2000	β 6/2000 α C6/2000	A98L–0004–0249/A1188RX (BC3554E1)
α C12/2000		A98L–0004–0249/A1189RX(BC3555E1)

APPENDIXES

A SERVO AMPLIFIER UNIT FRONT VIEW



B PARAMETERS

1. Controlled–axis parameters (data No. 000)
2. Coordinate system and stroke limit parameters (data Nos. 001, 068, 140 to 147, 154 to 165, 170)
3. Feedrate parameters (data Nos. 021, 040 to 050, 054, 061)
4. Acceleration/deceleration control parameters (data Nos. 002, 055 to 060)
5. Input/output signal parameters (data Nos. 003, 004, 020, 022, 062, 063, 148 to 152, 166 to 169)
6. Servo parameters (data Nos. 010 to 014, 016, 030 to 032, 070 to 092, 100 to 111, 180 to 182)

CAUTION
Do not change any parameters during operation.

B.1 CONTROLLED–AXIS PARAMETERS

	#7	#6	#5	#4	#3	#2	#1	#0
000	ROAX	RABX					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

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

CAUTION

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

B.2 COORDINATE SYSTEM AND STROKE LIMIT PARAMETERS

	#7	#6	#5	#4	#3	#2	#1	#0
001	EPEXB	EPEXA			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

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. 43.

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 detected, 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 detected, leading to deceleration and stop.

068	Number of magazines/turrets

Size : 2–byte
Range : 1 to 9999
Standard value : 0
Description : Sets up the number of magazines/turrets.

140	Machine coordinate of the reference position

Size : 4 bytes
Unit : User–specified unit
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.