

# Chapter 8

## Troubleshooting

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# 8-1 Error Processing

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## Preliminary Checks When a Problem Occurs

This section explains the preliminary checks and analytical tools required to determine the cause of a problem.

### ■ Checking the Power Supply Voltage

- ◆ Check the voltage at the power supply input terminals.

Main Circuit Power Supply Input Terminals (L1, L3)

R88D-GN□L-ML2 (50 W to 400 W): Single-phase, 100 to 115 VAC (85 to 127 V), 50/60 Hz

R88D-GN□H-ML2 (100 W to 1.5 kW): Single-phase, 200 to 240 VAC (170 to 264 V), 50/60 Hz

Main Circuit Power Supply Input Terminals (L1, L2, L3)

R88D-GN□H-ML2 (750 W to 7.5 kW): Three-phase, 200 to 240 VAC (170 to 264 V), 50/60 Hz

Control Circuit Power Supply Input Terminals (L1C, L2C)

R88D-GN□L-ML2: Single-phase, 100 to 115 VAC (85 to 127 V), 50/60 Hz

R88D-GN□H-ML2: Single-phase, 200 to 240 VAC (170 to 264 V), 50/60 Hz

If the voltage is outside of this range, there is a risk of operation failure, so be sure that the power supply is correct.

- ◆ Check the voltage of the sequence input power supply. (+24 VIN Terminal (CN1 pin 1))

Within the range of 11 to 25 VDC

If the voltage is outside of this range, there is a risk of operation failure, so be sure that the power supply is correct.

### ■ Checking Whether an Alarm Has Occurred

- ◆ Evaluate the problem using the 7-segment LED display on the front panel.  
You can also evaluate the problem by using the R88A-PR02G Parameter Unit.
- ◆ CX-Drive can also be used for the display. The operation status can also be monitored.  
Check the load status, including data trace.
- ◆ When an alarm has occurred:  
Check the alarm code that is displayed (□□) and evaluate the problem based on the alarm that is indicated.
- ◆ When an alarm has not occurred:  
Make an analysis according to the problem.

## Precautions When Troubleshooting

When checking and verifying I/O after a problem has occurred, the Servo Drive may suddenly start to operate or suddenly stop, so always take the following precautions.

You should assume that anything not described in this manual is not possible with this product.

### ■ Precautions

- ♦ Disconnect the cable before checking for wire breakage. Even if you test conduction with the cable connected, test results may not be accurate due to conduction via bypassing circuit.
- ♦ If the encoder signal is lost, the Servomotor may run away, or an error may occur. Be sure to disconnect the Servomotor from the mechanical system before checking the encoder signal.
- ♦ When performing tests, first check that there are no persons in the vicinity of the equipment, and that the equipment will not be damaged even if the Servomotor runs away. Before performing the tests, verify that you can immediately stop the machine using an emergency stop even if the Servomotor runs away.

## Replacing the Servomotor and Servo Drive

Use the following procedure to replace the Servomotor or Servo Drive.

### ■ Replacing the Servomotor

#### 1. Replace the Servomotor.

#### 2. Perform origin position alignment (for position control).

- ♦ When the Servomotor is replaced, the Servomotor's origin position (phase Z) may deviate, so origin alignment must be performed.
- ♦ Refer to the Position Controller's manual for details on performing origin alignment.

#### 3. Set up the absolute encoder.

- ♦ If a Servomotor with an absolute encoder is used, the absolute value data in the absolute encoder will be cleared when the Servomotor is replaced, so setup is again required. The rotation data will be different from before the Servomotor was replaced, so reset the initial Motion Control Unit parameters.
- ♦ For details, refer to *Absolute Encoder Setup* on page 6-6.

### ■ Replacing the Servo Drive

#### 1. Copy the parameters.

Use the Parameter Unit or CX-Drive to write down all the parameter settings or save them.

#### 2. Replace the Servo Drive.

#### 3. Set the parameters.

Use the Parameter Unit or CX-Drive to set all the parameters.

#### 4. Set up the absolute encoder.

- ♦ If a Servomotor with an absolute encoder is used, the absolute value data in the absolute encoder will be cleared when the Servo Drive is replaced, so setup is again required. The rotation data will be different from before the Servo Drive was replaced, so reset the initial Motion Control Unit parameters.
- ♦ For details, refer to *Absolute Encoder Setup* on page 6-6.

## 8-2 Alarm Table

### ■ Protective Functions

The Servo Drive has built-in protective functions. When a protective function is activated, the Servo Drive turns OFF the alarm output signal (ALM) and switches to the Servo OFF status. The alarm code will be displayed on the front panel.

Alarm type	Description
---	Protective function that allows the alarm to be reset, and leaves record in the alarm history.
PR	Protective function that does not allow the alarm to be reset, and requires the control power supply to be turned OFF and turned ON again after resolving the problem.
X	Protective function that does not leave record in the alarm history.

#### Precautions for Correct Use

- ♦ Alarms can be reset via the network, CX-Drive or the Parameter Unit.
- ♦ Overload (alarm code 16) cannot be reset for approximately 10 s after its occurrence.
- ♦ If "HH", "hh", or "yy" is displayed on the Alarm Number display, the built-in MPU is malfunctioning. Turn OFF the power supply.

### ■ Warning Function

The Servo Drive issues a warning before a protective function is activated, allowing you to check overload and other status in advance. A warning is also issued for a network error, allowing you to check the network status.

## ■ Alarms

Alarm Display	Alarm Type	Error Detection Function	Detection Details and Cause of Error
11	X	Control power supply undervoltage	The DC voltage of the main circuit has dropped below the specified value.
12	---	Overvoltage	The DC voltage of the main circuit is abnormally high.
13	X	Main power supply undervoltage	The DC voltage of the main circuit is low.
14	PR	Overcurrent	Overcurrent flowed to the IGBT. Servomotor power line ground fault or short circuit.
15	PR	Servo Drive overheat	The temperature of the Servo Drive radiator exceeded the specified value.
16	---	Overload	Operation was performed with torque significantly exceeding the rating for several seconds to several tens of seconds.
18	PR	Regeneration overload	The regenerative energy exceeded the processing capacity of the regeneration resistor.
21	PR	Encoder communications error	Communications between the encoder and the Servo Drive failed for a specified number of times, thereby activating the error detection function.
23	PR	Encoder communications data error	Communications error occurred for the data from the encoder.
24	---	Deviation counter overflow	The number of position deviation pulses exceeded the Deviation Counter Overflow Level (Pn209).
26	---	Overspeed	The rotation speed of the Servomotor exceeded the setting of the Overspeed Detection Level Setting (Pn073).
27	PR	Command error	The operation command resulted in an error.
29	---	Internal deviation counter overflow	The value of the internal deviation counter (internal control unit) exceeded $2^{27}$ (134217728).
34	---	Overrun limit error	The Servomotor exceeded the allowable operating range set in the Overrun Limit Setting (Pn026) with respect to the position command input.
36	PR X	Parameter error	Data in the parameter save area was corrupted when the data was read from the EEPROM at power-ON.
37	PR X	Parameter corruption	The EEPROM write verification data was corrupted when the data was read from the EEPROM at power-ON.
38	X	Drive prohibit input error	Forward and Reverse Drive Prohibit Inputs (NOT and POT) both became OPEN.
40	PR	Absolute encoder system down error	<b>ABS</b> The voltage supplied to the absolute encoder dropped below the specified value.
41	PR	Absolute encoder counter overflow error	<b>ABS</b> The multi-turn counter of the absolute encoder exceeded the specified value.
42	PR	Absolute encoder overspeed error	<b>ABS</b> The Servomotor rotation speed exceeded the specified value when power to the absolute encoder is supplied by the battery only.
44	PR	Absolute encoder one-turn counter error	A one-turn counter error was detected.
45	PR	Absolute encoder multi-turn counter error	An absolute encoder multi-turn counter or incremental encoder phase AB signal error was detected.
47	---	Absolute encoder status error	<b>ABS</b> The rotation of the absolute encoder is higher than the specified value.

## 8-2 Alarm Table

Alarm Display	Alarm Type	Error Detection Function	Detection Details and Cause of Error
48	R	Encoder phase Z error	A phase-Z pulse was not detected regularly.
49	R	Encoder PS signal error	A logic error was detected in the PS signal.
82	R	Node address setting error	The rotary switch for setting the node address of the Servo Drive was set out of range.
83	---	Communications error	Data received during each MECHATROLINK-II communications cycle repeatedly failed, exceeding the number of times set in the Communications Control (Pn005).
84	---	Transmission cycle error	While actuating MECHATROLINK-II communications, synchronization frames (SYNC) were not received according to the transmission cycle.
86	---	Watchdog data error	Synchronization data exchanged between the master and slave nodes during each MECHATROLINK-II communications cycle resulted in an error.
87	X	Emergency stop input error	The emergency stop input became OPEN.
90	---	Transmission cycle setting error	The transmission cycle setting error when the MECHATROLINK-II CONNECT command is received.
91	---	SYNC command error	A SYNC-related command was issued while MECHATROLINK-II was in asynchronous communications mode.
93	R	Parameter setting error	Parameter setting exceeded the allowable range.
95	R X	Servomotor non-conformity	The combination of the Servomotor and Servo Drive is not appropriate.
Others	R	Other errors	The control circuit malfunctioned due to excessive noise. An error occurred within the Servo Drive due to the activation of its self-diagnosis function.

**Note** The alarm display is in decimal.  
For example, if a SYNC command error occurs, "91" will flash on the front panel of the G-series Servo Drive. The warning code read from the host Position Control Unit (CJ1W-NC□71 or CS1W-NC□71) would be 405B.

## ■ Warnings

Priority	Warning Code	Warning Detection Function	Warning Details
High  Low	94h	Data setting warning	<ul style="list-style-type: none"> <li>Command argument setting is out of the range.</li> <li>Parameter write failure.</li> <li>Command settings are wrong, and others.</li> </ul>
	95h	Command warning	<ul style="list-style-type: none"> <li>Command output conditions are not satisfied.</li> <li>Received unsupported command.</li> <li>Subcommand output conditions are not satisfied.</li> </ul>
	96h	ML-II communications warning	One or more MECHATROLINK-II communications error occurred.
	90h	Overload warning	85% of the overload alarm trigger level has been exceeded.
	91h	Regeneration overload warning	85% of the regeneration overload alarm trigger level has been exceeded.
	92h	Battery warning	Voltage of absolute encoder battery has dropped below 3.2 V.
	93h	Fan lock warning	The built-in cooling fan stopped, or rotated abnormally.

**Note 1.** All warnings are retained. After resolving the problem, clear the alarms and the warnings.

**Note 2.** When multiple warnings occur, the warning codes are displayed on the front panel in the order of their priority (shown above).

**Note 3.** The alarm display is in hexadecimal.

For example, if a regenerative load warning occurs, "91" and "00" will alternately flash on the front panel of the G-series Servo Drive. The warning code read from the host Position Control Unit (CJ1W-NC□71 or CS1W-NC□71) would be 4091.

## 8-3 Troubleshooting

If an error occurs in the machine, determine the error conditions from the alarm indicator and operating status, identify the cause of the error, and take appropriate countermeasures.

### Error Diagnosis Using the Displayed Alarm Codes

Alarm code	Alarm Name	Cause	Countermeasure
11	Control power supply undervoltage	<p>The voltage between P and N in the control voltage converter has dropped below the specified value.</p> <ol style="list-style-type: none"> <li>1 The power supply voltage is low. A momentary power failure occurred.</li> <li>2 The power supply capacity is insufficient. The inrush current at power-ON caused the power supply voltage to drop.</li> <li>3 The Servo Drive has failed.</li> </ol>	<p>Measure the line voltage between control power supply L1C and L2C.</p> <ol style="list-style-type: none"> <li>1 Resolve the cause of the power supply voltage drop and/or momentary power failure.</li> <li>2 Increase the power supply capacity.</li> <li>3 Replace the Servo Drive.</li> </ol>
12	Overvoltage	<p>The voltage between P and N in the main circuit has exceeded the specified value. The power supply voltage is too high. Phase advance capacitor and/or UPS (uninterruptible power supply) is causing a jump in voltage.</p> <ol style="list-style-type: none"> <li>1 Regenerative energy cannot be absorbed due to a disconnection of the regeneration resistor.</li> <li>2 Regenerative energy cannot be absorbed due to the use of an inappropriate external regeneration resistor.</li> <li>3 The Servo Drive has failed.</li> </ol>	<p>Measure and check the line voltages between L1, L2, and L3 of the main power supply. Input a correct voltage. Remove the phase advance capacitor.</p> <ol style="list-style-type: none"> <li>1 Measure the resistance for the external regeneration resistor between terminals B1 and B2 of the Servo Drive, and check that the reading is normal. Replace it if disconnected.</li> <li>2 Provide the necessary regeneration resistance and wattage.</li> <li>3 Replace the Servo Drive.</li> </ol>
13	Main power supply undervoltage	<p>With the Undervoltage Alarm Selection (Pn065) set to 1, the main power supply between L1 and L3 was interrupted for longer than the time set by Momentary Hold Time (Pn06D). Alternatively, the voltage between P and N in the main circuit dropped below the specified value while the Servo Drive was ON.</p> <ol style="list-style-type: none"> <li>1 The power supply voltage is low.</li> <li>2 A momentary power failure occurred.</li> <li>3 The power supply capacity is insufficient - The inrush current at power-ON caused the power supply voltage to drop.</li> <li>4 Missing phase - A single-phase power supply was used for a three-phase Servo Drive.</li> <li>5 The Servo Drive has failed.</li> </ol>	<p>Measure and check the line voltages between L1, L2, and L3 of the main power supply.</p> <ol style="list-style-type: none"> <li>1 Resolve the cause of the power supply voltage drop and/or momentary power failure.</li> <li>2 Check the setting for the Momentary Hold Time (Pn06D).</li> <li>3 Increase the power supply capacity. Refer to the Servo Drive specifications for the power supply capacity.</li> <li>4 Correctly connect the phases (L1, L2, and L3) of the power supply. Connect single-phase 100 V and single-phase 200 V to L1 and L3.</li> <li>5 Replace the Servo Drive.</li> </ol>

Alarm code	Alarm Name	Cause	Countermeasure
14	Overcurrent	<p>The current on the inverter circuit exceeded the specified value.</p> <ol style="list-style-type: none"> <li>1 The Servo Drive has failed. (Failure of circuit, IGBT parts, etc.)</li> <li>2 Short circuit on Servomotor lines U, V, and W.</li> <li>3 Ground fault on the Servomotor lines.</li> <li>4 Servomotor burnout.</li> <li>5 Contact failure on the Servomotor lines.</li> <li>6 The dynamic brake relay has been consequently welded.</li> <li>7 The Servomotor is not compatible with the Servo Drive.</li> <li>8 The operation command input is received simultaneously with or before Servo-ON.</li> </ol>	<ol style="list-style-type: none"> <li>1 If the alarm is triggered immediately when the Servo Drive is turned ON with the Servomotor lines disconnected, replace the Servo Drive.</li> <li>2 Check for short circuit in the Servomotor lines U, V, and W. Connect the Servomotor lines correctly.</li> <li>3 Check the insulation resistance between Servomotor lines U, V, W and the ground line. If there is insulation failure, replace the Servomotor.</li> <li>4 Measure the interphase resistances of the Servomotor. If they are unbalanced, replace the Servomotor.</li> <li>5 Check the connector pins for connections U, V, and W of the Servomotor. If they are loose or have come off, securely fix them.</li> <li>6 Replace the Servo Drive.</li> <li>7 Check and match the capacity of the Servomotor and the Servo Drive.</li> <li>8 After the Servo ON, wait for at least 100 ms before inputting an operation command.</li> </ol>
15	Servo Drive overheat	<p>The temperature of the Servo Drive radiator or power elements exceeded the specified value.</p> <ol style="list-style-type: none"> <li>1 The Servo Drive's ambient temperature has exceeded the specified value. Radiation performance has dropped.</li> <li>2 There is excessive load.</li> </ol>	<ol style="list-style-type: none"> <li>1 Reduce the Servo Drive's ambient temperature, and improve the cooling conditions.</li> <li>2 Increase the capacity of the Servomotor. Reduce the effective load ratio, for example with a longer acceleration / deceleration time.</li> </ol>
16	Overload	<p>The effective values of the torque commands have exceeded the overload level set by the Overload Detection Level Setting (Pn072). Operation is performed with reverse time characteristics.</p> <ol style="list-style-type: none"> <li>1 The load is excessive, and the effective torque has exceeded the set level and operation has been performed for a long time.</li> <li>2 Oscillation, hunching, and vibration are occurring due to improper gain adjustment.</li> <li>3 Servomotor phases are incorrectly wired and/or are disconnected.</li> <li>4 The mechanical load is increasing. There is a problem with the mechanics.</li> <li>5 The holding brake is ON.</li> <li>6 The Servomotor lines are incorrectly wired between multiple axes.</li> </ol>	<p>Check that the torque (current) waveform is not oscillating, and that it is not fluctuating significantly in the vertical direction. Check the overload warning display and the load ratio.</p> <ol style="list-style-type: none"> <li>1 Increase the capacity of the Servo Drive and Servomotor, or reduce the load. Or increase the acceleration / deceleration time to reduce the effective torque.</li> <li>2 Readjust the gain to stop oscillation and hunching.</li> <li>3 Connect the Servomotor lines as specified in the wiring diagram. Replace the cables.</li> <li>4 Check that the mechanics operate smoothly.</li> <li>5 Measure the voltage at the brake terminal. Turn OFF the brake.</li> </ol> <p>Note You cannot reset the warning for at least 10 seconds after it occurred.</p>

## 8-3 Troubleshooting

Alarm code	Alarm Name	Cause	Countermeasure
18	Regeneration overload	<p>The regenerative energy exceeded the capacity of the regeneration resistor.</p> <ol style="list-style-type: none"> <li>1 The converter voltage was increased by regenerative energy during deceleration due to a large load inertia. The voltage was further increased due to insufficient energy absorption of the regeneration resistance.</li> <li>2 Because the Servomotor's rotation speed is too high, regenerative energy cannot be fully absorbed within the specified deceleration time.</li> <li>3 The operating limit of the External Regeneration Resistor is limited to 10%.</li> </ol>	<p>Check the regeneration resistance load ratio. Continuous regenerative braking is not acceptable.</p> <ol style="list-style-type: none"> <li>1 Check the operation pattern (speed monitor). Check the regeneration resistance load ratio and the over-regeneration warning display. Increase the capacity of the Servomotor and the Servo Drive to slow down the deceleration time. Use an External Regeneration Resistor.</li> <li>2 Check the operation pattern (speed monitor). Check the regeneration resistance load ratio and the over-regeneration warning display. Increase the capacity of the Servomotor and the Servo Drive to slow down the deceleration time. Lower the Servomotor rotation speed. Use an External Regeneration Resistor.</li> <li>3 Set Pn06C to 2.</li> </ol>
21	Encoder communications error	<p>Communications between the encoder and the Servo Drive failed for a specified number of times, thereby activating the error detection function. (No response to request from the Servo Drive.)</p>	<p>Check that the encoder line is properly connected.</p> <p>Check that there is no damage to the encoder due to incorrect connections. Replace the Servomotor and check again.</p>
23	Encoder communications data error	<p>Communications error occurred for the data from the encoder. Mainly a data error due to noise. The encoder line is connected, but the communications data is erroneous.</p>	<ul style="list-style-type: none"> <li>• Check that the encoder power supply voltage is within the range of 4.75 to 5.25 VDC. (If the encoder line is long.)</li> <li>• If the Servomotor line and the encoder line are bound together, separate them.</li> <li>• Check that the shield is connected to FG (frame ground), and that FG is grounded.</li> <li>• Attach a ferrite core to the encoder cable. Attach a radio noise filter to the power cable.</li> </ul>
24	Deviation counter overflow	<p>The number of position deviation pulses exceeded the Deviation Counter Overflow Level (Pn209).</p> <ol style="list-style-type: none"> <li>1 The Servomotor operation is not following the commands.</li> <li>2 The Deviation Counter Overflow Level (Pn209) is set too low. Calculate the deviation counter value based on the command speed and the position loop gain.</li> </ol>	<ol style="list-style-type: none"> <li>1 Use the speed monitor and torque monitor to check that the Servomotor is operating as commanded. Check that torque is not saturated. Check that the No. 1 Torque Limit (Pn05E) and the No. 2 Torque Limit (Pn05F) are not too small. Check by readjusting the gain, increasing the acceleration / deceleration times, and lowering the speed with the reduced load.</li> <li>2 Increase the setting for Pn209.</li> </ol>

Alarm code	Alarm Name	Cause	Countermeasure
26	Overspeed	The rotation speed of the Servomotor exceeded the setting of the Overspeed Detection Level Setting (Pn073).	<ul style="list-style-type: none"> <li>♦ Check that excessive speed commands have not been issued.</li> <li>♦ If overshoot is occurring due to improper gain adjustment, adjust the gain for the position loop and the speed loop.</li> </ul>
27	Command error	<p>The operation command resulted in an error.</p> <ol style="list-style-type: none"> <li>1 Incorrect value in position command. <ul style="list-style-type: none"> <li>· The amount of change in the position command (value calculated with the electronic gear ratio) exceeded the specified value.</li> <li>· The travel distance required for acceleration / deceleration, calculated when starting positioning, exceeded the specified value.</li> </ul> </li> <li>2 A MECHATROLINK-II link was established with the host while executing a standalone operation (normal mode autotuning, and jog operation). <p>Note If the alarms are cleared immediately after actuating communications, this alarm may be cleared immediately after it has been issued, and cannot be read.</p> </li> <li>3 Multi-turn data on the absolute encoder was cleared via RS-232 communications after actuating the MECHATROLINK-II link.</li> </ol>	<ul style="list-style-type: none"> <li>♦ Check that the operation commands are correct.</li> </ul> <ol style="list-style-type: none"> <li>1 Review the operation commands and settings. Check the settings. For example, check that the amount of change for the position command is not too large (i.e. interpolation function), the backlash compensation amount is not too large, the backlash compensation time constant is not too small, the electronic gear ratio is not too large, and the acceleration/deceleration is not too small.</li> <li>2 Do not actuate the network while executing normal mode autotuning and jog operation.</li> <li>3 Alarm code 27 is issued when clearing the multi-turn data on the absolute encoder via RS-232 communications. This is for safety purposes, not an error. When executing the multi-turn clear command via the network, an alarm will not be issued, but be sure to reset the control power supply.</li> </ol>
29	Internal deviation counter overflow	The value of the internal deviation counter (internal control unit) exceeded $2^{27}$ (134217728).	<p>Check that the speed monitor and torque monitor values are indicated as commanded by the Servo Drive. Check that torque is not saturated. Check that the No. 1 Torque Limit (Pn05E) and the No. 2 Torque Limit (Pn05F) are not too small.</p> <p>Check by readjusting the gain, increasing the acceleration / deceleration times, and lowering the speed with the reduced load.</p>
34	Overrun limit error	<p>The Servomotor exceeded the allowable operating range set by the Overrun Limit Setting (Pn026) with respect to the position command input.</p> <ol style="list-style-type: none"> <li>1 The gain is not appropriate for the load.</li> <li>2 The setting for Pn026 is too small.</li> </ol>	<ol style="list-style-type: none"> <li>1 Check the position loop gain, speed loop gain, integration time constant, and inertia ratio.</li> <li>2 Increase the setting for Pn026. Set Pn026 to 0 to disable the protective function.</li> </ol>
36	Parameter error	Data in the parameter save area was corrupted when the data was read from the EEPROM at power-ON.	<p>If the warning continues to occur even after retransferring all parameters, the Servo Drive may have failed. Replace the Servo Drive.</p>

## 8-3 Troubleshooting

Alarm code	Alarm Name	Cause	Countermeasure
37	Parameter corruption	The EEPROM write verification data was corrupted when the data was read from the EEPROM at power-ON.	If the warning continues to occur even after retransferring all parameters, the Servo Drive may have failed. Replace the Servo Drive.
38	Drive prohibit input error	<ol style="list-style-type: none"> <li>1 The Drive Prohibit Input Selection (Pn004) is set to 0, and both Forward and Reverse Drive Prohibit Inputs (POT and NOT) became OPEN.</li> <li>2 The Drive Prohibit Input Selection (Pn004) is set to 2, and either Forward or Reverse Drive Prohibit Input (POT or NOT) became OPEN.</li> <li>3 With the Drive Prohibit Input Selection (Pn004) set to 0, MECHATROLINK-II communications interrupted, and either Forward or Reverse Drive Prohibit Input (POT or NOT) turned ON, an operation command (jog operation or normal mode autotuning) was received via RS232. Or, either POT or NOT turned ON while operating on an operation command received via RS232.</li> </ol>	<p>Check the sensors, power supply, and wiring for the Forward and Reverse Drive Prohibit Inputs.</p> <p>Also check that the response of the power supply (12 to 24 VDC) is not too slow.</p> <p>Check that there is no command input in the direction of the Drive Prohibit Input.</p>
40	Absolute encoder system down error <b>ABS</b>	The power supply and battery voltage to the encoder dropped, and the capacitor voltage dropped below the specified value. (3.0 V or less)	Connect the power supply for the battery, and clear the absolute encoder. Refer to <i>Absolute Encoder Setup</i> on page 6-6. Initial setup of the absolute encoder must be performed to clear the alarm.
41	Absolute encoder counter overflow error <b>ABS</b>	The multi-turn counter of the encoder exceeded the specified value.	Check the setting for the Operation Switch When Using Absolute Encoder (Pn00B). Set the travel distance from the mechanical origin within 32767 rotations. Initial setup of the absolute encoder must be performed to clear the alarm.
42	Absolute encoder overspeed error <b>ABS</b>	The Servomotor rotation speed exceeded the specified value when power to the absolute encoder is supplied by the battery only during a power outage.	Check the power supply voltage on the encoder side (5 V $\pm$ 5%). Check the connection of the CN2 connector. Initial setup of the absolute encoder must be performed to clear the alarm.
44	Absolute encoder one-turn counter error	An error was detected in the one-turn counter for the encoder.	Replace the Servomotor. Check for malfunction due to noise. Also take EMC measures. Initial setup of the absolute encoder must be performed to clear the alarm.
45	Absolute encoder multi-turn counter error	An absolute encoder multi-turn counter or incremental encoder phase AB signal error was detected.	Replace the Servomotor. Check for malfunction due to noise. Also take EMC measures. Initial setup of the absolute encoder must be performed to clear the alarm.

Alarm code	Alarm Name	Cause	Countermeasure
47	Absolute encoder status error <b>ABS</b>	The encoder's detection values were higher than the specified value at power-ON.	Do not rotate the Servomotor when the power is turned ON.
48	Encoder phase Z error	A phase-Z pulse of the 2500 p/r 5-line serial encoder was not detected regularly. The encoder has failed.	Replace the Servomotor. Check for malfunction due to noise. Also take EMC measures.
49	Encoder PS signal error	Logic error was detected in the PS signal (magnetic pole) of the 2500 p/r 5-line serial encoder. The encoder has failed.	Replace the Servomotor.
82	Node address setting error	The rotary switch for setting the node address of the Servo Drive was set out of range. (Value is read at power-ON)	Check the value of the rotary switch for setting the node address. Set the rotary switch correctly (set to 1 to 31), and then turn OFF the control power supply for the Servo Drive and turn it ON again.
83	Communications error	Data received during each MECHATROLINK-II communications cycle repeatedly failed, exceeding the number of times set by the Communications Control (Pn005).	Check that commands are being sent from the master node to the slave node. Check the MECHATROLINK-II communications cable for disconnection or wiring problem. Check the connection of the terminator (termination resistor). Check the MECHATROLINK-II communications cable for excessive noise, and that the cable is laid properly. Also check the FG wiring for the Servo Drive. Increase the consecutive communications error detection count in the Communications Control (Pn005).
84	Transmission cycle error	While actuating MECHATROLINK-II communications, synchronization frames (SYNC) were not received according to the transmission cycle. • The synchronization frames themselves were faulty. • The transmission cycle of the synchronization frames was not as specified. (Includes dropped frames).	<ul style="list-style-type: none"> <li>♦ Check the transmission cycle of the synchronization frames sent from the master node, and ensure that it does not fluctuate and is as specified.</li> <li>♦ Check the communications cable for disconnection or wiring problem.</li> <li>♦ Check for excessive noise on the communications cable.</li> <li>♦ Check the connection of the terminator (termination resistor).</li> <li>♦ Check the laying of the communications cable and the FG wiring.</li> </ul>
86	Watchdog data error	Synchronization data exchanged between the master and slave nodes during each MECHATROLINK-II communications cycle resulted in an error.	<ul style="list-style-type: none"> <li>♦ Check the update process for the watchdog data (MN) on the master node.</li> </ul>

## 8-3 Troubleshooting

Alarm code	Alarm Name	Cause	Countermeasure
87	Emergency stop input error	<ul style="list-style-type: none"> <li>The emergency stop input became OPEN.</li> </ul>	<ul style="list-style-type: none"> <li>Check the power supply and wiring connected to the emergency stop input. Check that the emergency stop input is ON.</li> <li>Check that the response of the control signal power supply (12 to 24 VDC) at power-ON is not too slow in comparison to the startup of the Servo Drive.</li> </ul>
90	Transmission cycle setting error	<ul style="list-style-type: none"> <li>The transmission cycle setting for receiving the MECHATROLINK-II CONNECT command is incorrect.</li> </ul>	<ul style="list-style-type: none"> <li>Check the transmission cycle settings, and resend the CONNECT command.</li> </ul>
91	SYNC command error	<ul style="list-style-type: none"> <li>A SYNC-related command was issued while MECHATROLINK-II was in asynchronous communications mode.</li> </ul>	<ul style="list-style-type: none"> <li>Check the command sent from the master node.</li> </ul>
93	Parameter setting error	<ul style="list-style-type: none"> <li>The electronic gear ratio parameter is set outside the allowable setting range. (Less than 1/100 or greater than 100/1)</li> </ul>	<ul style="list-style-type: none"> <li>Check the parameter setting.</li> </ul>
95	Servomotor non-conformity	<ul style="list-style-type: none"> <li>The combination of the Servomotor and Servo Drive is not appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>Use the Servomotor and Servo Drive in the correct combination.</li> </ul>
Others	Other errors	<p>The control circuit malfunctioned due to excessive noise.</p> <p>An error occurred within the Servo Drive due to the activation of its self-diagnosis function.</p>	<p>Turn OFF the power supply, and then turn it back ON.</p> <p>If the error continues to occur, there may be a failure.</p> <p>Stop the operation, and replace the Servomotor and Servo Drive.</p>

## Error Diagnosis Using the Displayed Warning Codes

Warning Code	Error	Cause	Countermeasure
94h	Data setting warning	<ul style="list-style-type: none"> <li>♦ Command argument setting is out of the range.</li> <li>♦ Parameter write failure.</li> <li>♦ Command settings are wrong, and others.</li> </ul>	<ul style="list-style-type: none"> <li>♦ Check the setting range.</li> <li>♦ Check the control power supply voltage.</li> <li>♦ Check the command settings.</li> </ul>
95h	Command warning	<ul style="list-style-type: none"> <li>♦ Command output conditions are not satisfied.</li> <li>♦ Received unsupported command.</li> <li>♦ Subcommand output conditions are not satisfied.</li> <li>♦ Operation command in the drive prohibited direction was issued after being stopped by a POT/NOT input.</li> </ul>	<ul style="list-style-type: none"> <li>♦ Send the command after the command output conditions are satisfied.</li> <li>♦ Do not send unsupported commands.</li> <li>♦ Follow the subcommand output conditions and send.</li> <li>♦ Check the status of POT/NOT input and operation command.</li> </ul>
96h	ML-II communications warning	<ul style="list-style-type: none"> <li>♦ One or more MECHATROLINK-II communications error occurred.</li> </ul>	<ul style="list-style-type: none"> <li>♦ Refer to the countermeasures for <i>Communications error</i> on page 8-12 (alarm code 83).</li> </ul>
90h	Overload warning	<ul style="list-style-type: none"> <li>♦ 85% of the overload alarm trigger level has been exceeded.</li> </ul>	Refer to <i>Overload</i> on page 8-8.
91h	Regeneration overload	<ul style="list-style-type: none"> <li>♦ 85% of the regeneration overload alarm trigger level has been exceeded.</li> </ul>	Refer to <i>Regeneration overload</i> on page 8-9.
92h	Battery warning	<ul style="list-style-type: none"> <li>♦ Voltage of absolute encoder battery has dropped below 3.2 V.</li> </ul>	Replace the absolute encoder battery while the control power supply is being input.
93h	Fan lock warning	<ul style="list-style-type: none"> <li>♦ The built-in cooling fan stopped, or rotated abnormally.</li> <li>♦ Models with a built-in fan R88D- GN10H-ML2/ GN20H-ML2/ GN30H-ML2/-GN40H-ML2/-GN50H- ML2/-GN75H-ML2</li> </ul>	If the warning continues to occur, the fan may have failed. If so, the internal temperature of the Servo Drive will rise, causing a failure. Replace the fan.

### Error Diagnosis Using the Operating Status

Symptom	Probable cause	Items to check	Countermeasure
7-segment LED is not lit.	No control power supply.	Check that the control power supply voltage is within the specified range.	Ensure that power is supplied properly.
		Check that the power supply input is wired correctly.	Wire correctly.
LED (COM) is not lit.	MECHATROLINK-II communications not actuated.	Check that the network cable is connected correctly.	Check that the host controller is running.
		Check that the terminator is connected.	Check the connector and connection.
LED (COM) is flashing in green.	Asynchronous communications on the MECHATROLINK-II communications actuated.	Can be controlled from the host controller (Normal status).	Normal status.
LED (COM) is lit in green.	Synchronous communications on the MECHATROLINK-II communications actuated.	Controllable status (Normal status).	Normal status.
LED (COM) is flashing in red.	Recoverable alarm related to MECHATROLINK-II communications.	<ul style="list-style-type: none"> <li>♦ Reset and actuate the network again from the host controller.</li> <li>♦ Check the network wiring.</li> </ul>	Check the wiring and noise.
LED (COM) is lit in red.	Irrecoverable alarm related to MECHATROLINK-II communications.	Check that there is no overlap of node address on the network, and that the number of connected Servo Drives is less than 17.	Correct the network address.
An alarm has occurred.	Read the alarm code and the alarm history.	Check details of alarm by referring to <i>Error Diagnosis Using the Displayed Alarm Codes</i> on page 8-7.	Take countermeasures by referring to <i>Error Diagnosis Using the Displayed Alarm Codes</i> on page 8-7.

Symptom	Probable cause	Items to check	Countermeasure
Does not Servo lock.	Not Servo locked.	Check the response of the NCF71 Servo lock bit.	Set the Servo lock command bit on the host controller again.
	The power cable is not properly connected.	Check the wiring of the Servomotor power cable.	Wire the Servomotor power cable correctly.
	Servomotor power is not ON.	Check the wiring of the main circuit, and the voltage of the power supply.	Input the main circuit power supply and voltage correctly.
	The Forward and Reverse Drive Prohibit Inputs (POT and NOT) are OFF.	<ul style="list-style-type: none"> <li>♦ Check that the inputs for POT and NOT are not OFF.</li> <li>♦ Check the +24 VIN input for CN1.</li> </ul>	Turn ON POT and NOT, and input +24 VIN correctly.
	Torque limit is 0.	Check that torque limits Pn05E and Pn05F are not set to 0.	Set the maximum torque to be used for each.
	Torque control is used for the control from the host controller, and the torque command value is set to 0.	Check the control mode and the torque command value for the host controller.	Set the control mode for the host controller to position control mode, and check Servo lock.
	Servo Drive failure.	---	Replace the Servo Drive.
Servo lock is ON, but Servomotor does not rotate.	No command is sent from the host controller.	For position commands, check that speed and position are not set to 0.	Input the position and speed data to start the Servomotor.
	Cannot tell whether the Servomotor is rotating.	Check that the speed command from the host controller is not too slow.	Check the speed command from the host controller.
	The holding brake is working.	Check the brake interlock (BKIR) signal and the +24 VDC power supply.	For a Servomotor with brake, check that its holding brake is released by Servo lock.
	The No. 1 and No. 2 Torque Limits (Pn05E, Pn05F) are too small.	Check that the torque limits Pn05E and Pn05F are not set to a value close to 0.	Set the maximum torque to be used for each.
	Torque control is used for the control from the host controller, and the torque command value is too small.	Check the control mode and the torque command value for the host controller.	Set the control mode for the host controller to position control mode, and check Servo lock.
	The Speed Limit (Pn053) is set to 0 for torque control mode.	Check the Speed Limit (Pn053) value.	Increase the value for the Speed Limit (Pn053).
	Servo Drive failure.	---	Replace the Servo Drive.
The Servomotor operates momentarily, but it does not operate after that.	The Servomotor Power Cable is wired incorrectly.	Check the wiring of the Servomotor Power Cable phases U, V, and W.	Correctly wire the Servomotor Power Cable phases U, V, and W.
	Not enough position command data.	Check the position data, electronic gear, and others for NCF71.	Set the correct data.

## 8-3 Troubleshooting

Symptom	Probable cause	Items to check	Countermeasure
The Servomotor rotates without a command.	There is a small input for speed command mode.	Check that there is no input for speed command mode.	Set the speed command to 0, or switch to position control mode.
	There is a small input for torque command mode.	Check that there is no input for torque command mode.	Switch from torque control mode to position control mode.
The Servomotor rotates in the direction opposite to the command.	The Operating Direction Setting (Pn043) setting is incorrect.	Check the Operating Direction Setting (Pn043) value.	Change the Operating Direction Setting (Pn043) value.
	NCF71 command is incorrect.	<ul style="list-style-type: none"> <li>♦ Set values are inappropriate for an absolute command.</li> <li>♦ The polarity is incorrect for an incremental command.</li> </ul>	<ul style="list-style-type: none"> <li>♦ Check the current and target values.</li> <li>♦ Check the rotation direction.</li> </ul>
The holding brake does not work.	Power is supplied to the holding brake.	Check whether power is supplied to the holding brake.	<ul style="list-style-type: none"> <li>♦ Check the brake interlock (BKIR) signal and the relay circuit.</li> <li>♦ Check that the holding brake is not worn down.</li> </ul>
The Servomotor is overheating.	The load is too large.	Measure the torque using the front panel IM or a tool.	<ul style="list-style-type: none"> <li>♦ Slow down the acceleration/deceleration.</li> <li>♦ Lower the speed and measure the load.</li> </ul>
	The heat radiation conditions for the Servomotor have worsened.	<ul style="list-style-type: none"> <li>♦ Check that the specified heat radiation conditions are satisfied.</li> <li>♦ For a Servomotor with a brake, check the load ratio.</li> </ul>	<ul style="list-style-type: none"> <li>♦ Improve the heat radiation conditions.</li> <li>♦ Reduce the load.</li> <li>♦ Improve ventilation.</li> </ul>
	The ambient temperature is too high.	Check that the ambient temperature has not exceeded 40 °C.	<ul style="list-style-type: none"> <li>♦ Radiate heat and cool.</li> <li>♦ Reduce the load ratio.</li> </ul>
The Servomotor rotation is unstable.	Load and gain do not match.	Check the response waveforms for speed and torque.	Adjust the speed loop gain so that the rotation is stabilized.
	Load inertia exceeds the specified range.	Calculate the load inertia.	<ul style="list-style-type: none"> <li>♦ Check if the adjustments can be made via manual tuning.</li> <li>♦ Increase the capacity of the Servomotor.</li> </ul>
	Low rigidity is resulting in vibration.	Measure the vibration frequency of the load.	Enable damping control, and set the vibration filter frequencies.
	Loose coupling with the machine, and/or large gaps.	Check coupling with the machine.	Tighten the coupling with the machine.

Symptom	Probable cause	Items to check	Countermeasure
Machine position is misaligned.	Problem with the coupling between the Servomotor axis and the machine.	Check that the coupling of the Servomotor and the machine is not misaligned.	<ul style="list-style-type: none"> <li>♦ Re-tighten the coupling.</li> <li>♦ Replace with a tight coupling.</li> </ul>
	Deceleration stop command is received from the host controller.	Check the control ladder on the host controller.	Review the control on the host controller.
The Servomotor is slow to stop even if the RUN command is turned OFF while the Servomotor is rotating.	Load inertia is too large.	<ul style="list-style-type: none"> <li>♦ Check the load inertia.</li> <li>♦ Dynamic brake resistor is disconnected.</li> </ul>	<ul style="list-style-type: none"> <li>♦ Review the load inertia.</li> <li>♦ Replace the Servomotor and Servo Drive with appropriate models.</li> </ul>
	Dynamic brake is disabled.	Check if the dynamic brake is disabled or has failed.	<ul style="list-style-type: none"> <li>♦ If disabled, enable it.</li> <li>♦ If there is a failure, or disconnection of the resistor, replace the Servomotor.</li> </ul>
Overshoots when starting or stopping.	The Position Loop Gain (Pn010) is too large.	Review the Position Loop Gain (Pn010).	Adjust the gain to avoid overshooting.
	Poor balance between the Speed Loop Integration Time Constant (Pn012) and the Speed Loop Gain (Pn011).	Review the Speed Loop Integration Time Constant (Pn012) and the Speed Loop Gain (Pn011).	Use CX-Drive and analog monitors (SP, IM) to measure the response and adjust the gain.
	Inappropriate machine rigidity setting by realtime autotuning.	Review the machine rigidity setting.	Match the machine rigidity setting to the load rigidity.
	Inertial ratio setting differs from the load.	Review the Inertial Ratio (Pn020).	Match the Inertia Ratio (Pn020) to the load.

## 8-3 Troubleshooting

Symptom	Probable cause	Items to check	Countermeasure
Unusual noise and vibration occurs from the Servomotor or the load.	The Torque Command Filter Time Constant (Pn014) does not match the load.	Review the Torque Command Filter Time Constant (Pn014).	Increase the Torque Command Filter Time Constant (Pn014) to stop the vibration.
	Vibration occurs due to machine resonance.	Check if the resonance frequency is high or low.	If the resonance frequency is high, set an adaptive filter to stop the resonance, or measure the resonance frequency and set Notch Filters 1 and 2.
	<ul style="list-style-type: none"> <li>♦ The Position Loop Gain (Pn010) is too large.</li> <li>♦ Poor balance between the Speed Loop Integration Time Constant (Pn012) and the Speed Loop Gain (Pn011).</li> </ul>	Review the Position Loop Gain (Pn010), Speed Loop Integration Time Constant (Pn012), and the Speed Loop Gain (Pn011).	Use CX-Drive and analog monitors (SP, IM) to measure the response and adjust the gain.
	The Speed Feedback Filter Time Constant (Pn013) does not match the load.	Check the Speed Feedback Filter Time Constant (Pn013). The parameter is usually set to 0.	Increase the Speed Feedback Filter Time Constant (Pn013) and operate.
	Vibration occurs due to low mechanical rigidity.	Check whether the vibration frequency is 100 Hz or below.	If the vibration frequency is 100 Hz or below, stop the vibration by setting the vibration frequency for the vibration filter.
	Vibration occurs due to mechanical installation.	Check whether the coupling with the load is unbalanced.	Make adjustments to balance the rotation.
		Check for eccentricity of the load.	Eliminate eccentricity. Eccentricity of the load results in noise due to fluctuation of torque.
Check for noise from within the decelerator.		Check the decelerator specifications and perform an inspection.	

# 8-4 Overload Characteristics (Electronic Thermal Function)

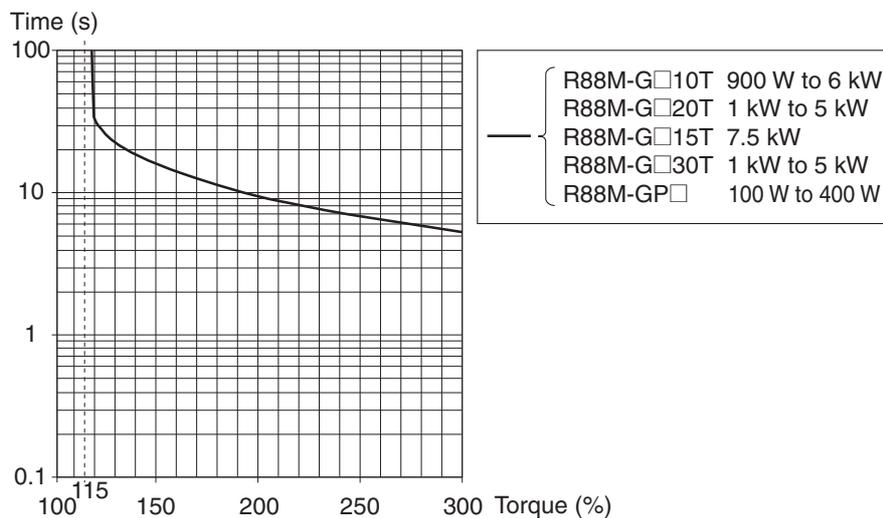
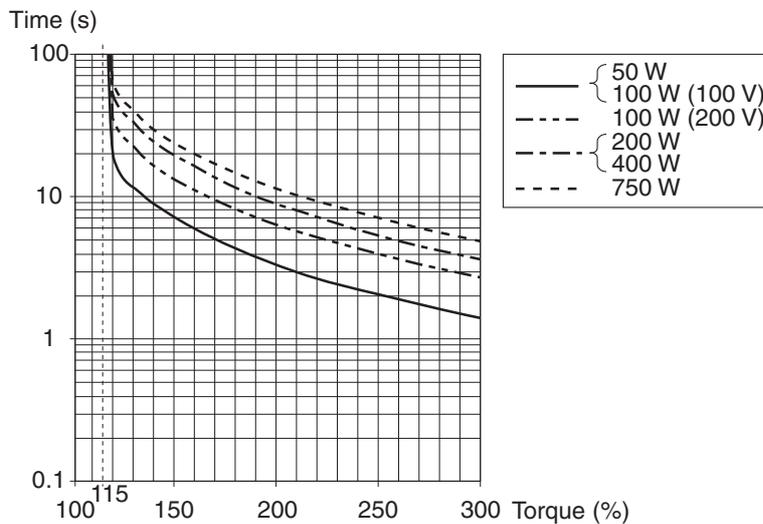
An overload protection (electronic thermal) function is built into the Servo Drive to protect the Servo Drive and Servomotor from overloading.

If an overload does occur, first eliminate the cause of the error and then wait at least one minute for the Servomotor temperature to drop before turning on the power again.

If the power is turned ON again repeatedly at short intervals, the Servomotor windings may burn out.

## Overload Characteristics Graphs

The following graphs show the characteristics of the load ratio and the electronic thermal function's operation time.



When the torque command = 0, and a constant torque command is continuously applied after three or more times the overload time constant has elapsed, the overload time  $t$  [s] will be:

$$t \text{ [s]} = - \text{Overload time constant [s]} \times \log_e (1 - \text{Overload level [\%]} / \text{Torque command [\%]})^2$$

(The overload time constant [s] depends on the Servomotor. The standard overload level is 115%.)

**Precautions for Correct Use**

- Overload (alarm code 16) cannot be reset for approximately 10 seconds after its occurrence.

## 8-5 Periodic Maintenance



### Caution



Resume operation only after transferring to the new Unit the contents of the data required for operation. Not doing so may result in equipment damage.



Do not attempt to disassemble or repair any of the products. Any attempt to do so may result in electric shock or injury.

Servomotors and Servo Drives contain many components and will operate properly only when each of the individual components is operating properly.

Some of the electrical and mechanical components require maintenance depending on application conditions. Periodic inspection and part replacement are necessary to ensure proper long-term operation of Servomotors and Servo Drives. (quotes from “The Recommendation for Periodic Maintenance of a General-purpose Inverter” published by JEMA)

The periodic maintenance cycle depends on the installation environment and application conditions of the Servomotor or Servo Drive.

Recommended maintenance times are listed below for Servomotors and Servo Drives. Use these for reference in determining actual maintenance schedules.

### Servomotor Service Life

- ♦ The service life for components is listed below.

Bearings: 20,000 hours

Decelerator: 20,000 hours

Oil seal: 5,000 hours

Encoder: 30,000 hours

These values presume an ambient Servomotor operating temperature of 40°C, shaft loads within the allowable range, rated operation (rated torque and rated r/min), and proper installation as described in this manual.

The oil seal can be replaced.

- ♦ The radial loads during operation (rotation) on timing pulleys and other components contacting belts is twice the still load. Consult with the belt and pulley manufacturers and adjust designs and system settings so that the allowable shaft load is not exceeded even during operation. If a Servomotor is used under a shaft load exceeding the allowable limit, the Servomotor shaft can break, the bearings can burn out, and other problems can occur.

## Servo Drive Service Life

- ♦ Details on the service life of the Servo Drive are provided below.
  - Aluminum electrolytic capacitors: 28,000 hours  
(at an ambient Servo Drive operating temperature of 55°C, the rated operation output (rated torque), installed as described in this manual.)
  - Axial fan: 10,000 to 30,000 hours
  - Inrush current prevention relay: Approx. 20,000 operations (The service life depends on the operating conditions.)
- ♦ When using the Servo Drive in continuous operation, use fans or air conditioners to maintain an ambient operating temperature below 40°C.
- ♦ We recommend that ambient operating temperature and the power ON time be reduced as much as possible to lengthen the service life of the Servo Drive.
- ♦ The life of aluminum electrolytic capacitors is greatly affected by the ambient operating temperature. Generally speaking, an increase of 10°C in the ambient operating temperature will reduce capacitor life by 50%.
- ♦ The aluminum electrolytic capacitors deteriorate even when the Servo Drive is stored with no power supplied. If the Servo Drive is not used for a long time, we recommend a periodic inspection and part replacement schedule of five years.
- ♦ If the Servomotor or Servo Drive is not to be used for a long time, or if they are to be used under conditions worse than those described above, a periodic inspection schedule of five years is recommended.
- ♦ Upon request, OMRON will examine the Servo Drive and Servomotor and determine if a replacement is required.

### Replacing the Absolute Encoder Battery **ABS**

Replace the Absolute Encoder Backup Battery if it has been used for more than three years or if an absolute encoder system down error (alarm code 40) has occurred.

#### ■ Replacement Battery Model and Specifications

Item	Specifications
Name	Absolute Encoder Backup Battery
Model	R88A-BAT01G
Battery model	ER6V (Toshiba)
Battery voltage	3.6 V
Current capacity	2000 mA·h

#### ■ Mounting the Backup Battery

##### Mounting the Battery for the First Time

Connect the absolute encoder battery to the Servomotor, and then set up the absolute encoder. Refer to *Absolute Encoder Setup* on page 6-6.

Once the absolute encoder battery is attached, it is recommended that the control power supply be turned ON and OFF once a day to refresh the battery.

If you neglect to refresh the battery, battery errors may occur due to voltage delay in the battery.

##### Replacing the Battery

If a battery alarm occurs, the absolute encoder battery must be replaced.

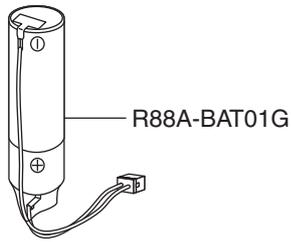
Replace the battery with the control power supply to the Servo Drive ON. If the battery is replaced with the control power supply to the Servo Drive OFF, data held in the encoder will be lost.

Once the absolute encoder battery has been replaced, clear the battery alarm. For details on clearing the alarm, refer to *Alarm Reset* on page 6-25.

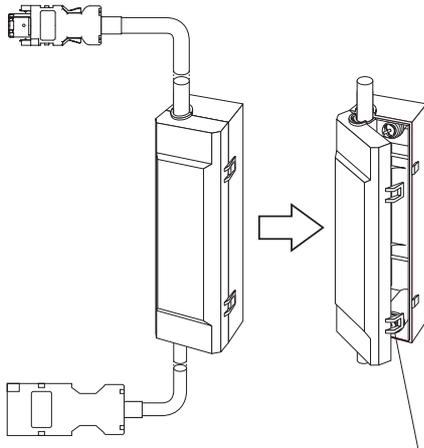
**Note** If the absolute encoder is cleared, or the absolute values are cleared using communications, all error and rotation data will be lost and the absolute encoder must be set up again. For details, refer to *Absolute Encoder Setup* on page 6-6.

**Battery Mounting Procedure**

1. Prepare the R88A-BAT01G replacement battery.

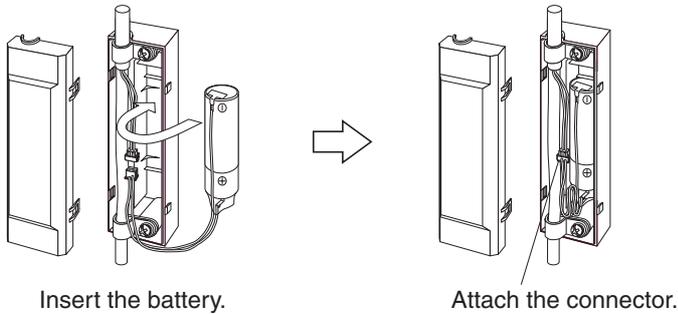


2. Remove the battery box cover.



Raise the hooks to remove the cover.

3. Put the battery into the battery box.



4. Close the cover to the battery box.

