This catalog is an introduction to only part of what Mitsubishi Electric has to offer. Mitsubishi Electric offers individualized solutions for the challenges in your factory.
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
- Expanded J4 axis operating range
- Compact installation with operation performed near the robot base
- Changes in operating posture made even more quickly
- Full use of installation space

**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
- Compatibility with internal Ethernet cable tools
- Full use of installation space
With a wide range of variations from Mitsubishi

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)**

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

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</table>

**Electric, committed to ease in selection.**

With a wide range of variations from Mitsubishi, 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)**

- **RH-20FH85 RH-20FH100**
  - Maximum load capacity: 20 kg
  - Maximum reach radius: 1000 mm
  - Environmental specifications:
    - Standard
    - Oil mist: ○[ISOclass5]
    - Clean: ○[ISOclass5]
  - Robot type:
    - Standard arm
    - L: Long arm
    - LL: Super long arm
  - Series:
    - F: F series
    - FH: FHR series
  - Maximum load capacity:
    - 2: 2 kg
    - 3: 3 kg
    - 4: 4 kg
    - 5: 5 kg
    - 6: 6 kg
    - 7: 7 kg
    - 12: 12 kg
    - 13: 13 kg
    - 20: 20 kg
  - Robot structure:
    - RV: Vertical, multiple-joint type
    - RH: Horizontal, multiple-joint type

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

- **RH-3FHR**
  - Maximum load capacity: 3 kg
  - Maximum reach radius: 350 mm
  - Environmental specifications:
    - Standard
    - Oil mist: ○[ISOclass5]
    - Clean: ○[ISOclass5]
  - Robot type:
    - Standard arm
    - L: Long arm
    - LL: Super long arm
  - Series:
    - F: F series
    - FH: FHR series
  - Maximum load capacity:
    - 2: 2 kg
    - 3: 3 kg
    - 4: 4 kg
    - 5: 5 kg
    - 6: 6 kg
    - 7: 7 kg
    - 12: 12 kg
    - 20: 20 kg
  - Robot structure:
    - RV: Vertical, multiple-joint type
    - RH: Horizontal, multiple-joint type
### RV-2F Specifications

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<tr>
<td>Structure</td>
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<td>Degrees of freedom</td>
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<td>Specification</td>
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<td>A type</td>
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<td>J1: ±240°</td>
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<tr>
<td>J2: ±120°</td>
<td></td>
<td>J3: ±360°</td>
</tr>
<tr>
<td>J4: ±200°</td>
<td></td>
<td>J5: ±120°</td>
</tr>
<tr>
<td>J6: ±360°</td>
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<td>J7: ±180°</td>
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</tbody>
</table>

*1: Position repeatability is ±6.66 mm.

*2: The depth of the 4-M5 screw is 8 mm. Specify thread engagement length of 7.5 to 8 mm.

*3: The depth of the 20H7, depth 6 is 6 mm. Specify thread engagement length of 7.5 to 8 mm.

*4: Make sure to leave enough space open for removing and attaching covers during maintenance work.

### RV-4F Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit</th>
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<td>A type</td>
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<td>Minimum load capacity (kg)</td>
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<tr>
<td>Maximum composite speed (mm/sec) *3</td>
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<td>Tolerable moment</td>
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<td>Moving space</td>
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<tr>
<td>J2: ±120°</td>
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<td>J4: ±200°</td>
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<td>J6: ±360°</td>
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<td>J7: ±180°</td>
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<tr>
<td>J8: ±90°</td>
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*1: Position repeatability is ±6.66 mm.

*2: The depth of the 4-M5 screw is 8 mm. Specify thread engagement length of 7.5 to 8 mm.

*3: Make sure to leave enough space open for removing and attaching covers during maintenance work.

### RV-4FL Specifications

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*1: Position repeatability is ±6.66 mm.

*2: The depth of the 4-M5 screw is 8 mm. Specify thread engagement length of 7.5 to 8 mm.

*3: Make sure to leave enough space open for removing and attaching covers during maintenance work.

---

**Note:** For detailed specifications, refer to the original document. The above information is a summary and may not include all specifications.
*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.

*6: Select either controller according to your application.

*5: Can also be used as a spare line (0.2 sq. mm, 4-pair cable) for conventional models.

*4: The cycle time is based on back-and-forth movement over a vertical distance of 25 mm and horizontal distance of 300 mm when the load is 1 kg.

*3: This is at the hand flange surface when all axes are composited.

**4.** The posture shown in the diagram results from when the robot axis angles are set as listed.

**3.** Specify a thread engagement length of 7.5 to 8 mm.

**2.** Make sure to leave enough space open for removing and attaching covers during maintenance work.

**1.** Make sure to leave enough space open for cable connections between devices.

**5.** The posture shown in the diagram results from when the robot axis angles are set as listed.

**3.** Specify a thread engagement length of 7.5 to 8 mm.

**2.** Make sure to leave enough space open for removing and attaching covers during maintenance work.

**1.** Make sure to leave enough space open for cable connections between devices.
**Specifications**

**Type** | **Unit** | **RV-13F(W/C)** | **RV-13FL(M/D)**
---|---|---|---
Machine class | Type | Fixed 6-axes, 13kg type
Protection degree | IP40 (standard)/ IP67 (oil mist) *7/ ISOclass3 *7 | | |
Degrees of freedom | 6 | | |
Tolerable amount of inertia | kg | | |
Position repeatability | mm | | |
Tool wiring | | | |
Maximum load capacity | kg | 13 (Rated: 12) *8 | |
Tool pneumatic pipes | Primary: 2 x 6 (w/ 4-pin connector for use) | | |
Machine class | Type | | | |
Maximum composite speed *3 mm/sec | | | |
Protection degree | IP40 (standard)/ IP67 (oil mist) *7/ ISOclass3 *7 | | |
Machine cable | | | |
Specifications

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Variable dimensions

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Variable dimensions

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<tr>
<td>X cross-section</td>
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<td>Y section details</td>
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Specifications

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Variable dimensions

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**Specifications**

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<th>RH-12FH65X/60X/C</th>
<th>RH-12FH70</th>
<th>RH-12FH85</th>
<th>RH-12FH100</th>
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<tr>
<td>Maximum composite speed*2</td>
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</tbody>
</table>

**Note:**
- Specifications are subject to change without notice. Please contact Mitsubishi Electric for updates.
- The values shown are nominal at 23°C. Clean specification/ Water resistant specification/ Dust resistant specification are factory-set custom specifications.
- *1: The value shown is nominal at 23°C. The values may differ depending on the characteristics of the oil you use. Consult with the Mitsubishi Electric dealer.
- *2: The value shown is nominal at 23°C. The values may differ depending on the characteristics of the oil you use. Consult with the Mitsubishi Electric dealer.
- *3: The cycle time is based on back-and-forth movement over a vertical distance of 25 mm and horizontal distance of 300 mm.
- *4: Specifications are subject to change without notice. Please contact Mitsubishi Electric for updates.
- *5: Select either controller according to your application.
- *6: Preservation of cleanliness levels depends on conditions of a back-and-forth flow of 0.3 sec in the clean room and clean room. A dry-air coupler for suctioning is provided at the back of the base.
- *7: Preservation of cleanliness levels depends on conditions of a back-and-forth flow of 0.3 sec in the clean room and clean room. A dry-air coupler for suctioning is provided at the back of the base.
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 *1) and special sealing are applied to these types of robots, they can be used in an environment sterilized with hydrogen peroxide gas and withstand 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.

*1: Food and Drug Administration
*2: Sanitation guideline of NSF (National Sanitation Foundation) in the United States

Models

<table>
<thead>
<tr>
<th>Vertical, multiple-joint type</th>
<th>Type</th>
<th>Chemical-resistant</th>
<th>H1 grease for food machinery</th>
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<tbody>
<tr>
<td>RV-4F series</td>
<td>RV-4FM</td>
<td>-SE01</td>
<td>-SE02</td>
</tr>
<tr>
<td>RV-7F series</td>
<td>RV-7FLM</td>
<td>-SE01</td>
<td>-SE02</td>
</tr>
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<td>RV-13F series</td>
<td>RV-13FLM</td>
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<td>-SE02</td>
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<td>RV-20F series</td>
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<td>-SE02</td>
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</table>

<table>
<thead>
<tr>
<th>Horizontal, multiple-joint type</th>
<th>Type</th>
<th>Chemical-resistant</th>
<th>H1 grease for food machinery</th>
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</thead>
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<td>-SE02</td>
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<td>RH-12PF series</td>
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<td>-SE02</td>
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<td>RH-20PF series</td>
<td>RH-20PF500XMM</td>
<td>-SE01</td>
<td>-SE02</td>
</tr>
</tbody>
</table>

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:
- 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.

Specifications

**A** NSF H1-certified grease is applied (Compliant to FDA)
- H1 grease for food machinery is applied to joint oil seals. (Oil seals exposed to the external air)

**B** Stainless materials are used for robot tips
- The tool flange of a robot tip is changed from a plated one to the one using stainless materials, and this enhances the corrosion resistance.

**C** Special hexagon flange bolts are used (Cover-fixing bolts)
- Liquid does not remain in the special bolts that are made of stainless-steel, and this improves detergency.
- Grooving is performed to the bolts to enable easy cleaning the area around the cover-fixing bolts.

**D** Chemical-resistant coating to chassis
- Chemical-resistant special coating is applied to the arm.

**E** Seals exposed to the external air are resistant to chemicals
- Highly chemical-resistant rubbers are used for oil seals and packing, the seals exposed to the external environment, and this improves the detergency at food and pharmaceutical factories.

**F** The chemical resistance of bellows is improved (RH-F series only)
- 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>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>H1 grease is applied to the seals exposed to the external air</td>
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<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>

**RH - 13 F L M - 1D 1 - SE01**

**RH - 20 FH 100 45 M - 1D 1 - SE01**

Options

- Controller type
- Environment specification
- Special device No.

Options

- Controller type
- Environment specification
- Special device No.
### Specifications

<table>
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<th>Type</th>
<th>Unit</th>
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<th>CR751-Q</th>
<th>CR751-D</th>
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<tr>
<td>Port number</td>
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<td>2P (front) and SP interface</td>
<td>2P (front) and SP interface</td>
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<tr>
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</table>

### Controller protection box (IP54)

**CR750-MB/CR751-MB**

- The controller protection box is used to protect the controller from oil mist and other usage environments. (For CR750)
- The front panel of the protection box has a mode switch and teaching box connector. It also contains a display window for viewing the controller operation panel.

**CR751-MB**

- The controller protection box is used to protect the controller from oil mist and other usage environments. (For CR751)

### Multiple CPU environment

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<th>Unit</th>
<th>Type</th>
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<td>High-speed standard base between multiple CPUs</td>
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<tr>
<td>-</td>
<td>Q006H 6 slots</td>
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<td>-</td>
<td>Q005H 5 slots</td>
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<tr>
<td>-</td>
<td>Q012H 12 slots</td>
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</tbody>
</table>

- **Power supply**: A universal model
- **Programmable controller**: Q100UD (E) HCPU, Q26UD (E/V) HCPU, Q20UD (E) HCPU, Q13UD (E/V) HCPU, Q10UD (E) HCPU, Q06UD (E/V) HCPU, Q04UD (E/V) HCPU, Q03UD (E/V) CPU

Note: The operation panel is not attached to the CR-751. Set up the robot operating environment according to your operation requirements and usage conditions. Automatic and other operation modes can be enabled from the teaching pendant.
Functions

Improved control performance
Produced the fastest operating performance in its class using high-performance motors and unique driver 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-FH: Twice as fast as the conventional speed]

High-speed execution of programs
Enables execution up to 1.2 times faster than with the SQ/SD series. Numerical operation and conditional branch processing speeds increased by up to twice as fast, leading to shortened takt times.

Robot programs can be executed 1.2 times faster than before if compiled in advance and processed using an intermediate language. Compilation processing time can be reduced 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 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.

Compatuability with internal Ethernet cable tools
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

Note) The sections of wiring that can be routed internally may differ depending on the model.

Space saving
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.

Expanded pivotal operating range
RV-FQ/2FD pivot operation
Expanded J1 axis pivotal operating range to allow access to back of robot
Movable stopper for the J1 axis
Rear access of RH-FQ/ FD

Compatible Options
Connectable
Internally embedded valves
Encoding sensor
Vision sensor

class="auto"
class="auto"
class="auto"
class="auto"
class="auto"
class="auto"
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.

Trajectory priority mode/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.

Improve trajectory 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.

- Improve palletization accuracy
- Improve trajectory accuracy

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

- 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.

Deflection compensation

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 allows the amount of force generated through interference during chucking and workpiece insertion to be reduced and external movement copying forces to be controlled.

- The compliance direction can be set arbitrarily using the robot coordinate system, the tool coordinate system, etc.
  - This is useful in protecting against workpiece interference and cutting down on stoppage.

- Reduce tooling costs
- Shorten line stop times
- Shorten startup times

Adaptation to operation

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.

**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 (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.

- Display of user-defined regions/freedom-limited planes

**User-defined screen creation tools**

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.

**Linked to iQ Works**

- Program management simplified
- 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.).

**GOT connection function**

- 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.

**Simplified control panel created using a GOT**

- No need for ladder circuits with the GOT connection

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

**Reduction cycle time**
- Reduce system costs

**Tracking**
- Transport, alignment, and installation work, etc. can be performed while robots are tracked with the workpiece on the conveyor without stopping the conveyor.
- Processing capability improved by up to 15% compared to that for SQ/SD robots.
- 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.)

**Additional axis function**
- The layout can be set up to include the robot traveling axis and turntable as well as user machines separate from the robot such as loaders and positioning devices.
- Up to 8 additional axes can be controlled by the controller.
- Additional axes and user machines can be operated from the robot program and teaching pendant without any additional motion control hardware. The same JOG operation as for the robot can be used. Robot language can be used for control operations.
- The robot controller has plug-and-play compatibility with the MELSERVO (MR-J4-B, MR-J3-BS) servos.
- Standard interface function (Separate servo amplifier and servo motor required.)

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

**No need for a dedicated control device**

**User interfaces**
- The various network options available allow connection to a variety of devices used throughout the world.
- Standard equipment: Ethernet, USB, SSCNET III
- Option: CC-Link, Profinet, DeviceNet, Network base card (EtherNet/IP, PROFINET IO)

Safety features

**Security 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.

**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 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.
- Ex.) 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
  - Compliant with the EMC Directive, 2004/108/EC
  - Compliant with the Machinery Directive, 2006/42/EC
- KCC: Korean Communications Commission
  - Compliant 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 halfway 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 that 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. [5 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.

- Measurement example: Transfer of 16-word data (With data matching check)
  - CC-Link: 262ms
  - Between multiple CPUs: 63 ms (Approx. 4×)

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: 236/256
  - CC-Link: 4 stations, 1×: 126/126
  - CC-Link: 4 stations, 8×: 894/894

Reduced wiring and number of units used

- System costs can be reduced with the use of wireless systems and deletion of I/O units and network units.

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.

- Direct communication between CPUs
  - 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.

- Direct control between CPUs and I/O units
  - No need for programmable controller programs for signal input/output
  - Improved responsivity without any delay due to scanning time

Batch management of 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.

- Enables access to other stations by Ethernet or serial communications enabled
  - No need for special programs as shared memory is used.

- Enables Robot 1, Robot 2, and Robot 3 to be monitored from a single location.

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

- Enables access to other stations by Ethernet or serial communications enabled

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

- Enables Robot 1, Robot 2, and Robot 3 to be monitored from a single location.
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.

Collision Avoidance

For automatic prevention of collisions between robots

The software constantly monitors robots 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)

Decreases 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

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.

Checking interference using the robot with a defined solid model

Enables installation work to be completed while gripper positions between robots are maintained.
**System Configuration**

### EQseries

**System Configuration**

- Hood set tube
- Hood output cable
- Hand input cables
- Subarm set tube
- Internal wiring and piping set for hood
- External user wiring and piping box

**Robot arm options**

- Robot CPU
- Machine cable
- Encoder (options)
- USB cable
- Additional axis function

**Controller options**

- I/O interface
- LAN (Ethernet)
- USB
- RS-232

**Software options**

- Additional-axis interface
- Drive unit

**Equipment used for standard configuration**

- Robot
- Machine cable
- Encoder
- Controller
- USB cable
- CPU-to-DU connection

---

### EDseries

**System Configuration**

- Hood set tube
- Hood output cable
- Hand input cable
- Subarm set tube
- Internal wiring and piping set for hood
- External user wiring and piping box

**Robot arm options**

- Robot CPU
- Machine cable
- Encoder (options)
- USB cable
- Additional axis function

**Controller options**

- I/O interface
- LAN (Ethernet)
- USB
- RS-232

**Software options**

- Additional-axis interface
- Drive unit

**Equipment used for standard configuration**

- Robot
- Machine cable
- Encoder
- Controller
- USB cable
- CPU-to-DU connection

---

**Configurations Options**

**For details, refer to the specifications sheets.**

<table>
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<tr>
<th>Classification</th>
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Note: This is a special specification for shipping. For details, refer to the specifications sheets.
**Options**

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

**Hand configuration**

<table>
<thead>
<tr>
<th>Hand configuration</th>
<th>Wiring format</th>
<th>Robot specifications</th>
<th>External wiring set for the forearm</th>
<th>External wiring set for the base (&quot;)</th>
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<td>-SH11</td>
<td>-SH04</td>
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</tbody>
</table>

**Required device**

- Air hoses: Up to 4 systems (4 mm diameter x 4), Input signals: 32 output points/ 32 input points
- Air/hand: up to 1 system (4 mm diameter x 3), Input signals: 32 output points/ 32 input points

**Comments**

- Robot models provide the electrical values for internal wiring model references.
- *1: The external wiring set for the base is provided for models with internal wiring and hoses.

---

**Configurations options (SE01)**

The following options are dedicated for the environmentally-resistant models (Chemical-resistant specification: SE01). For other models, refer to the options for the standard models.

### Classification

**Name** | **Type** | **Controller** | **Robot arm** | **Functional specifications**
---|---|---|---|---
External wiring set |  |  |  |  

- **Functional specifications**
  - Electrical hand, the electrical hand, the force sensor cable, and the Ethernet cable.
  - No hand input connection available.
  - Used for the forearm.
  - External wiring box used for connecting the external input/output, such as emergency stopper, force sensor input, and enabling device input.
  - Accepts EtherNet/IP and PROFINET IO modules (*1).
  - Admitted for the forearm. 2D-CBL for the teaching box.

---

**Robotic arm**

- **Functional specifications**
  - Air hoses: Up to 4 systems (4 mm diameter x 4), Input signals: 32 output points/ 32 input points
  - Air/hand: up to 1 system (4 mm diameter x 3), Input signals: 32 output points/ 32 input points

---

**Models with Internal wiring and hoses**

- For models with internal wiring and hoses
- For external wiring

---

For models with internal wiring and hoses

- External wiring set for the forearm
- External wiring set for the base

For external wiring

- Machine cable
### Options

**RV series Tooling (air-hand): External wiring**

- **Hand curl tube**: (Can be provided by the user.)
- **Solenoid valve**: 1 to 4 lines
- **External wiring BOX**: (Standard supplied)
- **Air hoses**: φ 6×2
- **Hand input cable**
- **Hand input signal**: 8 points

**RV series Tooling (air-hand): Internal wiring**

- **Solenoid valve**: 1 to 4 lines
- **Internal wiring models**: (models ending in ‘-SH01’)
- **External wiring BOX**: (Standard supplied)
- **Air hoses**: φ 6×2
- **Signal cable for the multi-function hand**
- **Ethernet cable**
- **Hand input signal**: 8 points

### 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 includes programming and editing, operational checking before robots are installed, measuring process tact time, debugging during robot startup, monitoring robot operation after startup, and trouble shooting.

#### Windows-compatible

- 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 is a registered trademark of Microsoft Corporation in the United States and other countries.*

#### Enhanced simulation functions

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

#### Support for all processes, from programming and startup to maintenance

- Programming can be completed using the MELFA-BASIC IV/V and Movemaster languages *(vary depending on the model).*
- Robot movement and operating status, input signals, and servo status can be monitored.

#### Advanced maintenance functions

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

#### Program editing and debugging functions

- Creation of programs in MELFA-BASIC IV/V and the Movemaster language. *1* Improvement of work operations by a multi-window format and the various editing functions. This is helpful for use in checking behaviors such as the execution of program steps, setting of breakpoint settings, and other tasks.

#### Simulation functions

- Offline robot motion and tact time check for designated parts of a program.
- Creation of programs in MELFA-BASIC IV/V and the Movemaster languages. *1* Improvement of work operations by a multi-window format and the various editing functions. This is helpful for use in checking behaviors such as the execution of program steps, setting of breakpoint settings, and other tasks.

#### 3D viewer

- Graphical representation of a work along with the dimensions, color and other specified details of the work area to be gripped.

#### 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, parameter management, etc.

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*1: MELFA-BASIC is a programming language that further expands upon and develops the commands needed for robot control. In MELFA-BASIC IV/V, the expansion of the command as well as parallel processing or structuring that were difficult to realize in BASIC language can make it possible to operate MELFA robots easily.*
Options

**MELFA-Works**

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

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

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### Features

- **Automatic robot program creation function**
- **Example Screens for MELFA-Works**

#### Loading of part data from peripheral devices and movements

Part data created in SolidWorks can be loaded into the robot controller.

The positions of loaded parts can be rearranged on the CAD origin and other parts. Positions can be changed using numerical input.

#### Installation of hands

Hands designed and created in SolidWorks can be installed on robots. An ATC (Auto Tool Changer) can be specified for each hand.

#### Handling of work

Simulations of hand signal control can be created using a robot program to handle workpieces.

#### CAD links

Operation data needed to perform selecting and other operations, requiring many teaching steps, can be easily created. All you need to select the area to be processed from CAD data. Since operation data created from CAD data source data, complex three-dimensional curves can be exceeded with ease.

The teaching position data can be input in real-time.

#### Offline teaching

The robot posture can be set up on the screen in advance.

#### Creation of robot programs (templates)

Workpiece processes can be created using a combination of the offline teaching and CAD link functions and then converted into robot programs. MELFA-Works offers simplified programming.

#### Assignment of robot programs

Robot programs can be created or edited in any modifications. A different robot program can also be specified for each tool.

#### Simulation of robot operations

Robot programs, including 3D motion signals, can be simulated. This means that movements of the robot can be visualized in advance, allowing for adjustments. The following two methods are provided to simulate 3D motion signals of your robot controller.

1. **Create robot posture of operations associated with 3D signals**
2. **Link 3D motion signals with 3D SolidWorks**

---

### Simple control

Simple programs can be created using specialized robot language.

---

### Product Features

<table>
<thead>
<tr>
<th>Features</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching position search</td>
<td>Allows loading of parts into the CAD origin and other parts. Positions can be changed using numerical input.</td>
</tr>
<tr>
<td>Force sense monitor</td>
<td>Enables force sense control setting status to be displayed.</td>
</tr>
<tr>
<td>Data reference</td>
<td>Allows logging start/stop commands to be specified in robot programs.</td>
</tr>
<tr>
<td>Gain changes</td>
<td>Function for acquiring force sensor information synchronized to position information as log data and displaying it in graph form.</td>
</tr>
<tr>
<td>Stiffness control</td>
<td>Enables force sensor detection and force control conditions during contact.</td>
</tr>
<tr>
<td>Force detection</td>
<td>Enables force sensor detection and force control conditions during contact.</td>
</tr>
<tr>
<td>Joystick</td>
<td>Function for controlling the robot while applying a specified force.</td>
</tr>
<tr>
<td>Jog function</td>
<td>Function for controlling the robot while applying a specified force.</td>
</tr>
<tr>
<td>Jog function</td>
<td>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 applied. Improved operating stability gained through position latch and retry processes when work operations fail. Log data can be used to manage quality control and analyze causes of work errors and other issues.</td>
</tr>
</tbody>
</table>

---

### System Configuration

- **Teaching pendant**
- **Teaching position search**
- **Force sense monitor**
- **Data reference**
- **Gain changes**
- **Stiffness control**

---

### Force Sensor Specifications

- **Rated load**
- **Max. speed**
- **Stiffness**
- **Damping**
- **Consumption current**
- **Weight (sensor unit)**
- **Dimensions**

---

### Force Sensor Interface Unit Specifications

- **Interface**
- **Input voltage**
- **Power (ABS)**
- **External dimensions**
- **Weight**
- **Construction**

---

### Options

**What is MELFA-Works?**

MELFA-Works is an add-in tool for SolidWorks® that adds unique functions to its application software packages. (*2) SolidWorks® is a registered trademark of SolidWorks Corp. (USA).

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### List of functions

- **RS-422**
- **LAN/USB**
- **Power supply cable**
- **Adapter cable**
- **24V DC power supply**
- **SSCNET III cable**
- **Sensor adapter**
- **Force sensor interface unit**
- **Sensor adapter**
- **Force sensor**

---

### Force sensor set

**3F-21D-WINE**

**Type: 4F-FS001-W200**

Allows copy and fitting work to be completed in the same way a person would while the force applied to the hand is monitored. Enables necessary work such as fine force adjustments and force detection to be completed.

- **Improved productivity**
- **Assembly of more complicated configurations**

---

### Simple control

Simple programs can be created using specialized robot language.

---

### Product Configuration

<table>
<thead>
<tr>
<th>Name</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force sensor interface unit</td>
<td>1</td>
</tr>
<tr>
<td>Teaching pendant</td>
<td>1</td>
</tr>
<tr>
<td>RT ToolBox2</td>
<td>1</td>
</tr>
</tbody>
</table>

---

**RT ToolBox2**

- **Calibration tool**
- **Force control**
- **Software control**
- **Force detection**
- **Force log**
- **Teaching box**
- **Force sense monitor**
- **Data reference**
- **Gain changes**
- **Teaching pendant**
- **Teaching position search**
- **Force sense monitor**
- **Data reference**
- **Gain changes**
- **Stiffness control**

---

### Product Configuration

- **RS-422**
- **LAN/USB**
- **Power supply cable**
- **Adapter cable**
- **24V DC power supply**
- **SSCNET III cable**
- **Sensor adapter**
- **Force sensor interface unit**
- **Teaching pendant**
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---

### Force Sense Interface Unit Specifications

- **Interface**
- **Input voltage**
- **Power (ABS)**
- **External dimensions**
- **Weight**
- **Construction**

---

### Options

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### Simple operation

Work conditions can be checked and adjusted by viewing position and force data from the teaching box and viewing graphs on RT ToolBox2.
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 control using 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.

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.

The calibration wizard allows settings used in converting workpiece 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: CR750 Series</td>
</tr>
<tr>
<td>Connected robot</td>
<td>CRnQ/CRnD or CR750/CR770</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>Robot program language</td>
<td>MELFA-BASIC V comes with dedicated vision sensor commands</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>640×480 1280×1024 1600×1200 2880×2160 3200×2400 4096×3120 5120×3840 6400×4800</td>
</tr>
<tr>
<td>Color sensor size</td>
<td>1/3 in. 1/3 in. 1/3 in. 1/1.8 in. 1/3 in. 1/3 in. 1/1.8 in.</td>
</tr>
<tr>
<td>CoD size</td>
<td>1.8 in. 1.8 in. 1.8 in. 1.8 in. 1.8 in. 1.8 in. 1.8 in.</td>
</tr>
</tbody>
</table>

**Simplified control using robot language**

MELFA-BASIC V comes with dedicated vision system control commands and status variables. These control commands and status variables enable the vision system to be controlled using simple programs.

<table>
<thead>
<tr>
<th>Instruction word</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/Open</td>
<td>Connect to the vision system and log in.</td>
</tr>
<tr>
<td>N/Stop</td>
<td>Shut down the specified vision program and receive the terminated results.</td>
</tr>
<tr>
<td>N/RUN</td>
<td>Start the specified vision program.</td>
</tr>
<tr>
<td>W/IN</td>
<td>Read the specified vision program.</td>
</tr>
<tr>
<td>N/Close</td>
<td>End the connection to the vision system.</td>
</tr>
<tr>
<td>N/Load</td>
<td>Load the specified vision program to enable it for startup.</td>
</tr>
<tr>
<td>N/Trg</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-Sight1000 series or In-Sight Micro series products. The use of job programs corresponding to work tasks performed regularly enables even customers who are new to vision systems to easily understand and use them without problems.