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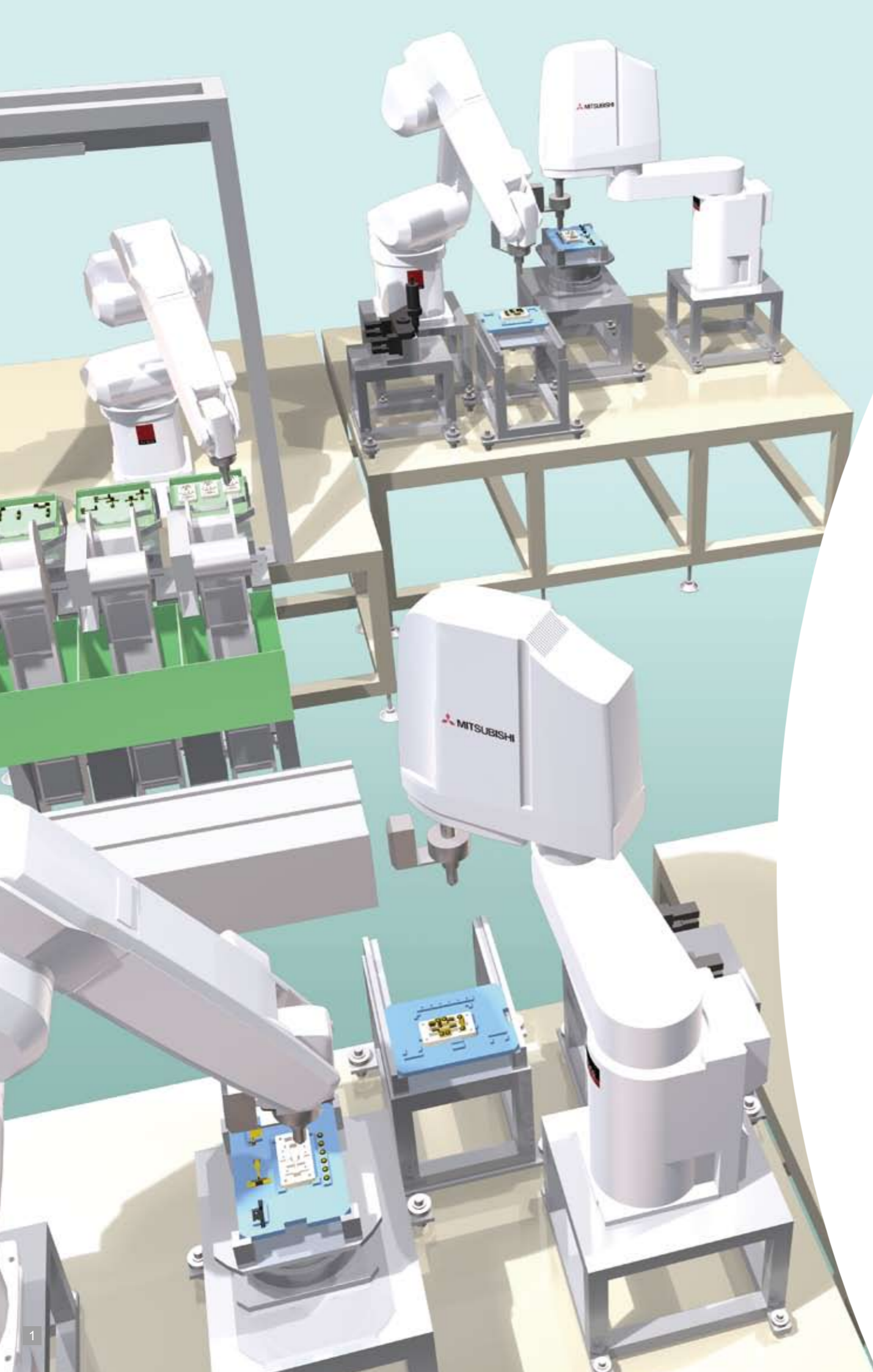
This catalog is an introduction to only part of what Mitsubishi Electric has to offer.  
 Mitsubishi Electric offers individualized solutions for the challenges in your factory.

When exported from Japan, this manual does not require application to the  
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# MELFA

INDUSTRIAL ROBOT CATALOG



# 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

# Lineup




## 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)



| Type                         | RV-2F   | RV-4F    | RV-4FL   | RV-7F         | RV-7FL   |
|------------------------------|---|----------|--|---------------|--|
| Maximum load capacity (kg)   | 2   | 4        | 4  | 7             | 7  |
| Maximum reach radius (mm)    | 504   | 515      | 649  | 713           | 908  |
| Environmental specifications | Standard  | ○ (IP30) | ○ (IP40)   | ○ (IP40)      | ○ (IP40)   |
|                              | Oil mist  | —        | ○ (IP67)   | ○ (IP67)      | ○ (IP67)   |
|                              | Clean   | —        | ○ (ISOclass3)  | ○ (ISOclass3) | ○ (ISOclass3)  |
| Controller                   | <br>CR750<br>(CR750: Japan, Europe, U.S.; CR751: Asia) |          | <br>CR751 |               | <br>Controllers with protective specifications<br>(Equipped with controller protection boxes) |

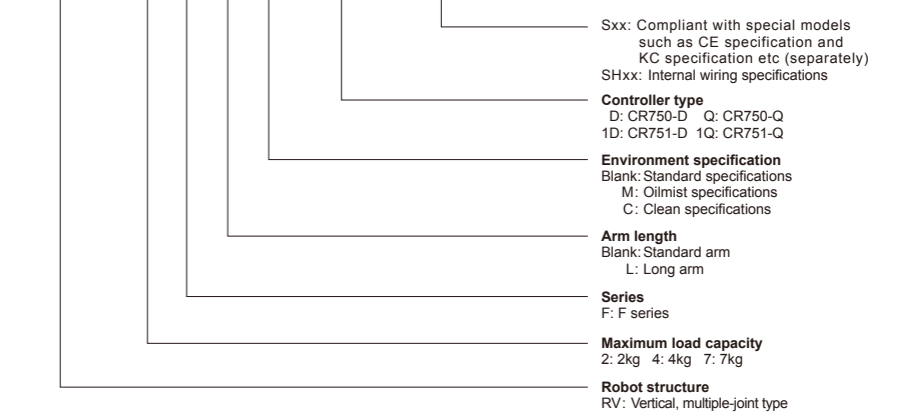
### Horizontal, multiple-joint type (RH)



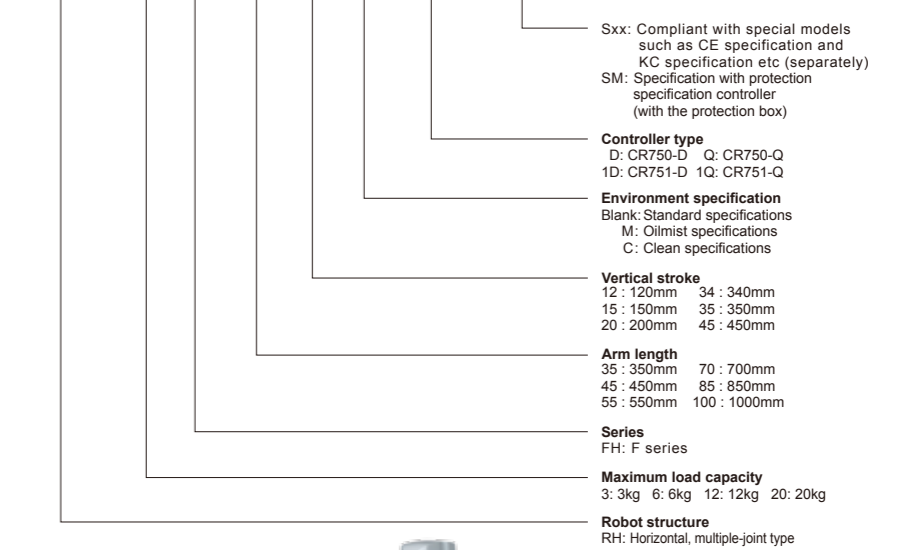
| Type                         | RH-3FH35   | RH-3FH45 | RH-3FH55 | RH-6FH35  | RH-6FH45      | RH-6FH55 | RH-12FH55  | RH-12FH70     | RH-12FH85 | RH-20FH85   | RH-20FH100 |  |
|------------------------------|--|----------|----------|---|---------------|----------|--|---------------|-----------|---|------------|--|
| Maximum load capacity (kg)   | 3  | 3        | 3        | 6   | 6             | 6        | 12   | 12            | 12        | 20  | 20         |  |
| Maximum reach radius (mm)    | 350  | 450      | 550      | 350   | 450           | 550      | 550  | 700           | 850       | 850   | 1000       |  |
| Environmental specifications | Standard   | ○ (IP20) |          |   | ○ (IP20)      |          |  | ○ (IP20)      |           | ○ (IP20)  |            |  |
|                              | Oil mist   | —        |          |   | ○ (IP65)      |          |  | ○ (IP65)      |           | ○ (IP65)  |            |  |
|                              | Clean  | —        |          |   | ○ (ISOclass3) |          |  | ○ (ISOclass3) |           | ○ (ISOclass3)   |            |  |
| Controller                   | <br>CR750 |          |          | <br>CR751<br>(CR750: Europe, U.S.; CR751: Japan, Asia) |               |          | <br>CR750 |               |           | <br>CR751<br>(CR750: Japan, Europe, U.S.; CR751: Asia) |            | <br>Controllers with protective specifications<br>(Equipped with controller protection boxes) |

## Electric, committed to ease in selection.

### RV - 4 F L C - D - Sxx



### RH - 6 FH 55 20 M - D - Sxx

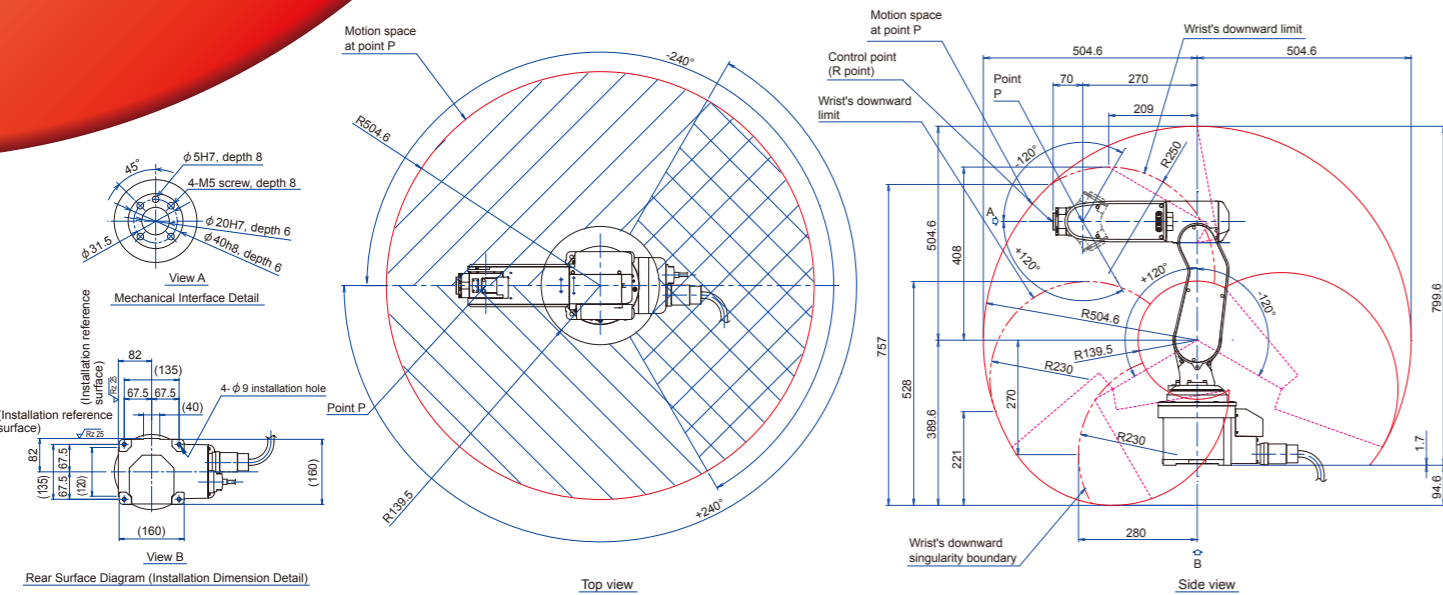




Vertical  
2 kg  
type

# RV-2F

## External Dimensions/Operating Range Diagram



## Specifications

| Type                         | Unit       | RV-2F(B)   |
|------------------------------|------------|--|
| Environmental specifications |            | Standard   |
| Protection degree            |            | IP30   |
| Installation                 |            | Floor type, ceiling type, (wall-mounted type *2)                                 |
| Structure                    |            | Vertical, multiple-joint type  |
| Degrees of freedom           |            | 6  |
| Drive system *1              |            | AC servo motor (J2, J3 and J5: with brake)                                       |
| Position detection method    |            | Absolute encoder   |
| Maximum load capacity        | kg         | 2  |
| Arm length                   | NO1 arm mm | 230 + 270  |
| Maximum reach radius         | mm         | 504  |
| Operating range              | J1         | 480 (±240)   |
|                              | J2         | 240 (-120 to +120)   |
|                              | J3         | 160 (-0 to +160)   |
|                              | J4         | 400 (±200)   |
|                              | J5         | 240 (-120 to +120)   |
|                              | J6         | 720 (-360 to +360)   |
| Maximum speed                | J1         | 300  |
|                              | J2         | 150  |
|                              | J3         | 300  |
|                              | J4         | 450  |
|                              | J5         | 450  |
|                              | J6         | 720  |
| Maximum composite speed *3   | mm/sec     | 4955   |
| Cycle time *4                | sec        | 0.6  |
| Position repeatability       | mm         | ±0.02  |
| Ambient temperature          | °C         | 0 to 40  |
| Mass                         | kg         | 19   |
| Tolerable moment             | J4         | 4.17   |
|                              | J5         | 4.17   |
|                              | J6         | 2.45   |
| Tolerable amount of inertia  | J4         | 0.18   |
|                              | J5         | 0.18   |
|                              | J6         | 0.04   |
| Tool wiring                  |            | Hand: 4 input points/4 output points<br>Signal cable for the multi-function hand |
| Tool pneumatic pipes         |            | φ4 x 4   |
| Machine cable                |            | 5m (connector on both ends)  |
| Connected controller         |            | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)                           |

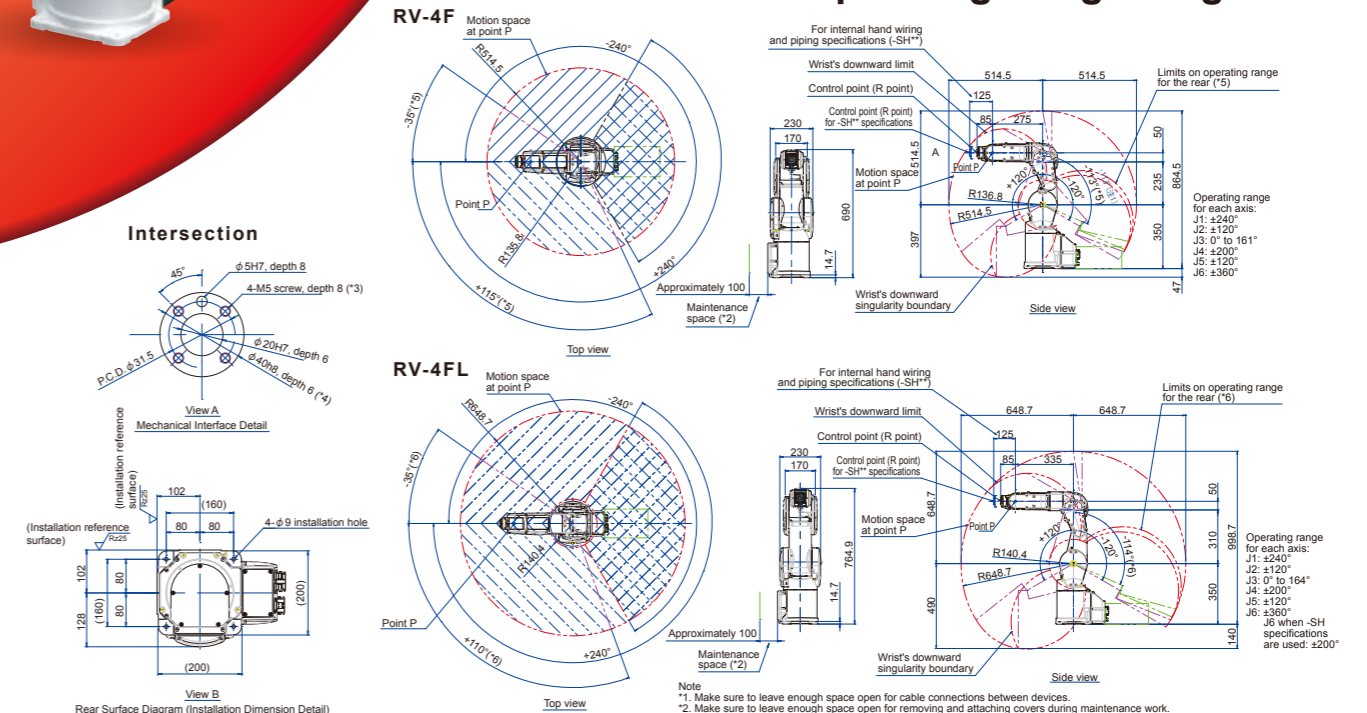
\*1: The standard model does not have a brake on the J1, J4, or J6 axis. There are models available with brakes included for all axes. (RV-2FB)  
 \*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.  
 \*3: This is the value at the surface of the mechanical interface when all axes are composited.  
 \*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.



Vertical  
4 kg  
type

# RV-4F RV-4FL

## External Dimensions/Operating Range Diagram



## Specifications

| Type                         | Unit       | RV-4F(M)(C)  | RV-4FL(M)(C)   |
|------------------------------|------------|--|--|
| Environmental specifications |            | Standard/ Oil mist/ Clean  | Standard/ Oil mist/ Clean  |
| Protection degree            |            | IP40 (standard)/ IP67 (oil mist) *1/ ISOclass3 *7  | IP40 (standard)/ IP67 (oil mist) *1/ ISOclass3 *7  |
| Installation                 |            | Floor type, ceiling type, (wall-mounted type *2)   | Floor type, ceiling type, (wall-mounted type *2)   |
| Structure                    |            | Vertical, multiple-joint type  | Vertical, multiple-joint type  |
| Degrees of freedom           |            | 6  | 6  |
| Drive system *1              |            | AC servo motor   | AC servo motor   |
| Position detection method    |            | Absolute encoder   | Absolute encoder   |
| Maximum load capacity        | kg         | 4  | 4  |
| Arm length                   | NO1 arm mm | 240 + 270  | 245 + 300  |
| Maximum reach radius         | mm         | 515  | 649  |
| Operating range              | J1         | 480 (±240)   | 480 (±240)   |
|                              | J2         | 240 (-120 to +120)   | 240 (-120 to +120)   |
|                              | J3         | 161 (-0 to +161)   | 164 (-0 to +164)   |
|                              | J4         | 400 (±200)   | 400 (±200)   |
|                              | J5         | 240 (-120 to +120)   | 240 (-120 to +120)   |
|                              | J6         | 720 (±360)   | 720 (±360)   |
| Maximum speed                | J1         | 450  | 420  |
|                              | J2         | 450  | 336  |
|                              | J3         | 300  | 250  |
|                              | J4         | 540  | 540  |
|                              | J5         | 623  | 623  |
|                              | J6         | 720  | 720  |
| Maximum composite speed *3   | mm/sec     | 9027   | 9048   |
| Cycle time *4                | sec        | 0.36   | 0.36   |
| Position repeatability       | mm         | ±0.02  | ±0.02  |
| Ambient temperature          | °C         | 0 to 40  | 0 to 40  |
| Mass                         | kg         | 39   | 41   |
| Tolerable moment             | J4         | 6.66   | 6.66   |
|                              | J5         | 6.66   | 6.66   |
|                              | J6         | 3.96   | 3.96   |
| Tolerable amount of inertia  | J4         | 0.2  | 0.2  |
|                              | J5         | 0.2  | 0.2  |
|                              | J6         | 0.1  | 0.1  |
| Tool wiring                  |            | Hand: 8 input points/8 output points<br>Signal cable for the multi-function hand and sensors<br>LAN X 1 <100 BASE-TX> (8-pin) *5 | Hand: 8 input points/8 output points<br>Signal cable for the multi-function hand and sensors<br>LAN X 1 <100 BASE-TX> (8-pin) *5 |
| Tool pneumatic pipes         |            | Primary: φ6 x 2 Secondary: φ4 x 8, φ4 x 4 (from base portion to forearm)   | Primary: φ6 x 2 Secondary: φ4 x 8, φ4 x 4 (from base portion to forearm)   |
| Machine cable                |            | 5m (connector on both ends)  | 5m (connector on both ends)  |
| Connected controller *6      |            | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)   | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)   |

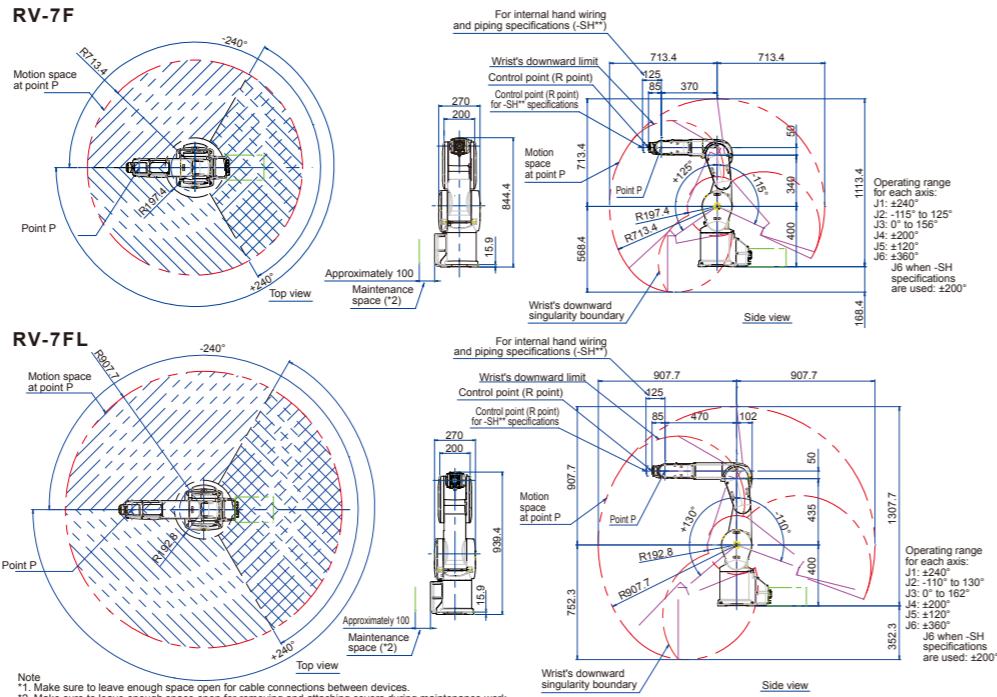
\*1: Please contact Mitsubishi Electric dealer since the environmental resistance may not be secured depending on the characteristics of oil you use. Air will need to be purged from the lines. For details, refer to the specifications sheet.  
 \*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.  
 \*3: This is the value at the surface of the mechanical interface when all axes are composited.  
 \*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.  
 \*5: Can also be used as a spare line (0.2 sq. mm, 4-pair cable) for conventional models.  
 \*6: Select either controller according to your application. CR751-D: Standalone type, CR751-Q: IQ Platform compatible type.  
 \*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. A φ8-mm coupler for suctioning is provided at the back of the base.



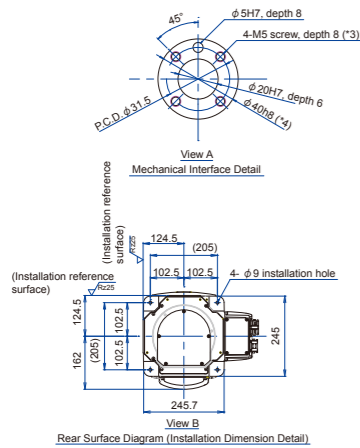
Vertical  
7 kg  
type

**RV-7F**  
**RV-7FL**

**External Dimensions/Operating Range Diagram**



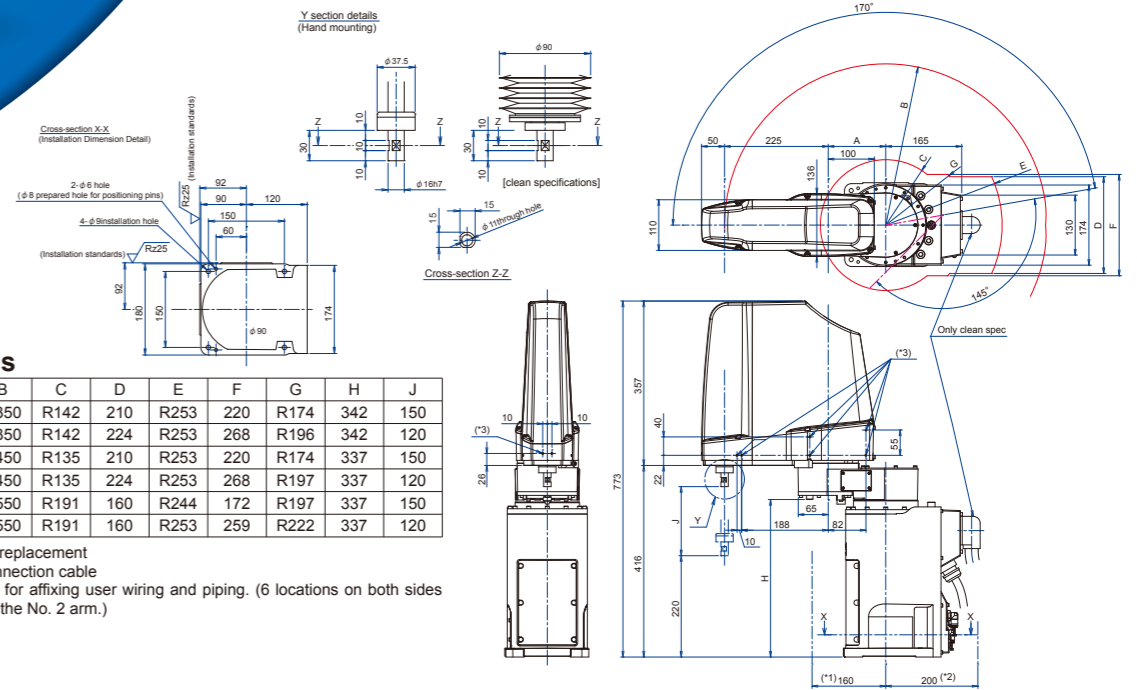
**Intersection**



Horizontal  
3 kg  
type

**RH-3FH35**  
**RH-3FH45**  
**RH-3FH55**

**External Dimensions/Operating Range Diagram**



**Variable dimensions**

| Robot series | A   | B    | C    | D   | E    | F   | G    | H   | J   |
|--------------|-----|------|------|-----|------|-----|------|-----|-----|
| RH-3FH3515   | 125 | R350 | R142 | 210 | R253 | 220 | R174 | 342 | 150 |
| RH-3FH3512C  | 125 | R350 | R142 | 224 | R253 | 268 | R196 | 342 | 120 |
| RH-3FH4515   | 225 | R450 | R135 | 210 | R253 | 220 | R174 | 337 | 150 |
| RH-3FH4512C  | 225 | R450 | R135 | 224 | R253 | 268 | R197 | 337 | 120 |
| RH-3FH5515   | 325 | R550 | R191 | 160 | R244 | 172 | R197 | 337 | 150 |
| RH-3FH5512C  | 325 | R550 | R191 | 160 | R253 | 259 | R222 | 337 | 120 |

- \*1: Space required for the battery replacement
- \*2: Space required for the interconnection cable
- \*3: Screw holes (M4, 6 mm long) for affixing user wiring and piping. (6 locations on both sides and 2 locations on the front of the No. 2 arm.)

**Specifications**

| Type                        | Unit    | RV-7F(M)(C)   | RV-7FL(M)(C)       |
|-----------------------------|---------|---|--------------------|
| Machine class               |         | Standard/ Oil mist/ Clean   |                    |
| Protection degree           |         | IP40 (standard)/ IP67 (oil mist) *1/ ISOclass3 *7   |                    |
| Installation                |         | Floor type, ceiling type, (wall-mounted type *2)  |                    |
| Structure                   |         | Vertical, multiple-joint type   |                    |
| Degrees of freedom          |         | 6   |                    |
| Drive system                |         | AC servo motor  |                    |
| Position detection method   |         | Absolute encoder  |                    |
| Maximum load capacity       | kg      | 7   |                    |
| Arm length                  | NO1 arm | mm  | 340 + 360          |
| Maximum reach radius        |         | mm  | 713                |
| Operating range             | J1      | deg   | 480 (±240)         |
|                             | J2      | deg   | 240 (-115 to +125) |
|                             | J3      | deg   | 156 (-0 to +156)   |
|                             | J4      | deg   | 400 (±200)         |
|                             | J5      | deg   | 240 (-120 to +120) |
|                             | J6      | deg   | 720 (±360)         |
| Maximum speed               | J1      | deg/sec   | 360                |
|                             | J2      | deg/sec   | 401                |
|                             | J3      | deg/sec   | 450                |
|                             | J4      | deg/sec   | 337                |
|                             | J5      | deg/sec   | 450                |
|                             | J6      | deg/sec   | 720                |
| Maximum composite speed *3  | mm/sec  | 11064   | 10977              |
| Cycle time *4               | sec     | 0.32  | 0.35               |
| Position repeatability      | mm      | ±0.02   |                    |
| Ambient temperature         | °C      | 0 to 40   |                    |
| Mass                        | kg      | 65  | 67                 |
| Tolerable moment            | J4      | Nm  | 16.2               |
|                             | J5      | Nm  | 16.2               |
|                             | J6      | Nm  | 6.86               |
|                             | J4      | Nm  | 0.45               |
| Tolerable amount of inertia | J4      | kgm <sup>2</sup>  | 0.45               |
|                             | J5      | kgm <sup>2</sup>  | 0.45               |
|                             | J6      | kgm <sup>2</sup>  | 0.10               |
|                             | J4      | kgm <sup>2</sup>  | 0.10               |
| Tool wiring                 |         | Hand: 8 input points/8 output points (20 pins total)<br>Serial signal cable for parallel I/O (2-pin + 2-pin power line)<br>LAN X 1 <100 BASE-TX> (8-pin) *5 |                    |
| Tool pneumatic pipes        |         | Primary: φ6 x 2 Secondary: φ4 x 8, φ4 x 4 (from base portion to forearm)  |                    |
| Machine cable               |         | 5m (connector on both ends)   |                    |
| Connected controller        |         | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)  |                    |

\*1: Please contact Mitsubishi Electric dealer since the environmental resistance may not be secured depending on the characteristics of oil you use. Air will need to be purged from the lines. For details, refer to the specifications sheet.  
 \*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.  
 \*3: This is at the hand flange surface when all axes are composited.  
 \*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.  
 \*5: Can also be used as a spare line (0.2 sq. mm, 4-pair cable) for conventional models.  
 \*6: Select either controller according to your application. CR751-D: Standalone type, CR751-Q: iQ Platform compatible type.  
 \*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. A φ8-mm coupler for suctioning is provided at the back of the base.

**Specifications**

| Type                        | Unit          | RH-3FH3515/12C  | RH-3FH4515/12C                    | RH-3FH5515/12C |
|-----------------------------|---------------|---|-----------------------------------|----------------|
| Machine class               |               | Standard/ Clean   |                                   |                |
| Protection degree *1        |               | IP20/ ISOclass3 *6  |                                   |                |
| Installation                |               | Floor type  |                                   |                |
| Structure                   |               | Horizontal, multiple-joint type   |                                   |                |
| Degrees of freedom          |               | 4   |                                   |                |
| Drive system                |               | AC servo motor  |                                   |                |
| Position detection method   |               | Absolute encoder  |                                   |                |
| Maximum load capacity       | kg            | Maximum 3 (rating 1)  |                                   |                |
| Arm length                  | NO1 arm       | mm  | 125                               | 225            |
|                             | NO2 arm       | mm  | 225                               | 325            |
| Maximum reach radius        | J1            | mm  | 350                               | 450            |
|                             | J2            | mm  | 225                               | 550            |
| Operating range             | J1            | deg   | 340 (±170)                        |                |
|                             | J2            | deg   | 290 (±145)                        |                |
|                             | J3 (Z)        | mm  | 150 (Clean specification: 120) *1 |                |
|                             | J4 (θ)        | deg   | 720 (±360)                        |                |
| Maximum speed               | J1            | deg/sec   | 420                               |                |
|                             | J2            | deg/sec   | 720                               |                |
|                             | J3 (Z)        | mm/sec  | 1100                              |                |
|                             | J4 (θ)        | deg/sec   | 3000                              |                |
| Maximum composite speed *2  | mm/sec        | 6800  | 7500                              | 8300           |
| Cycle time *3               | Y-X composite | mm  | 0.41                              | 0.46           |
|                             | J3 (Z)        | mm  | ±0.010                            | ±0.010         |
|                             | J4 (θ)        | deg   | ±0.010                            | ±0.012         |
| Ambient temperature         |               | 0 to 40   |                                   |                |
| Mass                        | kg            | 29  | 29                                | 32             |
| Tolerable amount of inertia | Rating        | 0.005   |                                   |                |
|                             | Maximum       | 0.06  |                                   |                |
| Tool wiring                 |               | Hand: 8 input points/8 output points (20 pins total)<br>Serial signal cable for parallel I/O (2-pin + 2-pin power line)<br>LAN X 1 <100 BASE-TX> (8-pin) *4 |                                   |                |
| Tool pneumatic pipes        |               | Primary: φ6 x 2 Secondary: φ4 x 8   |                                   |                |
| Machine cable               |               | 5m (connector on both ends)   |                                   |                |
| Connected controller *5     |               | CR750, CR751 (CR750: Europe, U.S.; CR751: Japan, Asia)  |                                   |                |

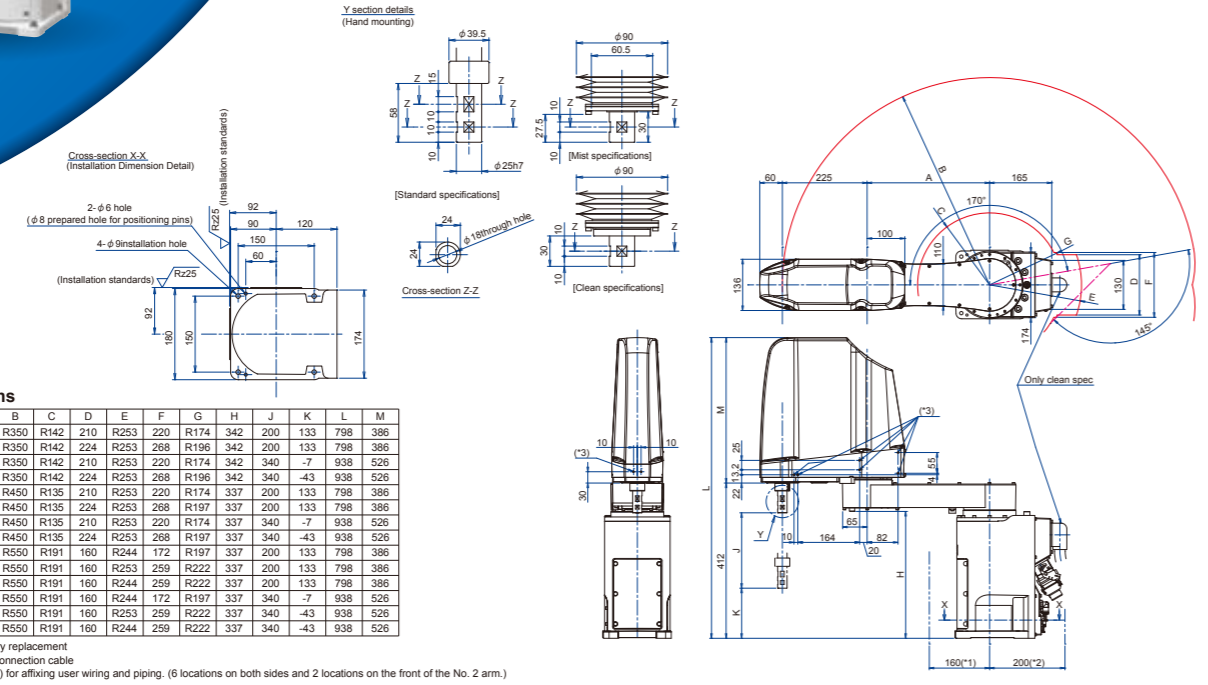
\*1: The range for vertical movement listed in the environmental resistance specifications (C: Clean specifications) for the RH-3FH is narrower than for the standard model. Keep this in mind when working with the RH-3FH. The environment-resistant specifications are factory-set custom specifications.  
 \*2: The value assumes composition of J1, J2, and J4.  
 \*3: Value for a maximum load capacity of 2 kg. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position. (The cycle time is based on back-and-forth movement over a vertical distance of 25 mm and horizontal distance of 300 mm.)  
 \*4: Can also be used as a spare line (0.2 sq. mm, 4-pair cable) for conventional models.  
 \*5: Select either controller according to your application. CR751-D: Standalone type, CR751-Q: iQ Platform compatible type.  
 \*6: Preservation of cleanliness levels depends on conditions of a downstream flow of 0.3 m/s in the clean room and internal robot suctioning. A φ8-mm coupler for suctioning is provided at the back of the base.



Horizontal  
6 kg  
type

**RH-6FH35**  
**RH-6FH45**  
**RH-6FH55**

**External Dimensions/Operating Range Diagram**



**Specifications**

| Type                        | Unit             | RH-6FH35XX/M/C          | RH-6FH45XX/M/C  | RH-6FH55XX/M/C |
|-----------------------------|------------------|-------------------------|---|----------------|
| Machine class               |                  |                         | Standard/ oil mist/ Clean   |                |
| Protection degree *1        |                  |                         | IP20 *6/ IP65 *7/ ISO3 *8   |                |
| Installation                |                  |                         | Floor type  |                |
| Structure                   |                  |                         | Horizontal, multiple-joint type   |                |
| Degrees of freedom          |                  |                         | 4   |                |
| Drive system                |                  |                         | AC servo motor  |                |
| Position detection method   |                  |                         | Absolute encoder  |                |
| Maximum load capacity       | kg               |                         | Maximum 6 (rating 3)  |                |
| Arm length                  | mm               | NO1 arm<br>NO2 arm      | 125<br>225  | 325            |
| Maximum reach radius        | mm               |                         | 350   | 550            |
| Operating range             | deg              | J1<br>J2                | 340 (±170)<br>290 (±145)  |                |
|                             | mm               | J3 (Z)                  | xx = 20 : 200/ xx = 34 : 340  |                |
|                             | deg              | J4 (θ)                  | 720 (±360)  |                |
| Maximum speed               | deg/sec          | J1<br>J2                | 400<br>670  |                |
|                             | mm/sec           | J3 (Z)                  | 2400  |                |
|                             | deg/sec          | J4 (θ)                  | 2500  |                |
| Maximum composite speed *2  | mm/sec           |                         | 6900  | 8300           |
| Cycle time *3               |                  |                         | 0.29  |                |
| Position repeatability      | mm               | Y-X composite<br>J3 (Z) | ±0.010<br>±0.01   | ±0.012         |
|                             | deg              | J4 (θ)                  | ±0.004  |                |
| Ambient temperature         |                  |                         | 0 to 40   |                |
| Mass                        | kg               |                         | 36  | 37             |
| Tolerable amount of inertia | kgm <sup>2</sup> | Rating<br>Maximum       | 0.01<br>0.12  |                |
| Tool wiring                 |                  |                         | Hand: 8 input points/8 output points (20 pins total)<br>Serial signal cable for parallel I/O (2-pin + 2-pin power line)<br>LAN X 1 <100 BASE-TX> (8-pin) *4 |                |
| Tool pneumatic pipes        |                  |                         | Primary: φ 6 x 2 Secondary: φ 4 x 8   |                |
| Machine cable               |                  |                         | 5m (connector on both ends)   |                |
| Connected controller *5     |                  |                         | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)  |                |

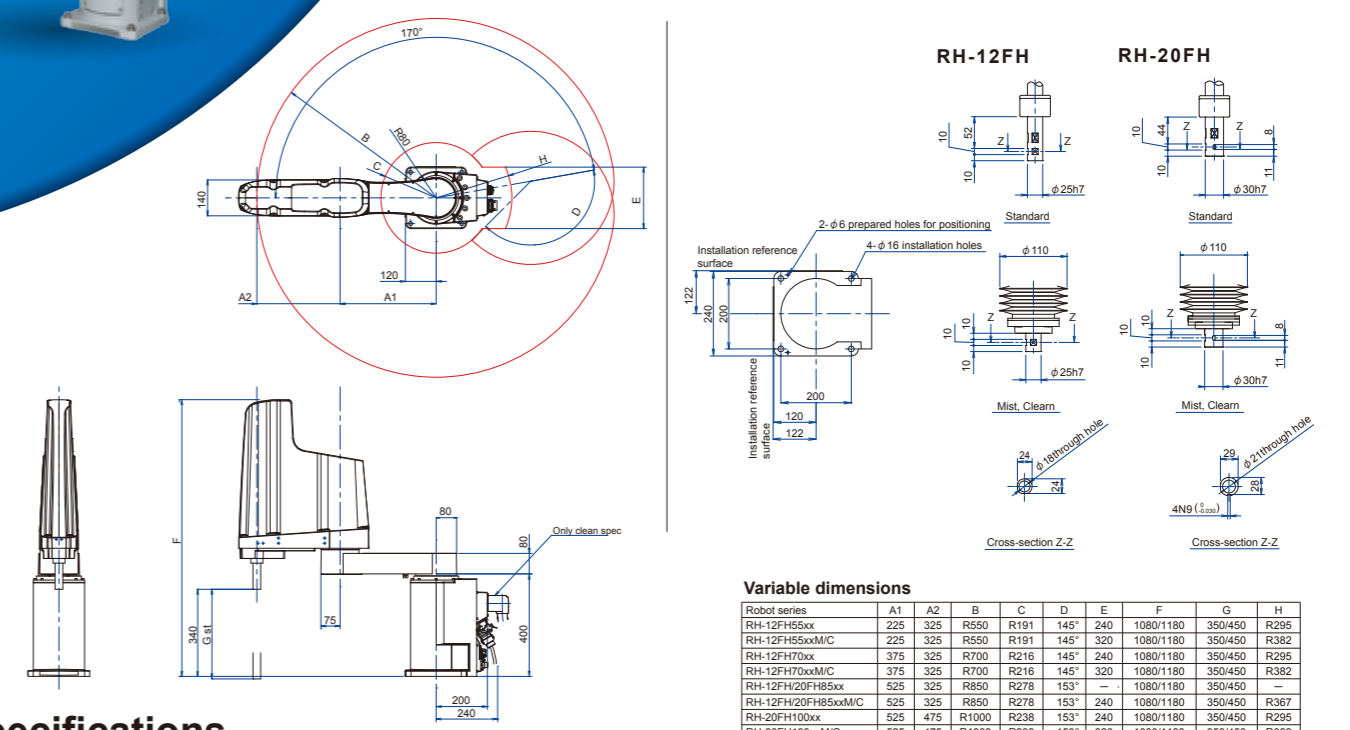
\*1: The range of vertical movement listed in the environmental resistance specifications (M: Oil mist specifications, C: Cleanroom specifications) for the RH-6FH is factory-set custom specifications.  
\*2: The value assumes composition of J1, J2, and J4.  
\*3: Value for a maximum load capacity of 2 kg. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position. (The cycle time is based on back-and-forth movement over a vertical distance of 25 mm and horizontal distance of 300 mm.)  
\*4: Can also be used as a spare line (0.2 sq. mm, 4-pair cable) for conventional models.  
\*5: Select either controller according to your application. CR751-D: Standalone type, CR751-Q: iQ Platform compatible type. Note that controllers with oil mist specifications come equipped with a controller protection box (CR750-MB) and "SM" is appended at the end of the robot model name. If you require it, consult with the Mitsubishi Electric dealer.  
\*6: IP54 rating for European models.  
\*7: Please contact Mitsubishi Electric dealer since the environmental resistance may not be secured depending on the characteristics of oil you use. Direct jet to the bellows is excluded.  
\*8: Preservation of cleanliness levels depends on conditions of a downstream flow of 0.3 m/s in the clean room and internal robot suctioning. A φ 8-mm coupler for suctioning is provided at the back of the base.



Horizontal  
12/20kg  
type

**RH-12FH55** **RH-20FH85**  
**RH-12FH70** **RH-20FH100**  
**RH-12FH85**

**External Dimensions/Operating Range Diagram**



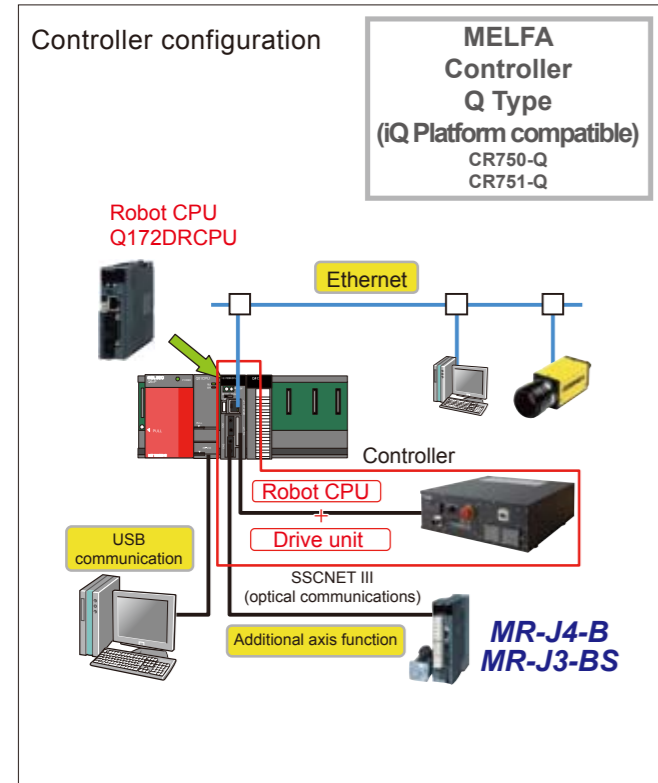
**Specifications**

| Type                        | Unit             | RH-12FH55XX/M/C         | RH-12FH70XX/M/C   | RH-12FH85XX/M/C | RH-20FH85XX/M/C | RH-20FH100XX/M/C  |
|-----------------------------|------------------|-------------------------|---|-----------------|-----------------|---|
| Machine class               |                  |                         | Standard/ oil mist/ Clean   |                 |                 | Standard/ oil mist/ Clean   |
| Protection degree *1        |                  |                         | IP20/ IP65 *6/ ISO3 *7  |                 |                 | IP20/ IP65 *6/ ISO3 *7  |
| Installation                |                  |                         | Floor type  |                 |                 | Floor type  |
| Structure                   |                  |                         | Horizontal, multiple-joint type   |                 |                 | Horizontal, multiple-joint type   |
| Degrees of freedom          |                  |                         | 4   |                 |                 | 4   |
| Drive system                |                  |                         | AC servo motor  |                 |                 | AC servo motor  |
| Position detection method   |                  |                         | Absolute encoder  |                 |                 | Absolute encoder  |
| Maximum load capacity       | kg               |                         | Maximum 12 (rating 3)   |                 |                 | Maximum 20 (rating 5)   |
| Arm length                  | mm               | NO1 arm<br>NO2 arm      | 225<br>375  | 525             | 525             | 525   |
| Maximum reach radius        | mm               |                         | 550   | 700             | 850             | 1000  |
| Operating range             | deg              | J1<br>J2                | 340 (±170)<br>290 (±145)  | 306 (±153)      |                 | 340 (±170)<br>306 (±153)  |
|                             | mm               | J3 (Z)                  | xx = 35 : 350/ xx = 45 : 450  |                 |                 | xx = 35 : 350/ xx = 45 : 450  |
|                             | deg              | J4 (θ)                  | 720 (±360)  |                 |                 | 720 (±360)  |
| Maximum speed               | deg/sec          | J1<br>J2                | 420<br>450  | 280             |                 | 280<br>450  |
|                             | mm/sec           | J3 (Z)                  | 2400  |                 |                 | 2400  |
|                             | deg/sec          | J4 (θ)                  | 2400  |                 |                 | 1700  |
| Maximum composite speed *2  | mm/sec           |                         | 11435   | 12535           | 11350           | 11372   |
| Cycle time *3               |                  |                         | 0.30  | 0.30            | 0.30            | 0.36  |
| Position repeatability      | mm               | Y-X composite<br>J3 (Z) | ±0.012<br>±0.015  | ±0.015          | ±0.015          | ±0.015  |
|                             | deg              | J4 (θ)                  | ±0.005  |                 |                 | ±0.005  |
| Ambient temperature         |                  |                         |   |                 |                 | 0 to 40   |
| Mass                        | kg               |                         | 65  | 67              | 69              | 75  |
| Tolerable amount of inertia | kgm <sup>2</sup> | Rating<br>Maximum       | 0.025<br>0.3  |                 |                 | 0.065<br>1.05   |
| Tool wiring                 |                  |                         | Hand: 8 input points/8 output points (20 pins total)<br>Serial signal cable for parallel I/O (2-pin + 2-pin power line)<br>LAN X 1 <100 BASE-TX> (8-pin) *4 |                 |                 | Hand: 8 input points/8 output points (20 pins total)<br>Serial signal cable for parallel I/O (2-pin + 2-pin power line)<br>LAN X 1 <100 BASE-TX> (8-pin) *4 |
| Tool pneumatic pipes        |                  |                         | Primary: φ 6 x 2 Secondary: φ 6 x 8   |                 |                 | Primary: φ 6 x 2 Secondary: φ 6 x 8   |
| Machine cable               |                  |                         | 5m (connector on both ends)   |                 |                 | 5m (connector on both ends)   |
| Connected controller *5     |                  |                         | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)  |                 |                 | CR750, CR751 (CR750: Japan, Europe, U.S.; CR751: Asia)  |

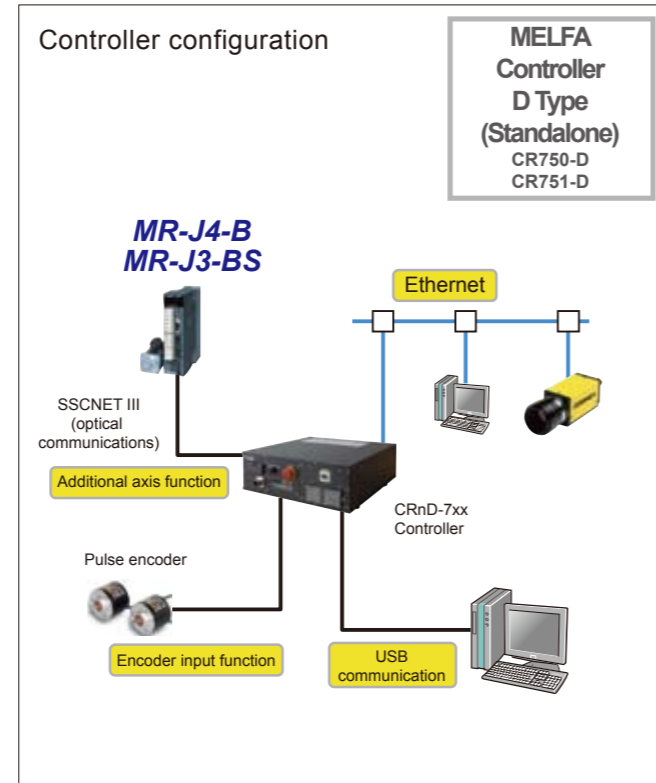
\*1: The environment-resistant specifications (C: Clean specification, M: Mist specification) are factory-set custom specifications.  
\*2: The value assumes composition of J1, J2, and J4.  
\*3: Value for a maximum load capacity of 2 kg. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position. (The cycle time is based on back-and-forth movement over a vertical distance of 25 mm and horizontal distance of 300 mm.)  
\*4: Can also be used as a spare line (0.2 sq. mm, 4-pair cable) for conventional models.  
\*5: Select either controller according to your application. CR751-D: Standalone type, CR751-Q: iQ Platform compatible type. Note that controllers with oil mist specifications come equipped with a controller protection box (CR750-MB) and "SM" is appended at the end of the robot model name. If you require it, consult with the Mitsubishi Electric dealer.  
\*6: Please contact Mitsubishi Electric dealer since the environmental resistance may not be secured depending on the characteristics of oil you use. Direct jet to the bellows is excluded.  
\*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. A φ 8-mm coupler for suctioning is provided at the back of the base.

# Controller

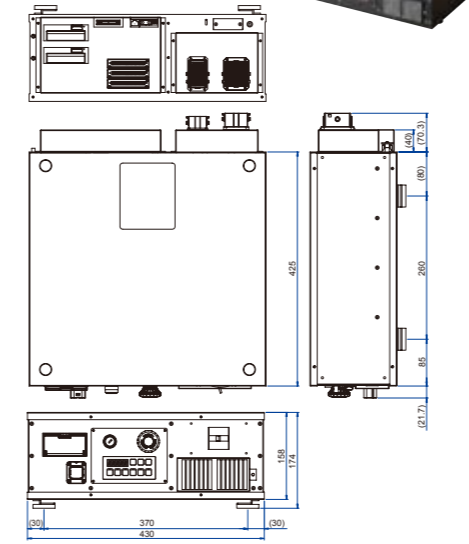
## FQ series



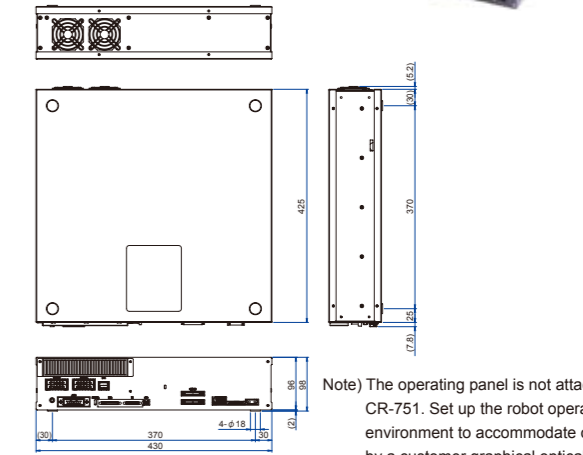
## FD series



Drive unit CR750-Q  
Controller CR750-D



Drive unit CR751-Q  
Controller CR751-D

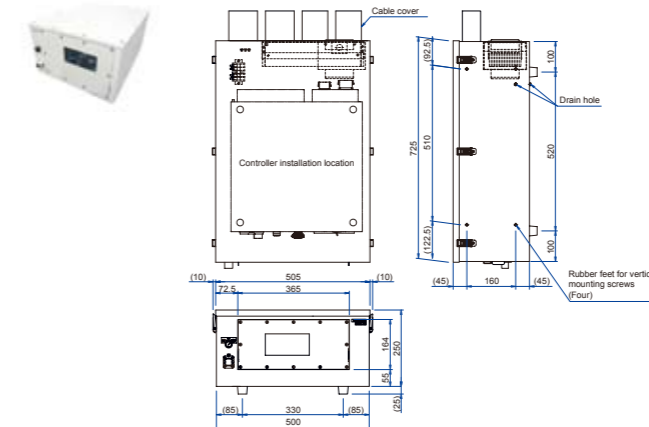


Note) The operating panel is not attached to the CR-751. Set up the robot operating environment to accommodate operation by a customer graphical optical terminal (GOT) or operating panel. Automatic and other operation modes can be enabled from the teaching pendant.

Controller protection box (IP54)

Drive unit CR750-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.



# Specifications

| Type                                 | Unit                               | CR750-Q<br>CR750-D   | CR751-Q<br>CR751-D  |
|--------------------------------------|------------------------------------|--|---|
| Robot CPU                            |                                    | FQ Q172DRCPU   |   |
| Path control method                  |                                    | PTP control and CP control   |   |
| Number of axes controlled            |                                    | Maximum 6 axes   |   |
| Robot language                       |                                    | MELFA-BASIC IV/V   |   |
| Position teaching method             |                                    | Teaching method, MDI method  |   |
| Memory capacity                      | Number of teaching points          | points   | FQ 13,000 / FD 39,000   |
|                                      | Number of steps                    | step   | FQ 26,000 / FD 78,000   |
|                                      | Number of programs                 | Unit   | FQ 256 / FD 512   |
| External input/output *5             | General-purpose I/O                | points   | FQ 8192 input points/8192 output points with the multiple CPU common device / FD 0 input/0 output (Up to 256/256 when options are used)     |
|                                      | Dedicated I/O                      |  | FQ Assigned to multiple CPU common device. / FD Assigned to general-purpose I/O.  |
|                                      | Hand open/close                    |  | 8 input / 8 output  |
|                                      | Emergency stop input               |  | 1 (redundant)   |
|                                      | Door switch input                  |  | 1 (redundant)   |
|                                      | Enabling device input              |  | 1 (redundant)   |
|                                      | Emergency stop output              |  | 1 (redundant)   |
|                                      | Mode output                        |  | 1 (redundant)   |
|                                      | Robot error output                 |  | 1 (redundant)   |
|                                      | Synchronization of additional axes |  | 1 (redundant)   |
| Interface                            | RS-422                             | ports  | 1 (Teaching pendant: dedicated T/B)   |
|                                      | Ethernet                           | ports  | FQ 1 (dedicated teaching pendant port) 10BASE-T / FD 1 (dedicated teaching pendant port), 1 (for customer) 10BASE-T/100BASE-TX              |
|                                      | USB                                | ports  | FQ 1 (USB port of programmable controller CPU unit can be used.) / FD 1 (Ver. 2.0 device functions only, mini B terminal)                   |
|                                      | Additional-axis interface          | channels   | 1 (SSCNET III)  |
|                                      | Extension slot *1                  | slots  | FQ — / FD 2   |
|                                      | Encoder input                      | channels   | FQ Q173DPX (Sold separately) / FD 2   |
| Ambient temperature                  | °C                                 | FQ 0 to 40 (drive unit)/0 to 55 (Robot CPU) / FD 0 to 40   |   |
| Relative humidity                    | %RH                                | 45 to 85   |   |
| Power supply *5                      | Input voltage range *2             | V  | RV-2F/4F, RH-3FH/6FH: Single-phase AC 180 V to 253 V<br>RV-7, RH-12FH/20FH: Three-phase AC 180 V to 253 V or Single-phase AC 207 V to 253 V |
|                                      | Power capacity *3                  | KVA  | RV-2F, RH-3FH : 0.5<br>RV-4F, RH-6FH : 1.0<br>RH-12FH/20FH : 1.5<br>RV-7F : 2.0   |
| External dimensions (including legs) | mm                                 | 430 (W) x 425 (D) x 174 (H)  | 430 (W) x 425 (D) x 98 (H)  |
| Weight                               | kg                                 | Approx. 16   | Approx. 12  |
| Structure [protective specification] |                                    | Self-contained floor type/open structure (Vertical and horizontal position can be placed) [IP20] |   |
| Grounding *4                         | Ω                                  | 100 or less (class D grounding)  |   |

\*1: For installing option interface.  
\*2: The rate of power-supply voltage fluctuation is within 10%.  
\*3: The power capacity indicates the rating for normal operation. Take note that the power capacity does not include the current being input when the power is turned on. The power capacity is only a rough guide and whether or not operation can be guaranteed depends on the input power-supply voltage.  
\*4: Grounding works are the customer's responsibility.  
\*5: For CR751, crimp or solder wiring for connection to user wiring connectors for emergency stop input/output, door switch input, etc. and power supply connectors. The optional terminal block replacement tool available separately can also be used to connect wiring.

# Multiple CPU environment



| Unit                        | Type  |
|-----------------------------|---|
| Base                        | High-speed standard base between multiple CPU<br>• Q35DB: 5 slots<br>• Q38DB: 8 slots<br>• Q312DB: 12 slots   |
| Power supply                | • Q61P<br>• Q62P<br>• Q63P<br>• Q64PN   |
| Programmable controller CPU | Universal model<br>• Q03UD (E) CPU<br>• Q04UD (E) HCPU<br>• Q06UD (E) HCPU<br>• Q10UD (E) HCPU<br>• Q13UD (E) HCPU<br>• Q20UD (E) HCPU<br>• Q26UD (E) HCPU<br>• Q100UD (E) HCPU |

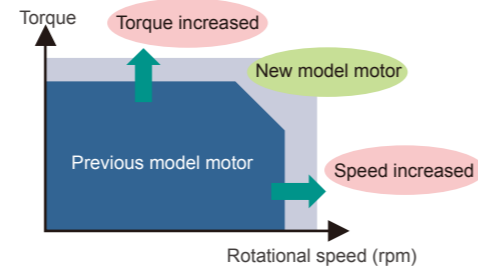
# Functions

## Shortened takt times

### 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-6FH: Twice as fast as the conventional speed]



### High-speed execution of programs

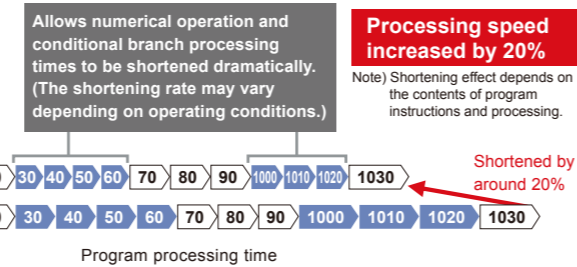
Enables execution up to 1.2 times faster than with the SQ/SD series. Numerical operation and conditional branch processing speeds increased by up to twice as fast, leading to shortened takt times.

#### Sample program

```

10 JOVRD 100
20 MOV P100
30 M1=M_IN (10)
40 IF M1=1 THEN GOTO 1000
50 IF M1=2 THEN GOTO 2000
60 IF M1=3 THEN GOTO 3000
70 MOV P999
80 ERROR 9000
90 END

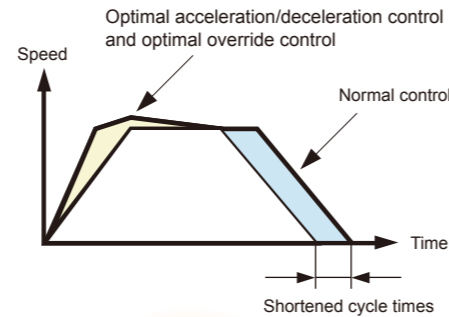
1000 PL=P1*POFF*PSHIFT
1010 PUP=PL
1020 PUP.Z=PUP.Z+MZ
1030 MOV PUP
    
```



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

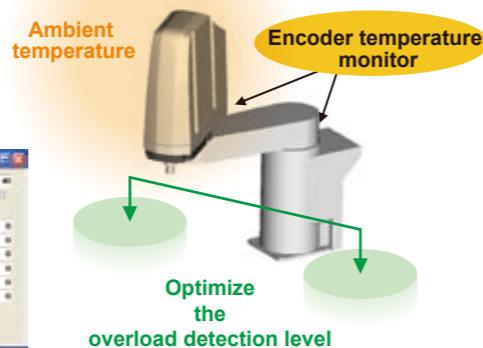
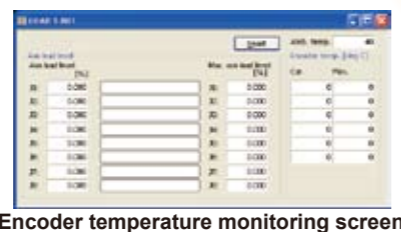
- Optimal acceleration/deceleration times and speeds set automatically based on robot operating position, posture, and load conditions.
- Load conditions are set, enabling acceleration/deceleration times and speeds to be changed automatically according to whether a workpiece is present or not.
- This 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.



## Improved tooling performance

### Compatibility 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

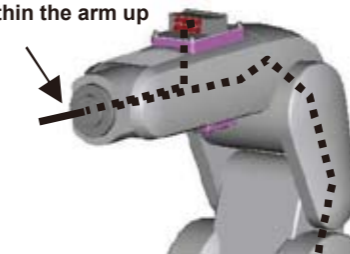
Attachment of the vision sensor to the wrist facilitates wiring.



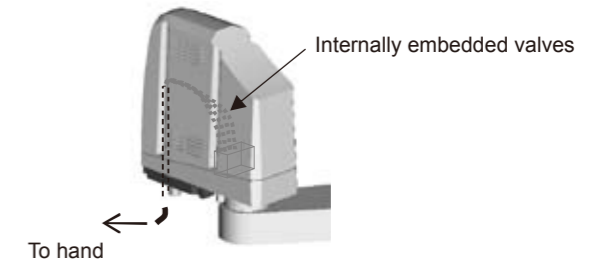
### Internal routing of hand wiring and wiring channels

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 wiring and wiring channels enabled within the arm up to the J6 axis tip.



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

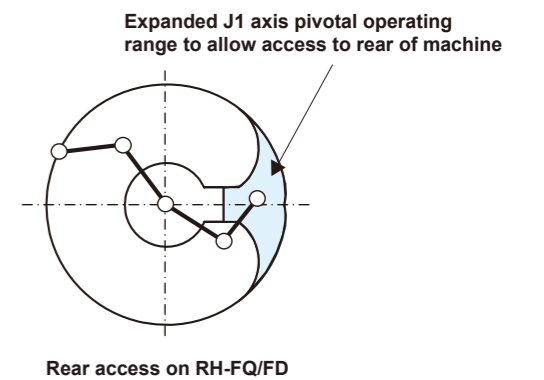
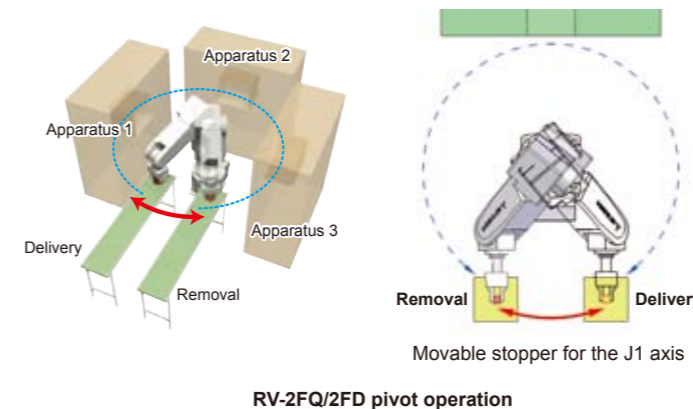


Note: Specify a model with Internal wiring (a model ending in '-SHxx'). The supported Internal wiring types may vary by model.

## Full use of installation space

### 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.



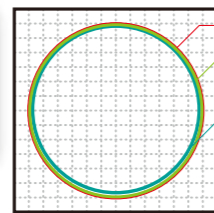


## Improved accuracy

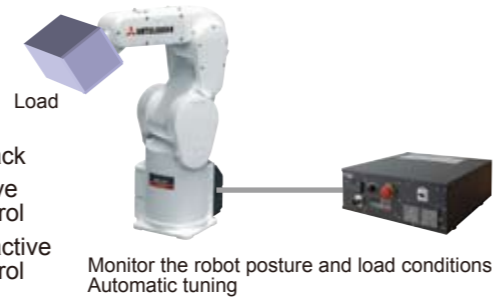
### Active gain control

- 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.



Target track  
With active gain control  
Without active gain control

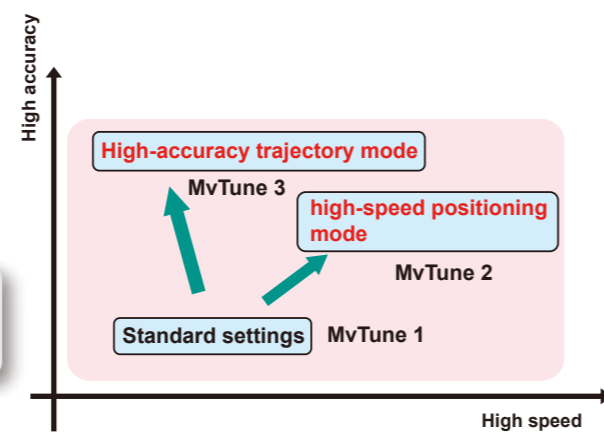


### Operating mode setting function

- 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.

- Improved trajectory accuracy
- Improved vibration-damping performance

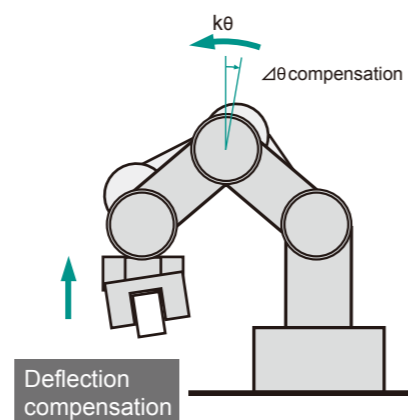


### Deflection compensation function

- 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.

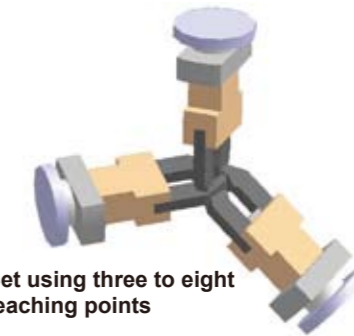
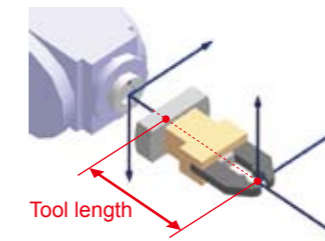
Effective for work transporting workpieces to cassettes with low pitch and palletizing work.

- Improved palletization accuracy
- Improved 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.

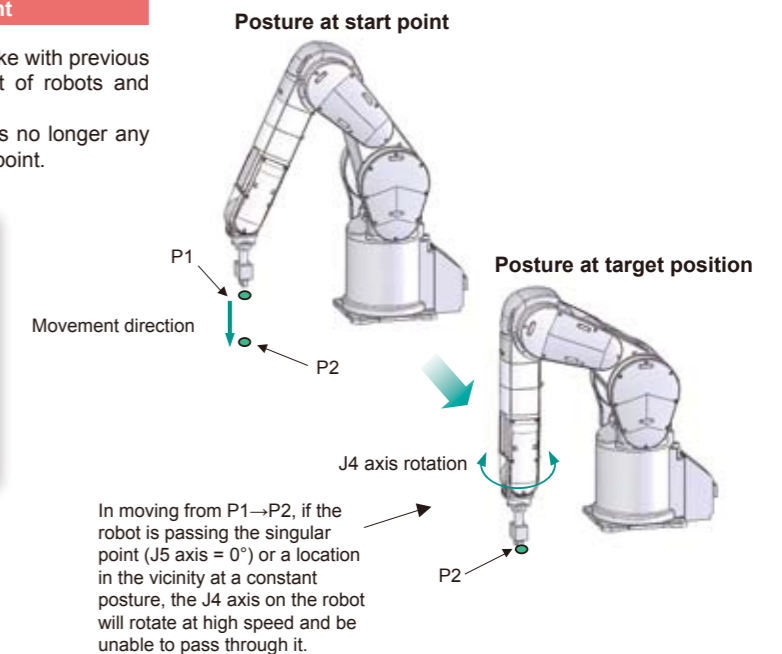


## Adaptation to operation

### 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.

**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.

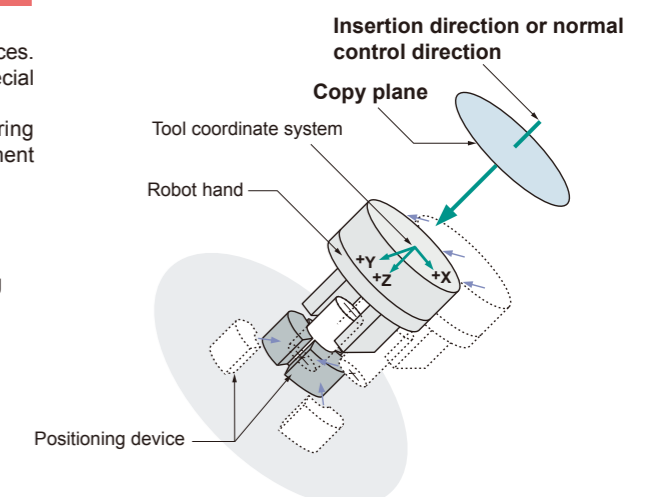


### Orthogonal compliance control

- 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.

- Reduced tooling costs
- Shortened line stop times
- Shortened startup times

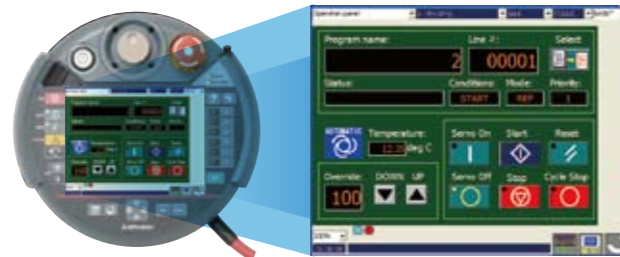


## Improved user friendliness

### 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.

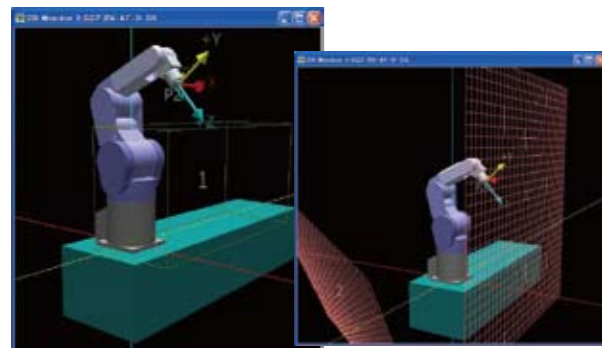


Robot control screen (R56TB)

Enables automatic operation of servo power on/off, startup, shutdown, reset, program selection, and other operations.

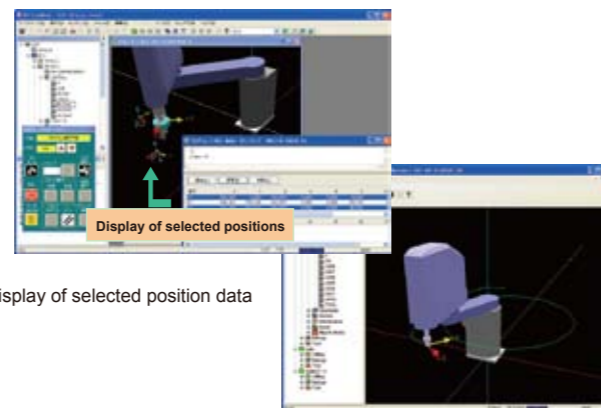
### Enhanced RT ToolBox 2 visual functions

Enhanced RT ToolBox2 (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 user-defined regions/freedom-limited planes

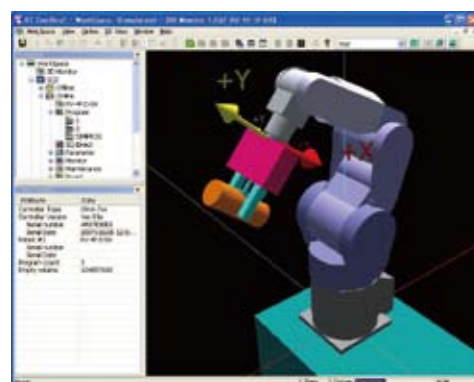
Display of teaching positions and trajectories of end points helps to facilitate confirmation tasks during programming or simulations.



Display of selected position data

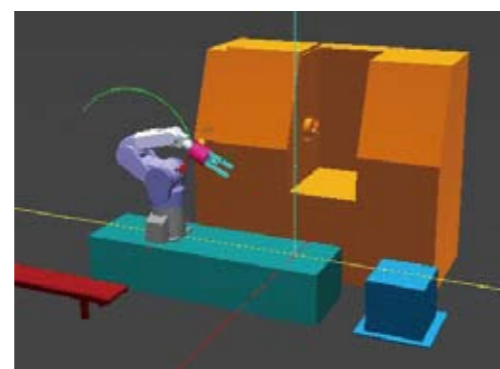
Display of trajectories

Hands can be created as combinations of basic diagrams on the Hand Editing screen and then attached to the robot. Allows the relationships between the hand, workpiece, and peripheral devices to be checked with a single glance during simulation.



Attachment of a hand created in RT ToolBox2

Standard 3D polygonal models can be imported into the program. Environmental models created using 3DCAD can be displayed on the screen, allowing operators to confirm the positional relationship between the robot and peripheral devices during simulation. (Applicable 3D data file formats: STL, OBJ)

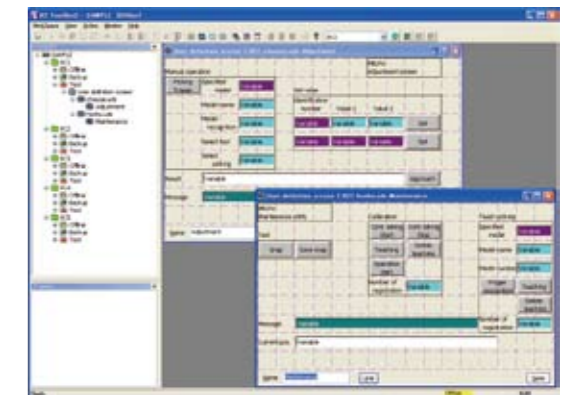


Example of a system environment screen from an imported model

### User-defined screen creation tools

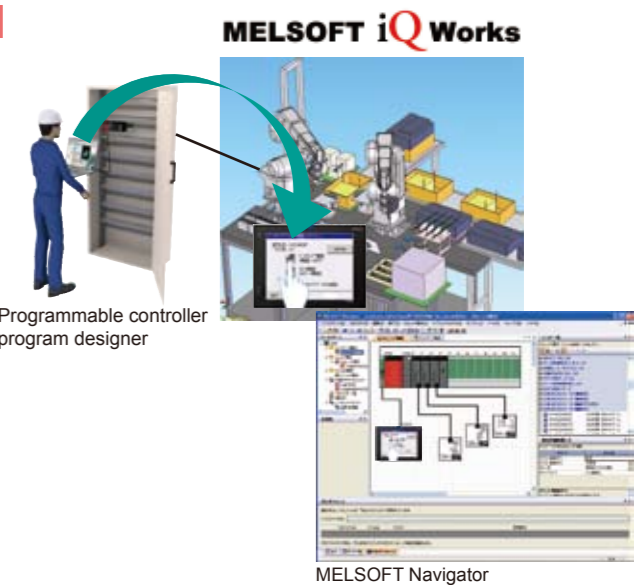
Screens can be created anew, imported, or exported from "User-defined Screen Editing" in the project tree. Buttons, lamps, robot information, labels, and ruled lines can be arranged into layouts and assigned to robot variables.

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.).

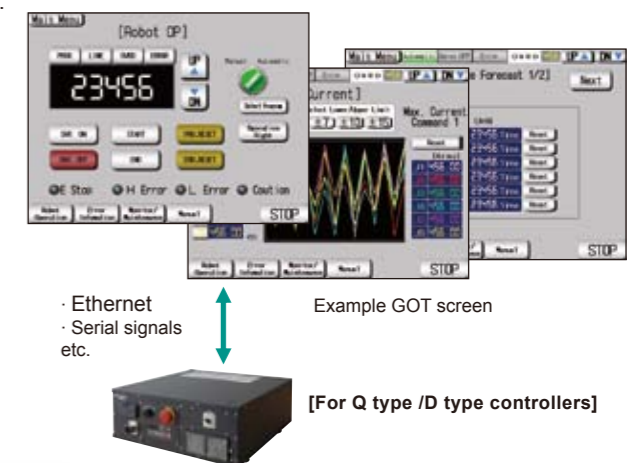


### GOT connection function

- 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.



[For Q type /D type controllers]



· Ethernet  
· Serial signals  
etc.

Example GOT screen

[For Q type /D type controllers]

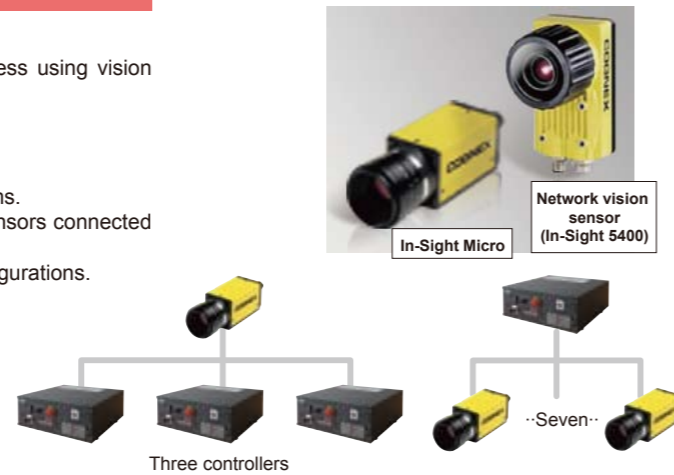
- Simplified control panel created using a GOT
- No need for ladder circuits with the GOT connection

\* 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

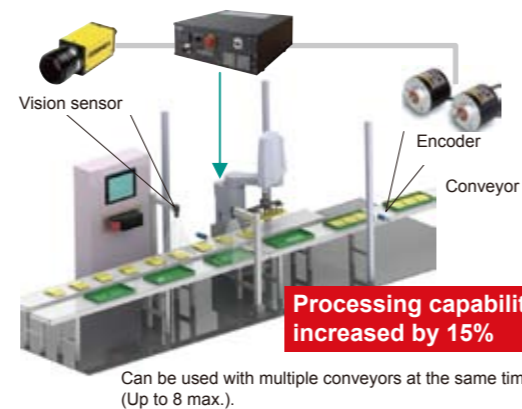
- Simple settings  
The robot and camera can be calibrated through a simple process using vision sensor setting tools.
- Simple connection  
Simple connection between the robot and camera using Ethernet.
- Simple control  
Simple control using vision control commands in the robot programs.
- Three robots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



- Shortened takt times
- Reduced system costs

### Tracking

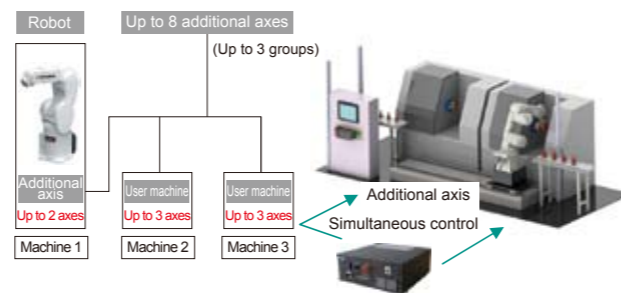
- Transport, alignment, and installation work, etc. can be performed while robots are tracked with the workpiece on the conveyor without stopping the conveyor. Processing capability improved by up to 15% compared to that for SQ/SD series robots.
- Different variations can be selected, including vision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



- No need for a positioning device
- Improved operating takt
- Reduced system costs

### 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.)



**Compatible with MR-J4-B (J3-compatible mode)\***

\*Applicable software: Ver. R3g/S3g or later.

- 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  
Profibus  
DeviceNet  
Network base card (EtherNet/IP)

## 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.

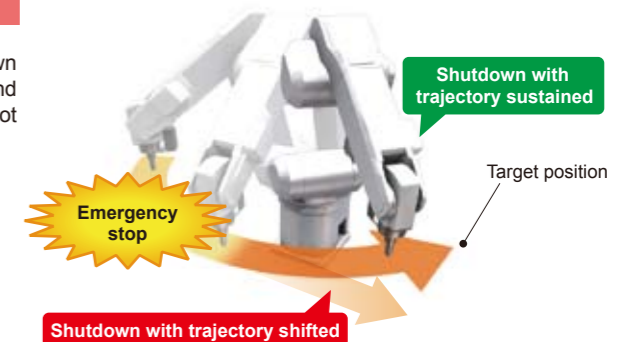
- Passwords can be set to protect created programs.
- The viewing and copying of data from the teaching pendant and RT ToolBox2 can be disabled.
- Writing operations for parameters can be disabled.

|                   | Protected and restricted functions   |
|-------------------|--|
| Program-related   | Reading and writing of programs<br>Program deletion and copying<br>Renaming and initialization of programs |
| Parameter-related | Writing of parameters  |
| RT Tool Box2      | Data backup and restore  |

### 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.

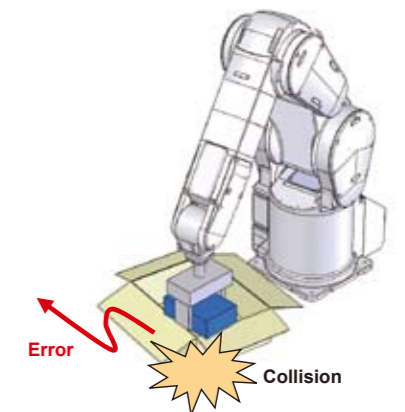
\* Use of this function does not guarantee that the trajectory will be sustained. The trajectory may be shifted out of line depending on the timing at which the emergency stop is activated.



### 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.

- Reduced tooling costs
- Shortened line stop times
- Reduced 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.

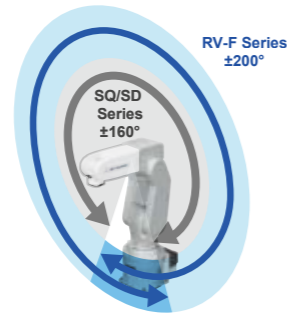
There are robots with special specifications that comply with various safety standards. Contact a Mitsubishi Electric dealer or sales agent for further details if interested.

### 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)

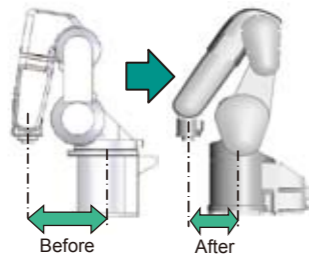
## Expanded J4 axis operating range

- 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.



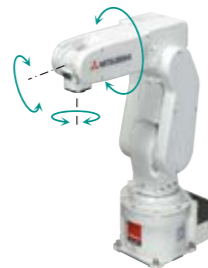
## Compact installation with operation performed near the robot base

- 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.



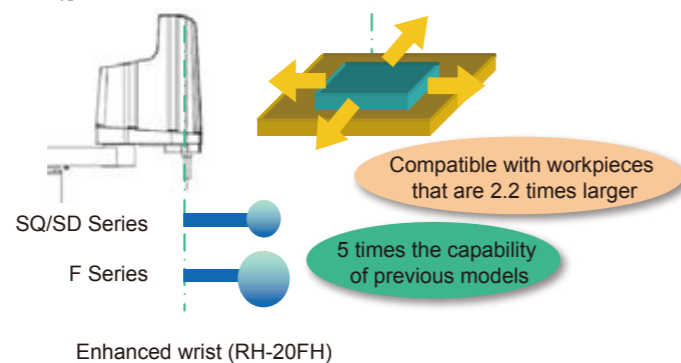
## Changes in operating posture can be made even more quickly!!

- 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 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

iQ Platform

### Improved responsivity 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.

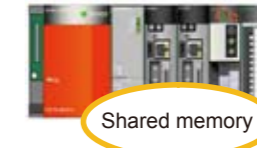
#### High-speed communications



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

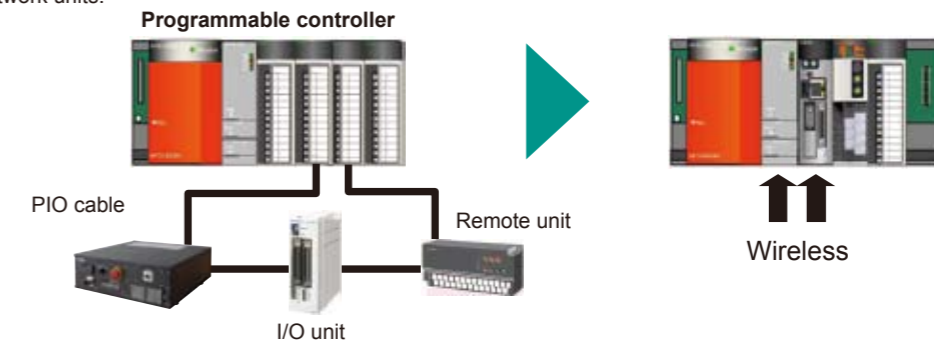
The number of device points between the programmable controller and robot was increased to 8192 input points and 8192 output points. This allows the system to handle larger programs, more complicated control, and other objects that require a lot of I/O points.



Number of I/O points: 8192/8192  
 Remote I/O: 256/256  
 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

### 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.

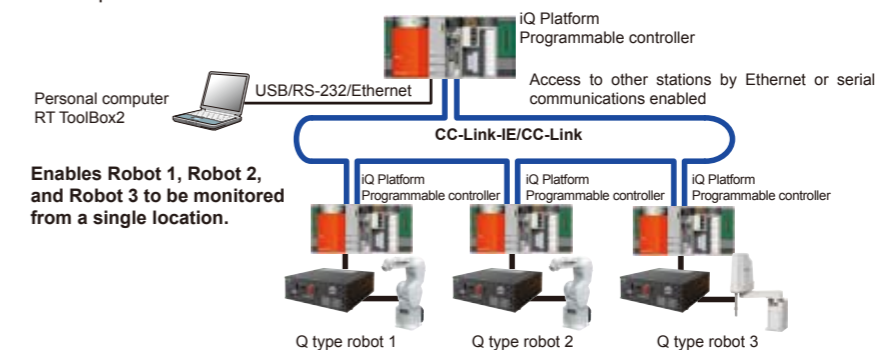


Direct control between CPUs and I/O units

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

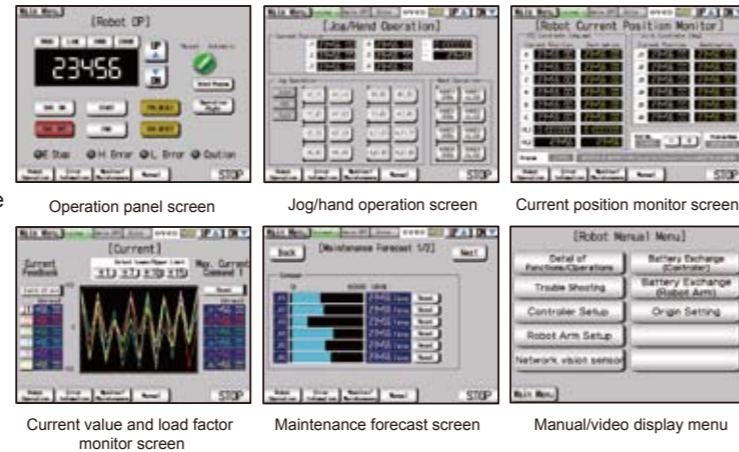
### Shared memory expansion

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.

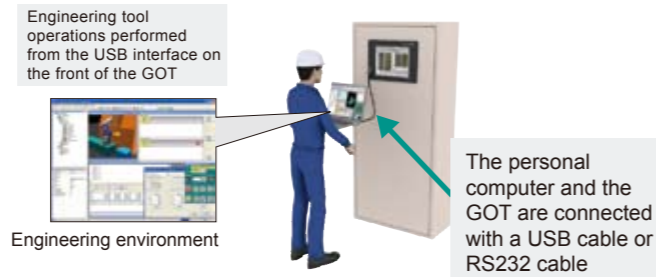
#### Internal robot information

- 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.)



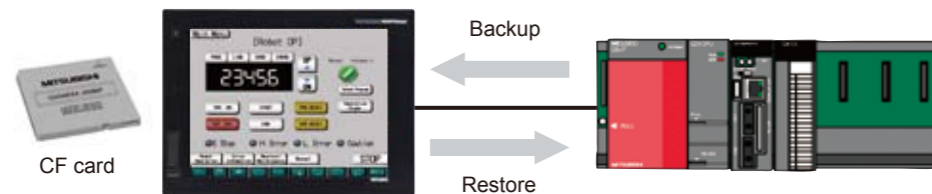
### GOT connection (transparent function) (For GOT1000 Series)

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



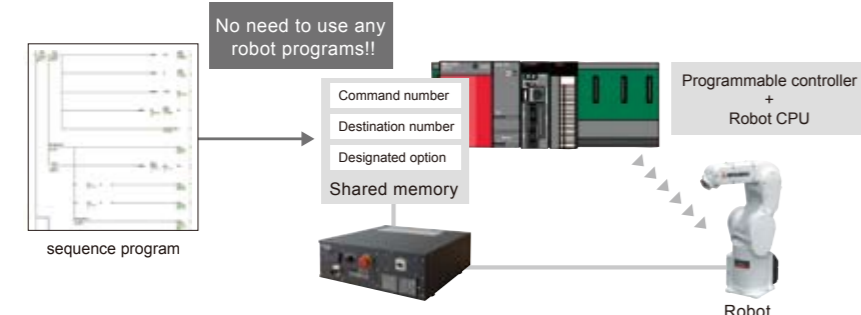
### GOT backup/restore functions (Supported on GT14, GT15 and GT16)

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.



#### [Details of supported control operations]

| Details        |  |
|----------------|--|
| Operation      | <ul style="list-style-type: none"> <li>• Joint-interpolated motion</li> <li>• Linear-interpolated motion</li> </ul>  |
| Motion control | <ul style="list-style-type: none"> <li>• Designated override</li> <li>• Designated acceleration/ deceleration settings</li> <li>• Designated speed</li> <li>• Tool settings</li> <li>• Designated auxiliary motion</li> <li>• Opening/closing of hand</li> </ul> |

## Collision Avoidance

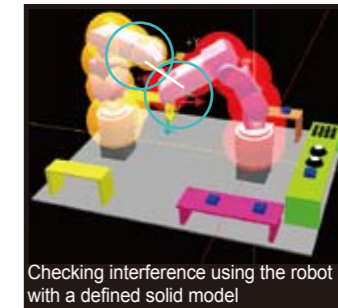


### For automatic prevention of collisions between robots

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)



[Q type controllers only]



Checking interference using the robot with a defined solid model

### 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.

[Q type controllers only]



### Coordinated transport

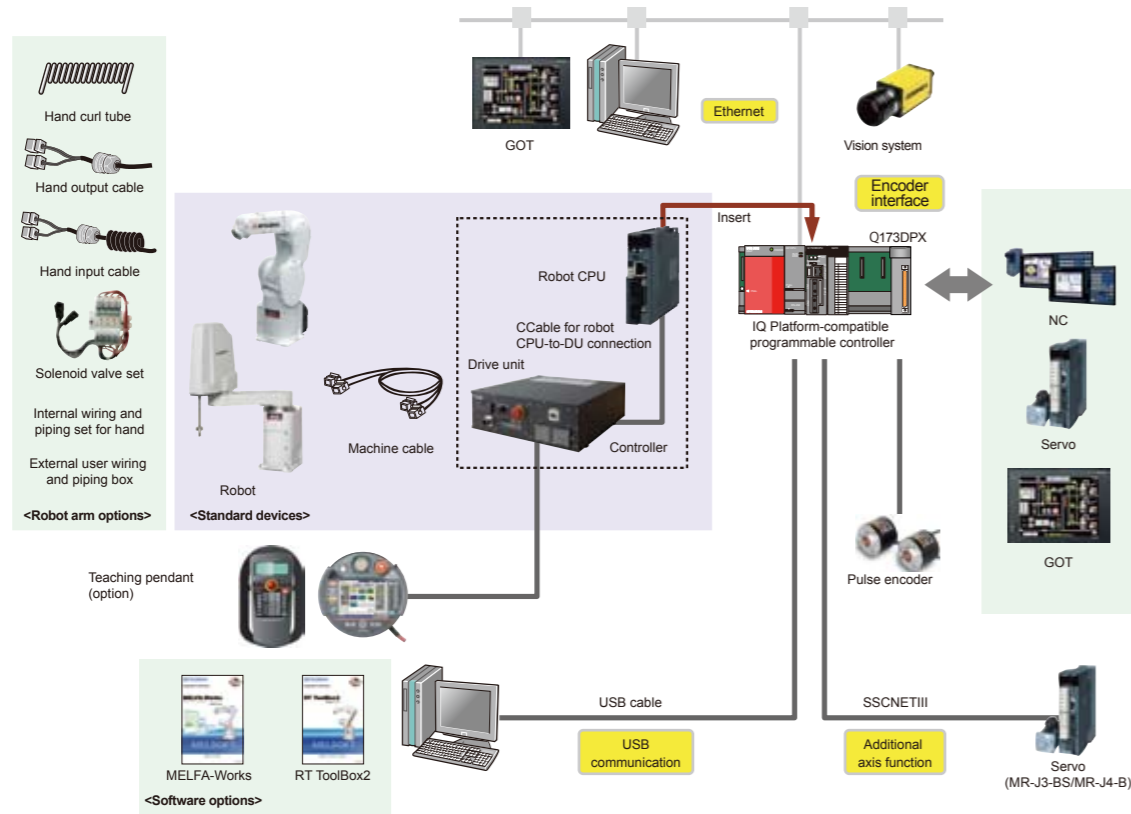
Enables transport of lengthy or heavy objects using multiple small-sized robots instead of larger ones.

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

# System Configuration

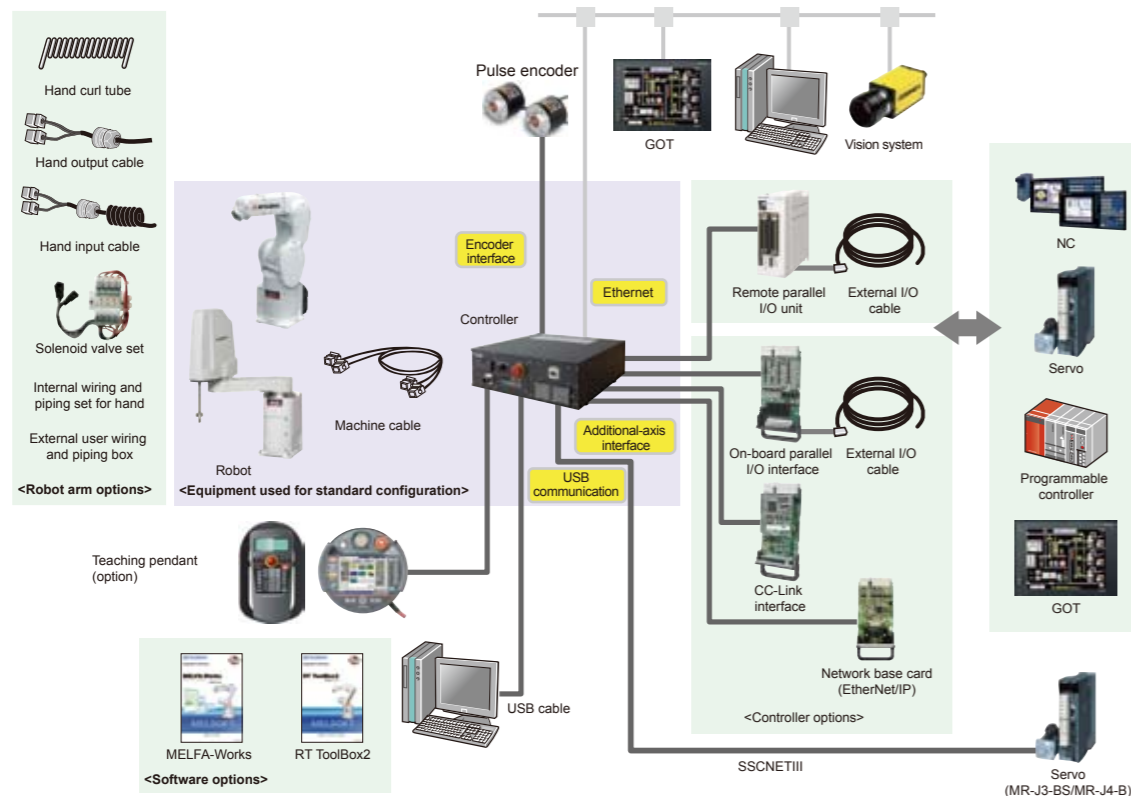
## FQseries

### System Configuration IQ Platform



## FDseries

### System Configuration



# Configurations Options

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

| Classification  | Name                 | Type | RV |    |    | RH  |                     | Functional specifications  |
|---|----------------------|------|----|----|----|-----|---------------------|--|
|   |                      |      | 2F | 4F | 7F | 3FH | 6FH<br>12FH<br>20FH |  |
| Solenoid valve set                                    | 1E-VD0□ (Sink)       | ○    | -  | -  | -  | -   | -                   | 1 to 2 valves, with solenoid valve output cable.<br>□ indicates the number of solenoid valves (1 or 2 valves)  |
|   | 1E-VD0□E (Source)    | -    | ○  | ○  | -  | -   | -                   | 1 to 4 valves, with solenoid valve output cable.<br>□ indicates the number of solenoid valves (1, 2, 3, or 4 valves)   |
|   | 1F-VD0□-02 (Sink)    | -    | -  | -  | ○  | ○   | -                   | 1 to 4 valves, with solenoid valve output cable.<br>□ indicates the number of solenoid valves (1, 2, 3, or 4 valves)   |
|   | 1F-VD0□E-01 (Source) | -    | -  | -  | -  | -   | ○                   | 1 to 4 valves, with solenoid valve output cable.<br>□ indicates the number of solenoid valves (1, 2, 3, or 4 valves)   |
|   | 1S-VD0□-01 (Sink)    | -    | -  | -  | -  | -   | -                   | 1 to 4 valves, with solenoid valve output cable.<br>□ indicates the number of solenoid valves (1, 2, 3, or 4 valves)   |
| Hand output cable                                     | 1E-GR35S             | ○    | -  | -  | -  | -   | -                   | Straight cable for 2-solenoid valve systems, total length of 300 mm, with a robot connector on one side and unterminated on the other side   |
|   | 1F-GR60S-01          | -    | ○  | ○  | -  | -   | -                   | Straight cable for 4-solenoid valve systems, total length of 300 mm, with a robot connector on one side and unterminated on the other side, equipped with a splash-proof grommet   |
| Hand input cable                                      | 1S-HC30C-11          | ○    | -  | -  | -  | -   | -                   | 4-point type, with a robot connector on one side and unterminated on the other side  |
|   | 1F-HC35S-02          | -    | ○  | ○  | -  | -   | -                   | 8-point type, total length of 1000 mm, with a robot connector on one side and unterminated on the other side   |
|   | 1F-HC35C-01          | -    | -  | -  | ○  | ○   | -                   | 8-point type, total length of 1650 mm (includes a 350-mm-long curled section), with a robot connector on one side and unterminated on the other side, equipped with a splash-proof grommet                                   |
| Hand (curl) tube                                      | 1E-ST0408C           | ○    | ○  | ○  | -  | -   | -                   | Compatibility with φ4-4 solenoid valve systems (L = 300 mm)  |
|   | 1E-ST0408C-300       | -    | -  | -  | ○  | ○   | -                   | Compatibility with φ4-4 solenoid valve systems (L = 300 mm)  |
|   | 1N-ST0608C-01        | -    | -  | -  | -  | -   | ○                   | Compatibility with φ6-4 solenoid valve systems   |
| External wiring set 1 for the forearm                 | 1F-HB01S-01          | -    | ○  | ○  | -  | -   | -                   | Used for the forearm. External wiring box used for connecting the hand input cable, the Ethernet cable, and the electrical hand and force sensor cable.  |
|   | 1F-HB02S-01          | -    | ○  | ○  | -  | -   | -                   | Used for the forearm. External wiring box used for connecting the force sensor, the electrical hand, and the Ethernet cable.   |
|   | 1F-HA01S-01          | -    | ○  | ○  | -  | -   | -                   | Used for the base. External wiring box used for connecting the communications output for the electrical hand, the electrical hand and force sensor cable, and the Ethernet cable. There are hand input connection available. |
|   | 1F-HA02S-01          | -    | ○  | ○  | -  | -   | -                   | Used for the base. External wiring box used for connecting the communications output for the electrical hand, the electrical hand, the force sensor cable, and the Ethernet cable. No hand input connection available.       |
| Internal wiring and piping set for hand               | 1F-HS604S-01         | -    | -  | -  | -  | -   | ○                   | Wiring and piping set for internal mounting in the tip axis (Compatible with 8 input points for hand systems + φ6-2 solenoid valve systems) For 350mm Z-axis stroke  |
|   | 1F-HS604S-02         | -    | -  | -  | -  | -   | ○                   | Wiring and piping set for internal mounting in the tip axis (Compatible with 8 input points for hand systems + φ6-2 solenoid valve systems) For 450mm Z-axis stroke  |
|   | 1F-HS408S-01         | -    | -  | -  | -  | -   | ○                   | Wiring and piping set for internal mounting in the tip axis (Compatible with 8 input points for hand systems + φ4-4 solenoid valve systems) For 200mm Z-axis stroke  |
|   | 1F-HS408S-02         | -    | -  | -  | -  | -   | ○                   | Wiring and piping set for internal mounting in the tip axis (Compatible with 8 input points for hand systems + φ4-4 solenoid valve systems) For 340mm Z-axis stroke  |
| External user wiring and piping box                   | 1F-UT-BOX            | -    | -  | -  | ○  | ○   | -                   | Box for external wiring of user wiring (hand I/O, hand tube)   |
|   | 1F-UT-BOX-01         | -    | -  | -  | -  | -   | ○                   | Box for external wiring of user wiring (hand I/O, hand tube)   |
| Machine cable (replacement for shorter 2-m type) (*1) | 1S-02UCBL-01         | -    | ○  | ○  | -  | ○   | ○                   | 2-m-long cables for securement purposes (2-wire set with power supply and signal)  |
|   | 1F-02UCBL-01         | -    | -  | -  | ○  | ○   | -                   | 2-m-long cables for securement purposes (2-wire set with power supply and signal)  |
| Machine cable, for extension/fixed                    | 1S-□□CBL-11          | ○    | -  | -  | -  | -   | -                   | Extension type, extended length 5m, 10m, 15m (2wires set with power and signal wires) □ indicates the length of cables (5, 10, 15m)  |
|   | 1S-□□CBL-01          | -    | ○  | ○  | -  | ○   | ○                   | Extension type, extended length 5m, 10m, 15m (2wires set with power and signal wires) □ indicates the length of cables (5, 10, 15m)  |
|   | 1F-□□CBL-02          | -    | -  | -  | ○  | -   | -                   | Direct type, 10m, 15m, 20m (2wires set with power and signal wires) □ indicates the length of cables (10, 15, 20m)   |
| Machine cable, for extension/flexible                 | 1S-□□LCBL-11         | ○    | -  | -  | -  | -   | -                   | Extension type, extended length 5m, 10m, 15m (2wires set with power and signal wires) □ indicates the length of cables (5, 10, 15m)  |
|   | 1S-□□LCBL-01         | -    | ○  | ○  | -  | ○   | ○                   | Extension type, extended length 5m, 10m, 15m (2wires set with power and signal wires) □ indicates the length of cables (5, 10, 15m)  |
| Stopper for changing the J1-axis operating range      | 1F-DH-11J1           | ○    | -  | -  | -  | -   | -                   | Stopper for making changes, changed as needed for customer installations   |
|   | 1F-DH-04             | -    | -  | ○  | -  | -   | -                   | Stopper for making changes, changed as needed for customer installations   |
|   | 1F-DH-03             | -    | ○  | -  | -  | -   | -                   | Stopper for making changes, changed as needed for customer installations   |
|   | 1F-DH-02             | -    | -  | -  | -  | -   | ○                   | Stopper for making changes, changed as needed for customer installations   |
|   | 1F-DH-01             | -    | -  | -  | -  | ○   | ○                   | Stopper for making changes, changed as needed for customer installations   |

Note 1) This is a special specification for shipping. Inquire for delivery and prices.

| Classification                           | Name   | Type          | CR750  |        | CR751  |   | Functional specifications  |
|--|--|---------------|--------|--------|--------|---|--|
|  |  |               | Q type | D type | Q type | D type  |  |
| Controller                               | Standard teaching pendant (7m, 15m)                                  | R32TB(-)**    | ○      | ○      | -      | -   | 7 m: Standard, 15 m: Custom ("15" is included in the model name) For controller CR-750-*   |
|  | High-function teaching pendant (7 m, 15 m)                           | R56TB(-)**    | ○      | ○      | -      | -   | 7 m: Standard, 15 m: Custom ("15" is included in the model name) For controller CR-750-*   |
|  | Standard teaching pendant (7m, 15m)                                  | R33TB(-)**    | -      | -      | ○      | ○   | 7 m: Standard, 15 m: Custom ("15" is included in the model name) For controller CR-751-*   |
|  | High-function teaching pendant (7 m, 15 m)                           | R57TB(-)**    | -      | -      | ○      | ○   | 7 m: Standard, 15 m: Custom ("15" is included in the model name) For controller CR-751-*   |
|  | On-board Parallel I/O interface (Sink type)                          | 2A-RZ361      | -      | ○      | -      | ○   | 32 output points/ 32 input points  |
|  | On-board Parallel I/O interface (Source type)                        | 2A-RZ371      | -      | ○      | -      | ○   | 32 output points/ 32 input points  |
|  | Remote Parallel I/O cable (5m, 15m)                                  | 2A-CBL**      | -      | ○      | -      | ○   | CBL05: 5 m, CBL15: 15 m, not terminated at one end. For 2A-RZ361/371.  |
|  | On-board Parallel I/O interface (Installed internally) (Sink type)   | 2D-TZ368      | -      | ○      | -      | ○   | 32 output points/ 32 input points  |
|  | On-board Parallel I/O interface (Installed internally) (Source type) | 2D-TZ378      | -      | ○      | -      | ○   | 32 output points/ 32 input points  |
|  | Remote Parallel I/O cable (5m, 15m)                                  | 2D-CBL**      | -      | ○      | -      | ○   | CBL05: 5 m, CBL15: 15 m, not terminated at one end. For 2D-TZ368/378.  |
|  | CC-Link interface  | 2D-TZ576      | -      | ○      | -      | ○   | CC-Link Intelligent device station, Ver. 2.0, 1 to 4 stations  |
|  | Network base card  | 2D-TZ535      | -      | ○      | -      | ○   | Communications interface for attaching to Anybus-CompactCom modules manufactured by HMS Accepts EtherNet/IP modules (*2)                                   |
|  | Force sensor set   | 4F-FS001-W200 | ○      | ○      | ○      | ○   | Set of devices required for the force control function including a force sensor and interface unit   |
|  | Terminal block replacement tool for the user wiring                  | 2F-CNUSR01M   | -      | -      | ○      | ○   | Terminal block replacement tool for the wiring for the external input/output, such as emergency input/output, door switch input, and enabling device input |
| AC power supply connection cable         | 2F-ACIN□P01M   | -             | -      | ○      | ○      | Connection terminal for the AC power supply input connector. In □, 1 indicates the single phase and 3 indicates three phases. |  |
| Controller protection box (*1)           | CR750-MB   | ○             | ○      | -      | -      | With a built-in CR750-D/Q for improved dust-proofing to IP54 (dedicated CR750)  |  |
| Personal computer support software       | 3D-11C-WINJ(E)   | ○             | ○      | ○      | ○      | With simulation function (CD-ROM)   |  |
| Personal computer support software -mini | 3D-12C-WINJ(E)   | ○             | ○      | ○      | ○      | Simple version (CD-ROM)   |  |
| Simulator (MELFA-Works)                  | 3F-21D-WINJ(E)   | ○             | ○      | ○      | ○      | Layout study/Takt time study/Program debug. Add-in software for Solidworks® (*3)  |  |

\*1: For CR-750

\*2: Users need to provide the HMS EtherNet/IP module (AB6314-B) themselves.

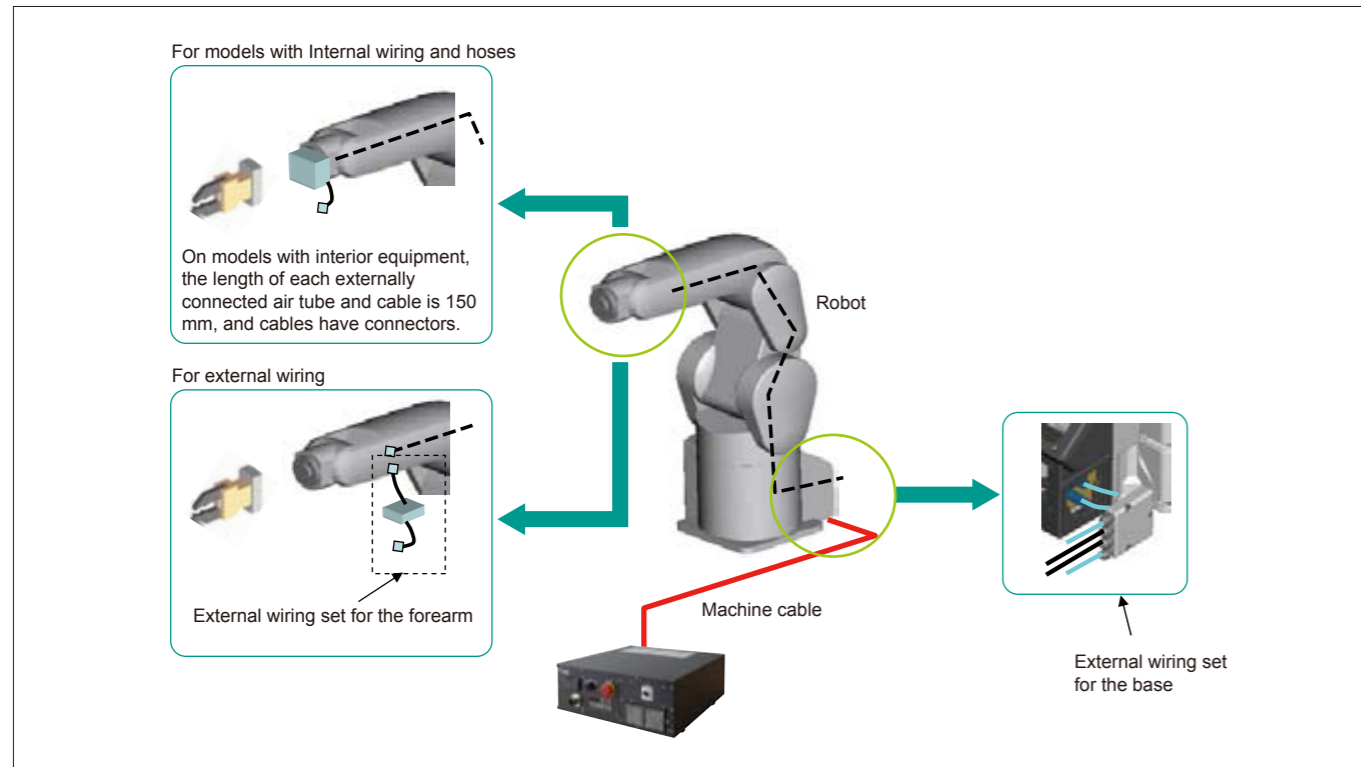
\*3: SolidWorks® is a registered trademark of SolidWorks Corporation (USA).

# Options

## RV-4F/RV-7F Series Tooling device configuration

| Hand configuration   | Wiring format  | Robot specifications | Required device                     |                                       | Comments   |
|--|--|----------------------|-------------------------------------|---------------------------------------|--|
|  |  |                      | External wiring set for the forearm | External wiring set for the base (*3) |  |
| • Air-hand +<br>Hand input signal                                      | Interior equipment   | -SH01                | — (*1)                              | —                                     | Air hoses: Up to 2 systems (4 mm diameter x 4 mm); 8 input signals |
|  | Exterior equipment   | Standard             | — (*2)                              | —                                     | Air hoses: Up to 4 systems (4 mm diameter x 8 mm) are possible.    |
| • Air-hand +<br>Hand input signal<br>• Vision sensor                   | Interior equipment   | -SH05                | — (*1)                              | (1F-HA01S-01)                         | Air hoses: Up to 1 system (4 mm diameter x 2 mm); 8 input signals  |
|  | Exterior equipment   | Standard             | 1F-HB01S-01 (*2)                    | 1F-HA01S-01                           | Air hoses: Up to 4 systems (4 mm diameter x 8 mm) are possible.    |
| • Air-hand +<br>Hand input signal<br>• Force sensor                    | Interior equipment   | -SH04                | — (*1)                              | (1F-HA01S-01)                         | Air hoses: Up to 1 system (4 mm diameter x 2 mm); 8 input signals  |
|  | Exterior equipment   | Standard             | 1F-HB01S-01 (*2)                    | 1F-HA01S-01                           | Air hoses: Up to 4 systems (4 mm diameter x 8 mm) are possible.    |
| • Air-hand +<br>Hand input signal<br>• Vision sensor<br>• Force sensor | Interior equipment<br>(Air hoses are part of exterior equipment) | -SH02                | — (*1)                              | (1F-HA01S-01)                         | Air hoses are exterior equipment: 4 systems (4 mm diameter x 8 mm) |
|  | End the connection   | Standard             | 1F-HB01S-01                         | 1F-HA01S-01                           | Air hoses: Up to 4 systems (4 mm diameter x 8 mm) are possible.    |

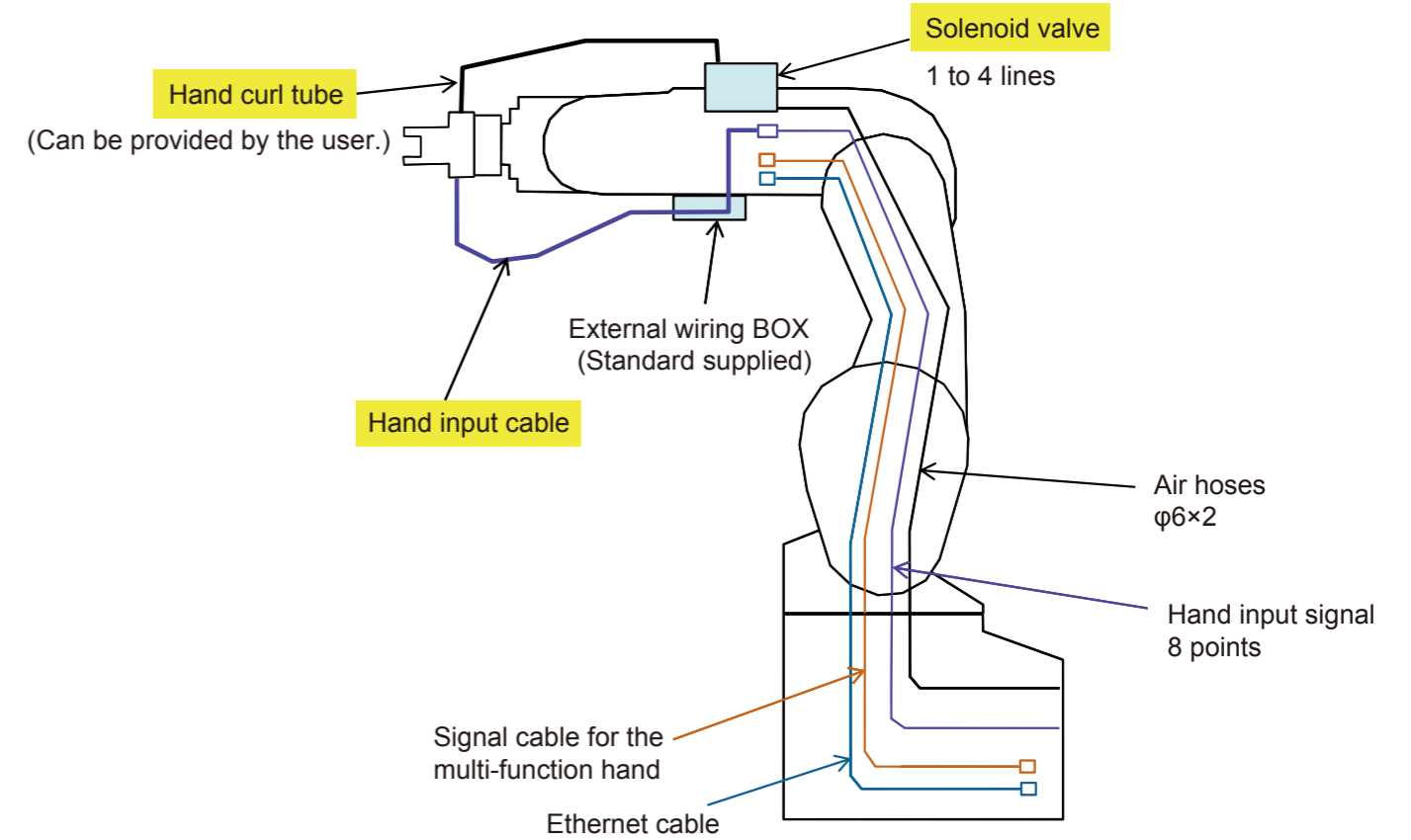
\*1: Users must provide the solenoid valves for Internal wiring model air-hands.  
 \*2: Users must provide solenoid valves and hoses/input cables as needed for External wiring model air-hands.  
 \*3: The external wiring set for the base is provided for models with Internal wiring and hoses.



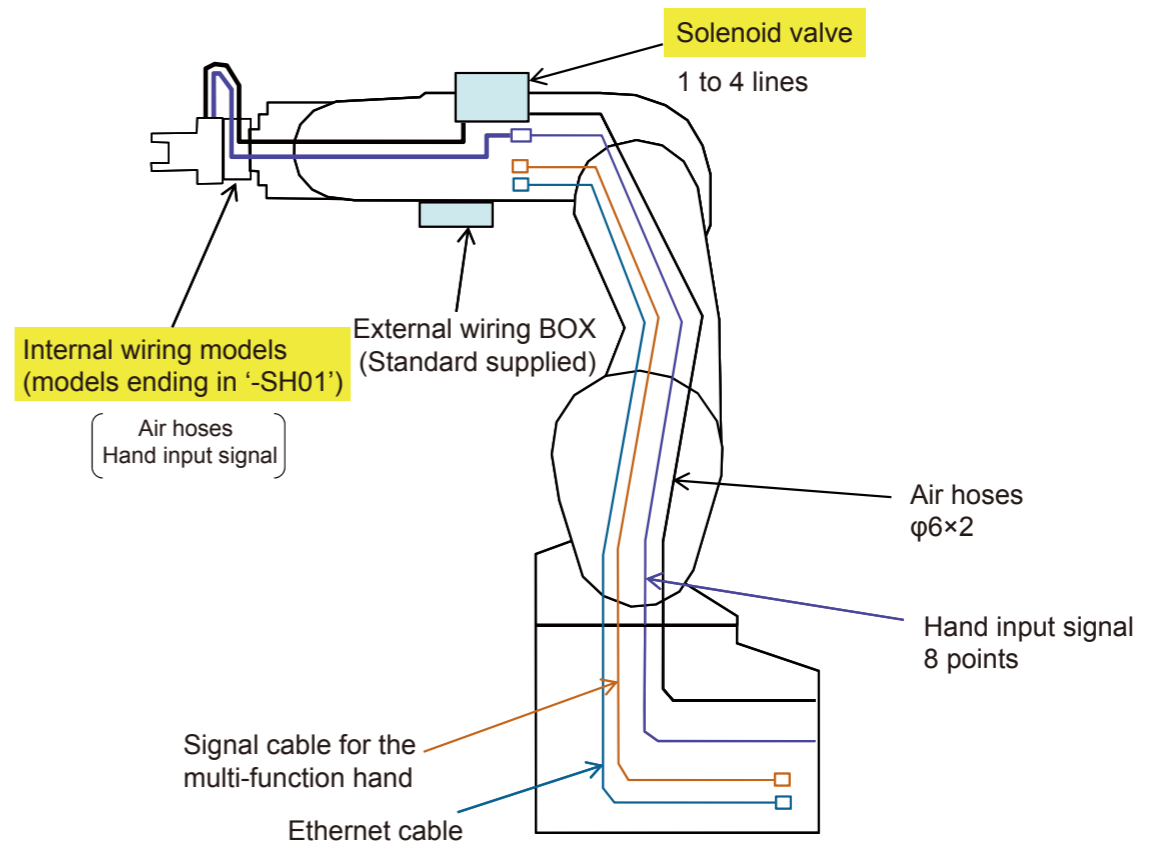
### Models with Internal wiring and hoses

| Devices supporting interior hoses | Model (special device number) |       |        |        |
|-----------------------------------|-------------------------------|-------|--------|--------|
|                                   | -SH01                         | -SH02 | -SH04  | -SH05  |
| Air 4 mm diameter (x4/x2)         | ○ (x4)                        | —     | ○ (x2) | ○ (x2) |
| Hand inputs (x8)                  | ○                             | ○     | ○      | ○      |
| Ethernet (Vision sensor)          | —                             | ○     | —      | ○      |
| Force sensor                      | —                             | ○     | ○      | —      |

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



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



# Options

## 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).

### 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

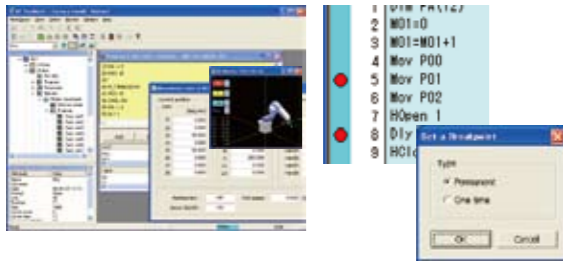
- Programming can be completed using the MELFA-BASIC IV/V and Movemaster languages (vary depending on the model).
- Robot movement and operating status, input signals, and servo status can be monitored.

### 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 languages. \*1 Improvement of work operations by a multi-window format and the various editing functions. This is helpful for use in checking operations such as the execution of program steps, setting of breakpoint settings, and other tasks.



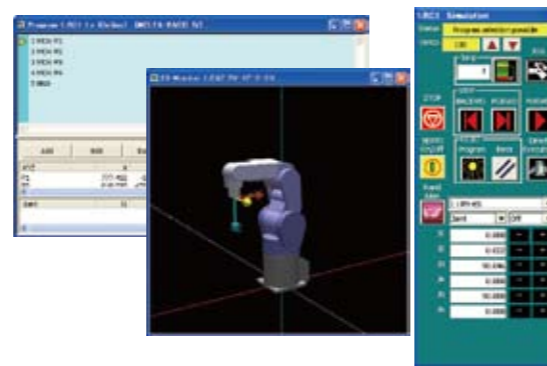
### 3D viewer

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



### Simulation functions

Offline robot motion and tact time check for designated parts of a program.



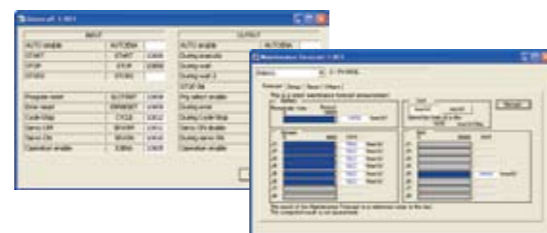
### Monitor functions

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



### Maintenance functions

These functions include maintenance forecast, position recovery support, parameter management, etc.



\*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 easily.

#### <Example of a Pick & Place program>

```

Mov Psafe      Move the evasion point
Mov Pget-50   Move the workpiece
              extraction position up
Mvs Pget      Move the workpiece
              extraction position
Dly 0.2       Wait 0.2-sec. on standby
Hclose 1     Close the hand
Dly 0.2       Wait 0.2-sec. on standby
Mvs Pget-50   Move the workpiece
              extraction position up
              Wait for a signal
              Move the workpiece
              position up
Wait M_In(12)=1
Mov Pput-80   Move the workpiece
              position up
              Move the workpiece
              position
Mvs Pput      Move the workpiece
              position
Dly 0.2       Wait 0.2-sec. on standby
Hopen 1      Close the hand
              .....
    
```

| Classification       | Main functions  |
|----------------------|---|
| Operation-related    | Joint, linear, and circular interpolation, optimal acceleration/deceleration control, compliance control, collision detection, and singular point passage |
| Input/output         | Bit/byte/word signals, interrupt control  |
| Numerical operations | Numerical operations, pose (position), character strings, logic operations  |
| Additional functions | Multi-tasking, tracking, and vision sensor functions  |

# MELFA-Works

A 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 PC's 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).

### Features

#### Automatic robot program creation function

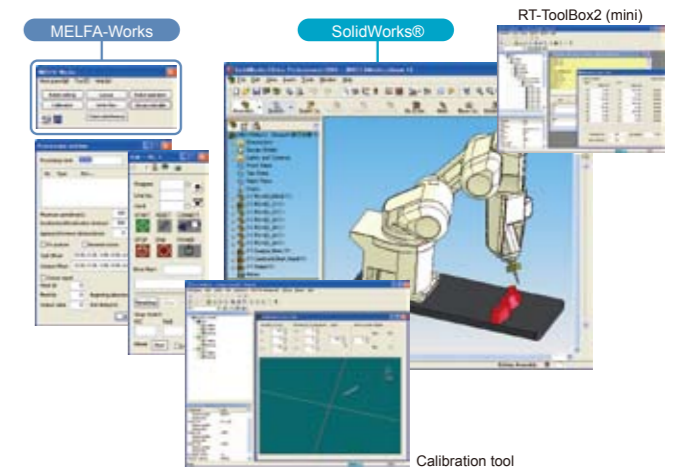
The teaching position data and robot operation programs necessary for operating robots can be generated automatically by simple loading of 3D CAD data (\*3) for the applicable works into SolidWorks® and then setting of processing conditions and areas using MELFA-Works.

\*3) Formats that can be loaded into SolidWorks®

- IGES
- STEP
- ParasolidR
- SAT (ACISR)
- Pro/ENGINEER
- CGR (CATIARgraphics)
- Unigraphics
- PAR (Solid Edge TM)
- IPT (Autodesk Inventor)
- DWG
- DXFTM
- STL
- VRML
- VDA-FS
- Mechanical Desktop
- CADKEYR
- Viewpoint
- RealityWave
- HOOPS
- HCG (Highly compressed graphics)

Note) Check the SolidWorks website and other published documents for the latest specifications.

### Example Screens for MELFA-Works



### List of functions

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

Part data created in Solidworks® can be loaded. The positions of loaded parts can be rearranged relative to the CAD origin and other parts. Part positions can also be changed via numerical input.

#### Installation of hands

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

#### Handling of work

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

#### CAD link

Operation data needed to perform sealing and other operations requiring many teaching steps are easily created. All you need is to select the target area to be processed from 3D CAD data. Since operation data is created from 3D CAD source data, complex three-dimensional curves can be recreated with ease. This leads to significant reduction in teaching time.

#### Offline teaching

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

#### Creation of robot programs (template)

Workflow processes can be created using a combination of the offline teaching and CAD link functions and then converted into robot programs. (MELFA-BASIC IV, V format)

#### Assignment of robot programs

Robot programs can be used as is without any modifications. A different robot program can also be specified for each task slot.

#### Simulation of robot operations

Robot programs, including I/O signals, can be simulated. This means that movements of the actual system can be recreated directly and accurately. The following two methods are provided to simulate I/O signals of your robot controller.  
(1) Create simple definitions of operations associated with I/O signals.  
(2) Link I/O signals with GX Simulator.

#### Display of the robot movement path

Robot movement path can be displayed in the application / the workspace as.

#### Interference checks

Interference between the robot and peripheral devices can be checked. A target of interference check can be specified by a simple mouse click it on the screen. Information explaining 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 saved to a logfile.

#### Saving of video data

Simulated movements can be saved to video files (AVI format).

#### Measurement of cycle times

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.

#### Robot program debugging functions

The following functions are provided to support the debug of robot programs.  
• Step operation : A specified program can be executed step by step.  
• Breakpoint : Breakpoints can be set in a specified program.  
• Direct execution : Desired robot commands can be executed.

#### Jog function

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

#### Traveling axis

A traveling axis can be installed to a robot to verify the operation of the system equipped with this.

#### Calibration

Point sequence data of CAD coordinates created by the CAD link function can be corrected to robot coordinate data. Operation programs and point sequence data can also be transferred to robots. To provide greater convenience for operators who perform calibration frequently on site, the calibration tool is provided as an application independent of MELFA-Works. Accordingly, the calibration tool can be operated effectively on a notebook computer in which SolidWorks® software is not installed



# Options

## Force sensor set

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 production stability

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 latches 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.

### Allows assembly of more complicated configurations

Force detection during contact allows operating directions and applied force to be changed and interrupts to be executed under trigger conditions combining position and force information.

### Simple control

Simple programs can be created using specialized robot language.

### Simple operation

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

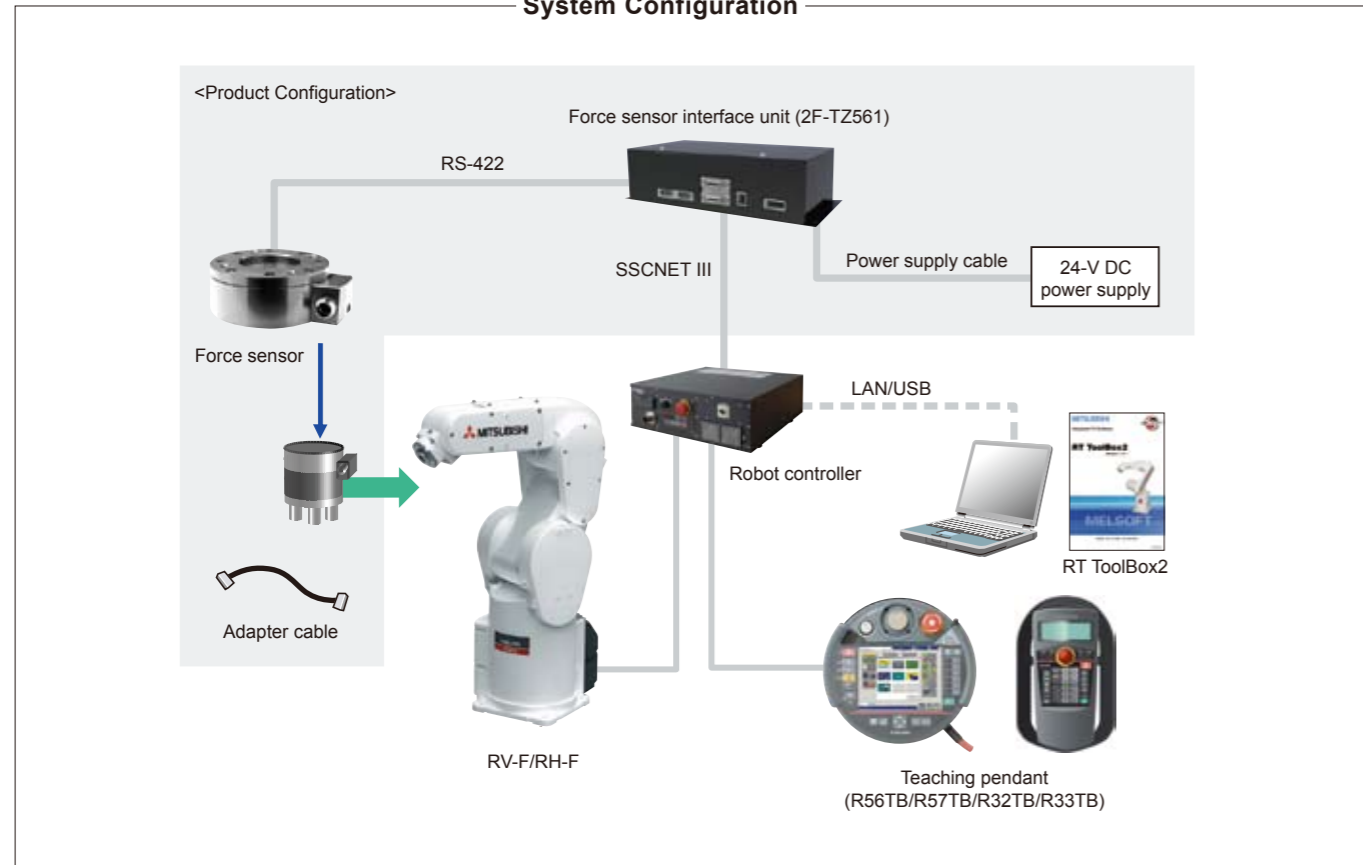
### Product features

| Item                   | Features   |
|------------------------|--|
| Force sensor control   | Force control: Function for controlling robots while applying a specified force  |
|                        | Stiffness control: Function for controlling the stiffness of robot appendages  |
|                        | Gain changes: Function for changing control characteristics while the robot is running   |
| Force sensor detection | Execution of interrupts: Interrupts can be executed (MO triggers) under trigger conditions combining position and force information.               |
|                        | Data latch: Function for acquiring force sensor and robot positions while contact made   |
|                        | Data reference: Function for display force sensor data and maintaining maximum values  |
| Force sensor log       | Synchronous data: Function for acquiring force sensor information synchronized to position information as log data and displaying it in graph form |
|                        | Start/stop trigger: Allows logging start/stop commands to be specified in robot programs   |
|                        | FTP transmission: Function for transferring acquired log files to the FTP server   |

### Product Configuration

| Name                                     | Qty.   |
|--|--------|
| Force sensor                             | Qty. 1 |
| Force sensor interface unit              | Qty. 1 |
| Sensor adapter                           | Qty. 1 |
| Adapter cable                            | Qty. 1 |
| 24-V DC power supply                     | Qty. 1 |
| 24-V DC power supply cable               | 1m     |
| Serial cable between the unit and sensor | 5m     |
| SSCNET III                               | 10m    |

### System Configuration



## 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.

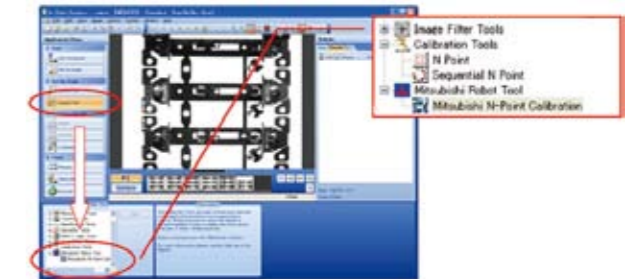
### Simplified job editing

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 workpiece positions recognized by the vision system into robot coordinate system coordinates easily and quickly.



### Robot controller specifications

| Item  | Specifications  |
|---|---|
| Software  | Robot controller:<br>CR750 Series<br>CRnQ-700 Series: R1 ver. or later<br>CRnD-700 Series: S1 ver. or later<br>RT ToolBox2: Ver. 1.0 or later recommended |
| Adapted robot controller                        | CR7xx/ CRnQ-7xx/ CRnD-7xx   |
| Connected robot                                 | All models  |
| Number of robots connected to the vision system | Number of cameras used per robot controller: Up to 7 max.<br>Number of robots that can be connected to a vision system: Up to 3 max.                      |
| Robot program language                          | MELFA-BASIC V comes with dedicated vision sensor commands   |

| Model name -□□□               | Entry  | In-Sight Series |         |                 |           |         |         |           |
|-------------------------------|--|-----------------|---------|-----------------|-----------|---------|---------|-----------|
|                               |  | Standard        |         | High resolution | Color     |         |         |           |
|                               | 100  | 110             | 140     | 143             | 110C      | 140C    | 143C    |           |
| Performance and magnification | Average performance data setting that for the standard version to 1 (*2) | 1x              | 2x      | 5x              | 4x        | 2x      | 5x      | 4x        |
| Camera                        | Resolution   | 640x480         | 640x480 | 640x480         | 1600x1200 | 640x480 | 640x480 | 1600x1200 |
|                               | CCD sensor size  | 1/3 in.         | 1/3 in. | 1/3 in.         | 1/1.8 in. | 1/3 in. | 1/3 in. | 1/1.8 in. |
|                               | Color  | x               | x       | x               | x         | o       | o       | o         |

### 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.

| Instruction word | Details  |
|------------------|--|
| NVOpen           | Connect to the vision system and log on.   |
| NVPst            | Start up the specified vision program and receive the transmitted results.   |
| NVRun            | Start up the specified vision program.   |
| NVIn             | Receive the transmitted results of the vision program specified by the NVRUN command.                                    |
| NVClose          | End the connection to the vision system.   |
| NVLoad           | Ready the specified vision program to enable it for startup.   |
| NVTrg            | Transmit a request to the vision system for the image and acquire the encoder values after the specified length of time. |

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 performed regularly enables even customers who are new to vision systems to easily understand and use them without problems.

