Mitsubishi Electric AC Servo System

MR-JET-G
User's Manual
(Introduction)
SAFETY INSTRUCTIONS

(Please read the instructions carefully before using the equipment.)
To use the equipment correctly, do not attempt to install, operate, maintain, or inspect the equipment until you have read through this manual, installation guide, and appended documents carefully. Do not use the equipment until you have a full knowledge of the equipment, safety information and instructions.

In this manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

<table>
<thead>
<tr>
<th>WARNING</th>
<th>Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAUTION</td>
<td>Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury.</td>
</tr>
</tbody>
</table>

Note that the CAUTION level may lead to a serious consequence depending on conditions. Please follow the instructions of both levels because they are important to personnel safety. Forbidden actions and required actions are indicated by the following diagrammatic symbols.

![Forbidden Action Symbol](image)

Indicates a forbidden action. For example, "No Fire" is indicated by ![Forbidden Action Symbol].

![Required Action Symbol](image)

Indicates a required action. For example, grounding is indicated by ![Required Action Symbol].

In this manual, precautions for hazards that can lead to property damage, instructions for other functions, and other information are shown separately in the "POINT" area. After reading this guide, keep it accessible to the operator.
[Installation/wiring]

⚠️ WARNING

- To prevent an electric shock, turn off the power and wait for 15 minutes or more before starting wiring and/or inspection.
- To prevent an electric shock, ground the servo amplifier.
- To prevent an electric shock, any person who is involved in wiring should be fully competent to do the work.
- To prevent an electric shock, mount the servo amplifier before wiring.
- To prevent an electric shock, connect the protective earth (PE) terminal (the terminal marked with the ⚡ symbol) of the servo amplifier to the protective earth (PE) of the cabinet.
- To prevent an electric shock, do not touch the conductive parts.

[Setting/adjustment]

⚠️ WARNING

- To prevent an electric shock, do not operate the switches with wet hands.

[Operation]

⚠️ WARNING

- To prevent an electric shock, do not operate the switches with wet hands.

[Maintenance]

⚠️ WARNING

- To prevent an electric shock, any person who is involved in inspection should be fully competent to do the work.
- To prevent an electric shock, do not operate the switches with wet hands.

DISPOSAL OF WASTE

Please dispose of this product, battery (primary battery) and other options according to your local laws and regulations.
Use this servo safely with preparation of the following related manuals as necessary if you use the servo for the first time.

This manual is necessary primarily for installing, wiring, and using options.

The manual is necessary for operating servo amplifiers.

The manual is necessary for using communication functions.

The manual is necessary for adjusting the operation status.

The manual is necessary for looking up details of each function.

The manual is necessary for specifying the causes of alarms and warnings.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>MR-JET-G User's Manual (Introduction)</td>
<td>IB(NA)-0300448ENG</td>
</tr>
<tr>
<td>(2)</td>
<td>MR-JET User's Manual (Hardware)</td>
<td>IB(NA)-0300453ENG</td>
</tr>
<tr>
<td>(3)</td>
<td>Rotary Servo Motor User's Manual (HG-KNS/HG-SNS)</td>
<td>IB(NA)-0300488ENG</td>
</tr>
<tr>
<td>(4)</td>
<td>MR-JET User's Manual (Function)</td>
<td>IB(NA)-0300488ENG</td>
</tr>
<tr>
<td>(5)</td>
<td>MR-JET-G User's Manual (Communication Function)</td>
<td>IB(NA)-0300463ENG</td>
</tr>
<tr>
<td>(6)</td>
<td>MR-JET User's Manual (Adjustment)</td>
<td>IB(NA)-0300473ENG</td>
</tr>
<tr>
<td>(7)</td>
<td>MR-JET-G User's Manual (Parameters)</td>
<td>IB(NA)-0300478ENG</td>
</tr>
<tr>
<td>(9)</td>
<td>MR-JET User's Manual (Troubleshooting)</td>
<td>IB(NA)-0300483ENG</td>
</tr>
</tbody>
</table>
Interpreting servo parameters

For a servo parameter which uses one particular digit to select a function, the position of its digit indicates the detail number of the servo parameter, and the value in hexadecimal which is set to the digit indicates the selected function.

For example, the detail number of the servo parameter in the last digit is expressed as [Pr. PA01.0]. In addition, a servo parameter which uses a combination of several digits to select a function, is expressed using ",," as seen in [Pr. PA01.0-1].

The following is an example of the servo parameter number PA01 with the setting values of "FEDCBA98" in hexadecimal.

- When setting a servo parameter with one particular digit

\[
\begin{align*}
[\text{Pr. PA01}] &= \text{FEDCBA98} \\
\text{Detail No.} &= \begin{align*}
\text{PA01.0} &= "8" \\
\text{PA01.1} &= "9" \\
\text{PA01.2} &= "A" \\
\text{PA01.3} &= "B" \\
\text{PA01.4} &= "C" \\
\text{PA01.5} &= "D" \\
\text{PA01.6} &= "E" \\
\text{PA01.7} &= "F"
\end{align*}
\end{align*}
\]

- When setting a servo parameter using a combination of several digits

\[
\begin{align*}
[\text{Pr. PA01}] &= \text{FDEBCA98} \\
\text{Detail No.} &= \begin{align*}
\text{PA01.0-1} &= "98" \\
\text{PA01.2-4} &= "CBA" \\
\text{PA01.5} &= "D" \\
\text{PA01.6} &= "E" \\
\text{PA01.7} &= "F"
\end{align*}
\end{align*}
\]

For example, if the servo parameter name is "Function selection A-1", the setting digit name is "Forced stop deceleration function selection", and the setting digit is the forth last digit in PA04, the servo parameter is expressed as shown below.

[Pr. PA04.3 Forced stop deceleration function selection]

<table>
<thead>
<tr>
<th>Servo parameter</th>
<th>Symbol</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA04.3</td>
<td>*AOP</td>
<td>Forced stop deceleration function selection</td>
<td>Set &quot;Forced stop deceleration function&quot; to enabled/disabled. Initial value 1h (enabled)</td>
</tr>
</tbody>
</table>
U.S. CUSTOMARY UNITS

U.S. customary units are not shown in this manual. Convert the values if necessary according to the following table.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>SI (metric) unit</th>
<th>U.S. customary unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>1 [kg]</td>
<td>2.2046 [lb]</td>
</tr>
<tr>
<td>Length</td>
<td>1 [mm]</td>
<td>0.03937 [inch]</td>
</tr>
<tr>
<td>Torque</td>
<td>1 [N•m]</td>
<td>141.6 [oz•inch]</td>
</tr>
<tr>
<td>Moment of inertia</td>
<td>1 [(× 10⁻⁴ kg•m²)]</td>
<td>5.4675 [oz•inch²]</td>
</tr>
<tr>
<td>Load (thrust load/axial load)</td>
<td>1 [N]</td>
<td>0.2248 [lbf]</td>
</tr>
<tr>
<td>Temperature</td>
<td>N [°C] × 9/5 + 32</td>
<td>N [°F]</td>
</tr>
</tbody>
</table>
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1  SPECIFICATIONS

1.1  Outline

MR-JET-_.G operates in the Ethernet open network (communication speed of up to 1 Gbps).

1.2  Model designation

Rating plate

The following shows an example of the rating plate for explanation of each item.

```
MR-JET-10G
Series: MR-JET-10G
Rated output: 100W
INPUT: 3AC/AC 200-240V 0.9A/1.5A 50/60Hz
OUTPUT: 3PH 0-240V 0-590Hz 1.5A
Max. Surrouning Air Temp.: 55°C
IP20/UL Open Type
R-R-WEK-TC301A463G51
```

Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.

```
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Rated output [kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>20</td>
<td>0.2</td>
</tr>
<tr>
<td>40</td>
<td>0.4</td>
</tr>
<tr>
<td>70</td>
<td>0.75</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>300</td>
<td>3</td>
</tr>
</tbody>
</table>
```
### 1.3 Servo amplifier standard specifications

**MR-JET-_G**

<table>
<thead>
<tr>
<th>Model: MR-JET-_</th>
<th>10G</th>
<th>20G</th>
<th>40G</th>
<th>70G</th>
<th>100G</th>
<th>200G</th>
<th>300G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>3-phase 0 V AC to 240 V AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>1.3</td>
<td>1.8</td>
<td>2.8</td>
<td>5.8</td>
<td>6.0</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>Power supply input</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage/Frequency</td>
<td>3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>0.9</td>
<td>1.5</td>
<td>2.6</td>
<td>3.8</td>
<td>5.0</td>
<td>10.5</td>
<td>14.0</td>
</tr>
<tr>
<td>Permissible voltage fluctuation</td>
<td>3-phase or 1-phase 170 V AC to 264 V AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible frequency fluctuation</td>
<td>Within ±5 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply capacity [kVA]</td>
<td>Refer to “Power supply capacity and generated loss” in the following manual. MR-JET User's Manual (Hardware)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inrush current [A]</td>
<td>Refer to “Inrush current at power-on” in the following manual. MR-JET User's Manual (Hardware)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interface power supply</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>24 V DC ±10 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current capacity [A]</td>
<td>0.3 *1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control method</strong></td>
<td>Sine-wave PWM control, current control method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dynamic brake</strong></td>
<td>Built-in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CC-Link IE TSN</strong></td>
<td>Communication cycle</td>
<td>125 μs, 250 μs, 500 μs, 1 ms, 2 ms, 4 ms, 8 ms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authentication class</td>
<td>Class B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communication function</strong></td>
<td>USB</td>
<td>Connection to a personal computer or other devices (MR Configurator2-compatible)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protective functions</strong></td>
<td>Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor heat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and excessive error protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Compliance with global standards</strong></td>
<td>CE marking</td>
<td>LVD: EN 61800-5-1, EMC: EN 61800-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UL standard</td>
<td>UL 61800-5-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Structure (IP rating)</strong></td>
<td>Natural cooling, open (IP20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Force cooling, open (IP20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*<em>Close mounting <em>2</em></em></td>
<td>3-phase power supply input</td>
<td>Possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-phase power supply input</td>
<td>Possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impossible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mass [kg]</strong></td>
<td>0.8</td>
<td>1.6</td>
<td>2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 This value is applicable when all I/O signals are used. Reducing the number of I/O points decreases the current capacity.

*2 If closely mounting the servo amplifiers, operate them at an ambient temperature of 0 °C to 45 °C or at 75 % or less of the effective load ratio.

*3 This current value is applicable when a 3-phase power supply is used.

*4 If using 1-phase 200 V AC to 240 V AC power supply, operate the servo amplifier at 75 % or less of the effective load ratio.
## Environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Operation</th>
<th>Transportation</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>0 °C to 55 °C (non-freezing)</td>
<td>-25 °C to 70 °C (non-freezing)</td>
<td>-25 °C to 70 °C (non-freezing)</td>
</tr>
<tr>
<td></td>
<td>Class 3K3 (IEC 60721-3-3)</td>
<td>Class 2K3 (IEC 60721-3-2)</td>
<td>Class 1K3 (IEC 60721-3-1)</td>
</tr>
<tr>
<td><strong>Ambient humidity</strong></td>
<td>5 %RH to 95 %RH (non-condensing)</td>
<td>5 %RH to 95 %RH (non-condensing)</td>
<td>5 %RH to 95 %RH (non-condensing)</td>
</tr>
<tr>
<td><strong>Ambience</strong></td>
<td>Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Altitude/atmospheric pressure</strong></td>
<td>Altitude: 2000 m or less ¹</td>
<td>Transportation conditions: Must be transported by ground/sea, or air at an atmospheric pressure of 700 hPa or more.</td>
<td>Atmospheric pressure: 700 hPa to 1060 hPa (equivalent to the altitude of -400 m to 3000 m.)</td>
</tr>
<tr>
<td><strong>Vibration resistance</strong></td>
<td>When there is continuous vibration: 10 Hz to 57 Hz, displacement amplitude 0.075 mm, 57 Hz to 150 Hz, acceleration amplitude 9.8 m/s², Class 3M1 (IEC 60721-3-3)</td>
<td>2 Hz to 8 Hz, displacement amplitude (half amplitude) 7.5 mm, 8 Hz to 200 Hz, acceleration amplitude 20 m/s², Class 2M3 (IEC 60721-3-2)</td>
<td>2 Hz to 9 Hz, displacement amplitude (half amplitude) 1.5 mm, 9 Hz to 200 Hz, acceleration amplitude 5 m/s², Class 1M2 (IEC 60721-3-1)</td>
</tr>
</tbody>
</table>

¹ Refer to "Restrictions when using this product at altitude exceeding 1000 m and up to 2000 m" in the following manual for using the product at altitude exceeding 1000 m.

MR-JET User's Manual (Hardware)
1.4 Function block diagram

The following shows the function block diagram of this servo amplifier.

*1 The built-in regenerative resistor is not used for MR-JET-10G and MR-JET-20G.

*2 Servo amplifiers with the rated output symbol of 200 (MR-JET-200G) or greater have a cooling fan.
1.5 Configuration including peripheral equipment

- To prevent a malfunction, do not connect these connectors to any network other than the specified network.
- Equipment other than the servo amplifier and servo motor is optional or a recommended product.

The following is an example using MR-JET-40G.

*1 The power factor improving AC reactor can also be used.
## 2.1 Function list

The function list of this servo amplifier is shown in the following table. For details of the functions, refer to each section indicated in the detailed explanation field.

### Control mode

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CiA 402 control mode</td>
<td>Cyclic synchronous position mode (csp)</td>
<td>This function operates the servo motor in the cyclic synchronous position mode.</td>
<td>Refer to “Control mode” in the following manual.</td>
</tr>
<tr>
<td></td>
<td>Cyclic synchronous velocity mode (csv)</td>
<td>This function operates the servo motor in the cyclic synchronous velocity mode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cyclic synchronous torque mode (cst)</td>
<td>This function operates the servo motor in the cyclic synchronous torque mode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Homing mode (hm)</td>
<td>This function either operates the servo motor in the homing mode or this function performs homing.</td>
<td></td>
</tr>
<tr>
<td>Test operation</td>
<td>Test operation mode</td>
<td>This function requires MR Configurator2 for Jog operation, positioning operation, motor-less operation, DO forced output and program operation.</td>
<td>Page 35 Test operation</td>
</tr>
</tbody>
</table>

### Drive motor

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder</td>
<td>High-resolution encoder</td>
<td>A 4,194,304 pulses/rev high-resolution encoder is used for the encoder of the rotary servo motor.</td>
<td></td>
</tr>
</tbody>
</table>

### Network

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open network (CC-Link line)</td>
<td>CC-Link IE TSN communication</td>
<td>This function connects the servo amplifier to equipment such as a controller through CC-Link IE TSN.</td>
<td>MR-JET-G User's Manual (Communication Function)</td>
</tr>
<tr>
<td>Common protocol</td>
<td>SLMP</td>
<td>This function supports SLMP (Seamless Message Protocol). Servo parameter settings and monitoring are available.</td>
<td></td>
</tr>
<tr>
<td>Remote maintenance</td>
<td>Automatic parameter setting</td>
<td>This function delivers the settings of the servo parameters and other areas from the controller.</td>
<td></td>
</tr>
</tbody>
</table>

### Position detection

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control method</td>
<td>Semi closed loop system</td>
<td>This function uses the servo motor encoder to configure semi closed loop systems.</td>
<td></td>
</tr>
<tr>
<td>Absolute position</td>
<td>Absolute position detection system</td>
<td>This function performs homing once, and thereafter does not require homing at every power-on.</td>
<td>MR-JET User's Manual (Hardware)</td>
</tr>
</tbody>
</table>
## Operation function

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop function</td>
<td>Quick Stop</td>
<td>This function stops the servo motor with a specified method and switches to the servo-off status.</td>
<td>Refer to “Quick stop” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td></td>
<td>Halt</td>
<td>This function stops the servo motor while the servo-on status is maintained.</td>
<td>Refer to “Halt” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td>Stroke limit function</td>
<td></td>
<td>This function uses LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) to limit the travel interval of the servo motor. Travel intervals can be limited with FLS (Upper stroke limit) and RLS (Lower stroke limit) via a controller.</td>
<td>Refer to “Stroke limit function” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td>Command generation</td>
<td>Rotation/travel direction selection</td>
<td>This function sets the rotation direction of the servo motor without changing the command polarity.</td>
<td>Refer to “Rotation/travel direction selection” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td></td>
<td>Electronic gear</td>
<td>This function performs positioning control with the value obtained by multiplying the position command from the upper controller by a set electronic gear ratio.</td>
<td>Refer to “Electronic gear function” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration function</td>
<td>This function enables smooth acceleration/deceleration.</td>
<td>Refer to “Acceleration/deceleration function” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td></td>
<td>Torque limit</td>
<td>This function limits the servo motor torque.</td>
<td>Refer to “Torque limit” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td></td>
<td>Speed limit</td>
<td>This function limits the servo motor speed in the torque control mode.</td>
<td>Refer to “Speed limit” in the following manual. MR-JET User's Manual Function</td>
</tr>
<tr>
<td></td>
<td>Command offset</td>
<td>This function compensates the position/speed/torque commands by adding a desired amount of offset to the commands.</td>
<td>Refer to “Command offset” in the following manual. MR-JET User's Manual Function</td>
</tr>
</tbody>
</table>
## Control function

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration suppression</td>
<td>Advanced vibration suppression control II</td>
<td>This function suppresses vibration and residual vibration at an arm end.</td>
<td>Refer to “Advanced vibration suppression control II” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td></td>
<td>Machine resonance suppression filter</td>
<td>This function decreases the gain of the specific frequency to suppress the resonance of the mechanical system.</td>
<td>Refer to “Machine resonance suppression filter” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td></td>
<td>Shaft resonance suppression filter</td>
<td>When driving the servo motor with a load mounted to the servo motor shaft, resonance due to shaft torsion may generate high frequency mechanical vibration. The shaft resonance suppression filter suppresses this vibration.</td>
<td>Refer to “Shaft resonance suppression filter” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td></td>
<td>Robust filter</td>
<td>This function improves a disturbance response when a response performance cannot be increased because of a large load to motor inertia ratio, such as a roll feed axis.</td>
<td>Refer to “Robust filter” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td></td>
<td>Slight vibration suppression control</td>
<td>This function suppresses vibration of ±1 pulse generated at each servo motor stop.</td>
<td>Refer to “Slight vibration suppression control” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td>Tracking control</td>
<td>Lost motion compensation function</td>
<td>This function improves the response delay generated when the machine moving direction is reversed.</td>
<td>Refer to “Lost motion compensation function” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td></td>
<td>Super trace control</td>
<td>This function reduces the droop pulses at the rated speed and at the uniform acceleration/deceleration to almost zero.</td>
<td>Refer to “Super trace control” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
<tr>
<td></td>
<td>Path tracking model adaptive control</td>
<td>This function reduces tracking errors in reciprocation.</td>
<td>Refer to “Path tracking model adaptive control” in the following manual. MR-JET User’s Manual (Adjustment)</td>
</tr>
</tbody>
</table>
### Adjustment function

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic adjustment</td>
<td>Quick tuning</td>
<td>This function automatically adjusts the gain at servo-on in a short time without acceleration/deceleration operation of the servo motor. Response without overshoot is possible, saving gain adjustment time.</td>
<td>Refer to “Quick tuning” in the following manual. [MR-JET User’s Manual (Adjustment)]</td>
</tr>
<tr>
<td>Auto tuning</td>
<td></td>
<td>This function automatically adjusts the gain to an optimum value even if the load applied to the servo motor shaft varies.</td>
<td>Refer to “Adjustment function types” in the following manual. [MR-JET User’s Manual (Adjustment)]</td>
</tr>
<tr>
<td>One-touch tuning</td>
<td></td>
<td>Gain adjustment is performed with this function just by pressing buttons on the servo amplifier or by clicking a button once on MR Configurator2. The one-touch tuning can also be performed via a network.</td>
<td>Refer to “One-touch tuning” in the following manual. [MR-JET User’s Manual (Adjustment)]</td>
</tr>
<tr>
<td>Custom adjustment</td>
<td>Model adaptive control</td>
<td>This function achieves a high response and stable control according to the ideal model. This is a two-degrees-of-freedom model and can adjust responses to the command and to the disturbance separately. In addition, this function can be disabled.</td>
<td>Refer to “Model adaptive control” in the following manual. [MR-JET User’s Manual (Adjustment)]</td>
</tr>
<tr>
<td></td>
<td>Gain switching function</td>
<td>This function switches gains during rotation and during stop, and uses an input device to switch gains during operation. Supports the gain switching by rotation direction and the 3-step gain switching. Therefore, more detailed gain switching is available.</td>
<td>Refer to “Gain switching function” in the following manual. [MR-JET User’s Manual (Adjustment)]</td>
</tr>
<tr>
<td>Adjustment support</td>
<td>Machine analyzer</td>
<td>This function analyzes the frequency characteristic of the mechanical system by simply connecting the servo amplifier with an MR Configurator2 installed personal computer.</td>
<td>Refer to “Adjustment functions available in combination with MR Configurator2” in the following manual. [MR-JET User’s Manual (Adjustment)]</td>
</tr>
</tbody>
</table>

### I/O, monitor

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI/DO</td>
<td>Input signal selection (device selection)</td>
<td>This function assigns the input devices including LSP (forward rotation stroke end) to certain pins of the connector.</td>
<td>Refer to “I/O device” in the following manual. [MR-JET User’s Manual (Function)]</td>
</tr>
<tr>
<td></td>
<td>Output signal selection (device setting)</td>
<td>This function assigns output devices such as MBR (Electromagnetic brake interlock) to certain pins of the connector.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output signal (DO) forced output</td>
<td>This function forcibly switches the output signals on and off regardless of the servo status. Use this function for checking output signal wiring and other areas.</td>
<td>[Page 39 Output signal (DO) forced output]</td>
</tr>
<tr>
<td>LED</td>
<td>Status display</td>
<td>This function shows the servo status on the 7-segment LED display.</td>
<td>[Page 22 Switch setting and display of the servo amplifier]</td>
</tr>
<tr>
<td>Monitor</td>
<td>Power monitoring function</td>
<td>This function calculates the running power and the regenerative power from the data in the servo amplifier such as speed and current. The power consumption and other information is displayed on MR Configurator2.</td>
<td>Refer to “Monitor” in the following manual. [MR-JET User’s Manual (Function)]</td>
</tr>
</tbody>
</table>
### Function

#### Function list

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
</table>
| Regenerative performance     | Regenerative option     | Use this function if the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capacity for the generated regenerative power. | Refer to "Regenerative option" in the following manual.  
[MR-JET User's Manual (Hardware)](#) |

### Engineering tool

#### Setup software

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup software</td>
<td>MR Configurator2</td>
<td>This function performs settings (such as servo parameter settings), test operation, and monitoring with a personal computer.</td>
<td>4 STARTUP</td>
</tr>
</tbody>
</table>

### Protective functions

#### Alarm

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
</table>
| Alarm                        | Alarm function          | When an error occurs during operation, the corresponding alarm or warning is displayed. When an alarm occurs, ALM (Malfunction) turns off and stops the servo motor. When a warning occurs, WNG (Warning) will turn on. However, depending on the warning, the servo motor stops or continues operation. | Refer to "Alarm function" in the following manual.  
[MR-JET User's Manual (Function)](#) |
| Alarm history clear          |                         | This function clears alarm histories.                                                                   | Refer to "Alarm history" in the following manual.  
[MR-JET User's Manual (Function)](#) |

#### Power error detection

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
</table>
| Power error detection        | Disconnection detection function | This function detects a disconnection in the servo motor power supply output.                        | Refer to "Disconnection detection function" in the following manual.  
[MR-JET User's Manual (Function)](#) |

#### Coasting distance reduction

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
</table>
| Coasting distance reduction  | Forced stop deceleration function | This function decelerates the servo motor to a stop at EM2 off and alarm occurrence.                | Refer to " Forced stop deceleration function" in the following manual.  
[MR-JET User's Manual (Function)](#) |

#### Drop protection

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
</table>
| Drop protection              | Electromagnetic brake interlock function | This function operates the electromagnetic brake at servo off and error occurrence, and prevents the vertical axis from dropping. | Refer to "Electromagnetic brake interlock function" in the following manual.  
[MR-JET User's Manual (Function)](#) |
| Vertical axis freefall prevention function |                         | This function avoids machine damage by pulling up the mechanical backlash of an electromagnetic brake. | Refer to "Vertical axis freefall prevention function" in the following manual.  
[MR-JET User's Manual (Function)](#) |

#### Braking protection

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braking protection</td>
<td>Dynamic brake</td>
<td>During the power shut-off and alarm occurrence, this function shorts between U, V, and W phases and operates the brake.</td>
<td>---</td>
</tr>
</tbody>
</table>

### Instantaneous power failure measures

#### Tough drive

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
</table>
| Tough drive                  | Tough drive function    | This function makes the equipment continue operating even under conditions where an alarm would normally occur. There are two types of tough drive function: the vibration tough drive and the instantaneous power failure tough drive. | Refer to "Tough drive function" in the following manual.  
[MR-JET User's Manual (Function)](#) |
### Diagnostics

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive data diagnosis</td>
<td>Drive recorder</td>
<td>This function continuously monitors the servo status and records the state transition before and after an alarm for a fixed period of time. The recorded data can be checked by the Waveform-Display button on the drive recorder window of MR Configurator2 being clicked. However, the drive recorder is not available when:</td>
<td>Refer to &quot;Drive recorder&quot; in the following manual. MR-JET User's Manual (Function)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The graph function of MR Configurator2 is being used. • The machine analyzer function is being used. • [Pr. PF21] is set to &quot;-1&quot;. • The controller is not connected (except the test operation mode). • An alarm related to the controller is occurring. The long-term sampling is supported and various alarms can be handled.</td>
<td></td>
</tr>
<tr>
<td>Graph function</td>
<td>This function obtains the servo status in the graph.</td>
<td>Refer to &quot;Graph function&quot; in the following manual. MR-JET User's Manual (Function)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This function obtains a graph by using the trigger synchronized on multiple servo amplifiers via a network.</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Failure diagnosis</td>
<td>Encoder communication diagnosis function</td>
<td>This function diagnoses with MR Configurator2 whether the encoder communication error is caused by the circuit malfunction of the servo amplifier or by the malfunction of the cables/encoder.</td>
<td>Refer to &quot;Encoder communication diagnosis function&quot; in the following manual. MR-JET User's Manual (Function)</td>
</tr>
<tr>
<td>Service life diagnosis</td>
<td>Servo amplifier service life diagnosis function</td>
<td>This function enables checking of the cumulative energization time, the number of the inrush relay on/off times, and the number of dynamic brake usage times. It gives an indication of the replacement time for parts on the servo amplifier with a service life (such as the capacitor and the relay) before they malfunction. MR Configurator2 is required for this function.</td>
<td>Refer to &quot;Servo amplifier service life diagnosis function&quot; in the following manual. MR-JET User's Manual (Function)</td>
</tr>
<tr>
<td>Motor service life diagnosis function</td>
<td>This function predicts failures of the equipment and the servo motor based on the machine total travel distance. It gives an indication of the replacement time for the servo motor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine diagnosis function</td>
<td>This function uses the data in the servo amplifier to estimate the friction and vibrational component of the drive system in the equipment and to recognize an error in machine parts such as ball screws and bearings.</td>
<td>Refer to &quot;Machine diagnosis&quot; in the following manual. MR-JET User's Manual (Function)</td>
<td></td>
</tr>
<tr>
<td>System diagnosis</td>
<td>System configuration information</td>
<td>This function uses MR Configurator2 to monitor information such as the servo amplifier model, connected servo motor, and encoder.</td>
<td>Refer to &quot;System configuration display&quot; in the following manual. MR-JET User's Manual (Function)</td>
</tr>
</tbody>
</table>

### History

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Function</th>
<th>Description</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>Alarm history</td>
<td>This function saves information of the alarm that occurred in the servo amplifier. The information is saved in chronological order and used for occasions such as analyzing the cause of the alarm.</td>
<td>Refer to &quot;Alarm history&quot; in the following manual. MR-JET User's Manual (Function)</td>
</tr>
</tbody>
</table>
To completely prevent unauthorized access to the system from external devices, the user also must take safety measures. Mitsubishi Electric Corporation cannot be held responsible for any problems caused by unauthorized access.
3 STRUCTURE

3.1 Parts identification

MR-JET-G

The following figure shows an MR-JET-40G servo amplifier.

*1 A protective sticker is attached to the front of the servo amplifier when shipped from the factory.
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Application</th>
<th>Detailed explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display section</td>
<td>The 1-digit, 7-segment LED display shows the servo status and alarm number.</td>
<td>☞ Page 22 Switch setting and display of the servo amplifier</td>
</tr>
<tr>
<td>2</td>
<td>Network status LEDs</td>
<td>Displays each network status.</td>
<td>☞</td>
</tr>
<tr>
<td>3</td>
<td>Rotary switches (SW1/SW2)</td>
<td>Set the IP address of the servo amplifier.</td>
<td>☞</td>
</tr>
<tr>
<td>4</td>
<td>Ethernet cable connector (CN1A)</td>
<td>Connect the controller, servo amplifier or each network connected device.</td>
<td>☞</td>
</tr>
<tr>
<td>5</td>
<td>Ethernet cable connector (CN1B)</td>
<td></td>
<td>☞</td>
</tr>
<tr>
<td>6</td>
<td>USB communication connector (CN5)</td>
<td>Connect with a personal computer.</td>
<td>☞</td>
</tr>
<tr>
<td>7</td>
<td>I/O signal connector (CN3)</td>
<td>Connect the digital I/O signals.</td>
<td>Refer to &quot;Connectors and pin assignment&quot; in the following manual. MR-JET User's Manual (Hardware)</td>
</tr>
<tr>
<td>8</td>
<td>Encoder connector (CN2)</td>
<td>Connect a servo motor encoder or an external encoder.</td>
<td>☞</td>
</tr>
<tr>
<td>9</td>
<td>Power connector (CNP1)</td>
<td>Connect the input power supply, built-in regenerative resistor, regenerative option, and servo motor.</td>
<td>Refer to &quot;Explanation of power supply system&quot; in the following manual. MR-JET User's Manual (Hardware)</td>
</tr>
<tr>
<td>10</td>
<td>Charge light</td>
<td>When the main circuit is charged, this light is on. While the light is on, do not change the connections of the wires.</td>
<td>☞</td>
</tr>
<tr>
<td>11</td>
<td>Protective earth (PE) terminal</td>
<td>Connect this terminal to the protective earth (PE) of the cabinet.</td>
<td>Refer to &quot;Explanation of power supply system&quot; in the following manual. MR-JET User's Manual (Hardware)</td>
</tr>
<tr>
<td>12</td>
<td>Rating plate</td>
<td>Indicates information such as model and capacity.</td>
<td>☞ Page 8 Rating plate</td>
</tr>
<tr>
<td>13</td>
<td>Servo status LED</td>
<td>Displays the servo status.</td>
<td>☞ Page 22 Switch setting and display of the servo amplifier</td>
</tr>
</tbody>
</table>
3.2 Switch setting and display of the servo amplifier

Network settings can be configured using switches on the servo amplifier. The network communication status and alarm status can also be checked on the display (1-digit, 7-segment LED) of the servo amplifier.

Switches

If a metal screw driver contacts with the conductive areas, the switches may malfunction. Therefore, use an insulated screw driver instead of a metal screw driver to operate the rotary switches (SW1/SW2).

To apply the settings of all switches, cycle the power supply or reset the software.

The following explains the rotary switches (SW1/SW2).

Switch identification

Rotary switches (SW1/SW2)

The IP address of the servo amplifier can be set with the rotary switches (SW1/SW2). SW1 indicates an upper digit and SW2 indicates a lower digit of a hexadecimal.

To set 02h, set the rotary switches to the following positions.

The rotary switches are set to 01h when shipped from the factory.

To apply the settings of the rotary switches, set "0" (The rotary switch is used.) in [Pr. NPA01 IP address setting]. To set the IP address without using the rotary switches, set them to 0 and use an engineering tool.

For how to set IP addresses, refer to "IP address setting function" in the following manual.

MR-JET-G User's Manual (Communication Function)
7-segment LED

The network connection status, servo status, and alarm/warning occurrence statuses can be checked on the 7 segment LED display.

Display sequence

The following shows the display sequence of the 7-segment LED display after power-on. Once a system check is complete and the servo amplifier is started, the network connection status will be displayed.

![Display sequence diagram]

Alarm display

When an alarm/warning occurs, the alarm status is displayed after the network connection status. This is an example of the alarm display for when [AL. 032.2 Overcurrent] is occurring.

![Alarm display diagram]

When the network is connected

The 7-segment LED display during network connection is as follows.

![Network connection status diagram]
### When the network is not connected

The 7-segment LED display shows as follows during initialization.

<table>
<thead>
<tr>
<th>Display</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image 1]</td>
<td>Controller not connected</td>
<td>Indicates that the servo amplifier is not connected to the controller.</td>
</tr>
<tr>
<td>![Image 2]</td>
<td>Data not linked</td>
<td>Indicates that initial communication for CC-Link IE TSN is in progress.</td>
</tr>
<tr>
<td>![Image 3]</td>
<td>Cyclic communication in progress</td>
<td>Indicates the Pre-Operational state shown in the state transition diagram of the NMT state machine.</td>
</tr>
<tr>
<td>![Image 4]</td>
<td>Cyclic communication being stopped</td>
<td>Indicates the Safe-Operational state shown in the state transition diagram of the NMT state machine.</td>
</tr>
<tr>
<td>![Image 5]</td>
<td></td>
<td>Indicates that the servo amplifier is in the state of the reserved station.</td>
</tr>
</tbody>
</table>
## Other status displays

<table>
<thead>
<tr>
<th>Display</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Image" /></td>
<td>Test operation mode</td>
<td>Indicates that the test operation mode was set.</td>
</tr>
<tr>
<td><img src="image2" alt="Image" /></td>
<td>CPU error</td>
<td>Indicates that a CPU watchdog error has occurred.</td>
</tr>
<tr>
<td><img src="image3" alt="Image" /></td>
<td>—</td>
<td>This is for manufacturer setting.</td>
</tr>
<tr>
<td><img src="image4" alt="Image" /></td>
<td>Initialization in progress</td>
<td>Indicates that initialization of settings such as parameters is in progress.</td>
</tr>
<tr>
<td><img src="image5" alt="Image" /></td>
<td>IP address setting in progress</td>
<td>Indicates that the IP address is being set via network.</td>
</tr>
</tbody>
</table>
Status LEDs

The servo status LED shows the servo status. The network status LEDs show the network status.

### Servo status LED

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
</table>

### Network status LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN</td>
<td>Off: Indicates that an alarm is occurring. On: Indicates that the servo amplifier is on.</td>
</tr>
<tr>
<td>ERR</td>
<td>Off: Indicates that no alarm or warning is occurring. Blinking: Indicates that a warning is occurring. On: Indicates that an alarm is occurring.</td>
</tr>
<tr>
<td>LA A</td>
<td>Indicates the CN1A link status. On: Linking up</td>
</tr>
<tr>
<td>LA B</td>
<td>Indicates the CN1B link status. On: Linking up</td>
</tr>
</tbody>
</table>
STARTUP

- MR-JET-_G servo amplifiers can only be set with MR Configurator2 version 1.105K or later.
- This chapter explains how to start up the servo amplifier by using MR Configurator2 version 1.100E.
- Before starting operation, check each servo parameter. Depending on the machine, an unexpected operation may occur.

Servo parameter setting method

- Servo parameters may be changed by the controller via a network. In this case, take measures such as not turning on the controller or not connecting the network cable to the controller, so that the servo parameter setting does not change.

MR Configurator2 is the software which performs the servo parameter setting, graph measurement/display, test operation, and other settings. This chapter describes the startup procedure of the servo amplifier when the servo amplifier is connected to a personal computer which has MR Configurator2 installed. To learn more about using MR Configurator2, refer to Help in MR Configurator2.

1. Connect the servo amplifier and the personal computer with a USB cable. Turn on the servo amplifier.

2. Start MR Configurator2 and create a new project. For the connection setting, select USB. Select the servo amplifier model.
3. Selecting "Parameter" from the project tree opens the "Parameter Setting" screen.

4. From the display selection tree on the "Parameter Setting" screen, select the group of servo parameters to be set.
5. After changing the servo parameter, click "Selected Items Write" or "Axis Writing".

6. Servo parameters with * before the abbreviation and servo parameters marked as ** are enabled by cycling the power or performing a software reset. Click "Software Reset" in MR Configurator2 to perform the software reset.
4.1 Switching power on for the first time

When switching the power on for the first time, make a startup according to the procedures shown below.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Installation and wiring</td>
<td>Install and wire the servo amplifier and servo motor.</td>
<td>MR-JET User's Manual (Hardware)</td>
</tr>
<tr>
<td>2. Test operation of the servo</td>
<td>With the servo motor disconnected from the machine, operate the servo motor at the lowest speed possible, and check whether the servo motor operates correctly.</td>
<td>Page 31 Test operation of the servo motor alone in test operation mode</td>
</tr>
<tr>
<td>motor alone in test operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Equipment configuration setting</td>
<td>Perform each parameter setting according to the equipment configuration.</td>
<td>Page 32 Equipment configuration setting</td>
</tr>
<tr>
<td>4. Controller-related setting</td>
<td>Perform necessary settings according to commands from the controller.</td>
<td>Page 32 Controller-related setting</td>
</tr>
<tr>
<td>5. Operation by controller command</td>
<td>Operate the servo motor at the lowest speed possible by giving commands to the servo amplifier from the controller, and check whether the servo motor operates correctly.</td>
<td>Page 33 Operation by controller command</td>
</tr>
<tr>
<td>6. Actual operation</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Test operation of the servo motor alone in test operation mode

- If the servo motor operates in an unintended manner, stop the servo motor with EM2 (Forced stop 2).

Check that the servo amplifier and servo motor operate normally. With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor operates correctly. This section describes how to check the servo motor operation in the JOG operation. The test operation also includes the positioning operation and program operation.

1. Set [Pr. PC05.1 Test operation selection] to "1" (enabled).
2. Cycle the power of the servo amplifier. When initialization is completed, the display shows as follows.

Test operation status display

3. Open the "JOG Mode" screen of MR Configurator2.

4. To operate the servo motor, input the motor speed and acceleration/deceleration time constants, then click "Forward CCW" or "Reverse CW". The servo motor operates only while the button is being clicked. Give a low speed command at first and check the operation.

5. After the test operation, set [Pr. PC05.1 Test operation selection] back to "0" (disabled).
Equipment configuration setting

Set the servo parameters for each function appropriately for the equipment configuration. Refer to the following for details.

MR-JET User's Manual (Function)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation/travel direction selection</td>
<td>To change the rotation/travel direction (POL), change the servo parameter.</td>
<td></td>
</tr>
<tr>
<td>Stroke limit function</td>
<td>Limit switches can be used to limit travel intervals of the servo motor.</td>
<td></td>
</tr>
<tr>
<td>In-position setting</td>
<td>Positioning completion status can be checked with in-position. Set this as</td>
<td></td>
</tr>
<tr>
<td>Forced stop deceleration function</td>
<td>Stops the servo motor at EM2 ( Forced stop 2) off. Perform settings such as</td>
<td></td>
</tr>
<tr>
<td>Vertical axis freefall prevention function</td>
<td>For vertical axes, this function pulls up the shaft slightly. When using a</td>
<td></td>
</tr>
</tbody>
</table>

Controller-related setting

Refer to the applicable network instruction manual for the network connection setting.

<table>
<thead>
<tr>
<th>Network</th>
<th>Reference manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC-Link IE TSN</td>
<td>MR-JET-G User's Manual (Communication Function)</td>
</tr>
</tbody>
</table>

Set the servo parameter using the controller according to the control mode to be used.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network standard mode</td>
<td>Operates in the modes such as csp/csv/cst specified in CiA 402.</td>
<td>Refer to &quot;Control mode&quot; in the following manual.</td>
</tr>
<tr>
<td>Command unit select function</td>
<td>This function enables the unit of speed command to be selected.</td>
<td>Refer to &quot;Command unit select function&quot; in the following manual.</td>
</tr>
<tr>
<td>Electronic gear setting</td>
<td>Perform the settings related to the controller command unit and amplifier</td>
<td>Refer to &quot;Electronic gear function&quot; in the following manual.</td>
</tr>
<tr>
<td>Homing</td>
<td>To perform homing with the function of the amplifier without using the</td>
<td>Refer to &quot;Control mode&quot; in the following manual.</td>
</tr>
</tbody>
</table>

Set each servo parameter that is necessary for the operation using controller commands.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command unit select function</td>
<td>This function enables the unit of speed command to be selected.</td>
<td>Refer to &quot;Command unit select function&quot; in the following manual.</td>
</tr>
<tr>
<td>Electronic gear setting</td>
<td>Perform the settings related to the controller command unit and amplifier</td>
<td>Refer to &quot;Electronic gear function&quot; in the following manual.</td>
</tr>
<tr>
<td>Homing</td>
<td>To perform homing with the function of the amplifier without using the</td>
<td>Refer to &quot;Control mode&quot; in the following manual.</td>
</tr>
</tbody>
</table>
Operation by controller command

Confirm that the servo motor operates correctly under the commands from the controller. Give a low speed command at first to check the servo motor operations such as the rotation direction. If the servo motor does not operate in the intended direction, check the input signal.

1. Open the batch display screen in MR Configurator2. Confirm that there is no error in the items such as servo motor speed and load ratio.

2. Open the I/O Monitor screen. Confirm that there is no error in the I/O signal.
4.2 Instructions on startup

Instructions for power-on

- When the absolute position detection system is used in a rotary servo motor, [AL. 025 Absolute position erased] occurs the first time that the power is turned on and the servo motor cannot be changed to servo-on status. Shut off the power once, then cycle the power to deactivate the alarm.

- If the power is switched on while the servo motor is being rotated by an external force, an alarm may occur. Make sure that the servo motor is not operating before switching on the power. In addition, refer to the manual for the servo motor or encoder being used.

Stop

If any of the following situations occur, the servo amplifier suspends and stops the operation of the servo motor. If the servo motor is operated by the network command, the servo motor may be stopped by the controller command.

<table>
<thead>
<tr>
<th>Operation/command</th>
<th>Stopping condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm occurrence</td>
<td>The servo motor decelerates to a stop. There are also alarms that activate and stop the dynamic brake. Refer to the following for the details of alarm. [MR-JET User's Manual (Troubleshooting)]</td>
</tr>
<tr>
<td>EM2 (Forced stop 2) off</td>
<td>The servo motor decelerates to a stop. [AL. 0E6 Servo forced stop warning] occurs. In the torque mode, EM2 functions the same as EM1.</td>
</tr>
<tr>
<td>Limit switch off</td>
<td>If LSP (Forward rotation stroke end), LSN (Reverse rotation stroke end), FLS (Upper stroke limit), or RLS (Lower stroke limit) is turned off, the servo motor will stop slowly and become in the servo-lock state. Operation in the opposite direction is possible.</td>
</tr>
</tbody>
</table>

Instructions for network disconnection

To turn off the system power and disconnect the servo amplifier from the network, specific procedures may be required. For details, refer to "Establishing and disconnecting the communication" in the following manual. [MR-JET-G User's Manual (Communication Function)]

4.3 Troubleshooting at startup

Investigation by using MR Configurator2.

The reason that the servo motor does not rotate can be investigated via MR Configurator2. The cause that the servo motor fails to rotate is acquired from the servo amplifier of the target axis, and displayed on "No Motor Rotation". The window will remain blank when no cause exists. "- - - -" is displayed when off-line or the cause cannot be acquired.
4.4 Duplicate setting

Servo amplifier parameters for which setting has been completed can be copied to another servo amplifier. Use this function when replacing the servo amplifier of equipment with another servo amplifier during operation, and when starting up multiple devices with the same configuration.

Restrictions

■ The following data are not duplicated. Set them as required after the duplication.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homing</td>
<td>The information of the home position is not duplicated. Execute homing again.</td>
</tr>
<tr>
<td>Machine service life diagnosis</td>
<td>Machine service life diagnosis information may not be duplicated. Refer to &quot;Machine diagnosis&quot; in the following manual, and perform required settings.</td>
</tr>
</tbody>
</table>

■ The following data is not duplicated.

- Alarm history data
- Drive recorder data

Duplication using MR Configurator2

1. The data set in MR Configurator2 can be saved as a project.
2. To copy the project to a different servo amplifier, open the project and then connect the servo amplifier and a personal computer via a USB cable. Turn on the servo amplifier.
3. Write the required data in MR Configurator2. After the writing is completed, cycle the power or reset the software as necessary.

4.5 Test operation

Using the test operation function enables the machine operation to be checked before the actual operation. With a personal computer and MR Configurator2, operations such as the JOG operation, positioning operation, output signal forced output, and program operation can be used.

Precautions

- The test operation mode is designed for checking servo operation. This mode is not for checking machine operation. Do not use this mode with the machine. Use this mode only with the servo motor.

Execution method

Test operation mode is enabled by MR Configurator2. To set to the normal operation mode again after executing the test operation mode, cycle the power or reset the software.

- Perform the test operation after the forced stop has been released. For details of the forced stop deceleration function, refer to "Forced stop deceleration function" in the following manual.
Test operation mode

Setting the servo amplifier to the test operation mode enables the test operation while the personal computer and servo amplifier are connected via a USB cable.

1. Set [Pr. PC05.1 Test operation selection] to "1" (enabled).
2. Cycle the power of the servo amplifier. When initialization is completed, the display shows as follows.

   Test operation status display

3. Use MR Configurator2 to perform the test operation.

4. After the test operation, set [Pr. PC05.1 Test operation selection] back to "0" (disabled).

Motor driving by test operation

JOG operation

The JOG operation can be performed when there is no command from the controller. The motor can be operated at the specified speed. Operate on the jog operation screen of MR Configurator2.

- Motor operation setting (1)
  Set the motor speed and acceleration/deceleration time constants for JOG operation. When changing the speed to the permissible speed, set the speed in [Pr. PA 28.4 Speed range limit selection].

- Limit switch automatic ON (2)
  JOG operation can be performed when the limit switch is not connected. Be sure to avoid causing a collision while performing the operation.

- Operation (3)
  The servo motor can be started (CCW/CW), paused, stopped, and forcibly stopped. Clicking "Start" starts the operation. When "Rotation only while the CCW or CW button is being pushed" is selected, operation will continue until clicking "Stop" or "Forced Stop" after clicking "Forward CCW" and "Reverse CW".
Positioning operation

Positioning operation can be performed without the controller. Perform the operation on the Positioning Mode screen of MR Configurator2.

■ Motor operation setting (1)
Set the motor speed, acceleration/deceleration time constants, and travel distance in the positioning operation mode. When changing the speed to the permissible speed, set the speed in [Pr. PA 28.4 Speed range limit selection].

■ Limit switch (2)
Select "Limit switch automatic ON" to perform the positioning operation when the limit switch is not connected. Be sure to avoid causing a collision while performing the operation.

■ Move until Z-phase signal (3)
When "Z-phase signal movement" is selected, the servo motor moves until the first Z-phase signal after positioning operation.

■ Operation (4)
The servo motor can be started (CCW/CW), paused, stopped, or forcibly stopped. Clicking "Operation Start" starts the operation in the specified operation condition.

■ Repeat operation (5)
Selecting "Make the repeated operation valid" enables the repeat operation. Selecting "Make the aging function valid" enables the continuous operation until clicking "Stop" or "Forced stop". Set the repeat pattern, the dwell time, and the number of operations.

■ Operation status (6)
The operation status during the repeat operation and the number of operations are displayed.
Program operation

Positioning operation using multiple operation patterns can be performed without a controller. Perform this operation on the Program Operation screen of MR Configurator2. For details, refer to Help of MR Configurator2.

1. Open the Program Operation screen of MR Configurator2.

2. Clicking "Program Edit" in the program operation screen opens the Program Edit screen. Input the program and click "OK". For program commands, refer to Help of MR Configurator2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Screen operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Program display</td>
<td>Displays the program. To edit the display item, click &quot;Program Edit&quot;.</td>
</tr>
<tr>
<td>(2)</td>
<td>Operation</td>
<td>The following operations can be performed: operation start, pause, stop, and forced stop. Clicking &quot;Operation Start&quot; starts the operation.</td>
</tr>
<tr>
<td>(3)</td>
<td>Repeat execution</td>
<td>Displays the number of execution times. Selecting &quot;Aging function&quot; enables the repeated operation of the operation program.</td>
</tr>
</tbody>
</table>
Motor-less operation

Without connecting a servo motor to the servo amplifier, output signals or status displays can be provided in response to the controller commands as if the servo motor is actually running. This operation can be used to check the sequence of a controller. Use this operation after the forced stop has been released. Use this operation with the servo amplifier connected to the controller.

To perform the motor-less operation, set [Pr. PC05.0 Motor-less operation selection] to "1" (enabled). To terminate the motor-less operation, set [Pr. PC05.0] to "0" (disabled).

Load conditions

The operation is performed in the following conditions. Note that the conditions may differ from those of actual machines.

<table>
<thead>
<tr>
<th>Load item</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load torque</td>
<td>0</td>
</tr>
<tr>
<td>Load to motor inertia ratio</td>
<td>[Pr. PB06 Load to motor inertia ratio/load to motor mass ratio]</td>
</tr>
</tbody>
</table>

Alarm

In the motor-less operation, some alarms and warnings are not generated. The following are examples of alarms which do not occur.

- [AL. 016 Encoder initial communication error 1]
- [AL. 01E Encoder initial communication error 2]
- [AL. 01F Encoder initial communication error 3]
- [AL. 020 Encoder normal communication error 1]
- [AL. 021 Encoder normal communication error 2]
- [AL. 025 Absolute position erased]
- [AL. 092 Battery cable disconnection warning]
- [AL. 09F Battery warning]

Output signal (DO) forced output

Output signals can be forcibly switched on/off regardless of the servo status. Use this function for checking output signal wiring and other areas. Operate this function on the DO Forced Output screen of MR Configurator2.

Each output signal can be turned on/off by clicking the ON/OFF button next to its name. After checking, click "Test Operation Mode Cancel" and terminate the output signal (DO) forced output.
4.6 Servo amplifier setting initialization

Servo amplifier settings can be initialized by using the engineering tool (MR Mode Change packed with MR Configurator2). However, information related to the servo amplifier, including power-on cumulative time and the number of relays on/off, is not initialized.

- The storage area of the servo amplifier has a limit for the number of writings. Do not use this function frequently.
- Execute the initialization with the servo amplifier disconnected from the network and directly connected to MR Mode Change via a USB cable.

Initialization procedure by MR Mode Change

Open MR Mode Change and use a USB cable to connect the servo amplifier that will be initialized with a personal computer. Turn on the servo amplifier.

Confirm that "Reset to factory settings" is selected, then click "Write". After the writing is completed, cycle the power or reset the software.

Cycling the power or resetting the software initializes the setting of the servo amplifier at startup. Confirm that the initialization has completed by reading the settings from the servo amplifier.
5 MAINTENANCE, INSPECTION AND PARTS REPLACEMENT

5.1 Inspection items

Precautions

- To prevent an electric shock or a fire, do not disassemble, repair, or modify the product. Disassembled, repaired, and/or modified products are not covered under warranty.
- For repair and parts replacement, contact your local sales office.
- To prevent a malfunction, do not perform an insulation resistance test (megger test) on the servo amplifier.

Periodic inspection

Perform the following inspections.

- Check for loose terminal block screws. Retighten any loose screws.
- Check the cables and the like for scratches or cracks. Inspect them periodically according to operating conditions especially when the servo motor is movable.
- Check that the connector is securely connected to the servo amplifier.
- Check that the wires are not coming out from the connector.
- Check for dust accumulation on the servo amplifier.
- Check for unusual noise generated from the servo amplifier.
- Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.
5.2 Parts with a service life

The service life of the following parts is listed below. In addition, the service life varies depending on the operating methods and environment. If any fault is found in a part, it is necessary to replace it immediately regardless of its service life. For parts replacement, please contact your local sales office.

<table>
<thead>
<tr>
<th>Part name</th>
<th>Recommended service life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothing capacitor</td>
<td>10 years</td>
</tr>
<tr>
<td>Relay</td>
<td>Total number of times of power-on, forced stop by EM1 (Forced stop 1), and sudden stop command from controller: 100,000</td>
</tr>
<tr>
<td>Cooling fan</td>
<td>50,000 hours to 70,000 hours (7 to 8 years)</td>
</tr>
</tbody>
</table>

**Smoothing capacitor**

The characteristic of the smoothing capacitor is deteriorated due to ripple currents or other factors. The service life of the capacitor greatly varies depending on ambient temperature and operating conditions. The service life of the capacitor is 10 years under continuous operation in air-conditioned environments (ambient temperatures of 40 °C or less at altitudes of up to 1000 m and 30 °C or less at altitudes of over 1000 m and up to 2000 m).

**Relays**

Contact faults occur due to contact wear arisen from switching currents. A relay will reach the end of its service life if the following actions are performed a total of 100,000 times: powering on the servo amplifier, inputting the EM1 command (Forced stop 1), and inputting the quick stop command from the servo controller. In addition, the service life of a relay may vary depending on the power supply capacity.

**Servo amplifier cooling fan**

The cooling fan bearings will reach the end of their service life in 50,000 hours to 70,000 hours. Therefore, the cooling fan must be replaced after seven to eight years of continuous operation as a guideline. If unusual noise or vibration is found during inspection, the cooling fan must also be replaced. The service life has been calculated in an environment which contains no corrosive gas, flammable gas, oil mist, or dust. The average annual ambient temperature was 40 °C.
5.3 Replacing fan unit

The internal circuits of the servo amplifier may be damaged by static electricity. Take the following precautions.

- Ensure that the work bench and your body are grounded.
- Do not directly touch conductive areas such as the connector pins and electrical parts.

The fan unit is composed of a cooling fan and its cover.

<table>
<thead>
<tr>
<th>Servo amplifier</th>
<th>Fan units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR-JET-200G/MR-JET-300G</td>
<td>MR-JET-FAN1</td>
</tr>
</tbody>
</table>

Replacement procedure

For the replacement procedure of fan units, refer to "Replacement procedure of fan units" in the following manual.

MR-JET User's Manual (Hardware)
6 COMPLIANCE WITH GLOBAL STANDARDS

6.1 Compliance with global standards

Refer to the following manual for information about compliance with global standards.
MELSERVO-JET Safety Instructions and Precautions for AC Servos (IB(NA)-0300492CHN)

6.2 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods


To comply with the ICAO-TI and the IMDG Code, we have modified the indication on the package for general-purpose AC servo batteries.

The above change will not affect the function or performance of the product.

Target model

<table>
<thead>
<tr>
<th>Battery (cell)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>ER6</td>
</tr>
<tr>
<td>ER17330</td>
</tr>
<tr>
<td>A6BAT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Battery unit (assembled)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>ER6</td>
</tr>
<tr>
<td>CR17335A</td>
</tr>
<tr>
<td>MR-BAT6V1SET(-A)</td>
</tr>
<tr>
<td>MR-BAT6V1BJ</td>
</tr>
</tbody>
</table>

Purpose

To enable safer transportation of lithium metal batteries.

Change in regulations

The following points have been changed for lithium metal batteries transportation by sea or air based on the IATA Dangerous Goods Regulations 54th edition effective January 1, 2013 in addition to the revision of the Recommendations of the United Nations Rev. 15 and the ICAO-TI 2009-2010 Edition. For lithium metal batteries, battery cells alone are classified as UN3090, and batteries assembled or packed with equipment are classified as UN3091.
6.2 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods

■ Transportation of lithium metal batteries alone

<table>
<thead>
<tr>
<th>Packaging requirements</th>
<th>Classification</th>
<th>Main requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight cells or fewer per package with one gram or less of lithium content per cell</td>
<td>UN3090 PI968 Section II</td>
<td>The package must pass a 1.2 m drop test, and a handling label with a battery illustration (size: 120 × 110 mm) must be attached to the package.</td>
</tr>
<tr>
<td>Two or fewer assembled batteries per package with two grams or less of lithium content per battery</td>
<td>UN3090 PI968 Section I</td>
<td>The package must pass a 1.2 m drop test, and a handling label with a battery illustration (size: 120 × 110 mm) must be attached to the package.</td>
</tr>
<tr>
<td>More than eight cells per package with one gram or less of lithium content per cell</td>
<td>UN3090 PI968 Section IB</td>
<td>The batteries must be handled according to Class 9 Dangerous Goods Regulations -e.g., attaching the Class 9 hazard label.</td>
</tr>
<tr>
<td>More than two assembled batteries per package with two grams or less of lithium content per battery</td>
<td>UN3090 PI968 Section IA</td>
<td>The package must comply with Class 9 Packages and be handled according to Class 9 Dangerous Goods Regulations -e.g., attaching the Class 9 hazard label.</td>
</tr>
<tr>
<td>Cells with more than one gram of lithium content per cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembled batteries with more than two grams of lithium content per battery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

■ Transportation of lithium metal batteries packed with or contained in equipment

- For batteries packed with equipment, follow the necessary requirements of UN3090 PI969. Batteries are classified into either Section II/Section I depending on the lithium content/packaging requirements.
- For batteries assembled in equipment, follow the necessary requirements of UN3090 PI970. Batteries are classified into either Section II/Section I depending on the lithium content/packaging requirements. The special handling may be unnecessary depending on the number of batteries and gross mass per package.

Ex.

Mitsubishi Electric label with battery illustration

![Mitsubishi Electric label with battery illustration](image)

* UN number(s)
** Telephone number for additional information

Example of Mitsubishi Electric label with battery illustration

(Available from January 1, 2017)

■ Details of the package change

The following caution has been added to the packages of the corresponding batteries.

"Containing lithium metal battery. Regulations apply for transportation."

■ Transportation precaution for customers

For sea or air transportation, the handling label (above Fig.) must be attached to the package of a Mitsubishi Electric cell or battery. In addition, attaching the label to the outer package of an overpack containing several packages by Mitsubishi Electric is also required. When the content of a package must be handled as dangerous goods (Class 9), the Shipper's Declaration for Dangerous Goods is required, and the package must be compliant with Class 9 Packages. Documentation like the handling label in the specified design and the Shipper's Declaration for Dangerous Goods are required for transportation. Please attach the documentation to the packages and the outer package of the overpack.

The requirements of the IATA Dangerous Goods Regulations are subject to change according to the annual revision. When customers transport lithium batteries by themselves, the responsibility for the cargo lies with the customers. Thus, be sure to check the latest version of the IATA Dangerous Goods Regulations.
6.3 Symbol for the new EU Battery Directive

The symbol for the new EU Battery Directive (2006/66/EC) that is plastered to the general-purpose AC servo battery is explained here.

This mark is valid only in EU.

This mark is in accordance with directive 2006/66/EC Article 20 "Information for end-users" and Annex II.

MITSUBISHI ELECTRIC products are designed and manufactured with high quality materials and components which can be recycled and/or reused.

This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from household waste.

If a chemical symbol is shown beneath the above symbol, a heavy metal of the corresponding chemical symbol is contained in the battery or the accumulator with the following standard concentration or more.

This will be indicated as follows.

Hg: mercury (0.0005 %), Cd: cadmium (0.002 %), Pb: lead (0.004 %)

In the European Union, there are separate collection systems for used batteries and accumulators. Batteries and accumulators must be disposed of properly.

Help us to conserve the environment we live in.
## 6.4 Status of general-purpose AC servo products for compliance with the China RoHS directive

### Outline
The China RoHS directive: 电子信息产品污染控制管理办法 (Management Methods for Controlling Pollution by Electronic Information Products) came into effect on March 1, 2007. The China RoHS directive was replaced by the following China RoHS directive: 电器电子产品有害物质限制使用管理办法 (Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products). The succeeding China RoHS directive has been in effect since July 1, 2016.

The China RoHS directive restricts the following hazardous substances: six hazardous substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)) which are also restricted by EU RoHS 2 (directive 2011/65/EU), and other hazardous substances specified by the State (currently no applicable substances).

### Status of our products for compliance with the China RoHS directive

The following table shows the logo types for the environmental protection use period, and whether the six hazardous substances are contained in our products or not. This table was created based on the standard SJ/T11364.

<table>
<thead>
<tr>
<th>Part name</th>
<th>Hazardous substance (substance/threshold/standard)*1</th>
<th>Logo for environmental protection use period*2</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo amplifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servo system controller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting board</td>
<td>×</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Heat sink</td>
<td>×</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Resin cabinet</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Plate and screw</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Servo motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bracket</td>
<td>×</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Mounting board</td>
<td>×</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Resin cabinet</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Core and cable</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Cable product</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Connector</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Optional unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting board</td>
<td>×</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Resin cabinet</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
<tr>
<td>Plate and screw</td>
<td>○</td>
<td>○○○○</td>
<td></td>
</tr>
</tbody>
</table>

*1 ○: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T26572.
×: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T26572.

*2 Indications based on "Marking for the restriction of the use of hazardous substances in electrical and electronic products" [SJ/T11364-2014]

Indicates that a certain hazardous substance is contained in the product manufactured or sold in China.
Follow safety and usage precautions for the product, and use the product within a limited number of years from the production date. Doing so prevents any hazardous substances in the product from causing environmental pollution or seriously affecting human health or property.
Indicates that no certain hazardous substance is contained in the product.
**Difference between the China RoHS directive and the EU RoHS directive**

The China RoHS directive allows no restriction exemption unlike the EU RoHS directive. Although a product complies with the EU RoHS directive, a hazardous substance in the product may be considered to be above the limit requirement (marked “×”) in the China RoHS directive.

The following shows some restriction exemptions and their examples according to the EU RoHS directive.

- Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0.35 % lead by weight, lead as an alloying element in aluminum containing up to 0.4 % lead by weight, and copper alloy containing up to 4 % lead by weight, e.g. brass-made insert nuts
- Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)
- Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices
- Electrical and electronic components containing lead in a glass or ceramic matrix compound, e.g. chip resistors

**Status of our products for compliance with the China RoHS directive (Chinese)**

The following table is given in Chinese according with a request by "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products".

<table>
<thead>
<tr>
<th>部件名称</th>
<th>有害物质 (物质名称/阈值/基准)*1</th>
<th>环保使用期限</th>
<th>备注</th>
</tr>
</thead>
<tbody>
<tr>
<td>伺服放大器</td>
<td>铅 (Pb)</td>
<td>0.01wt% (100ppm)</td>
<td>15</td>
</tr>
<tr>
<td>伺服系统控制器</td>
<td>砷 (As)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电路板组件</td>
<td>汞 (Hg)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>防热片</td>
<td>镉 (Cd)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>金属板</td>
<td>铅 (Pb)</td>
<td>0.1wt% (1000ppm)</td>
<td>15</td>
</tr>
<tr>
<td>金属板、螺丝</td>
<td>镉 (Cd)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>托架</td>
<td>铅 (Pb)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电路板组件</td>
<td>砷 (As)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电路板组件</td>
<td>汞 (Hg)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>防热片</td>
<td>镉 (Cd)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>铁心、电线</td>
<td>铅 (Pb)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电流加工品</td>
<td>铅 (Pb)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电线</td>
<td>砷 (As)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电路板组件</td>
<td>汞 (Hg)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>连接器</td>
<td>镉 (Cd)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>选件模块</td>
<td>铅 (Pb)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电路板组件</td>
<td>砷 (As)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>连接器</td>
<td>汞 (Hg)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>电路板组件</td>
<td>镉 (Cd)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>金属板、螺丝</td>
<td>铅 (Pb)</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

*1 ○：表示该有害物质在该部件所有均质材料中的含量均在GB/T26572规定的限量要求以下。
×：表示该有害物质在该部件的至少一种均质材料中的含量超出GB/T26572规定的限量要求。

*2 根据“电子电气产品有害物质限制使用标识要求”、[SJ/T11364-2014]的表示
该标志表示在中国制造/销售的产品中含有特定有害物质。
该标志表示在中国制造/销售的产品中含有特定有害物质。
只要遵守本产品的安全及使用方面的注意事项，从生产日算起的环保使用期限内不会造成环境污染或对主体、财财产产生深刻的影响。

REVISIONS

*The manual number is given on the bottom left of the back cover.

<table>
<thead>
<tr>
<th>Revision date</th>
<th>*Manual number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 2019</td>
<td>IB(NA)-0300448ENG-A</td>
<td>First edition</td>
</tr>
</tbody>
</table>

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WARRANTY

Warranty

1. Warranty period and coverage
We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]
For terms of warranty, please contact your original place of purchase.

[Limitations]
(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.
(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7. a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8. any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production
(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries
Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability
Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:
(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications
Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product
(1) For the use of our AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in AC Servo, and a backup or fail-safe function should operate on an external system to AC Servo when any failure or malfunction occurs.
(2) Our AC Servo is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used. In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used. We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.
TRADEMARKS

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IB(NA)-0300448ENG-A(1911)MEE

MODEL:
MODEL CODE:

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS: 1-14, YADA-MINAMI 5-CHOME, HIGASHI-KU, NAGOYA, JAPAN

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Specifications are subject to change without notice.