This catalog is an introduction to only part of what Mitsubishi Electric has to offer.

When imported from Japan, this manual does not require application to the Ministry of International Trade and Industry for service transaction permission.

Specifications are subject to change without notice.
Features

Mitsubishi Electric's F-Series industrial robots are equipped with technology developed and tested at its own production plants. Equipped with advanced technology and easy-to-use features, these robots are designed to facilitate automation of any production plant.

- Designed for flexible automation
- Compact and powerful
- High reliability

**Vertical type**

A compact 6-axis jointed robot with an optimal arm length and wider range of movement suited for complex assembly and processing tasks. Compact body and slim arm design, allowing operating area to be expanded and load capacity increased. Layout accommodates a wide range of applications from transport of mechanical parts to assembly of electrical parts. Environmental resistance specifications enable application to a wide range of uses without needing to consider the installation environment.

- The fastest high-speed operation in its class
- Contributes to improved productivity with high-frequency operations
- Prevention of interference with cables
- Compatibility with internal Ethernet cable tools
- Full use of installation space
- Expanded J4 axis operating range

**Horizontal type**

Matches perfectly to a variety of applications with a wide range of operating areas and variations. High speed and high accuracy achieved with the highly rigid arm and latest servo control technology. Suitable for a wide range of fields from mass production of food and pharmaceutical products requiring high-speed operation to assembly operations requiring high precision.

- The fastest high-speed operation in its class
- Improved speed for vertical movements
- Improved continuous operability
- Enhanced wrist axis
- Internal routing of cables results in simplified cable management
With a wide range of variations from Mitsubishi Electric, committed to ease in selection.

The Mitsubishi Electric robot product line is equipped with all of the basic performance features desired in a robot, such as being powerful, speedy, and compact. The variations that Mitsubishi Electric is confident meet the needs of the current era and have pushed Factory Automation forward in a dramatic way.

### Vertical, multiple-joint type (RV)

<table>
<thead>
<tr>
<th>Type</th>
<th>RV-2F</th>
<th>RV-4F</th>
<th>RV-4FL</th>
<th>RV-7F</th>
<th>RV-7FL</th>
<th>RV-7FLL</th>
<th>RV-13F</th>
<th>RV-13FL</th>
<th>RV-20F</th>
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<tbody>
<tr>
<td>Maximum load capacity (kg)</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>13</td>
<td>13</td>
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<td>20</td>
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<tr>
<td>Maximum reach radius (mm)</td>
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<td>515</td>
<td>649</td>
<td>713</td>
<td>908</td>
<td>1503</td>
<td>1094</td>
<td>1388</td>
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### ENVIRONMENTAL SPECIFICATIONS

- **Standard**: ○ (IP30) ○ (IP40) ○ (IP45) ○ (IP65) ○ (IP67) ○ (ISO class 3) ○ (ISO class 5)
- **Oil mist**: ○ (IP30) ○ (IP40) ○ (IP45) ○ (IP65) ○ (IP67) ○ (ISO class 3) ○ (ISO class 5)
- **Clean**: ○ (ISO class 3) ○ (ISO class 5)

### Controller

- CR750
- CR751

### Horizontal, multiple-joint type (RH)

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<thead>
<tr>
<th></th>
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### ENVIRONMENTAL SPECIFICATIONS

- **Standard**: ○ (IP30) ○ (IP40) ○ (IP45) ○ (IP65) ○ (IP67) ○ (ISO class 3) ○ (ISO class 5)
- **Oil mist**: ○ (IP30) ○ (IP40) ○ (IP45) ○ (IP65) ○ (IP67) ○ (ISO class 3) ○ (ISO class 5)
- **Clean**: ○ (ISO class 3) ○ (ISO class 5)

### Controller

- CR750
- CR751

*Controllers with protective specifications (Equipped with controller protection boxes)*

Sxx: Compliant with special models such as CE specification and KC specification etc (separately)

SHxx: Internal wiring specifications

Environment specification

- Blank: Standard specifications
- M: Oilmist specifications
- C: Clean specifications

Controller type

- D: CR750-D Q: CR750-Q
- 1D: CR751-D 1Q: CR751-Q

Arm length

- Blank: Standard arm
- L: Long arm
- LL: Super long arm

Series

- F: F series
- RH: Vertical, multiple-joint type
- RV: Horizontal, multiple-joint type

**RH - 3 FH45 6 FH 35 6 FH 45 6 FH 55 12 FH 35 12 FH 45 12 FH 55 12 FH 70 12 FH 85 20 FH 85 20 FH 100 3 FH 4R**
### Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>RV-2F</th>
<th>RV-4F</th>
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<tr>
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<td>Protection degree</td>
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<tr>
<td>Structure</td>
<td></td>
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</tr>
<tr>
<td>Degrees of freedom</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Drive system</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Position detection method</td>
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<tr>
<td>Ambient temperature</td>
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<tr>
<td>Mass</td>
<td>kg</td>
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<td>Tolerable moment</td>
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<td>Tolerable amount of inertia</td>
<td>kgm²</td>
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<td>Tool wiring</td>
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<tr>
<td>Tool processor pipes</td>
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<td></td>
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<tr>
<td>Machine cable</td>
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<tr>
<td>Connected controller</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Machine specifications</strong></td>
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<tr>
<td><strong>Environment specifications</strong></td>
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<td>Installation</td>
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<td>Drive system</td>
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<tr>
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<tr>
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<td>°C</td>
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<td></td>
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</tr>
<tr>
<td>Mass</td>
<td>kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerable moment</td>
<td>Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerable amount of inertia</td>
<td>kgm²</td>
<td></td>
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</tr>
<tr>
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<tr>
<td>Tool processor pipes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine cable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connected controller</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Please consult Mitsubishi Electric Corporation for details on the installation and use of the machine.*

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**RV-2F**: Double joint type, maximum load capacity is limited when the installation method is facing backward at 11° from the vertical.

**RV-4F**: Maximum speed is limited.

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**RV-2F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

**RV-4F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

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**RV-2F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

**RV-4F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

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**RV-2F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

**RV-4F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

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**RV-4F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

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**RV-4F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

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**RV-2F**: Vertical, multiple-joint type. Vertical, multiple-joint type.

**RV-4F**: Vertical, multiple-joint type. Vertical, multiple-joint type.
RV-13F
RV-13FL

External Dimensions/Operating Range Diagram

Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit</th>
<th>RV-13F(M)(C)</th>
<th>RV-13FL(B)(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine class</td>
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<td>Standard Oil mist Clean</td>
<td>IP40 (standard)/ IP67 (oil mist) *1/ ISOclass3 *7</td>
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<tr>
<td>Protection degree</td>
<td></td>
<td>-90° to +150°</td>
<td>90° to ±360°</td>
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<tr>
<td>Degrees of freedom</td>
<td></td>
<td>J1: ±190°</td>
<td>J1: ±190°</td>
</tr>
<tr>
<td>Max. speed</td>
<td>deg/sec</td>
<td>20.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Max. mass</td>
<td>kg</td>
<td>13.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Tolerable amount of inertia</td>
<td>kgm²</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>Tooling</td>
<td>mm</td>
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<td>10.0</td>
</tr>
<tr>
<td>Position repeatability</td>
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<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Cycle time</td>
<td>sec</td>
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<td>1.1</td>
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<tr>
<td>Tolerable moment</td>
<td>Nm</td>
<td>49.0</td>
<td>49.0</td>
</tr>
<tr>
<td>Drive system</td>
<td></td>
<td>Absolute encoder</td>
<td>Absolute encoder</td>
</tr>
<tr>
<td>Tool wiring</td>
<td></td>
<td>Serial signal cable for parallel I/O (2-pin + 2-pin power line)</td>
<td>Serial signal cable for parallel I/O (2-pin + 2-pin power line)</td>
</tr>
<tr>
<td>Control point (R point)</td>
<td></td>
<td>at the surface of the mechanical interface</td>
<td>at the surface of the mechanical interface</td>
</tr>
</tbody>
</table>

*1: The maximum load capacity in the machine's control panel is 13 kg, but this may vary depending on the specifications of the machine. *2: The maximum load capacity in the machine's control panel is 15 kg, but this may vary depending on the specifications of the machine. *7: Preservation of cleanliness levels depends on conditions of a downstream flow of 0.3 m/s in the clean room and internal robot suctioning. *8: The maximum load capacity in the machine's control panel is 15 kg, but this may vary depending on the specifications of the machine. *9: The maximum load capacity in the machine's control panel is 15 kg, but this may vary depending on the specifications of the machine.
### RH-3FH35

**External Dimensions/Operating Range Diagram**

#### Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit</th>
<th>RH-3FH3515/C</th>
<th>RH-3FH3515/C</th>
<th>RH-3FH3515/C</th>
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<tbody>
<tr>
<td>Load cell</td>
<td>kg</td>
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<td></td>
</tr>
<tr>
<td>Protection class</td>
<td></td>
<td>IP54: Standard type; IP55: Clean model</td>
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<tr>
<td>Structure</td>
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<td>Horizontal, multiple-pole type</td>
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<td>Drive system</td>
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<td>DC servo motor</td>
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</tr>
<tr>
<td>Position detection method</td>
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<td>Absolute encoder</td>
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<td></td>
</tr>
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<td>Maximum load capacity</td>
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<td>3.0</td>
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<td>Minimum reach radius</td>
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<td>800</td>
</tr>
<tr>
<td>Operating range</td>
<td>J1 [deg]</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
</tr>
<tr>
<td>J2 (X) [deg]</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
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</tr>
<tr>
<td>J3 (Z) [deg]</td>
<td>1100</td>
<td>1100</td>
<td>1100</td>
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<tr>
<td>Maximum speed [deg/sec]</td>
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<td>4.0</td>
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<tr>
<td>J2 (X)</td>
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<tr>
<td>J3 (Z)</td>
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<td>1100</td>
<td>1100</td>
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<td>0.41</td>
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</tr>
<tr>
<td>J3 (Z)</td>
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<td>3.00</td>
<td>3.00</td>
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</tr>
<tr>
<td>Position repeatability</td>
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<td>±0.010</td>
<td>±0.010</td>
</tr>
<tr>
<td>J2 (X)</td>
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<td>±0.010</td>
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<tr>
<td>J3 (Z)</td>
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<td>±0.012</td>
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#### Variable dimensions

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<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
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<td>RH-3FH5515</td>
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<td>220</td>
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### RH-6FH35

**External Dimensions/Operating Range Diagram**

#### Specifications

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<th>Unit</th>
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<tr>
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<td>Protection class</td>
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<td></td>
</tr>
<tr>
<td>Structure</td>
<td></td>
<td>Horizontal, multiple-pole type</td>
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<tr>
<td>Drive system</td>
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<td>AC servo motor</td>
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<tr>
<td>Position detection method</td>
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<td>Arm length</td>
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<td>330</td>
<td>330</td>
</tr>
<tr>
<td>Minimum reach radius</td>
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<td>800</td>
</tr>
<tr>
<td>Operating range</td>
<td>J1 [deg]</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
</tr>
<tr>
<td>J2 (X) [deg]</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
<td>360 (±170)</td>
<td></td>
</tr>
<tr>
<td>J3 (Z) [deg]</td>
<td>1100</td>
<td>1100</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>Maximum speed [deg/sec]</td>
<td>J1</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>J2 (X)</td>
<td>5.0</td>
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<td>5.0</td>
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</tr>
<tr>
<td>J3 (Z)</td>
<td>1100</td>
<td>1100</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>Cycle time [sec]</td>
<td>J1</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
</tr>
<tr>
<td>J2 (X)</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>J3 (Z)</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>Position repeatability</td>
<td>J1</td>
<td>±0.010</td>
<td>±0.010</td>
<td>±0.010</td>
</tr>
<tr>
<td>J2 (X)</td>
<td>±0.010</td>
<td>±0.010</td>
<td>±0.010</td>
<td></td>
</tr>
<tr>
<td>J3 (Z)</td>
<td>±0.012</td>
<td>±0.012</td>
<td>±0.012</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>deg C</td>
<td>-20 to 40</td>
<td>-20 to 40</td>
<td>-20 to 40</td>
</tr>
<tr>
<td>Vibration</td>
<td>mm</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
</tr>
</tbody>
</table>

#### Variable dimensions

<table>
<thead>
<tr>
<th>Model series</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>RH-6FH4515</td>
<td>125</td>
<td>290</td>
<td>110</td>
<td>210</td>
<td>220</td>
<td>210</td>
<td>110</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>RH-6FH5515</td>
<td>225</td>
<td>290</td>
<td>140</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>140</td>
<td>320</td>
<td></td>
</tr>
</tbody>
</table>
The resistance to corrosion due to chemical cleaning is enhanced, and this improves detergency and cleanliness. These types of robots are applicable to the production environments including conveying or processing medicinal products and foods.

- Enhanced resistance to acid and alkaline cleaning liquids
  - Since special coating (compliant to FDA) and special sealing are applied to these types of robots, they can be used in an environment sterilized with hydrogen peroxide gas and wipe cleaning with hydrogen peroxide water.
  - Stainless materials are used to enhance the corrosion resistance.

- NSF H1 2-certified grease for food machinery
  The grease for food machinery is used to improve cleanliness.

- Surface shape that prevents foreign matter from getting into and remaining inside
  Specially-shaped bolts and the smooth surface facilitate daily cleaning.

For the specifications of each model, refer to the specifications of each standard model. Note that these models have the following differences from the standard models.

1. The protection degree of all the models is IP65.
2. These models are 2-3 kg heavier than the standard models. For details, refer to each specification sheet.

The environment-resistant specifications (For medicinal products and foods)

- NSF H1 2-certified grease for food machinery
  - H1 grease for food machinery is applied to joint oil seals (Oil seals exposed to the external air)
  - Special hexagon flange bolts are used
  - Special coating (Compliant to FDA)

- Stainless materials
  - Stainless materials are used for robot tips
  - Special coating (Compliant to FDA) for the tool flange of a robot tip

- Chemical-resistant coating to chassis
  - Chemical-resistant coating to chassis (For medicinal products and foods)

- Corrosion resistance of bellows
  - Bellows exposed to the external environment

The chemical resistance of bellows is improved (RH-F series only)

- Fluorine resin bellows
  - Fluorine resin is used for bellows, and this enhances the chemical resistance and improves the detergency at food and pharmaceutical factories.

Correspondence table for environmental resistance specifications (for medicinal products and foods)

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Item</th>
<th>Chemical-resistant</th>
<th>H1 grease for food machinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>H1 grease is applied to the seals exposed to the external air</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>B</td>
<td>Stainless materials are used for robot tips</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>C</td>
<td>Special hexagon flange bolts are used</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>D</td>
<td>Chemical-resistant coating to chassis</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E</td>
<td>Chemical-resistant seals</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>F</td>
<td>The chemical resistance of bellows is improved</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

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  - The protection degree of all the models is IP65.
  - These models are 2-3 kg heavier than the standard models. For details, refer to each specification sheet.

*1: CE/KC specification
*2: Sanitation guideline of NSF (National Sanitation Foundation) in the United States
*3: NSF H1 certified grease for food machinery (Sealant of NSF H1 certified grease for food machinery)
*4: For the notations, refer to the standard models. (Refer page 4)
Functions

Increase throughput

Improved control performance

- Produced the fastest operating performance in its class using high-performance motors and unique drive control technology developed by Mitsubishi Electric.
  - Enabled high torque output at high rotational speed, shortening acceleration/deceleration time.
  - Shortened positioning time for improved device throughput.
  - Continuous operability improved
  - Improved speed for the vertical movements that are so essential to horizontal multi-joint robot operation. 2400 mm/s. [RH-FR: Twice as fast as the conventional speed]

High-speed execution of programs

- Enables execution up to 1.2 times faster than with the SQ/GD series.
- Numerical operation and conditional branch processing speeds increased by up to twice as fast, leading to shortened takt times.
- Sample program
  - RH-F Series
  - SQ/GD Series
  - Processing speed increased by 25%
  - Shortened by around 20%

Robot programs can be executed 1.2 times faster than before if compiled in advance and processed using an intermediate language.
Takt times can be shortened by up to 3 times as much for longer lines. (Compared to previous models)

Optimal acceleration/deceleration control and optimal override control

- Optimal acceleration/deceleration times and speeds set automatically based on robot operating position, posture, and load conditions.
- Load conditions are set, enabling acceleration/deceleration times and speeds to be changed automatically according to whether a workpiece is present or not.
- This enables the maximum operating speed to be produced for each task.
- Time needed to shorten cycle times reduced.

Improved continuous operability

- Overload detection levels optimized based on the ambient temperature settings for the robot (set in the parameters). This helps improve continuous operability using load levels calculated based on actual environmental conditions for the robot axes.
- The encoder temperature is monitored such that the machine is shut down due to error if the temperature exceeds the tolerable limit.

Internal installation of wiring and piping for connecting to vision sensors enabled.

- Hand 8 input points/8 output points
- Ethernet cable for the vision sensor
- Internal wiring types may vary by model.

Internal routing of hand wiring and wiring channels

- Internal routing of cables and air hoses is enabled through the internal channels that lead up to the end of the robot arm.
- Such internal routing increases the areas of the work envelope that the robot can reach without twisting and entangling cables and hoses.
- This prevents interference with cables around devices and reduces the risk of wiring disconnection.

Internal routing of hand wiring and wiring channels enabled within the arm up to the J1 axis hip.

- The sections of wiring that can be routed internally may differ depending on the model.
- 'Attachment of the vision sensor to the wrist facilitates setting.'

Space saving

Expanded pivotal operating range

- Improved flexibility for robot layout design considerations.
- Enabling more effective use of access space around the entire perimeter including to the rear.
- Shortened movement distances, enabling takt times to be shortened.

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Optimize the overload detection level

- Encoder temperature monitoring screen
- Encoder temperature monitored
- Optimize the overload detection level

Expanded J1 axis pivotal operating range to allow access to task of robot

- RV-FQ/FD pivot operation
  - Movable stopper for the J1 axis
  - Rear access of RH-FQFD
**Improved accuracy**

**Active gain control**
- Optimal motor control tuning set automatically based on robot operating position, posture, and load conditions.
- Improves tracking accuracy for the target trajectory.

- Active gain control is a control method that allows the position gain to be changed in real time.
- This is effective for standard operations and tooling work requiring high accuracy.

**Operating mode setting function**
- Trajectory priority models/speed priority operation can be set in programs to match customer system requirements.
- Optimal motor control tuning set automatically based on robot operating position, posture, and load conditions.
- Improves tracking accuracy for the target trajectory.

- This is effective for standard operations and tooling work requiring high accuracy.

**Deflection compensation function**
- Compensates for deflection in the robot arm occurring due to gravity.
- Calculates the amount of compensation needed based on the operating position, posture, and load conditions of the robot and compensates for any deflection automatically.
- Compensates not only for static deflection due to gravitational pull but also for dynamic deflection due to the inertial force present during operation.

- Effective for work transporting workpieces to cassettes with low pitch and palletizing work.

**Adaptation to operation**
- The robot can be made to pass through the singular point, unlike with previous robot models. This allows for greater flexibility in the layout of robots and surrounding areas.
- Teaching operations can be performed more easily as there is no longer any need to cancel operations due to the presence of the singular point.

- What a singular point is: There is an unlimited number of angles at which the J4 and J6 axes can be set such that the angle of the J5 axis is 0° when linear interpolation operations are performed using position data from a joint coordinate system. This point is the singular point and is the point at which the robot cannot be operated at an assigned position and posture under normal conditions. The position at which this occurs is referred to as a singular point.

**Orthogonal compliance control**
- This function reduces the rigidity of the robot arm and tracks external forces. The robot itself is equipped with a compliance function, which makes special hands and sensors unnecessary.
- This is useful in protecting against workpiece interference and cutting down on stoppage.

- The compliance direction can be set arbitrarily using the robot coordinate system, the tool coordinate system, etc.

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**Simplified tool length setting**
- Tool settings for the tool coordinate system can be set by attaching the tool and using three to eight of the same teaching points.
- Enables settings to be made for the actual tool including errors introduced when the tool was made and other data without needing to calculate values from the tool diagram.

**Function for passing through the singular point**
- In moving from P1→P2, if the robot is passing the singular point (J5 axis=0°) or a location in the vicinity at a constant posture, the J4 axis on the robot will rotate at high speed and be unable to pass through it.

**Tool settings for the tool coordinate system can be set by attaching the tool and using three to eight of the same teaching points. Enables settings to be made for the actual tool including errors introduced when the tool was made and other data without needing to calculate values from the tool diagram.**

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**Improved user friendliness**

**Simple automatic operation from the teaching box**

- Enables the robot to be controlled from the robot control screen using the same functions as on the operating panel of the robot controller.
- Monitoring screens can be set up individually to match the needs of user debugging conditions.

  - Enabled for R32B/R33TB and R56TB/R57TB.

**Enhanced RT ToolBox 2 visual functions**

- Enhanced RT ToolBox 2 (PC software) graphic display function allowing setting parameters to be displayed visually. Visual confirmation using this function helps to proactively prevent setting errors.

- Display of teaching positions and trajectories of end points helps to facilitate confirmation tasks during programming or simulations.

- Hands can be created as combinations of basic diagrams on the Hand Editing screen and then attached to the robot. Standard 3D polygonal models (applicable 3D data file formats: STL, OBJ) can be imported into the program, allowing operators to confirm the relationship among the hands, workpieces, and peripheral devices during simulation.

- Up to 80000 records of data including current position, speed, axial loading, and sensor information can be obtained in every operating cycle of the robot and displayed in a graph. Execution rows and I/O signals are recorded and used for analyzing the robot status, and this improves the debug efficiency.

- The obtained data can be saved as an image (Bitmap) or in the CSV format.

- Attachments of a hand created in RT ToolBox2 onto the robot.

**GOT connection function**

- Enables batch management of programs and data in blocks from the programmable controller to the servo, display device, and robot.
- Device model selection simplified
  - All Mitsubishi device models are listed in the Navigator, enabling its use as a device model selection tool.
  - Ver. 1.24A and later is equipped with robot CPU selection capability and comes packaged with RT ToolBox2 (mini ver.).

- The robot can be controlled directly from a Mitsubishi GOT 1000.
  - Enables robot controller statuses to be uploaded and operations to be controlled directly from the GOT. Allows robot startup/shutdown, status/alarm monitoring, and other tasks to be completed from the GOT easily and quickly.
  - Use of the transparent function enables editing of programs and parameters from the USB interface on the front GOT screen, improving user friendliness.

- Screens can be created anew, imported, or exported from "User-defined Screen Editing" in the project tree. Buttons, lamps, robot information, labels, and ruled lines can be arranged into layouts and assigned to robot variables.

  - Data created here is exported and loaded into the R56/57TB.
  - Can be used as a user screen.

**User-defined screen creation tool**

- Program management simplified
  - Enables batch management of programs and data in blocks from the programmable controller to the servo, display device, and robot.
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  - All Mitsubishi device models are listed in the Navigator, enabling its use as a device model selection tool.
  - Ver. 1.24A and later is equipped with robot CPU selection capability and comes packaged with RT ToolBox2 (mini ver.).

**Linked to iQ Works**

- The personal computer and the GOT are connected with a USB cable or RS232 cable.
  - Operation of engineering tools from the USB interface on the front GOT screen.
  - The personal computer and the GOT are connected with a USB cable or RS232 cable.

- [For Q type /D type controllers]
  - Ethernet
  - Serial signals etc.

- Example GOT screen

  * You can download a sample image from the Mitsubishi FA site.
  - (Sample data corresponds to the GT16, 640 x 480 or more)

**Simplified control panel created using a GOT**

- No need for ladder circuits with the GOT connection
Safety features

Security features were added to protect programs and parameters. Read/Write protection prevents parameters from being overwritten and programs from being changed inadvertently. Sensitive data can be protected using password protection.

- Passwords can be set to protect created programs.
- The viewing and copying of data from the teaching pendant and RT ToolBox2 can be disabled.
- Writing operations for parameters can be disabled.

Connection to peripheral devices

Vision sensor

- Simple settings
  The robot and camera can be calibrated through a simple process using vision sensor setting tools.
- Simple connection
  Simple connection between the robot and camera using Ethernet.
- Simple control
  Simple control using vision control commend in the robot programs.
- Three robots connected to a single vision sensor
  Seven vision sensors connected to a single robot
  - Enables costs to be reduced even for complicated system configurations.

Sustained tracking during emergency stop

The robot trajectory can be sustained even when the machine is shut down using an emergency stop. This allows interference with peripheral devices and other objects to be reduced or even fully prevented using the inertia of the robot arm to let it coast to a stop.

Collision detection function

- This function detects if the arm collides with an obstacle while teaching or operating, and helps reduce damage to the robot arm and tools.
- The collision detection function can be used to protect the workspace from becoming damaged due to interference between the workpiece and affected objects.
- The detection level can be changed according to the protection targets.
- The collision detection function can be programmed to generate an alarm or perform a specific escape move or both.

Additional axis function

- The layout can be set up to include the robot traveling axis and turntable as well as user machines as independent systems.
- Different variations can be selected, including vision tracking in combination with a vision sensor, tracking in combination with an opto-electric sensor, etc.
- Programs can be created easily in robot language (MELFA BASIC IV, V).
- Standard interface function. (D type only.) (Separate encoder and vision sensor required.)

- No need for a positioning device
- Reduce cycle time
- Reduce system costs

Target position

Collision

Unchanged

End stop

Emergency stop


data backup and restore

Additional axis function

Three controllers

Three robots connected to a single vision sensor

Seven vision sensors connected to a single robot

Standard interface function. (D type only.) (Separate encoder and vision sensor required.)

The collision detection function can be used to protect the workpiece from becoming damaged due to interference between the workpiece and affected objects.

The detection level can be changed according to the protection targets.

The collision detection function can be programmed to generate an alarm or perform a specific escape move or both.

- An error is output due to the robot stopping suddenly, an error is output after escape movements are made, etc.

Reduce tooling costs

Shorten line stop times

Reduce maintenance costs

Complies with safety standards

Complies with the latest ISO 10218-1 (2011) standards for Robots and robotic devices - Safety requirements.

Meets the requirements for PL d of ISO13849-1 Category 3.

Safety circuits (emergency stop circuits) can easily be installed for the customer's entire system, not just for the robot itself.

There are robots with special specifications that comply with various safety standards. Contact a Mitsubishi Electric dealer or sales agent for further details if interested.

Applicable standards

- CE: European Conformity (European safety standards)
  - Compliant with the EMC Directive, 2004/108/EC
  - Compliant with the Machinery Directive, 2006/42/EC
- KCC: Korean Communications Commission (Korean safety certification)
  - Complies with the revised Korea Radio Act (Article 58 Section 2)
**Expanded J4 axis operating range**

- Expanding the J4 axis operating range enables the posture to be changed continuously during assembly and transport operations. It also eliminates the need for the robot to move in the opposite direction partway through an operation.

**Compact installation with operation performed near the robot base**

- Use of a flap-style arm contributes to a slimming of customer equipment, enabling operations to be completed in even closer proximity to the robot.

**Changes in operating posture can be made even more quickly!!**

- Changes in operating posture, which occur frequently during assembly, can be completed at rapid speed, increasing the speed of the axis close at hand as well as the speed of the base axis. Enables changes to be made to the operating posture at high-speed.

**Enhanced wrist axis**

- Tolerable J4 axis inertia dramatically increased. Applies easily to multiple hands, offset hands, etc. (8 times that of previous models (RH-20FH))

---

**Features of IQ Platform Controllers**

- **Improved responsibility through high-speed communications**
  - Increases the speed of data communications between CPUs and dramatically reduces I/O processing times using a high-speed standard base between multiple CPUs.

- **Large amounts of data**
  - The number of device points between the programmable controller and robot was increased to 8192 input points and 8192 output points. This allows the system to handle larger programs, more complicated control, and other objects that require a lot of I/O points.

- **Number of I/O points**: 8192/8192
  - Remote I/O: 256/256
  - CC-Link (4 stations, 1×): 126/126
  - CC-Link (4 stations, 8×): 894/894

- **Programmable controller**
  - Measurement example: Transfer of 16-word data (With data matching check)
    - CC-Link: 263ms
    - Between multiple CPUs: 63ms (Approx. 4×)

- **Direct communication between CPU units**
  - Enables shared memory to be read from and written to between multiple robot CPUs.
  - Speeds for data communications between robots increase, enabling more detailed control, such as with an interference prevention function or coordinated control, and cutting down on wasted time.

  - No need for special programmable controller programs as shared memory is used.

- **Direct control between I/O units**
  - Enables data to be read and written directly between the CPU unit and I/O unit.
  - Responsivity improved and interlock times and cycle times shortened using high-speed I/O communications to peripheral devices.

  - No need for programmable controller programs for signal input/output.
  - Improved responsivity without any delay due to scanning time.

- **Direct communication between multiple robots**
  - Enables access to robots in the programmable controller network from a PC connected to the main CPU. Leads to a shortening of rise times and improved maintainability for robots on the production line.

**Batch management of multiple robots**

- Enables a single access to multiple robots, leading to a shorter rise time and improved maintainability for robots on the production line.
Enhanced efficiency of monitoring and maintenance operations onsite using a single GOT (display device) as the Human Machine Interface (HMI).

- Enables the robot to be controlled from the GOT even without a teaching box.
- Current robot position data, error information, and other items can be displayed easily on the GOT.

**Internal robot information**
- Error, variable, and program information
- Robot status (Current speed, current position, etc.)
- Maintenance information (Remaining battery capacity, grease life, etc.)
- Servo data (Load factor, current values, etc.)

**Programs and parameters can be edited from the USB interface on the front of the GOT using a transparent function for improved operability.**

Robot data on the GOT can be backed up to and restored from a CF card or USB memory stick. With no need for a PC.

This helps prevent data from being lost due to the empty battery / battery or robot malfunction.

Data can be saved after periodic maintenance tasks are performed or when unexpected errors occur. Dramatically improves serviceability.

**Robots can be controlled easily using programmable controller language.**

System operation can be controlled using a single programmable controller. This enables the operation of the programmable controller to handle making changes to system specifications and troubleshooting directly.

**Enhanced efficiency of monitoring and maintenance operations onsite using a single GOT (display device) as the Human Machine Interface (HMI).**

- Current value and load factor
- Robot position data
- Maintenance forecast
- Jog/hand operation
- Operation panel

**GOT connection (transparent function) (For GOT1000 Series)**

Programs and parameters can be edited from the USB interface on the front of the GOT using a transparent function for improved operability.

**GOT backup/restore functions (Supported on GT14, GT15 and GT16)**

Robot data on the GOT can be backed up to and restored from a CF card or USB memory stick. With no need for a PC.

This helps prevent data from being lost due to the empty battery / battery or robot malfunction.

Data can be saved after periodic maintenance tasks are performed or when unexpected errors occur. Dramatically improves serviceability.

**Direct execution function for programmable controllers**

Robots can be controlled easily using programmable controller language. System operation can be controlled using a single programmable controller. This enables the operation of the programmable controller to handle making changes to system specifications and troubleshooting directly.

**Collision Avoidance**

The software constantly monitors robot motion, predicts collisions before they occur, and immediately stops the robots. This avoids damage to the robot during both the JOG operations and automatic mode operations. Also, this enables the number of interlocks needed to prevent collisions between robots to be reduced. (Alarm shutdown)

- Q type controllers only

Checking interference using the robot with a defined solid model

**Deceases downtime during startup operation**

Reduces the number of recovery man-hours required after collisions due to teaching operation errors or failure to set interlocks.

**Coordinated control between multiple robots**

Enables coordinated control between multiple robots through CPU connection between the robots. Easy to operate and use under normal operation through individual robot operation.

**Coordinated transport**

Enables transport of lengthy or heavy objects using multiple small-sized robots instead of larger ones.
Options

RV-4F/RV-7F/13F/20F Series Tooling device configuration

<table>
<thead>
<tr>
<th>Hand configuration</th>
<th>Wiring format</th>
<th>Robot specifications</th>
<th>Required device</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm + Fingertip PIN</td>
<td>Interface equipment</td>
<td>1F-VD0</td>
<td>Standard</td>
<td>(1)</td>
</tr>
<tr>
<td>Arm + Fingertip PIN</td>
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<td>1F-VD0</td>
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<td>Standard</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For models with Internal wiring and hoses:

- For external wiring:
  - External wiring set for the forearm
  - External wiring set for the base

- For models with Internal wiring and hoses:
  - External wiring set for the base

For external wiring:

- External wiring set for the base

Models with Internal wiring and hoses

<table>
<thead>
<tr>
<th>Devices supporting internal hoses</th>
<th>Model (special device number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
<tr>
<td>6 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
<tr>
<td>8 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
<tr>
<td>10 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
<tr>
<td>12 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
<tr>
<td>15 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
<tr>
<td>20 mm diameter</td>
<td>1F-HA01S-01</td>
</tr>
</tbody>
</table>

* Customers must purchase additional hoses for external wiring models. (×2)
* Change the color and material of the external wiring set for models with external wiring and hoses.
Options

RV series Tooling (air-hand): External wiring

- Solenoid valve
  - 1 to 4 lines
- Hand curl tube
  - (Can be provided by the user.)
- External wiring BOX
  - (Standard supplied)
- Hand input cable
- Air hoses
  - Φ6×2
- Signal cable for the multi-function hand
- Ethernet cable

RV series Tooling (air-hand): Internal wiring

- Solenoid valve
  - 1 to 4 lines
- External wiring BOX
  - (Standard supplied)
- Hand input cable
- Air hoses
  - Φ6×2
- Signal cable for the multi-function hand
- Ethernet cable

RT ToolBox2
Software for program creation and total engineering support.

This PC software supports everything from system startup to debugging, simulation, maintenance and operation.

This is divided into programming and editing, operational checking before robots are installed, measuring process test time, debugging during robot startup, monitoring robot operation after startup, and trouble shooting.

Support for all processes from programming and startup to maintenance

- Easy operation on Windows®
  - Compatible with Windows® 2000, Windows® XP, Windows® Vista, and Windows® 7 (32-bit Ver. 1.8 or later, 64-bit Ver. 2.0 or later)
  - Windows®-compatible
  - This function is compatible with all models that connect to CRn-500 series and CRn-700 controllers.
  - Robots can be operated and task time calculated using a personal computer.
  - (Not available for the mini version.)
  - Robots movement, operating status, input signals, and servo status can be monitored.

Program editing and debugging functions

- Enhanced editing function
  - This function is compatible with all models that connect to CRn-500 series and CRn-700 controllers.
  - Robots can be operated and task time calculated using a personal computer.
  - (Not available for the mini version.)
  - Robots movement, operating status, input signals, and servo status can be monitored.

- Advanced functions
  - The software has a maintenance function that notifies the operating maintenance period, battery life cycles as well as position recovery support function when trouble occurs, etc. and is effective for preventative maintenance, shortening of recovery time.

- Simulation functions
  - Offline robot motion and task time check for designated parts of a program.

- Monitor functions
  - This is used to monitor program execution status and variables, input signals, etc.

- Maintenance functions
  - These functions include maintenance forecast, position recovery support, position error assignment, etc.
Options

MELFA-Works

Type: 3F-21D-WINE

3D robot simulator offering powerful support for system design and preliminary layout.

What is MELFA-Works?

MELFA-Works is an add-in tool (1) for SolidWorks(2) used for robot simulation in production systems on PCs, converting processing paths of workpieces into robot position data. Adding MELFA-Works into...on the robot simulation functions.

(1) MELFA-Works is an add-in tool that adds certain functions to application software packages.
(2) SolidWorks® is a registered trademark of Dassault Systèmes (France).

Features

Automatic robot operation function

The teaching position data and robot operation programs necessary for operating robots can be generated automatically by simply loading 3D CAD data (3) for the applicable work into MELFA-Works and then setting of processing conditions and errors using MELFA-Works.

Product Lineup

MELFA-Works is an add-in tool (1) for SolidWorks(2) used for robot simulation in production systems on PCs, converting processing paths of workpieces into robot position data. Adding MELFA-Works into...on the robot simulation functions.

(1) An add-in tool is a software program that adds certain functions to application software packages.
(2) SolidWorks® is a registered trademark of SolidWorks Corp, (USA).

Simple control

Simple programs can be created using specialized robot language.

Product features

Simple control

Features

Force control

- Enables control of forces and torques.

Data latch

- Stores the teaching position data and robot operation programs necessary for operating robots.

Execution of interrupts

- Allows execution of interrupts to be specified in robot programs.

Data reference

- Enables parts to be inserted or attached without being damaged while absorbing shifts in position due to part variations and emulating the slight amounts of external force.

Display of robot movement path

- Displays the robot movement path as it is displayed in the application program. (MELFA-BASIC IV, V format)

System Configuration

The positions of loaded parts can be rearranged relative to the CAD origin and other parts. Part positions can also be changed via manual input.

Loading of part data from peripheral devices and management

Part data created in SolidWorks can be handled.

Interference check

- Interference between the robot and peripheral devices can be checked. Interference can be detected by a simple mouse click on the workspace. Information displaying the condition of interference that occurred (such as the contacted part, program line that was being executed when the interference occurred, and corresponding robot position) can be exported to a file.

Simulations of hand signal control can be created using a robot program to handle workpieces. Simulated movements can be saved to video files (AVI format).

System Configuration

- Breakpoint : Breakpoints can be set in a specified program.
- Direct execution : Desired robot commands can be executed.
- Variable display : Displays the variable data currently being monitored.
- Teaching pendant : Teaching pendant is used to teach the robot.
- Jog function

- The robot shown in SolidWorks® can be jogged just like a real robot.

Saving of video data

- Interference check: Video data can be saved in video files (AVI format).

Saving of video data

- The cycle time of robot movement can be measured using an easy-to-use function resembling a stopwatch. It realizes the cycle time measurement of a specified part in a program.

Creating of robot programs (templates)

- The robot shown in SolidWorks® can be jogged just like a real robot.

Simulation of robot operations

- Teaching pendant: Teaching pendant is used to teach the robot.

- Jog function

- The robot shown in SolidWorks® can be jogged just like a real robot.

Maintenance of teaching data

- The cycle time of robot movement can be measured using an easy-to-use function resembling a stopwatch. It realizes the cycle time measurement of a specified part in a program.

- Teaching pendant: Teaching pendant is used to teach the robot.

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### Options

#### In-Sight (Manufactured by COGNEX: For Mitsubishi Electric FA devices)

The In-Sight software developed exclusively for use with Mitsubishi Electric FA devices with enhanced linking to In-Sight, the vision system produced by COGNEX Corporation, offers better compatibility with FA devices, allowing it to be utilized more easily as a more user-friendly vision system.

- **Simplified settings using Easy Builder**
  - Easy Builder allows connection to vision systems, setting of job (vision programs) settings, and calibration between the robot and vision system to be completed easily and quickly.

- **Simplified connection using Ethernet**
  - Up to three robots and seven vision systems can be connected together to the same system by Ethernet connection. Vision system information can be shared between multiple robots.

- **Simplified execution of robot language**
  - The included dedicated vision system commands enable vision system startup, job selection, and control of data receiving and other operations to be completed quickly and easily using a single command without any need for protocols.

- **Simplified job editing**
  - Jobs (Vision recognition programs) are created from the job editing screen. Jobs can be edited using condition settings and other data, eliminating the need for specialized knowledge of vision control commands and other programming instructions.

- **Simplified calibration**
  - The calibration wizard allows settings used in converting workspace positions recognized by the vision system into robot coordinate system coordinates easily and quickly.

#### Robot controller specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software</td>
<td>Robot controller: CR7xx Series, CRnQ-7xx Series: R1 ver. or later, CRnD-7xx Series: S1 ver. or later</td>
</tr>
<tr>
<td></td>
<td>RT ToolBox2: Ver. 1.0 or later recommended</td>
</tr>
<tr>
<td></td>
<td>Adapted robot controller Connected robot All models</td>
</tr>
<tr>
<td>Number of robots connected to the vision system</td>
<td>Number of cameras used per robot controller: Up to 7 max.</td>
</tr>
<tr>
<td></td>
<td>Number of robots that can be connected to a vision system: Up to 3 max.</td>
</tr>
<tr>
<td>Robot program language</td>
<td>MELFA-BASIC V comes with dedicated vision sensor commands</td>
</tr>
</tbody>
</table>

#### In-Sight Series

<table>
<thead>
<tr>
<th>Model name (LCD)</th>
<th>Resolution</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>640×480</td>
<td>640×480</td>
</tr>
<tr>
<td></td>
<td>640×480</td>
<td>640×480</td>
</tr>
<tr>
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<tr>
<td></td>
<td>640×480</td>
<td>640×480</td>
</tr>
</tbody>
</table>

#### In-Sight Micro Series

<table>
<thead>
<tr>
<th>Item</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIP</td>
<td>Connect to the vision system and log on.</td>
</tr>
<tr>
<td>NIPut</td>
<td>Start up the specified vision program and receive the transmitted results.</td>
</tr>
<tr>
<td>NIRun</td>
<td>Start up the specified vision program.</td>
</tr>
<tr>
<td>NIR</td>
<td>Receive the transmitted results of the vision program specified by the NVRUN command.</td>
</tr>
<tr>
<td>NIClose</td>
<td>End the connection to the vision system.</td>
</tr>
<tr>
<td>NILoad</td>
<td>Ready the specified vision program to enable it for startup.</td>
</tr>
<tr>
<td>NITr</td>
<td>Transmit a request to the vision system for the image and acquire the encoder values after the specified length of time.</td>
</tr>
</tbody>
</table>

Separate MELFA-Vision software is available for customers using In-Sight5000 series or In-Sight Micro series products. The use of job programs corresponding to work tasks is performed regularly enables even customers who are new to vision systems to easily understand and use them without problems.