MITSUBISHI INDUSTRIAL ROBOT
SQ/SD Series

Changes for the Better

MITSUBISHI ELECTRIC

MITSUBISHI INDUSTRIAL ROBOT
SQ/SD Series

MELFA
INDUSTRIAL ROBOT CATALOG

| Country/Region	Sales office	Tel/Fax
U.S.A	Mitsubishi Electric Automation Inc. 500 Corporate Woods Parkway Vernon Hills, IL 60061, USA	Tel: +1-847-478-2100 Fax: +1-847-478-0327
Brazil	MELCO-TEC Rep. Com.e Assessoria Tecnica Ltda. Av Paulista, 1439-Cj. 72 Cerqueira Cesar CEP 01311-200, Sao Paulo, SP, CEP:01311-200, Brazil	Tel: +55-11-3146-2200 Fax: +55-11-3146-2217
Germany	Mitsubishi Electric Europe B.V. German Branch Gothaer Strasse 8 D-40880 Ratingen, GERMANY	Tel: +49-2102-486-0 Fax: +49-2102-486-1120
U.K	Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire., AL10 8XB, UK	Tel: +44-1707-276100 Fax: +44-1707-278992
Italy	Misubishi Electric Europe B.V. Italy Branch VIALE COLLEONI 7-20041 Agrate Brianza(Milano),Italy	Tel: +39-039-60531 Fax: +39-039-6053312
Spain	Mitsubishi Electric Europe B.V. Spanish Branch Carretera de Rubi 76-80 E-08190 Sant Cugat del Valles(Barcelona), Spain	Tel: +34-93-565-3131 Fax: +34-93-589-1579
France	Mitsubishi Electric Europe B.V. French Branch 25,Boulevard des Bouvets, F-92741 Nanterre Cedex, France	Tel: +33-1-5568-5568 Fax: +33-1-5568-5757
Czech Republic	Mitsubishi Electric Europe B.V. Czech Branch Avenir Business Park, Radlická 714/113a CZ-158 00 Praha 5	Tel: +420-251-551-470 Fax: +420-251-551-471
Poland	Mitsubishi Electric Europe B.V. Polish Branch ul. Krakowska 50 32-083 Balice, Poland	Tel: +48-12-630-47-00 Fax: +48-12-630-47-01
Russia	Mitsubishi Electric Europe B.V. Moscow Office 52/3, Kosmodamianskaya nab., 115054, Moscow, Russia	Tel: +7-812-633-3497 Fax: +7-812-633-3499
South Africa	Circuit Breaker Industries Ltd. Private Bag 2016,ZA-1600 Isando, South Africa	Tel: +27-11-928-2000 Fax: +27-11-392-2354
China	Mitsubishi Electric Automaiton(Shanghai) Ltd. 17/F Chong Hing Finance Center,No.288 West Nanjing Road, Shanghai 200003 CHINA	Tel: +86-21-2322-3030 Fax: +86-21-2322-3000
Taiwan	Setsuyo Enterprise Co., Ltd. 6F., No.105 Wu-Kung 3rd.Rd, Wu-Ku Hsiang, Taipei Hsine, Taiwan	Tel: +886-2-2299-2499 Fax: +886-2-2299-2509
Korea	Mitsubishi Electric Automation Korea Co., Ltd. 1480-6, Gayang-dong, Gangseo-ku Seoul 157-200, Korea	Tel: +82-2-3660-9552 Fax: +82-2-3664-8372
Singapore	Mitsubishi Electric Asia Pte, Ltd. 307 Alexandra Road #05-01/02, Mitsubishi Electric Bulding Singapore 159943	Tel: +65-6470-2480 Fax: +65-6476-7439
Thailand	Mitsubishi Electric Automation (Thailanad) Co., Ltd. Bang-Chan Industrial Estate No.111 Soi Serithai 54, T.Kannayao, A.Kannayao, Bangkok 10230 Thailand	Tel: +66-2-517-1326 Fax: +66-2-517-1328
Indonesia	P.T. Autoteknindo Sumber Makmur Muara Karang Selatan Block A/Utara No.1 Kav. No.11 Kawasan Industri/Pergudangan Jakarta-Utara P.O Box5045 Jakarta 11050, Indonesia	Tel: +62-21-663-0833 Fax: +62-21-663-0832
India	Messung Systems Pvt.,Ltd. Electronic Sadan NO:III Unit No15, M.I.D.C Bhosari, Pune-411026, India	Tel: +91-20-2712-3130 Fax: +91-20-2712-8108
Australia	Mitsubishi Electric Australia Pty.Ltd. 348 Victoria Road, Rydalmere, N.S.W 2116, Australia	Tel: +61-2-9684-7777 Fax: +61-2-9684-7245

MITSUBISHI ELECTRIC CORPORATION

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

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
Ministry of International Trade and Industry for service transaction permission.

for a greener tomorrow

eco Changes
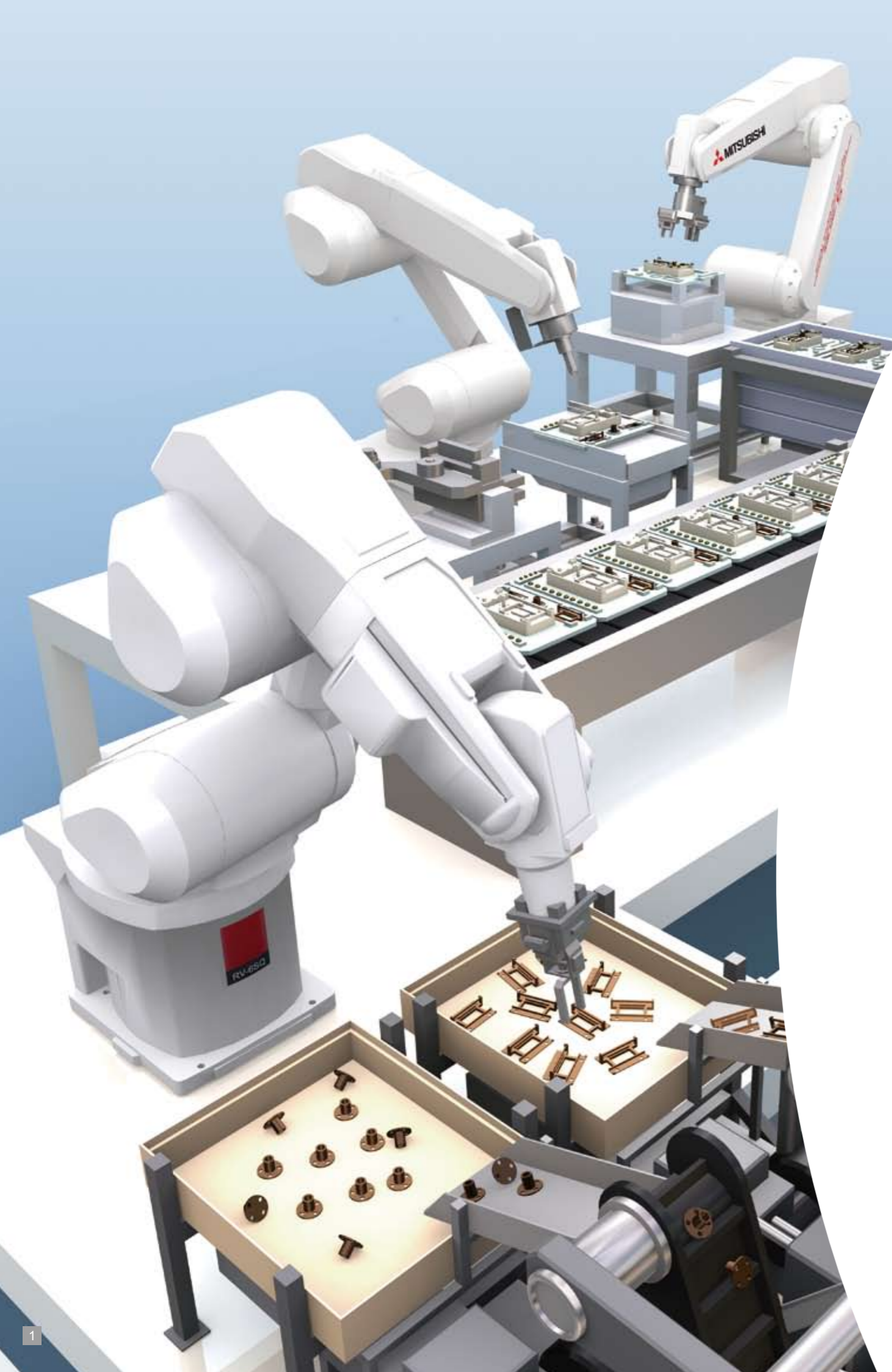
Features

Mitsubishi Electric's line of industrial robots offers high performance and reliability to address demanding applications across many industries. Utilization of our own leading servo and motion technologies provide superior speed and repeatability. Likewise, extended compatibility with other automation products allows for greater flexibility of integration. Standard, clean-room, and mist-proof models are available for many environments.

- Compliant to all major safety standards for global acceptance (ISO, ANSI, CE and UL models are available)
- Multiple network interfaces assure convenience and flexibility in integration
- Comprehensive programming, modeling and diagnostic software is intuitive and easy to use

Vertical type

Compact but powerful vertically articulated RV models are available in five and six axis configurations. Floor mount or ceiling mount capabilities enhances overall design flexibility. Small footprints with high rigidity and payload capabilities are ideal for high speed / high accuracy applications.

- Offers the fastest high-speed operation in its class
- High-accuracy operation with rigid arm design and active gain control
- Suitable for many environmental conditions

Horizontal type

Our horizontally articulated RH (SCARA) robots range from 350mm to 1000mm in reach and can handle up to 20Kg payload. The RH series is an excellent choice for high speed material handing, packaging, and assembly. Leading acceleration, speeds, settling time, and rigidity allow the RH to handle high throughput applications.

- Application flexibility due to wide variations in payload, reach, and stroke
- Capable of high-speed and high-accuracy operation with a simple arm and advanced motion control
- Available in ceiling mount configuration

Product Lineup

Robot Specifications

Controller Specifications

Features (SQ series)

Functions

System Configuration

Configurations Options

Support Software

Lineup

A wide range of available models allows for ease of selection

The Mitsubishi Electric robot product line is equipped with all of the performance features expected for demanding applications such as strength, speed, and a compact footprint.
Mitsubishi's broad offering ensures a confident fit for most every application.

RV - 3 SD J B C - Sxx

-Sxx: Compliant with special models such as CE specification and UL specification etc. (separately)

Environment specification
Blank: Standard specifications
C : Clean specifications

Brake specification
Blank: J4 and J6 axis has no brake
B : All axes have the brake

Axis configuration
Blank: 6-axis type
J : 5-axis type

Series
SQ: SQ series
SD: SD series

Maximum load capacity
2: 3kg 3: 3kg 6: 6kg 12: 12kg

Robot structure
RV: Vertical, multiple-joint type

Vertical, multiple-joint type (RV)

|	▶P5	▶P7	▶P8	▶P9	▶P10	▶P11	▶P12
Type	RV-2SQ RV-2SD	RV-3SQJ RV-3SDJ	RV-3SQ RV-3SD	RV-6SQ RV-6SD	RV-6SQL RV-6SDL	RV-12SQ RV-12SD	RV-12SQL RV-12SDL
Number of axes	6	5	6	6	6	6	6
Maximum load capacity (kg)	3	3.5	3.5	6	6	12	12
Maximum reach radius (mm)	504	641	642	695	901	1086	1385

Controller *1

CR1QA-7xx
CR1DA-7xx ▶P19

For RV-2SQ

For RV-2SD/
RV-3SQ/RV-3SD

CR2QA-7xx
CR2DA-7xx ▶P19

CR3Q-7xx/CR3D-7xx type for mist specification

CR2QA-7xx
CR2DA-7xx ▶P19

CR3Q-7xx/CR3D-7xx type for mist specification

CR3Q-7xx
CR3D-7xx ▶P19

RH - 6 SDH 55 17 M - Sxx

-Sxx: Compliant with special models such as CE specification and UL specification etc. (separately)

Environment specification
Blank: Standard specifications
M : Oilmist specifications
C : Clean specifications

Vertical stroke
17 : 170mm   32 : 320mm
20 : 200mm   35 : 350mm
27 : 270mm   38 : 380mm
30 : 300mm   45 : 450mm

Arm length
35 : 350mm   70 : 700mm
45 : 450mm   85 : 850mm
55 : 550mm   100 : 1000mm

Series
SQH: SQ series
SDH: SD series

Maximum load capacity
6: 6kg 12: 12kg 20: 20kg

Robot structure
RH: Horizontal, multiple-joint type

Horizontal, multiple-joint type (RH)

|	▶P13	▶P15	▶P15	▶P15	▶P16	▶P16	▶P16	▶P17	▶P17
Type	RH-3SQHR RH-3SDHR	RH-6SQH35 RH-6SDH35	RH-6SQH45 RH-6SDH45	RH-6SQH55 RH-6SDH55	RH-12SQH55 RH-12SDH55	RH-12SQH70 RH-12SDH70	RH-12SQH85 RH-12SDH85	RH-20SQH85 RH-20SDH85	RH-20SQH100 RH-20SDH100
Number of axes	4	4	4	4	4	4	4	4	4
Maximum load capacity (kg)	3	6	6	6	12	12	12	20	20
Maximum reach radius (mm)	350	350	450	550	550	700	850	850	1000

Controller *1

CR2QA-7xx
CR2DA-7xx ▶P19

CR1QA-7xx
CR1DA-7xx ▶P19

CR2QA-7xx
CR2DA-7xx ▶P19

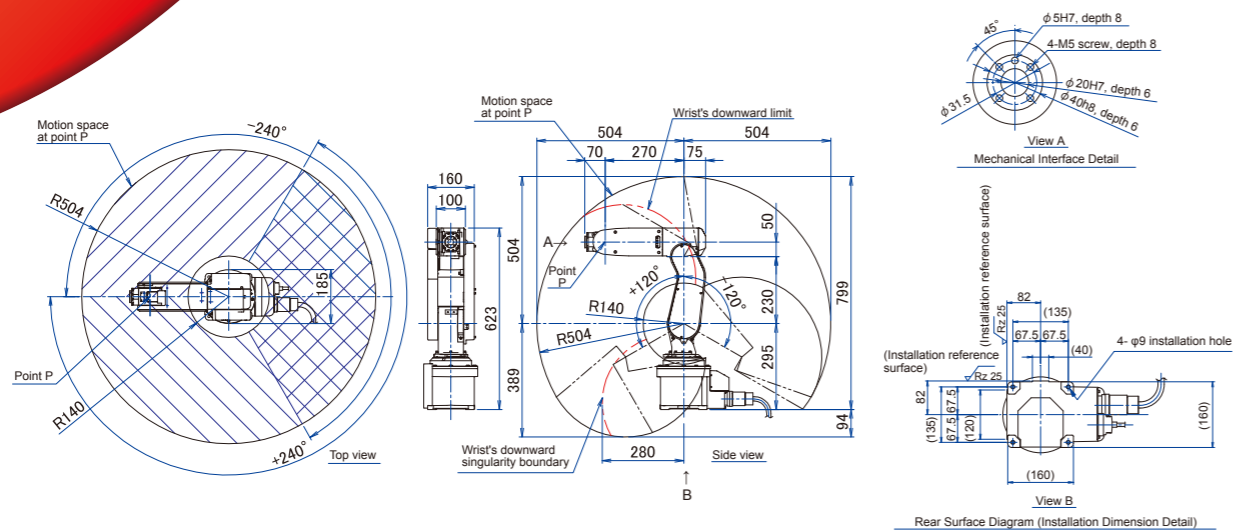CR3Q-7xx/CR3D-7xx type for mist specification
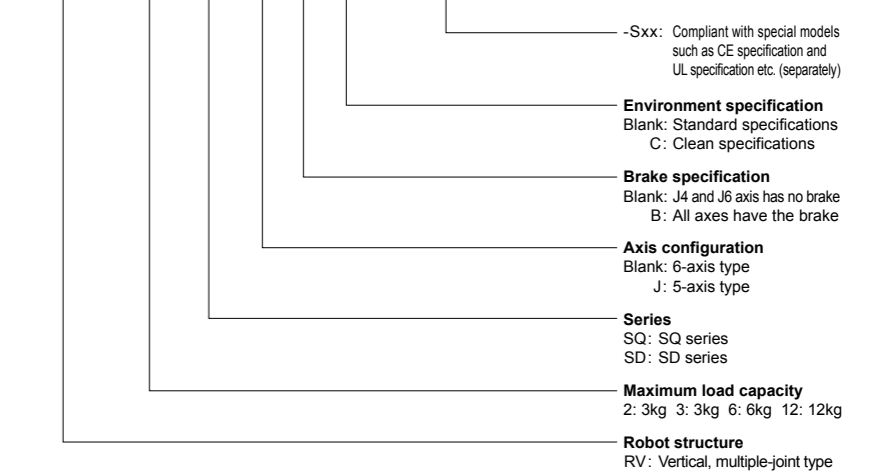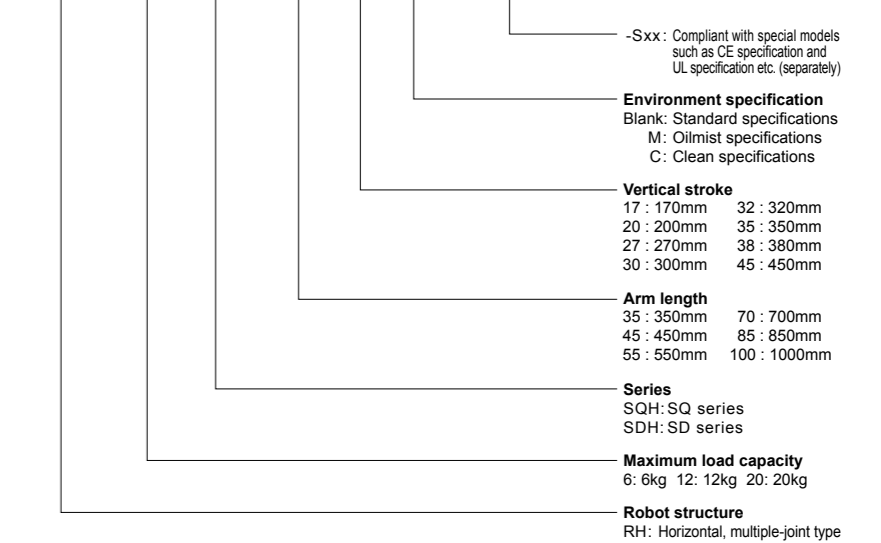
*1: 7xx in controller type names differ according to the robot arm.

Vertical 2kg type

RV-2SQ
RV-2SD

External Dimensions/Operating Range Diagram

Motion space at point P
~240°
R504
R140
185
Point P
R140
±240°
Top view

160
100
504
623
389
Side view

160
270
75
504
504
50
A
Point P
+120°
R140
230
R504
295
120°
799
94
280
B
Wrist's downward limit
Wrist's downward singularity boundary

45°
φ5H7, depth 8
4-M5 screw, depth 8
φ20H7, depth 6
φ40h8, depth 6
φ31.5
View A
Mechanical Interface Detail

82 (135)
67.5 67.5
(40)
Rz 25
4-φ9 installation hole
(160)
(Installation reference surface)
82
(135) φ7.5 67.5 (120)
(160)
View B
Rear Surface Diagram (Installation Dimension Detail)

<Operating range restriction> When J1 axis is within (-75° < J1 < 70°) and J2 axis is within (J2 < -110°), J3 axis is restricted within (80° ◻ J3).

Specifications

Type		Unit	RV-2SQ / RV-2SD
Machine class			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 (rating) *3		kg	3 (2)
Arm length		mm	230 + 270
Maximum reach radius		mm	504
Operating range	J1	deg	480 (-240 to +240)
	J2		240 (-120 to +120)
	J3		160 (-0 to +160)
	J4		400 (-200 to +200)
	J5		240 (-120 to +120)
	J6		720 (-360 to +360)
Maximum speed	J1	deg/sec	225
	J2		150
	J3		275
	J4		412
	J5		450
	J6		720
Maximum composite speed *4		mm/sec	Approx. 4400
Cycle time *5		sec	0.6-0.7
Position repeatability		mm	±0.02
Ambient temperature		°C	0 to 40
Mass		kg	19
Tool wiring *6			Hand: 4 input points / 0 output points
Tool pneumatic pipes			Primary piping: φ4 x 4 (from base portion to forearm)
Machine cable			5m (connector on both ends)
Connected controller			CR1QA-772 / CR1DA-771

*1: The standard model has no brake on the J1-axis, J4-axis, and J6-axis. (A model with brake on all axes is also available.)
*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*3: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*4: This is at the hand flange surface when all axes are composited.
*5: 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.
*6: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.

A COMPACT 6 AXIS ROBOT IDEALLY SUITED FOR ASSEMBLY, MATERIAL HANDLING, INSPECTION, AND A WIDE VARIETY OF OTHER TASKS.

● Reduced profile while maintaining a large operating range
- The length and shape of the arm are designed for optimum performance and maximum reach while providing the ability to reach positions close to the robot base.
- A greater range of motion is insured in applications requiring celling or wall mount.
- J1 operation range is expanded to 480°(±240°). This eliminates any rear side dead zone.

### ● Advanced servo control provides high-speed and high-accuracy operation
- Maximum composite speed is 4,400mm/s. Additionally, the speeds of axes J4-J6 have been optimized to satisfy high-speed assembly applications.
- Positioning repeatability of ±0.02mm combined with active-gain control and highly rigid arm design for high accuracy positioning at high speed.

● Unique arm design allows greater range of motion and accessibility.
- Offset arm design greatly reduces the robots minimum operating radius allowing work close to the robot base.
- Reduced elbow protrusion lessens rear interference points.
- A compact wrist design enables the robot to reach into smaller spaces at many angles.

Ability to layout the work cell with points near the robot base

Range of motion is now closer to the base of the robot. This allows more flexibility and smaller system footprint.


Close proximity is permitted!!
Offset arm design
Work
Layout is made more compact.
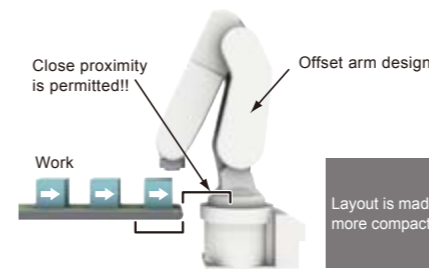
Position/posture at minimum operating radius

The minimum radius becomes smaller by the offset arm design. However the overall operating range is greater.

Increased space efficiency and the compact layout is possible.

Quicker posture changes- ideal for assembly applications

Assembly work typically requires many postures compared to pick and place work.
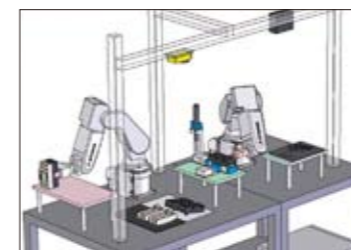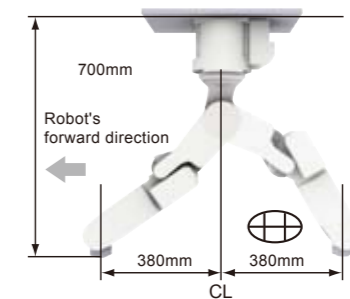

Assembly cell

Increasing the speed of posture change has a significant affect on overall cycle time. By optimizing the performance of axes J4-J6, posture change time is improved.

The speed of J4,J5 and J6 have improved.

Large work area can be reached without rotating the arm

Extended back reaching access is effective for ceiling mount applications.

700mm
Robot's forward direction
380mm 380mm
CL
Unlike its conventional varieties, the robot can even extend back into its rear space.

Expanded J2 operation range for extended back reach.

Wide work area can be reached without turning around the arm. Decreases extra motion and reduces the cycle time.

The J1 operation range designed +/- 240 degree

Cycle time can be shortened if it is possible to take a short cut path.

Apparatus 2
Apparatus 1
Delivery
Removal
Apparatus 3
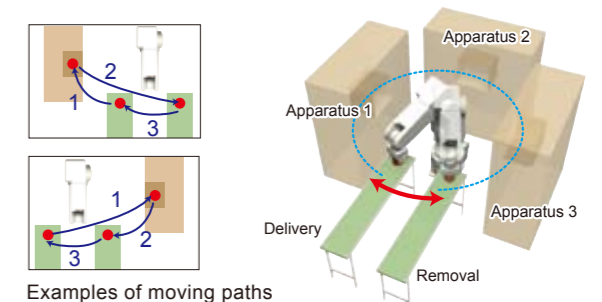
Examples of moving paths

J1 operation range expanded to 480°(±240°).

Minimize path, Minimize cycle time.
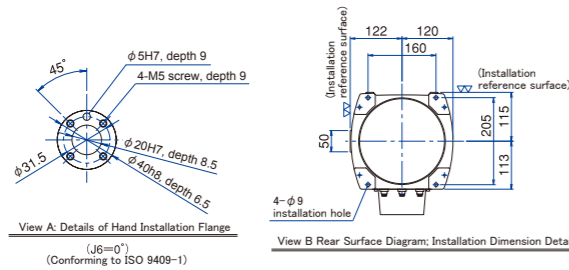Increased flexibility of machine layout.

RV-3SQJ / RV-3SDJ

Vertical 3kg type

External Dimensions/Operating Range Diagram
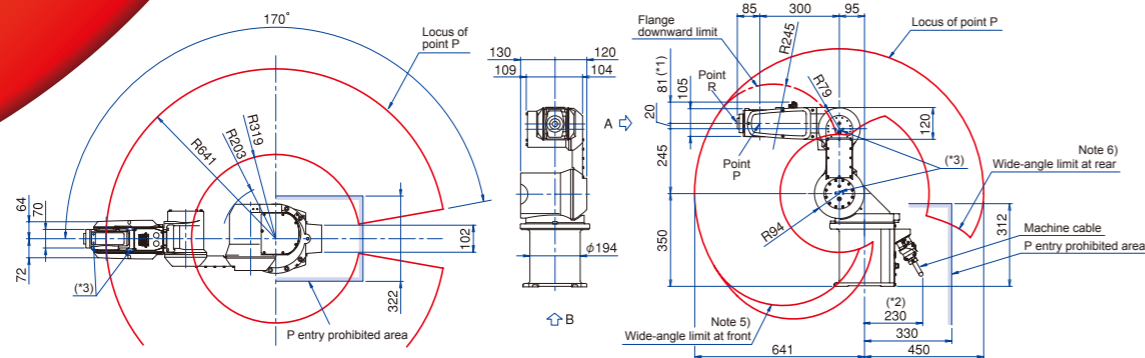
<Wide-angle/narrow-angle limits at front>　Note 5: When the J1-axis angle is inside the range of 170 deg ≧ |J1| > 125 deg, the operating range of the J2-axis is limited to 120 deg > J2 ≧ -90 deg.

<Wide-angle/narrow-angle limits at rear>　Note 6: When the J2-axis angle is inside the range of -30 deg > J2 ≧ -90 deg, the operating range of the J3-axis is limited to the range where "14 x J2 + 9 x J3 > -1530" and "137 deg > J3 > -100 deg" are both satisfied.
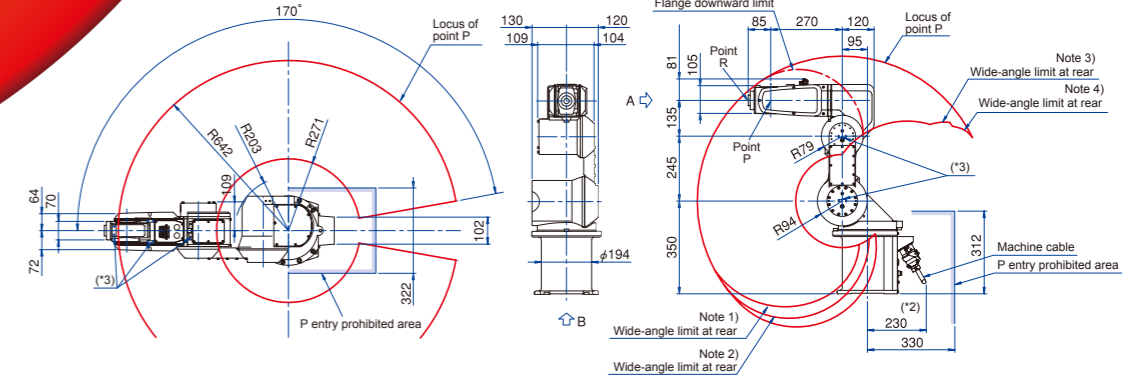
Note
(*1) Indicates the dimension when the solenoid valve (optional) is installed.
(*2) Indicates the space required for the interconnection cable.
(*3) Indicates the screw hole (M4) used for affixing user wiring and piping.
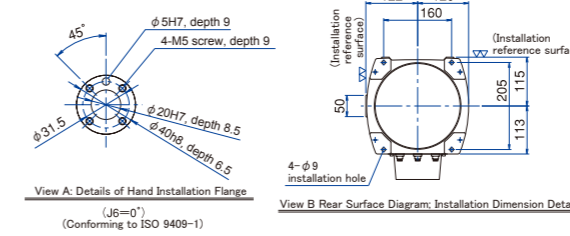
View A: Details of Hand Installation Flange
（J6=0°）(Conforming to ISO 9409-1)

View B Rear Surface Diagram; Installation Dimension Detail

Specifications

Type	Unit	RV-3SQJ / RV-3SDJ	RV-3SQJ-SM / RV-3SDJ-SM	RV-3SQJC / RV-3SDJC
Machine class		Standard (oil mist)		Clean
Protection degree		IP65 *1		Class 10 (0.3 μ m)
Installation		Floor type, ceiling type, (wall-mounted type *3)		Floor type
Structure		Vertical, multiple-joint type		
Degrees of freedom		5		
Drive system		AC servo motor		
Position detection method		Absolute encoder		
Maximum load capacity (rating) *2	kg	3.5 (3)		
Arm length	mm	245 + 300		
Maximum reach radius	mm	641		
Operating range	J1	deg	340 (±170)	
	J2		225 (-90 to + 135)	
	J3		237 (-100 to + 137)	
	J4		—	
	J5		240 (±120)	
	J6		720 (±360)	
Maximum speed	J1	deg/sec	250	
	J2		187	
	J3		250	
	J4		—	
	J5		412	
	J6		660	
Maximum composite speed *4	mm/sec	Approx. 5300		
Cycle time	sec	0.61		
Position repeatability	mm	±0.02		
Ambient temperature	°C	0 to 40		
Mass	kg	Approx. 33		
Tool wiring *5		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#27 (0.1mm²)		
Tool pneumatic pipes		Primary: φ6 x 2　　Secondary: φ4 x 8		
Machine cable		5m (connector on both ends)		
Connected controller *6		CR1QA-731 / CR1DA-731	CR1QA-731 + CR1D-MB / CR1DA-731 + CR1D-MB	CR1QA-731 / CR1DA-731

*1: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*2: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*3: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*4: This is at the hand flange surface when all axes are composited.
*5: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.
*6: Select either controller according to your application. "-SM6" is appended at the end of the robot model name when the CR3Q-711M/CR3D-711M is selected.

RV-3SQ / RV-3SD

Vertical 3kg type

External Dimensions/Operating Range Diagram

<Wide-angle/narrow-angle limits at front>　Note 1: When the J1-axis angle is inside the range of 170 deg ≧ J1 > 125 deg, the operating range of the J2-axis is limited to 125 deg > J2 ≧ -90 deg.

Note 2: When the J1-axis angle is inside the range of -125 deg > J1 ≧ -170 deg, the operating range of the J2-axis is limited to 130 deg > J2 ≧ -90 deg.

<Wide-angle/narrow-angle limits at rear>　Note 3: When the J2-axis angle is inside the range of -30 deg > J2 ≧ -60 deg, the operating range of the J3-axis is limited to the range where "4 x J2 + 3 x J3 > -180" and "171 deg > J3 > -20 deg" are both satisfied.

Note 4: When the J2-axis angle is inside the range of -60 deg > J2 ≧ -90 deg, the operating range of the J3-axis is limited to the range where "2.7 x J2 + J3 > -142" and "171 deg ≧ J3 > -20 deg" are both satisfied.

Note
(*1) Indicates the dimension when the solenoid valve (optional) is installed.
(*2) Indicates the space required for the interconnection cable.
(*3) Indicates the screw hole (M4) used for affixing user wiring and piping.

View A: Details of Hand Installation Flange
（J6=0°）(Conforming to ISO 9409-1)

View B Rear Surface Diagram; Installation Dimension Detail

Specifications

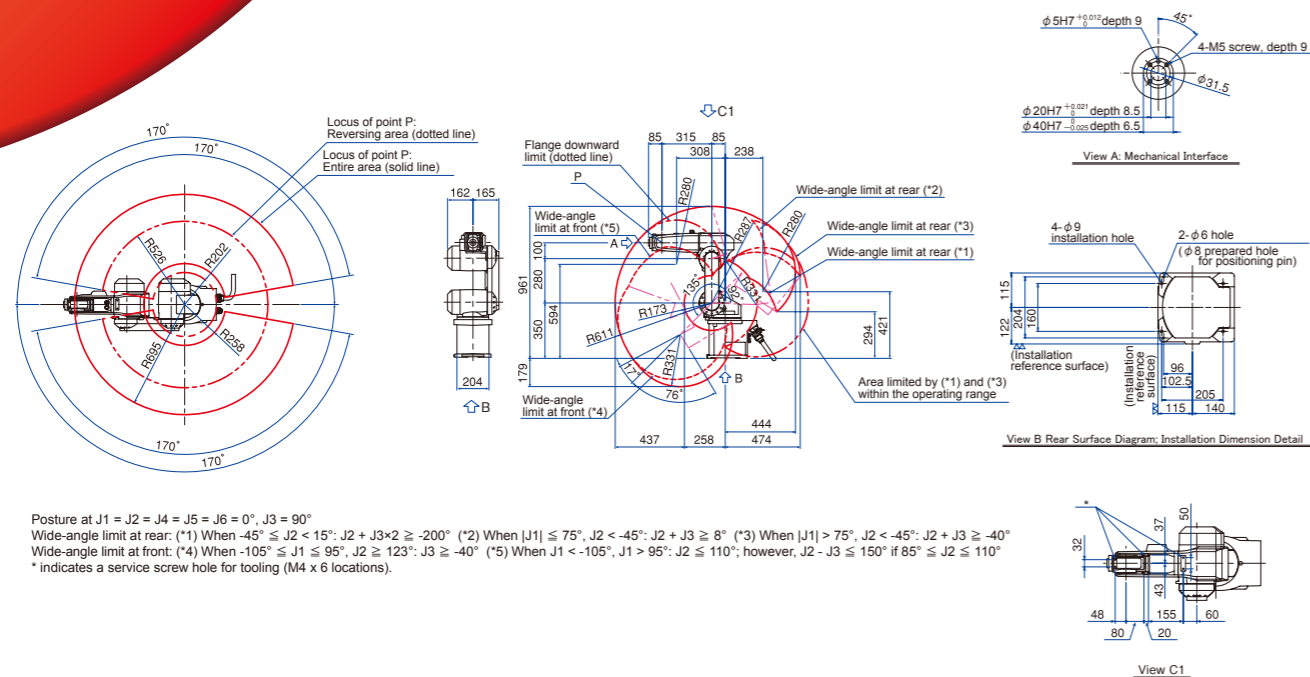| Type	Unit	RV-3SQ / RV-3SD	RV-3SQ-SM / RV-3SD-SM	RV-3SQC / RV-3SDC
Machine class		Standard (oil mist)		Clean
Protection degree		IP65 *1		Class 10 (0.3 μ m)
Installation		Floor type, ceiling type, (wall-mounted type *3)		Floor type
Structure		Vertical, multiple-joint type		
Degrees of freedom		6		
Drive system		AC servo motor		
Position detection method		Absolute encoder		
Maximum load capacity (rating) *2	kg	3.5 (3)		
Arm length	mm	245 + 270		
Maximum reach radius	mm	642		
Operating range	J1	deg	340 (±170)	
	J2		225 (-90 to + 135)	
	J3		191 (-20 to + 171)	
	J4		320 (±160)	
	J5		240 (±120)	
	J6		720 (±360)	
Maximum speed	J1	deg/sec	250	
	J2		187	
	J3		250	
	J4		412	
	J5		412	
	J6		660	
Maximum composite speed *4	mm/sec	Approx. 5500		
Cycle time	sec	0.63		
Position repeatability	mm	±0.02		
Ambient temperature	°C	0 to 40		
Mass	kg	Approx. 37		
Tool wiring *5		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#27 (0.1mm²)		
Tool pneumatic pipes		Primary: φ6 x 2　　Secondary: φ4 x 8		
Machine cable		5m (connector on both ends)		
Connected controller *6		CR1QA-721 / CR1DA-721	CR1QA-721 + CR1D-MB / CR1DA-721 + CR1D-MB	CR1QA-721 / CR1DA-721

*1: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*2: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*3: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*4: This is at the hand flange surface when all axes are composited.
*5: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.
*6: Select either controller according to your application. "-SM6" is appended at the end of the robot model name when the CR3Q-711M/CR3D-711M is selected.
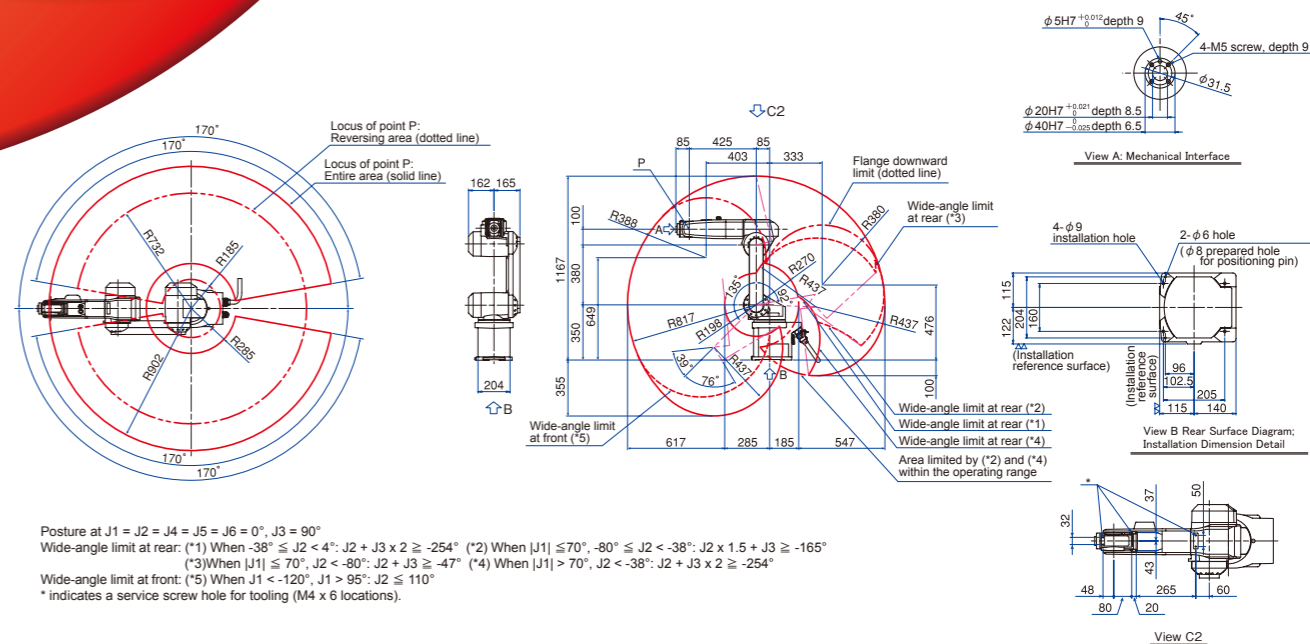
RV-6SQ / RV-6SD

Vertical 6 kg type

External Dimensions/Operating Range Diagram

Posture at J1 = J2 = J4 = J5 = J6 = 0°, J3 = 90°
Wide-angle limit at rear: (*1) When -45° ≦ J2 < 15°: J2 + J3×2 ≧ -200° (*2) When |J1| ≦ 75°, J2 < -45°: J2 + J3 ≧ 8° (*3) When |J1| > 75°, J2 < -45°: J2 + J3 ≧ -40°
Wide-angle limit at front: (*4) When -105° ≦ J1 ≦ 95°, J2 ≧ 123°: J3 ≦ -40° (*5) When J1 < -105°, J1 > 95°: J2 ≦ 110°; however, J2 - J3 ≦ 150° if 85° ≦ J2 ≦ 110°
* indicates a service screw hole for tooling (M4 x 6 locations).

Specifications

Type	Unit	RV-6SQ / RV-6SD	RV-6SQ-SM6 / RV-6SD-SM6	RV-6SQC / RV-6SDC
Machine class		Standard (oil mist)		Clean
Protection degree		IP65 (J4 to J6), IP54 (J1 to J3) *1		Class 10 (0.3μm)
Installation		Floor type, ceiling type, (wall-mounted type *2)		Floor type
Structure		Vertical, multiple-joint type		
Degrees of freedom		6		
Drive system		AC servo motor (with brake on all axes)		
Position detection method		Absolute encoder		
Maximum load capacity (rating) *3	kg	6 (5)		
Arm length	mm	280 + 315		
Maximum reach radius	mm	695		
Operating range	J1	deg	340 (±170)		
	J2		227 (-92 to +135)		
	J3		273 (-107 to +166)		
	J4		320 (±160)		
	J5		240 (±120)		
	J6		720 (±360)		
Maximum speed	J1	deg/sec	401		
	J2		321		
	J3		401		
	J4		352		
	J5		450		
	J6		660		
Maximum composite speed *4	mm/sec	Approx. 9300		
Cycle time *5	sec	0.47		
Position repeatability	mm	±0.02		
Ambient temperature	°C	0 to 40		
Mass	kg	Approx. 58		
Tool wiring *6		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#27 (0.1mm²)		
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ4 x 8		
Machine cable		5m (connector on both ends)		
Connected controller *7		CR2QA-711 / CR2DA-711	CR3Q-711M / CR3D-711M	CR2QA-711 / CR2DA-711

*1: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*3: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*4: This is at the hand flange surface when all axes are composited.
*5: 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. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position.
*6: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.
*7: Select either controller according to your application. "-SM6" is appended at the end of the robot model name when the CR3Q-711M/CR3D-711M is selected.

RV-6SQL / RV-6SDL

Vertical 6 kg type

External Dimensions/Operating Range Diagram

Posture at J1 = J2 = J4 = J5 = J6 = 0°, J3 = 90°
Wide-angle limit at rear: (*1) When -38° ≦ J2 < 4°: J2 + J3 x 2 ≧ -254° (*2) When |J1| ≦70°, -80° ≦ J2 < -38°: J2 x 1.5 + J3 ≧ -165°
(*3)When |J1| ≦ 70°, J2 < -80°: J2 + J3 ≧ -47° (*4) When |J1| > 70°, J2 < -38°: J2 + J3 x 2 ≧ -254°
Wide-angle limit at front: (*5) When J1 < -120°, J1 > 95°: J2 ≦ 110°
* indicates a service screw hole for tooling (M4 x 6 locations).

Specifications

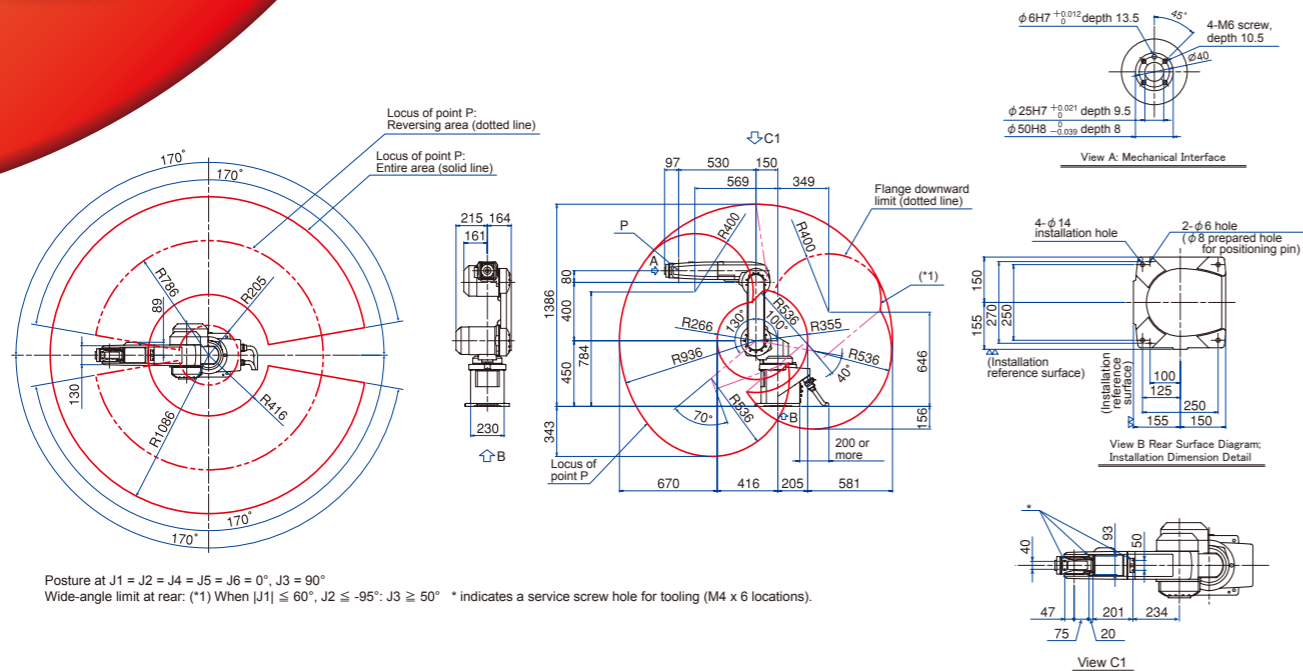| Type	Unit	RV-6SQL / RV-6SDL	RV-6SQL-SM6 / RV-6SDL-SM6	RV-6SQLC / RV-6SDLC
Machine class		Standard (oil mist)		Clean
Protection degree		IP65 (J4 to J6), IP54 (J1 to J3) *1		Class 10 (0.3μm)
Installation		Floor type, ceiling type, (wall-mounted type *2)		Floor type
Structure		Vertical, multiple-joint type		
Degrees of freedom		6		
Drive system		AC servo motor (with brake on all axes)		
Position detection method		Absolute encoder		
Maximum load capacity (rating) *3	kg	6 (5)		
Arm length	mm	380 + 425		
Maximum reach radius	mm	902		
Operating range	J1	deg	340 (±170)		
	J2		227 (-92 to +135)		
	J3		295 (-129 to +166)		
	J4		320 (±160)		
	J5		240 (±120)		
	J6		720 (±360)		
Maximum speed	J1	deg/sec	250		
	J2		267		
	J3		267		
	J4		352		
	J5		450		
	J6		660		
Maximum composite speed *4	mm/sec	Approx. 8500		
Cycle time *5	sec	0.50		
Position repeatability	mm	±0.02		
Ambient temperature	°C	0 to 40		
Mass	kg	Approx. 60		
Tool wiring *6		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#27 (0.1mm²)		
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ4 x 8		
Machine cable		5m (connector on both ends)		
Connected controller *7		CR2QA-711 / CR2DA-711	CR3Q-711M / CR3D-711M	CR2QA-711 / CR2DA-711

*1: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*3: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*4: This is at the hand flange surface when all axes are composited.
*5: 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. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position.
*6: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.
*7: Select either controller according to your application. "-SM6" is appended at the end of the robot model name when the CR3Q-711M/CR3D-711M is selected.
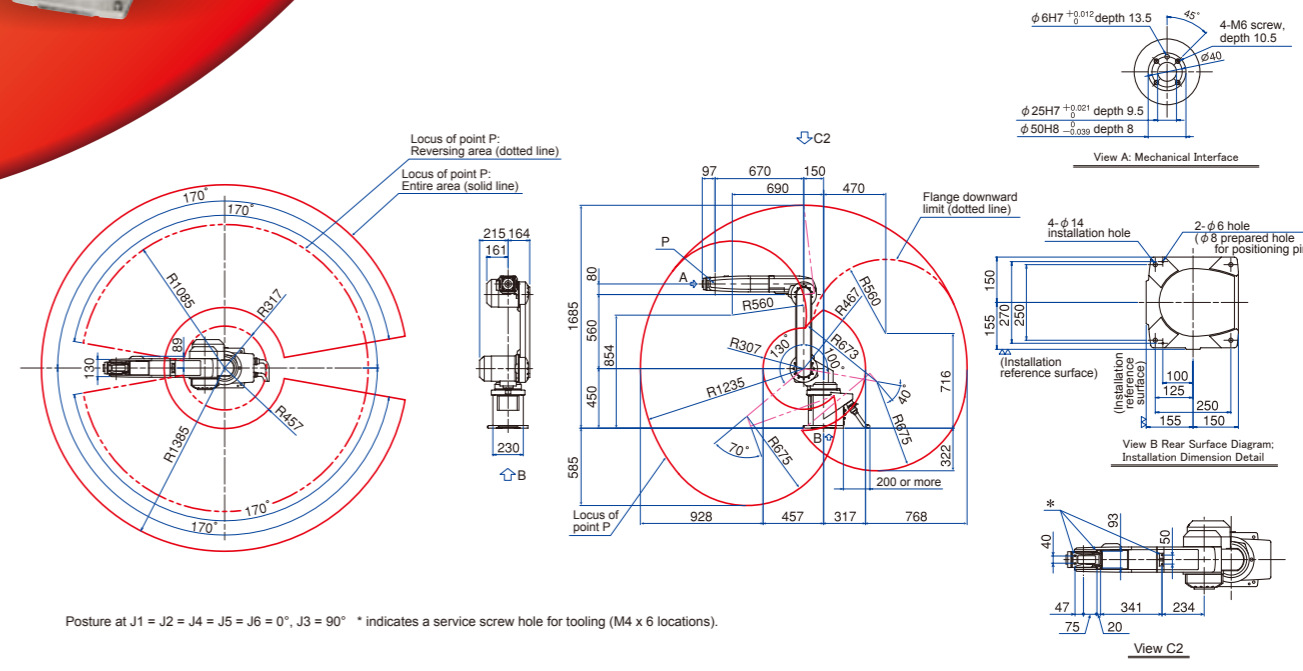
Left Page

Vertical 12kg type

RV-12SQ
RV-12SD

External Dimensions/Operating Range Diagram

Locus of point P: Reversing area (dotted line)
Locus of point P: Entire area (solid line)

Flange downward limit (dotted line)

φ6H7 $^{+0.012}_{0}$ depth 13.5
4-M6 screw, depth 10.5

φ25H7 $^{+0.021}_{0}$ depth 9.5
φ50H8 $^{0}_{-0.039}$ depth 8

View A: Mechanical Interface

4-φ14 installation hole
2-φ6 hole (φ8 prepared hole for positioning pin)

(Installation reference surface)

View B Rear Surface Diagram; Installation Dimension Detail

Posture at J1 = J2 = J4 = J5 = J6 = 0°, J3 = 90°
Wide-angle limit at rear: (*1) When |J1| ≦ 60°, J2 ≦ -95°: J3 ≧ 50°   * indicates a service screw hole for tooling (M4 x 6 locations).

View C1

Specifications

Type	Unit	RV-12SQ / RV-12SD	RV-12SQ-S300 / RV-12SD-S300	RV-12SQC / RV-12SDC
Machine class		Standard (oil mist)		Clean
Protection degree		IP65 (J4 to J6), IP54 (J1 to J3) *1		Class 10 (0.3 μm)
Installation		Floor type, ceiling type, (wall-mounted type *2)		Floor type
Structure		Vertical, multiple-joint type		
Degrees of freedom		6		
Drive system		AC servo motor (with brake on all axes)		
Position detection method		Absolute encoder		
Maximum load capacity (rating) *3	kg	12 (10)		
Arm length	mm	400 + 530		
Maximum reach radius	mm	1086		
Operating range	J1	deg	340 (±170)	
	J2		230 (-100 to +130)	
	J3		290 (-130 to +160)	
	J4		320 (±160)	
	J5		240 (±120)	
	J6		720 (±360)	
Maximum speed	J1	deg/sec	276	
	J2		230	
	J3		267	
	J4		352	
	J5		375	
	J6		660	
Maximum composite speed *4	mm/sec	Approx. 9600		
Cycle time *5	sec	0.66		
Position repeatability	mm	±0.05		
Ambient temperature	°C	0 to 40		
Mass	kg	Approx. 93		
Tool wiring *6		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#27 (0.1mm²)		
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ6 x 8		
Machine cable		7m (connector on both ends)		
Connected controller *7		CR3Q-701M / CR3D-701M	CR2QA-701 / CR2DA-701	CR3Q-701 / CR2QA-701 CR3D-701 / CR2DA-701

*1: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*3: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*4: This is at the hand flange surface when all axes are composited.
*5: 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 5 kg. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position.
*6: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.
*7: Select either controller according to your application. "-S300" is appended at the end of the robot model name when the CR2QA-701/CR2DA-701 is connected.CR2QA-701/CR2DA-701 (IP20) are open structures. Take care with the installation environment.

Right Page

Vertical 12kg type

RV-12SQL
RV-12SDL

External Dimensions/Operating Range Diagram

Locus of point P: Reversing area (dotted line)
Locus of point P: Entire area (solid line)

Flange downward limit (dotted line)

φ6H7 $^{+0.012}_{0}$ depth 13.5
4-M6 screw, depth 10.5

φ25H7 $^{+0.021}_{0}$ depth 9.5
φ50H8 $^{0}_{-0.039}$ depth 8

View A: Mechanical Interface

4-φ14 installation hole
2-φ6 hole (φ8 prepared hole for positioning pin)

(Installation reference surface)

View B Rear Surface Diagram; Installation Dimension Detail

Posture at J1 = J2 = J4 = J5 = J6 = 0°, J3 = 90°   * indicates a service screw hole for tooling (M4 x 6 locations).

View C2

Specifications

| Type	Unit	RV-12SQL / RV-12SDL	RV-12SQL-S300 / RV-12SDL-S300	RV-12SQLC / RV-12SDLC
Machine class		Standard (oil mist)		Clean
Protection degree		IP65 (J4 to J6), IP54 (J1 to J3) *1		Class 10 (0.3 μm)
Installation		Floor type, ceiling type, (wall-mounted type *2)		Floor type
Structure		Vertical, multiple-joint type		
Degrees of freedom		6		
Drive system		AC servo motor (with brake on all axes)		
Position detection method		Absolute encoder		
Maximum load capacity (rating) *3	kg	12 (10)		
Arm length	mm	560 + 670		
Maximum reach radius	mm	1385		
Operating range	J1	deg	340 (±170)	
	J2		230 (-100 to +130)	
	J3		290 (-130 to +160)	
	J4		320 (±160)	
	J5		240 (±120)	
	J6		720 (±360)	
Maximum speed	J1	deg/sec	230	
	J2		172	
	J3		200	
	J4		352	
	J5		375	
	J6		660	
Maximum composite speed *4	mm/sec	Approx. 9500		
Cycle time *5	sec	0.74		
Position repeatability	mm	±0.05		
Ambient temperature	°C	0 to 40		
Mass	kg	Approx. 98		
Tool wiring *6		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#27 (0.1mm²)		
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ6 x 8		
Machine cable		7m (connector on both ends)		
Connected controller *7		CR3Q-701M / CR3D-701M	CR2QA-701 / CR2DA-701	CR3Q-701 / CR2QA-701 CR3D-701 / CR2DA-701

*1: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*2: The wall-mounted specification is a custom specification where the operating range of the J1-axis is limited.
*3: The maximum load capacity indicates the maximum payload when the wrist flange is facing downward (±10°).
*4: This is at the hand flange surface when all axes are composited.
*5: 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 5 kg. The cycle time may increase if specific requirements apply such as high work positioning accuracy, or depending on the operating position.
*6: When the tool (hand) output is used, the pneumatic hand interface (optional) is required.
*7: Select either controller according to your application. "-S300" is appended at the end of the robot model name when the CR2QA-701/CR2DA-701 is connected.CR2QA-701/CR2DA-701 (IP20) are open structures. Take care with the installation environment.

Horizontal 3kg type

RH-3SQHR
RH-3SDHR

External Dimensions/Operating Range Diagram
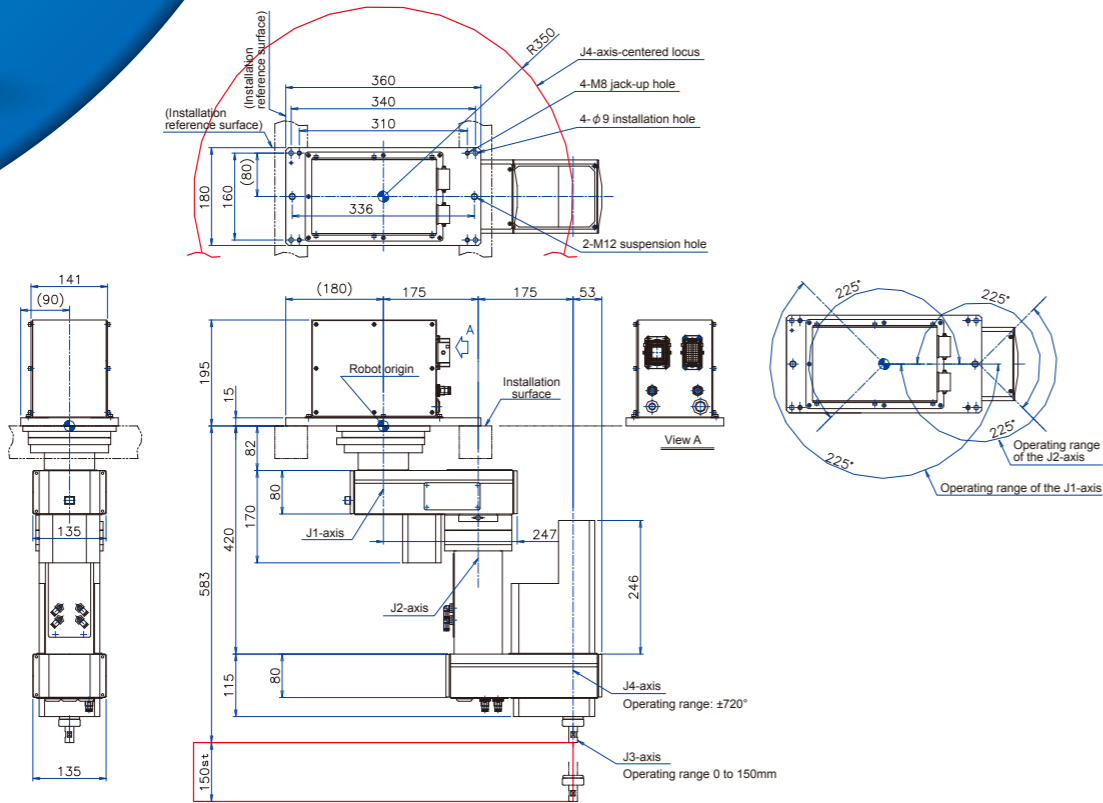
Specifications

| Type		Unit	RH-3SQHR RH-3SDHR
Machine class			Standard
Protection degree			IP20
Installation			Ceiling type
Structure			Horizontal, multiple-joint type
Degrees of freedom			4
Drive system			AC servo motor (J1, J2 and J4: with no brake, J3: with brake)
Position detection method			Absolute encoder
Maximum load capacity (rating)		kg	3 (1)
Arm length	No. 1 arm	mm	175
	No. 2 arm	mm	175
Maximum reach radius (No. 1 + No. 2)		mm	350
Operating range	J1	deg	450 (±225)
	J2	deg	450 (±225)
	J3 (Z)	mm	150 (0 to 150)
	J4 (θ)	deg	1440 (±720)
Maximum speed	J1	deg/sec	672
	J2	deg/sec	708
	J3 (Z)	mm/s	1500
	J4 (θ)	deg/sec	3146
Maximum composite speed *1		mm/sec	6267
Cycle time *2		sec	0.32
Position repeatability	X-Y composite	mm	±0.01
	J3 (Z)	mm	±0.01
	J4 (θ)	deg	±0.01
Ambient temperature		°C	0 to 40
Mass		kg	Approx. 24
Tool wiring			Hand: 8 input points / 0 output points, 8 spare lines (8 output points by options)
Tool pneumatic pipes			Primary: φ6 x 2 (Secondary: φ4 x 8)
Machine cable			5m (connector on both ends)
Connected controller			CR2QA-781 / CR2DA-781

*1: The value assumes composition of J1 and J2.
*2: Back-and-forth movement over a vertical distance of 25 mm and horizontal distance of 300 mm when the load is 1 kg
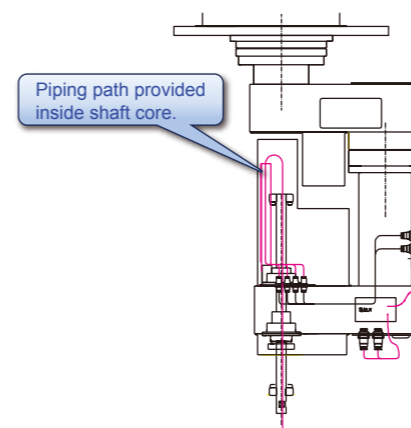
Diverse applications include assembly of electric and electronic parts, precision assembly of small parts, inspections, high speed transfer, and packing.

● **Capable of high-speed operation with dedicated motor and high rigidity mechanical structure**
· The highly rigid arm section and Mitsubishi low-inertia motor enable operations at high acceleration/deceleration speeds with high accuracy.
· An inverted SCARA design that is arranged such that the No.2 arm can completely pass by the No.1 arm. This allows high-speed operation between points following the optimum path.
· High-speed movement with a cycle time of 0.32 seconds. (30% increase from Mitsubishi conventional models)
  (*Cycle time: 0.32 sec ... Load: 1kg, Operation: 25mm vertical - 300mm horizontal reciprocal operation)

● **Space-saving layout realized with ceiling mounted installation**
· The ceiling mounted installation allows previously unusable robot installation spaces to be used effectively. A wide operating range encompasses the entire cylindrical area (Φ700 x 150) under the arm.
· The cylindrical operating range simplifies the layout setting by eliminating restrictions resulting from the layout orientation of pallets and conveyors, etc.

● **Improved robot system start up and serviceablity**
· The iQ Platform is supported allowing the robot to be operated, monitored and controlled easily from the Mitsubishi programmable controller and GOT.
· The robot's internal information (error status, maintenance information, etc.) can be displayed on the GOT, and control can be realized without a robot program.
· Piping work is simplified by providing a hand piping path in the Z axis shaft.
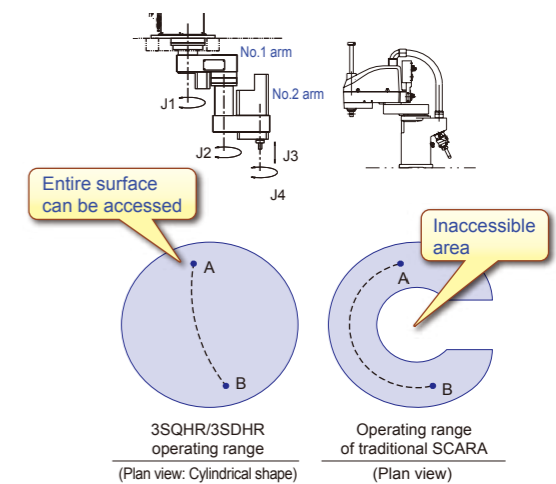
Easy installation and start up
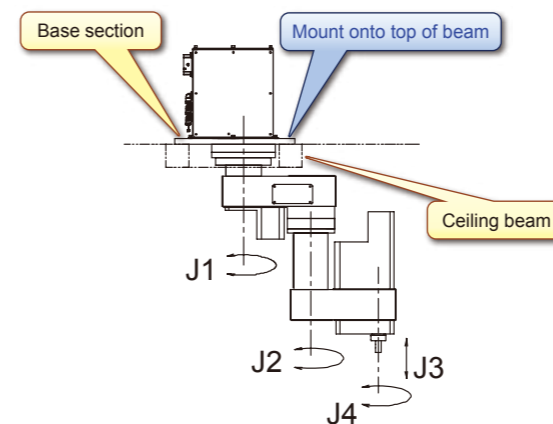
(1) The robot can be mounted and installed onto the top of a ceiling beam making it easy to install the system.

Saving work-cell space

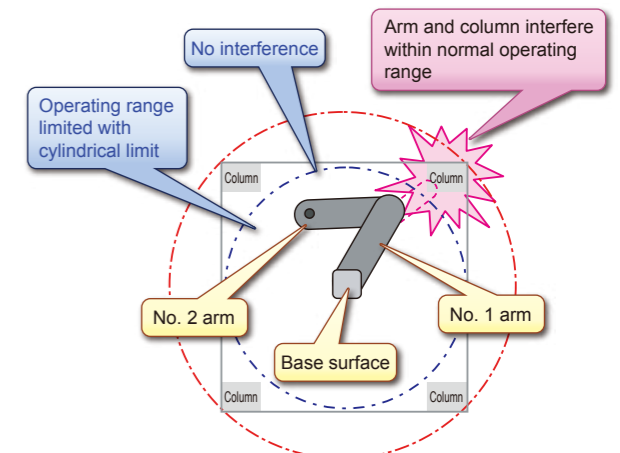**Installing the robot on the ceiling eliminates wasted space.**

(2) An interior path for piping the hand is provided at the end axis allowing tools to be piped easily. This eliminates problems with external piping.


(3) When starting up a compact system which fits into the robot's maximum operating range, if the cylindrical operating range limit function is used, the robot will move without protruding from the set cylindrical range. This allows the system to be started up and adjusted without worrying about interference.

Left Page

RH-6SQH
RH-6SDH

External Dimensions/Operating Range Diagram
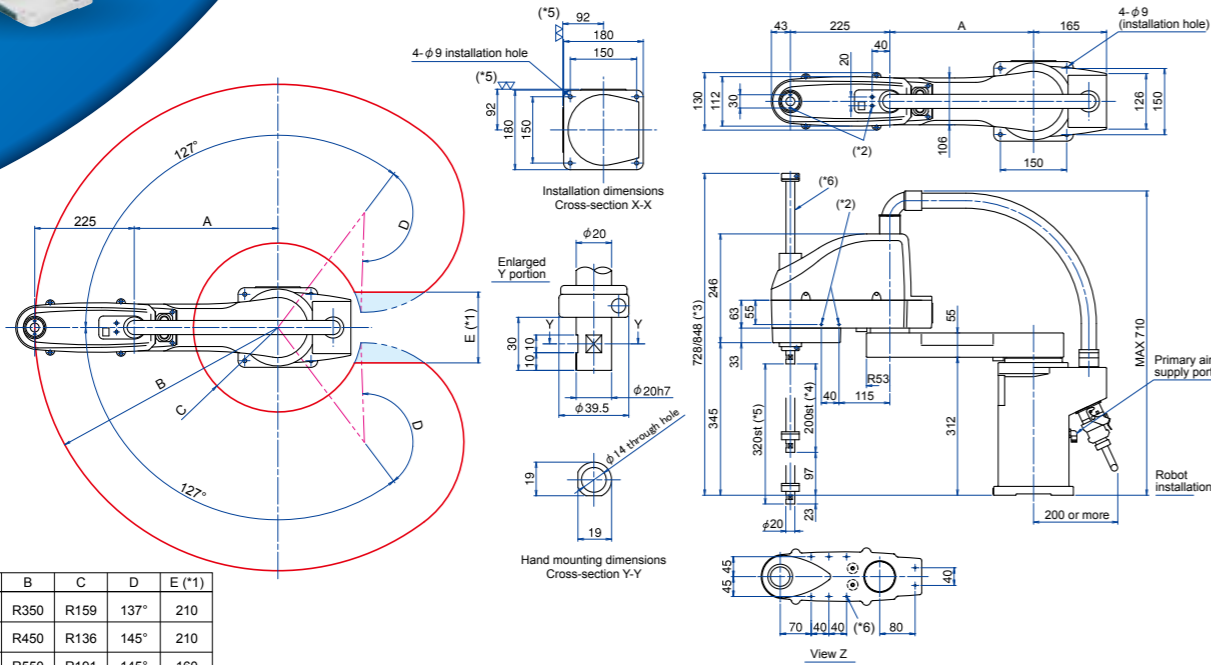
Variable dimensions

Robot series	A	B	C	D	E (*1)
RH-6SQH35 RH-6SDH35	125	R350	R159	137°	210
RH-6SQH45 RH-6SDH45	225	R450	R136	145°	210
RH-6SQH55 RH-6SDH55	325	R550	R191	145°	160

*1: Limited area according to the drawing of operating ranges. *2: Indicates the screw hole (M4) used for affixing user wiring and piping. *3: 788 (908) on the oil mist and clean specification models.
*4: 170 st on the oil mist and clean specification models. *5: 270 st on the oil mist and clean specification models.
*6: On the oil mist and clean specification models, bellows are installed in the exposed areas (top and bottom) of the ball screw spline.

Specifications

| Type	Unit	RH-6SQH35xx RH-6SDH35xx	RH-6SQH45xx RH-6SDH45xx	RH-6SQH55xx RH-6SDH55xx	RH-6SQH35xxM RH-6SDH35xxM	RH-6SQH45xxM RH-6SDH45xxM	RH-6SQH55xxM RH-6SDH55xxM	RH-6SQH35xxC RH-6SDH35xxC	RH-6SQH45xxC RH-6SDH45xxC	RH-6SQH55xxC RH-6SDH55xxC
Machine class		Standard			Oil mist proof			Clean		
Protection degree *1		IP20			IP54 *2			Class 10 (0.3 μm)		
Installation		Floor type								
Structure		Horizontal, multiple-joint type								
Degrees of freedom		4								
Drive system		AC servo motor (J1, J2 and J4: with no brake, J3: with brake)								
Position detection method		Absolute encoder								
Maximum load capacity	kg	6								
Arm length — No. 1 arm	mm	125	225	325	125	225	325	125	225	325
Arm length — No. 2 arm	mm	225								
Maximum reach radius	mm	350	450	550	350	450	550	350	450	550
Operating range — J1	deg	254 (±127)								
Operating range — J2	deg	274 (±137)	290 (±145)		274 (±137)	290 (±145)		274 (±137)	290 (±145)	
Operating range — J3 (Z)		200 (97 to 297)/320 (-23 to 297)			170 (97 to 267)/270 (-23 to 247)					
Operating range — J4 (θ)		720 (±360)								
Maximum speed — J1	deg/sec	375								
Maximum speed — J2	deg/sec	612								
Maximum speed — J3 (Z)	deg/sec	1177								
Maximum speed — J4 (θ)	deg/sec	2411								
Maximum composite speed *3	mm/sec	6473 (4694)	7128 (5349)	7782 (6003)	6473 (4694)	7128 (5349)	7782 (6003)	6473 (4694)	7128 (5349)	7782 (6003)
Cycle time *4	sec	0.42		0.43	0.42		0.43	0.42		0.43
Position repeatability — X-Y composite	mm	±0.02								
Position repeatability — J3 (Z)	mm	±0.01								
Position repeatability — J4 (θ)	deg	±0.02								
Ambient temperature	°C	0 to 40								
Mass	kg	Approx. 20		Approx. 21	Approx. 20		Approx. 21	Approx. 20		Approx. 21
Tool wiring *5		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#24 (0.2mm²)								
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ4 x 8								
Machine cable		5m (connector on both ends)								
Connected controller *6		CR1QA-761 / CR1DA-761			CR1QA-761 (Protection box (CR1D-MB) included for -SM specification) CR1DA-761 (Protection box (CR1D-MB) included for -SM specification)			CR1QA-761 / CR1DA-761		

*1: Take note that on the models of environment-resistant specifications (C: Clean specification, M: Mist specification), the operating range of the vertical axis is smaller than on the standard models.
The environment-resistant specifications are factory-set custom specifications. For the approximate timeframe for delivery, contact the Mitsubishi Electric dealer or sales agent near you.
*2: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*3: The value assumes composition of J1, J2, and J4.The value in parentheses assumes composition of J1 and J2.
*4: Based on a 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.)
*5: If the hand output is used, the air hand interface (optional) is required.
*6: Select either controller according to your application. The controller protection box is attached to the mist specification controller (CR1D-MB (protection box) is attached to CR1QA-7xx/CR1DA-7xx (IP20)),
and "-SM" is appended to the model name. If you require it, consult with the Mitsubishi Electric dealer.

Right Page

RH-12SQH
RH-12SDH

External Dimensions/Operating Range Diagram
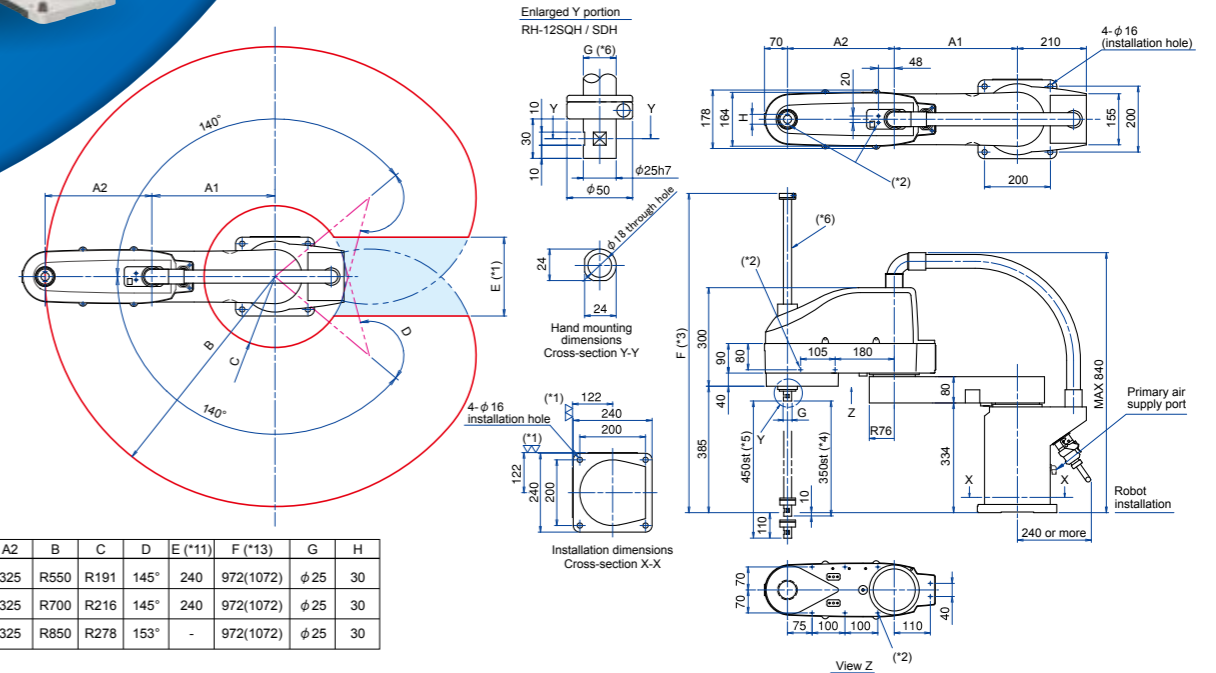
Variable dimensions

Robot series	A1	A2	B	C	D	E (*11)	F (*13)	G	H
RH-12SQH55 RH-12SDH55	225	325	R550	R191	145°	240	972(1072)	φ25	30
RH-12SQH70 RH-12SDH70	375	325	R700	R216	145°	240	972(1072)	φ25	30
RH-12SQH85 RH-12SDH85	525	325	R850	R278	153°	-	972(1072)	φ25	30

*1: Limited area according to the drawing of operating ranges. *2: Indicates the screw hole (M4) used for affixing user wiring and piping.
*3: 1027 (1127) on the RH-12SQH/12SDH-series models, and 999 (1079) on the RH-20SQH/20SDH-series models, of oil mist or clean specification.
*4: 300 st on the oil mist and clean specification models. *5: 380 st on the oil mist and clean specification models.
*6: On the oil mist and clean specification models, bellows are installed in the exposed areas (top and bottom) of the ball screw spline.

Specifications

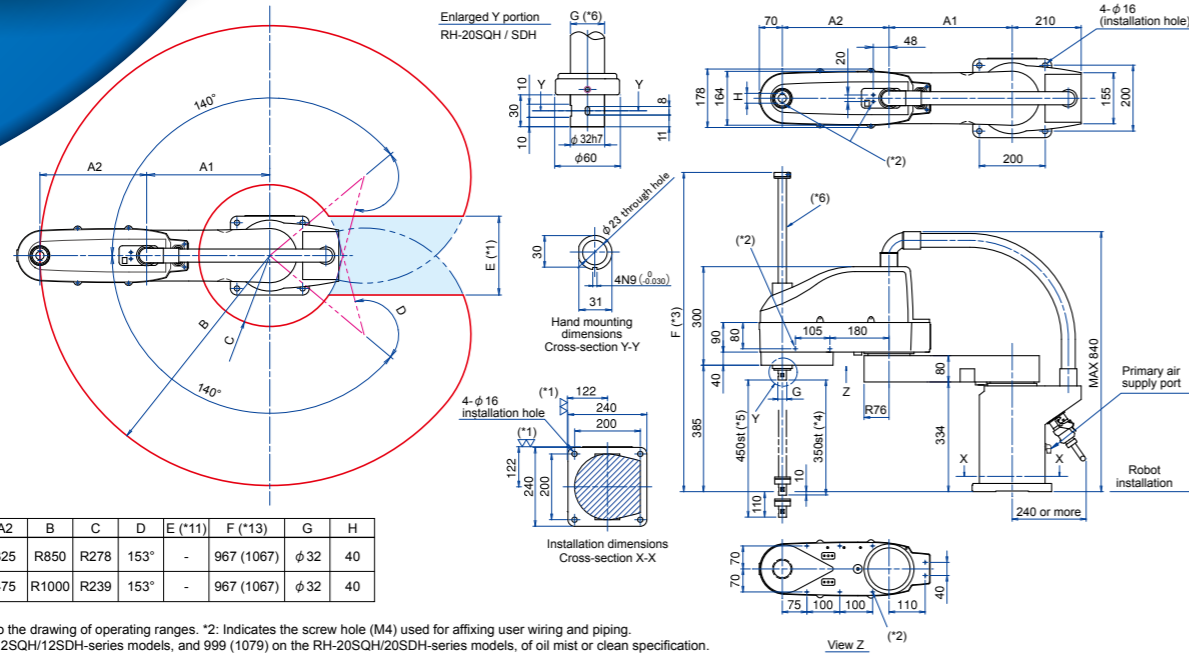| Type	Unit	RH-12SQH55xx RH-12SDH55xx	RH-12SQH70xx RH-12SDH70xx	RH-12SQH85xx RH-12SDH85xx	RH-12SQH55xxM RH-12SDH55xxM	RH-12SQH70xxM RH-12SDH70xxM	RH-12SQH85xxM RH-12SDH85xxM	RH-12SQH55xxC RH-12SDH55xxC	RH-12SQH70xxC RH-12SDH70xxC	RH-12SQH85xxC RH-12SDH85xxC
Machine class		Standard			Oil mist proof			Clean		
Protection degree *1		IP20			IP54 *2			Class 10 (0.3 μm)		
Installation		Floor type								
Structure		Horizontal, multiple-joint type								
Degrees of freedom		4								
Drive system		AC servo motor (J1, J2 and J4: with no brake, J3: with brake)								
Position detection method		Absolute encoder								
Maximum load capacity	kg	12								
Arm length — No. 1 arm	mm	225	375	525	225	375	525	225	375	525
Arm length — No. 2 arm	mm	325								
Maximum reach radius	mm	550	700	850	550	700	850	550	700	850
Operating range — J1	deg	280 (±140)								
Operating range — J2	deg	290 (±145)		306 (±153)	290 (±145)		306 (±153)	290 (±145)		306 (±153)
Operating range — J3 (Z)		350 (-10 to +340)/450 (-110 to +340)			300 (-10 to +290)/380 (-110 to +270)					
Operating range — J4 (θ)		720 (±360)								
Maximum speed — J1	deg/sec	360		288	360		288	360		288
Maximum speed — J2	deg/sec	412.5								
Maximum speed — J3 (Z)	deg/sec	1300								
Maximum speed — J4 (θ)	deg/sec	1500								
Maximum composite speed *3	mm/sec	10555 (5796)	11498 (6738)	11221 (6612)	10555 (5796)	11498 (6738)	11221 (6612)	10555 (5796)	11498 (6738)	11221 (6612)
Cycle time *4	sec	0.43	0.44	0.45	0.43	0.44	0.45	0.42	0.44	0.45
Position repeatability — X-Y composite	mm	±0.02	±0.025		±0.02	±0.025		±0.02	±0.025	
Position repeatability — J3 (Z)	mm	±0.01								
Position repeatability — J4 (θ)	deg	±0.03								
Ambient temperature	°C	0 to 40								
Mass	kg	Approx. 41	Approx. 43	Approx. 45	Approx. 41	Approx. 43	Approx. 45	Approx. 41	Approx. 43	Approx. 45
Tool wiring *5		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#24 (0.2mm²)								
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ6 x 8								
Machine cable		5m (connector on both ends)								
Connected controller *6		CR2QA-741 / CR2DA-741								

*1: Take note that on the models of environment-resistant specifications (C: Clean specification, M: Mist specification), the operating range of the vertical axis is smaller than on the standard models. The environment-resistant
specifications are factory-set custom specifications. For the approximate timeframe for delivery, contact the Mitsubishi Electric dealer or sales agent near you.
*2: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*3: The value assumes composition of J1, J2, and J4. The value in parentheses assumes composition of J1 and J2.
*4: Based on a load capacity of 5kg. 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.)
*5: If the hand output is used, the pneumatic hand interface (optional) is required.
*6: Select either controller according to your application. The mist specification controller is CR3Q/CR3D type, and "-SM6" is appended to the model name. If you require it, consult with the Mitsubishi Electric dealer.

RH-20SQH
RH-20SDH

External Dimensions/Operating Range Diagram

Enlarged Y portion
RH-20SQH / SDH

Hand mounting dimensions
Cross-section Y-Y

Installation dimensions
Cross-section X-X

View Z

Variable dimensions

Robot series	A1	A2	B	C	D	E (*11)	F (*13)	G	H
RH-20SQH85 RH-20SDH85	525	325	R850	R278	153°	-	967 (1067)	φ32	40
RH-20SQH100 RH-20SDH100	525	475	R1000	R239	153°	-	967 (1067)	φ32	40

*1: Limited area according to the drawing of operating ranges. *2: Indicates the screw hole (M4) used for affixing user wiring and piping.
*3: 1027 (1127) on the RH-12SQH/12SDH-series models, and 999 (1079) on the RH-20SQH/20SDH-series models, of oil mist or clean specification.
*4: 300 st on the oil mist and clean specification models. *5: 380 st on the oil mist and clean specification models.
*6: On the oil mist and clean specification models, bellows are installed in the exposed areas (top and bottom) of the ball screw spline.

Specifications

Type	Unit	RH-20SQH85xx RH-20SDH85xx	RH-20SQH100xx RH-20SDH100xx	RH-20SQH85xxM RH-20SDH85xxM	RH-20SQH100xxM RH-20SDH100xxM	RH-20SQH85xxC RH-20SDH85xxC	RH-20SQH100xxC RH-20SDH100xxC
Machine class		Standard		Oil mist proof		Clean	
Protection degree *1		IP20		IP54 *2		Class 10 (0.3μm)	
Installation		Floor type					
Structure		Horizontal, multiple-joint type					
Degrees of freedom		4					
Drive system		AC servo motor (J1, J2 and J4: with no brake, J3: with brake)					
Position detection method		Absolute encoder					
Maximum load capacity	kg	20					
Arm length No. 1 arm	mm	525					
Arm length No. 2 arm	mm	325	475	325	475	325	475
Maximum reach radius	mm	850	1000	850	1000	850	1000
Operating range J1	deg	280 (±140)					
Operating range J2	deg	306 (±153)					
Operating range J3 (Z)	deg	350 (-10 to + 340)/450 (-110 to +340)		300 (-10 to + 290)/380 (-110 to +270)			
Operating range J4 (θ)	deg	720 (±360)					
Maximum speed J1	deg/sec	288					
Maximum speed J2	deg/sec	412.5					
Maximum speed J3 (Z)	deg/sec	1200					
Maximum speed J4 (θ)	deg/sec	1500					
Maximum composite speed *3	mm/sec	11221 (6612)	13055 (8446)	11221 (6612)	13055 (8446)	11221 (6612)	13055 (8446)
Cycle time *4	sec	0.46	0.57	0.46	0.57	0.46	0.57
Position repeatability X-Y composite	mm	±0.025					
Position repeatability J3 (Z)	mm	±0.01					
Position repeatability J4 (θ)	deg	±0.03					
Ambient temperature	°C	0 to 40					
Mass	kg	Approx. 47	Approx. 51	Approx. 47	Approx. 51	Approx. 47	Approx. 51
Tool wiring *5		Hand: 8 input points / 8 output points (forearm), 8 spare lines: AWG#24 (0.2mm²)					
Tool pneumatic pipes		Primary: φ6 x 2 Secondary: φ6 x 8					
Machine cable		5m (connector on both ends)					
Connected controller *6		CR2QA-751 / CR2DA-751					

*1: Take note that on the models of environment-resistant specifications (C: Clean specification, M: Mist specification), the operating range of the vertical axis is smaller than on the standard models. The environment-resistant specifications are factory-set custom specifications. For the approximate timeframe for delivery, contact the Mitsubishi Electric dealer or sales agent near you.
*2: Please contact to Mitsubishi Electric dealer since the environmental resistance cannot be secured depending on the characteristics of oil you use.
*3: The value assumes composition of J1, J2, and J4. The value in parentheses assumes composition of J1 and J2.
*4: Based on a load capacity of 5kg. 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.)
*5: If the hand output is used, the pneumatic hand interface (optional) is required.
*6: Select either controller according to your application. The mist specification controller is CR3Q/CR3D type, and "-SM6" is appended to the model name. If you require it, consult with the Mitsubishi Electric dealer.

MELFA RH SERIES HAS A VERSATILITY TO FULFILL A WIDE RANGE OF TASKS FROM THE PRECISION ASSEMBLY OF SMALL PARTS TO TRANSFER AND PACKAGING OF HEAVY ITEMS.
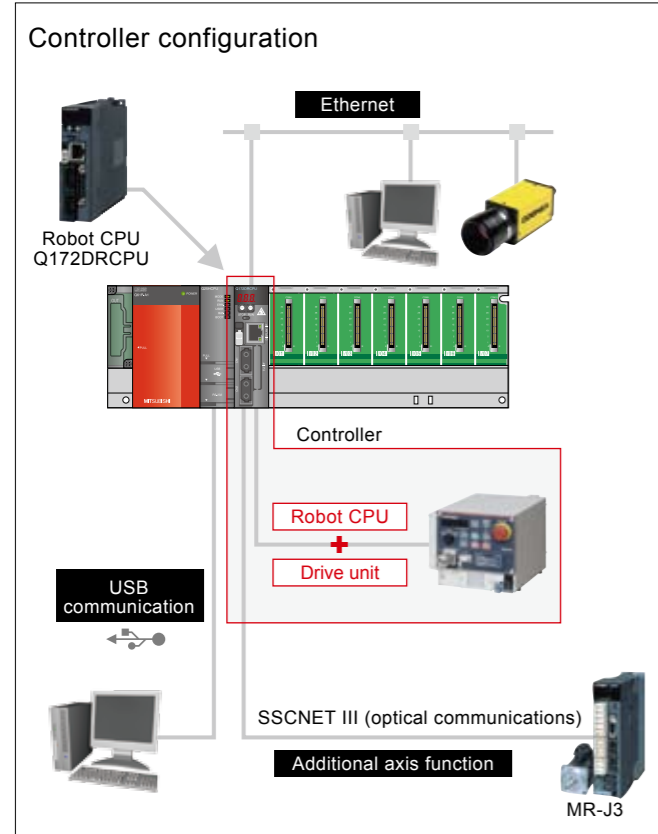
● **Payload: 6 kg to 20 kg**
  · The conventional 18 kg model has been enhanced to a 20 kg rating. Greater payloads are now possible.
  · Ability to use heavier multifunction tooling.

● **Arm reach: 350 mm to 1,000 mm**
  · Arm reach has been extended to 1000 mm. (20 kg model only)
  · A greater flexibility in choosing pallet sizes and layout design.
   Also, eliminated are problems with the shortage of stroke which are encountered when rearranging conventional units.

● **Z Stroke: 200 mm to 450 mm**
  · Z stroke with 6 to 20 kg model is available with an extended stroke:
     · 6 kg model: 320 mm added to conventional 200 mm
     · 12/20 kg model: 450 mm added to conventional 350 mm
  · More application versatility in long reach applications such as packaging.

Model	RH-6SQH/6SDH	RH-12SQH/12SDH	RH-20SQH/20SDH
Payload	6 kg	12 kg	20 kg
Reach	350 mm / 450 mm	550 mm / 700 mm	850 mm / 1000 mm
Z stroke	200 mm / 320 mm	350 mm	450 mm

Controller

SQ series

Controller configuration

Ethernet

Robot CPU
Q172DRCPU

Controller

Robot CPU
+
Drive unit

USB
communication

SSCNET III (optical communications)

Additional axis function

MR-J3

SD series

A variety of interfaces are available as standard.

MR-J3

SSCNET III
(optical communications)

Additional axis function

Ethernet

CRnD-7xx
Controller

Encoder input function

USB communication

Pulse encoder
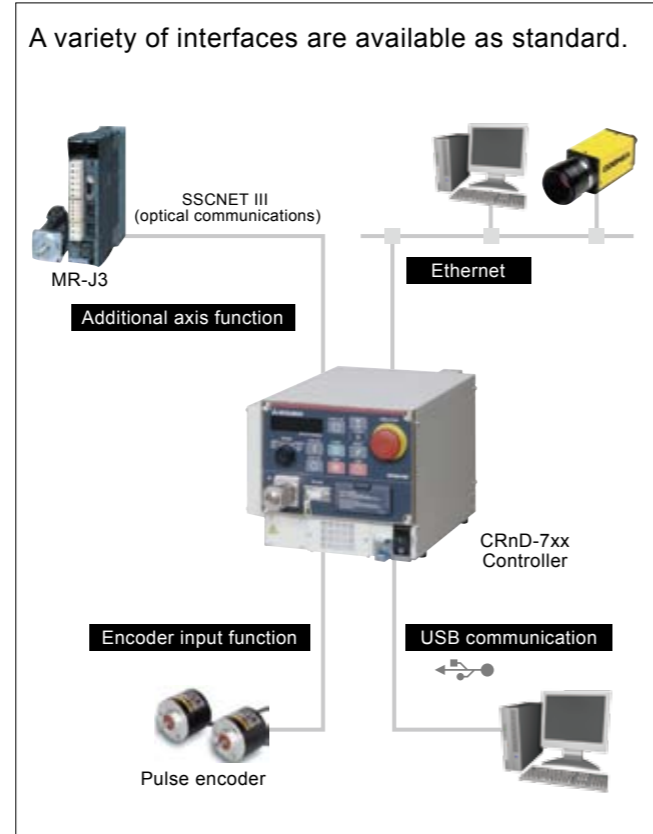
Drive unit DU1A-7xx
Controller CR1DA-7xx

(*1) 50 mm if a dummy teaching pendant plug is installed.
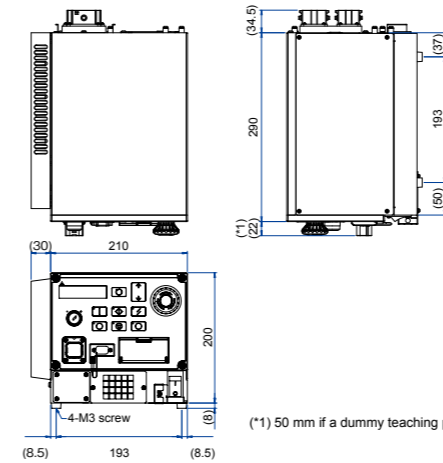
Drive unit DU2A-7xx
Controller CR2DA-7xx

(*1) 50 mm if a dummy teaching pendant plug is installed.
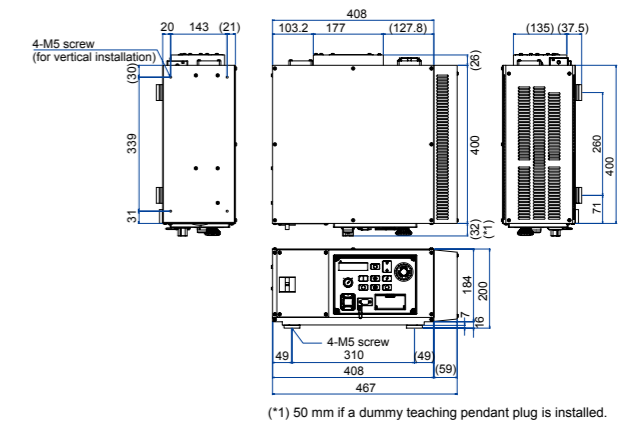
Drive unit DU3-7xx (M)
Controller CR3D-7xx (M)

Suspension bolt
2-M10

Dimensions of caster specification
(factory-set custom specification)

Drive unit CR1QA-772

(*1) 50 mm if a dummy teaching pendant plug is installed.
Note) The robot controller is not equipped with an operating panel.
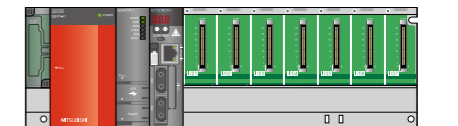The operating panel for operation, such as switch box or GOT,
is prepared by customer.
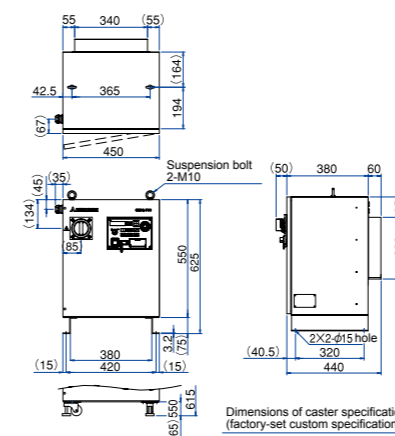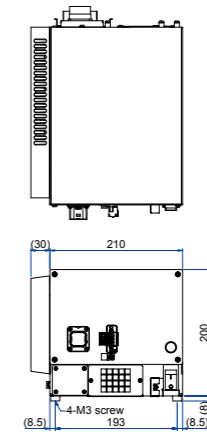
Specifications

Type	Unit	CR1QA-772 CR1DA-771	CR1QA-721 CR1DA-721	CR1QA-731 CR1DA-731	CR2QA-711 CR2DA-711	CR2QA-701 CR2DA-701	CR3Q-701M CR3Q-711M CR3D-701M CR3D-711M	CR3Q-701 CR3D-701	CR1QA-761 CR1DA-761	CR2QA-781 CR2DA-781	CR2QA-741 CR2QA-751 CR2DA-741 CR2DA-751	CR3Q-741M CR3Q-751M CR3D-741M CR3D-751M
Robot CPU		Q172DRCPU										
Drive unit		DU1A-772	DU1A-721	DU1A-731	DU2A-711	DU2A-701	DU3-701M DU3-711M	DU3-701	DU1A-761	DU2A-781	DU2A-741 DU2A-751	DU3-741M DU3-751M
Path control method		PTP control and CP control										
Number of axes controlled		6 axes		5 axes	6 axes					4 axes		
Robot language		MELFA-BASIC V or MELFA-BASIC IV										
Position teaching method		Teaching method, MDI method										
Memory capacity — Number of teaching points	points	13,000										
Memory capacity — Number of steps	step	26,000										
Memory capacity — Number of programs	Unit	256										
External input/output — General-purpose I/O	points	SQ 8192 input points/8192 output points with the multiple CPU common device / SD 0 input/0 output (Up to 256/256 when options are used)										
External input/output — Dedicated I/O		SQ Assigned to multiple CPU common device. / SD Assigned to general-purpose I/O.										
External input/output — Special stop input		1										
External input/output — Hand open/close		4 input / 0 output *7			8 input / 0 output *6							
External input/output — Emergency stop input		1 (redundant)										
External input/output — Door switch input		1 (redundant)										
External input/output — Enabling device input		1 (redundant)										
External input/output — Emergency stop output		1 (redundant)										
External input/output — Mode output		1 (redundant)										
External input/output — Robot error output		1 (redundant)										
External input/output — Synchronization of additional axes		1 (redundant)										
Interface — RS-232	ports	SQ – / SD 1 (for the extension of a personal computer, vision sensor, etc.)										
Interface — RS-422		1 (Teaching pendant: dedicated T/B)										
Interface — Ethernet		SQ 1 (dedicated teaching pendant port) 10BASE-T / SD 1 (dedicated teaching pendant port), 1 (for customer) 10BASE-T/100BASE-TX										
Interface — USB		SQ 1 (USB port of programmable controller CPU unit (mini B terminal) can be used.) / SD 1 (device functions only, mini B terminal)										
Interface — Hand dedicated slot	slots	1 (dedicated for pneumatic hand interface)										
Interface — Key switch interface	points	SQ 1 / SD –	–									
Interface — Additional-axis interface	channels	1 (SSCNET III)										
Interface — Tracking interface		SQ Q173DPX (sold separately) / SD 1										
Interface — Memory slot	slots	SQ – / SD 1										
Interface — Extension slot *1		SQ – / SD 1			SQ – / SD 3				SQ – / SD 1		SQ – / SD 3	
Ambient temperature	°C	0 to 40										
Relative humidity	%RH	SQ 0 to 40 (drive unit)/0 to 55 (Robot CPU) / SD 45 to 85										
Power supply — Input voltage range	V	3-phase AC180 to 253 *2										
Power supply — Power capacity *3	KVA	0.5	1.0		2.0		3.0		1.0	2.0		3.0
External dimensions (including legs)	mm	240 (W) x 290(D) x 200 (H) (excluding protrusions)	240 (W) x 290 (D) x 200 (H)		470 (W) x 400 (D) x 200 (H)		450 (W) x 440 (D) x 625 (H) *5	450 (W) x 380 (D) x 625 (H) *5	240 (W) x 290 (D) x 200 (H)	470 (W) x 400 (D) x 200 (H)		450 (W) x 440 (D) x 625 (H) *5
Weight	kg	Approx. 9	Approx. 21				Approx. 60		Approx. 9	Approx. 21		Approx. 60
Structure [protective specification]		Self-contained floor type/open structure [IP20]					Self-contained floor type/ sealed structure [IP54]		Self-contained floor type/open structure [IP20]			Self-contained floor type/ sealed structure [IP54]
Grounding *4	Ω	100 or less (class D grounding)										

Multiple CPU environment

Unit	Type
Base	High-speed standard base between multiple CPU • Q38DB: 8 slots • G312DB: 12 slots
Power supply	• Q61P • Q62P • Q63P • Q64PN
Programmable controller CPU	Universal model (CPU that can transmit by multiple CPU high speed transmission) • Q03UD (E) CPU • Q04UD (E) HCPU • Q06UD (E) HCPU • Q10UD (E) HCPU • Q13UD (E) HCPU • Q20UD (E) HCPU • Q26UD (E) HCPU • Q100UD (E) HCPU

Note) For details of each programmable controller unit,
refer to the programmable controller manuals,
MELFANSweb, etc.

*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: 615 (H) for the caster specification.
*6: 8 input /8 output when pneumatic hand interface is used.
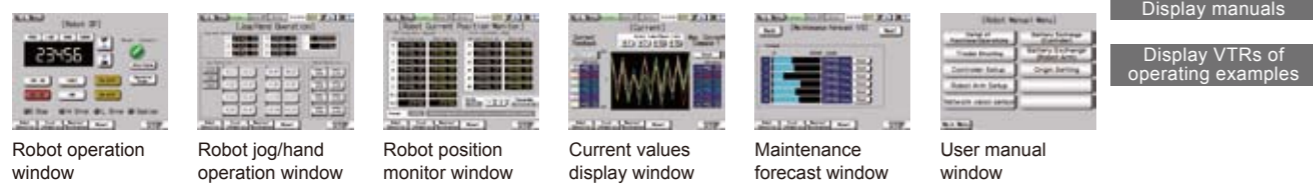*7: 4 input /4 output when pneumatic hand interface is used.

Features (SQ series)

Shared memory expansion function (operating and monitor functions)

Robot Controller Software Ver. N8 or later | No need for a teaching pendant/ personal computer

● **Convenient monitoring and retrieval of information from robot and other machine components at a single point.**

The following types of operating and information windows can be displayed on the GOT:

Display manuals

Display VTRs of operating examples

Robot operation window | Robot jog/hand operation window | Robot position monitor window | Current values display window | Maintenance forecast window | User manual window

● **Easy to get the status of the robot!**

● Essential data from the robot can be displayed without referring to the robot program, editing software, or teaching pendant.

GOT interface provides easy access to robot data and status.

Status information of robot
● Error, variable, and program information
● Robot status (current speed, current position, etc.)
● Maintenance information (remaining battery/grease life, etc.)
● Servo data (load factor/current value, etc.)

Customer system panel

Panel operations

GOT1000 (GT16/GT15)

Robot controller | Teaching pendant | Personal computer support software

---

Sequencer direct operation

Robot Controller Software Ver. N8 or later | No need to use any programs

● **The ability to command the robot directly fron the programmable controller language.**
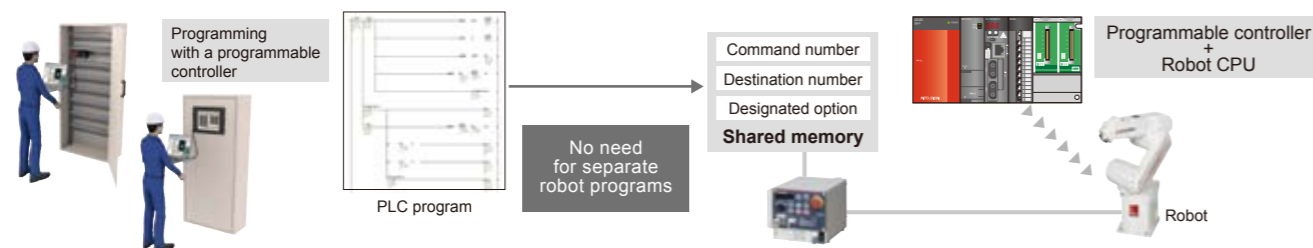
Use of this function

Traditional method

In most cases, the PLC program and robot program are written independently by different programmers and in different languages. This increases programming and debug time and the need for multiple programming environments.

PLC programmer | Robot programmer

With direct robot control from a programmable controller

Programming can be accoplished directly within the programmable controller language. No need to use a second language/ program to control the robot.

PLC programmer

What is the direct execution function for programmable controller?

Robots can be operated through writing of setting values decided in advance to given addresses in multi-CPUs and shared memory, regardless of programm (ladder, ST language, SFC, etc.). Joint interpolation movement and linear interpolation movement modes are available. Additionally robot operations such as operating speed, acceleration/deceleration, and tool settings can be set in detail.
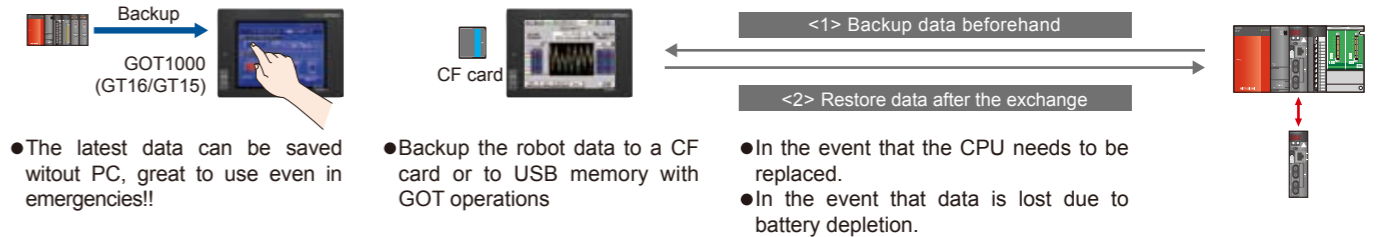
Programming with a programmable controller

PLC program

No need for separate robot programs

Command number
Destination number
Designated option
Shared memory

Programmable controller + Robot CPU

Robot

Advantages provided by the direct robot control from a programmable controller

● System operation can be controlled solely by the programmable controller. Easy to operate those systems because only PLC programmer can handle system specifications or trouble shooting.

GOT backup / restore function

Robot Controller Software SQ: Ver. N8 or later, SD: Ver. P8 or later | Features for protecting program data

● **Robot data can be backed-up and restored from GOT without personal computer (for SQ/SD series)**

Backup

GOT1000 (GT16/GT15)

CF card

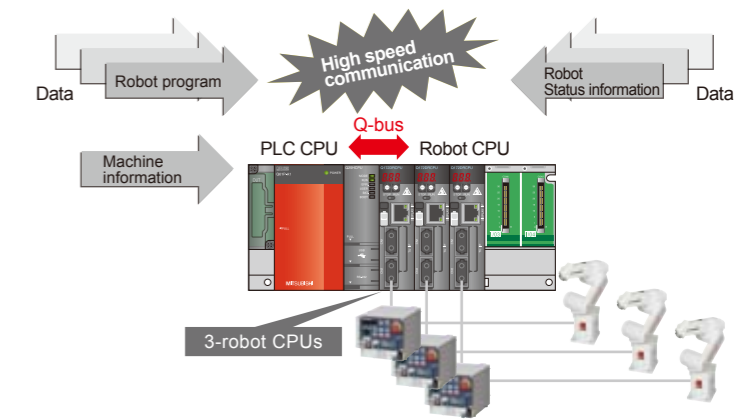<1> Backup data beforehand

<2> Restore data after the exchange

● The latest data can be saved witout PC, great to use even in emergencies!!

● Backup the robot data to a CF card or to USB memory with GOT operations

● In the event that the CPU needs to be replaced.
● In the event that data is lost due to battery depletion.

Note) To use the back-up / restore function with the GOT, install an operating system (OS) with a backup/restore function on the GOT using GT Designer3 Ver. 1.07H or later.
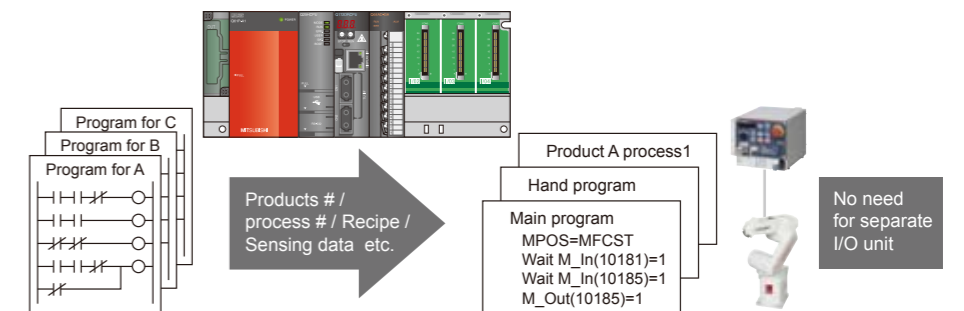

High-speed communication between the programmable controller ↔ robot

With the robot CPU mounted in an iQ system, communications between the programmable controller or other available CPU's are much faster and at greater volumes. Total machine integration is simplified and performance is enhanced.

High speed communication

Data | Robot program | Robot Status information | Data

Machine information

Q-bus

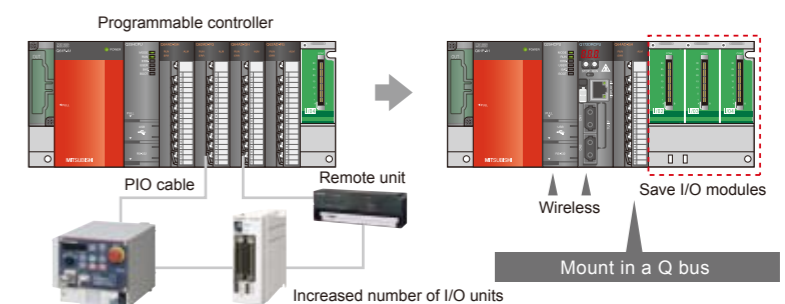PLC CPU | Robot CPU

3-robot CPUs

High capacity communication between the programmable controller ↔ robot

High capacity communication can support multi machines system with large I/O requirements. Enables simplified integration of all I/O in complex systems.
(8192 Input/8192 Output)

Program for C
Program for B
Program for A

Products # / process # / Recipe / Sensing data etc.

Product A process1
Hand program
Main program
MPOS=MFCST
Wait M_In(10181)=1
Wait M_In(10185)=1
M_Out(10185)=1

No need for separate I/O unit

Save wiring / save communication modules

No need for any configurations options

Less wiring and shard modules reduces overall system cost.

Programmable controller

PIO cable | Remote unit | Save I/O modules

Wireless | Mount in a Q bus

Increased number of I/O units

Program maintenace from one port.

Multiple robots can be accessed from a personal computer connected to the main CPU via a control network. This provides convenience and time savings when performing setup and maintenance.
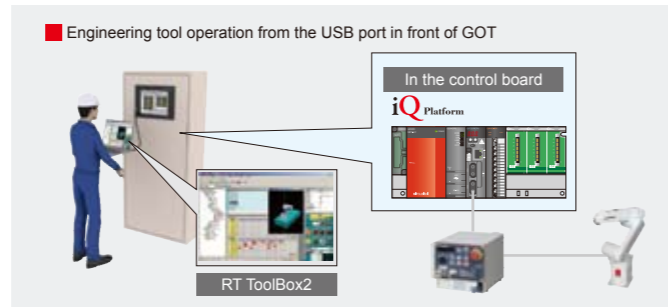
Personal computer
RT ToolBox2

Also enables access to other stations by Ethernet or serial communications

USB/RS-232/Ethernet

iQ Platform
Programmable controller

Controller network (CC-Link IE)

iQ Platform
Programmable controller

iQ Platform
Programmable controller

iQ Platform
Programmable controller

SQ robot 1

SQ robot 2

SQ robot 3
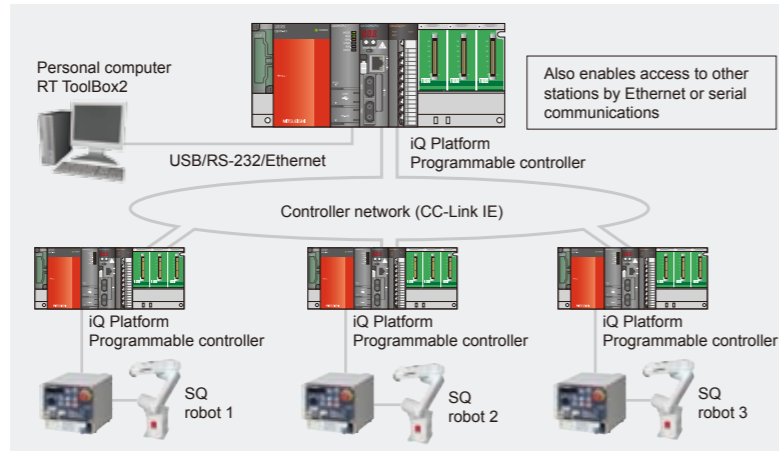
Robots 1, 2, and 3 can be monitored from a single location.

GOT connection (transparent function)

Simple connection

Programs and parameters can be written from the USB interface on the front of the GOT using a transparent function.This function is available for SD Series as well.

Note) Compatible with the transparent function when the GOT and CPU are connected by bus connection and in direct connection mode.

Engineering tool operation from the USB port in front of GOT

In the control board

iQ Platform

RT ToolBox2

Robot CPU ↔ Robot CPU direct communication

High speed direct communication with shared memory between CPU's increases the efficiency of detailed control programs which improves processing time.

| Conventional communication	Enhanced communication
(1) #2CPU communicates with PLC CPU	(1) Direct communication between #2CPU with #3CPU
(2) PLC CPU forwards data (3) PLC CPUcommunicates with #3CPU	·No need for the PLC program to communicate between CPUs. ·High response with no delay of PLC's scan time.

Robot CPU ↔ IO control unit direct operation

High speed direct communication with shared memory, robot CPU, and I/O signals improves response time and reduces tact time.

Conventional communication	Enhanced communication
(1) #2CPU communicates with PLC CPU	(1) #2CPU controls IO signal unit directly
(2) PLC CPU forwards data (3) PLC CPU control IO signal unit	·No need for the PLC program to communicate between CPU and IO signal unit. ·High response with no delay of PLC's scan time.

Functions

Optimal acceleration/deceleration control and optimal override function

● The optimal acceleration/deceleration time and speed are automatically set according to operation position, posture, and load conditions of the robot.

Speed

Optimal acceleration/ deceleration control and optimal override control

Normal control

Time

Shortened cycle time
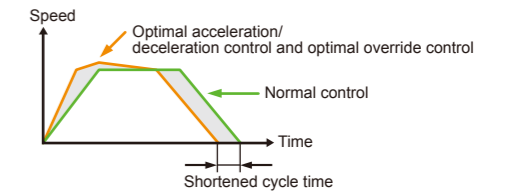
Improved productivity through shortened cycle times

Shortened startup time

Active gain control

● Optimal motor control tuning is set automatically based on the operating position, posture, and load conditions of the robot.
● Active gain control is a control method that allows the position gain to be changed in real time.
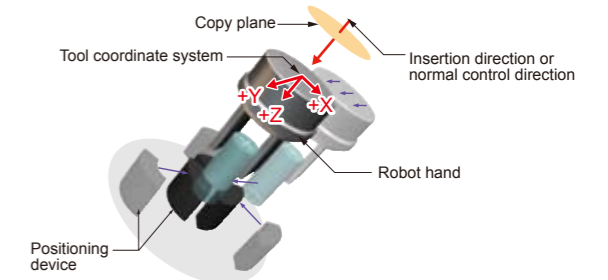● This is effective for standard operations and tooling work requiring high accuracy.

Load

Target track
With active gain control
Without active gain control

Monitor the robot posture and load conditions
Automatic tuning
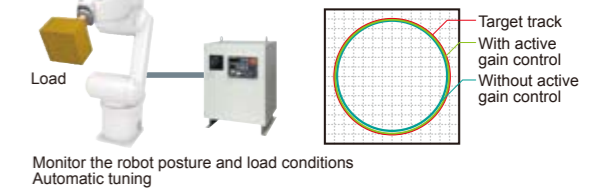
Improved trajectory accuracy

Improved vibration-damping performance

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.
● The amount of force generated through interference during chucking and workpiece insertion can be reduced, and external movement copying forces can 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.

Copy plane

Tool coordinate system

Insertion direction or normal control direction

+Y +Z +X

Robot hand

Positioning device

Reduce tooling cost

Shortened startup time

Automatic gravitation compensation

● Independent of the load fixture - if near the base or far away - the gravitation control positions the load always with the same accuracy. This supports the high precision robot arm.
● Calculates the amount of compensation needed based on the movement position, posture, and load conditions of the robot and compensates for any deflection automatically.
● This is effective for work transporting workpieces to cassettes with low pitch and palletizing work.

kθ

Δθ compensation

Automatic gravitation compensation
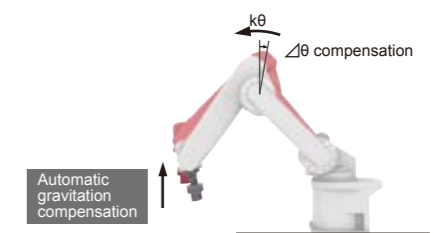
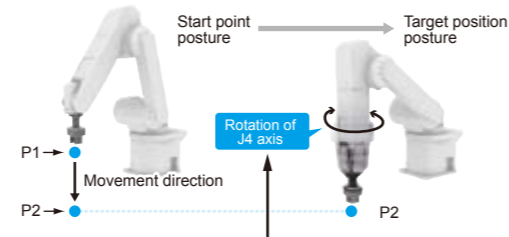**Improved palletization accuracy**

Improved trajectory accuracy

Function for passing through points of singularity

- The robot can pass through the singularity point, and the flexible layout can be achieved.
- Teaching operations can be performed easily as there is no longer any need to cancel operations due to the singularity point.

What is a singularity point?:
There is an unlimited number of angles at which one interpolation axis can be set for a given position, the posture of the robot changes when linear interpolation operations are performed using position data from a joint coordinate system. In this case the robot can't be operated at a assigned position and posture under normal conditions. The position at which this occurs is referred to as a singularity point.

| Expansion of the operating area |
| Easy to design |
| Shortened teaching operation times |

Start point posture → Target position posture

Rotation of J4 axis

P1
Movement direction
P2   P2

In moving from P1→P2, if the robot is passing the singularity point (J5 axis=0°) or a location in the vincinty at a constant posture, the J4 axis on the robot will rotate at high speed, unable to pass through it.

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 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.
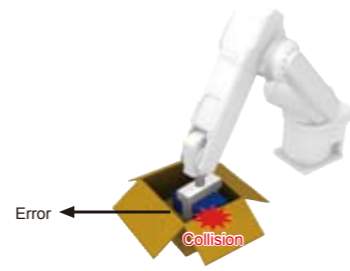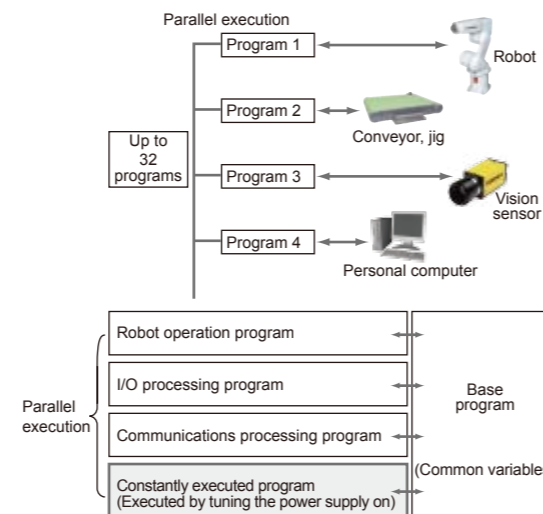
| Shortened startup time |
| Reduced tooling cost |
| Reduced line stop time |
| Reduced maintenance cost |

Error ← Collision

Multi-tasking function

- Division of tasks other than robot motion tasks, such as machine vision, external motion, and I/O can divided and executed in one of 32 slots at the same time.
- Reading external sensor data for example has no impact on robot motion processing or movement.
- Priority can be assigned to processes between programs.

Parallel execution

Program 1 → Robot
Program 2 → Conveyor, jig
Program 3 → Vision sensor
Program 4 → Personal computer

Up to 32 programs

Parallel execution:
- Robot operation program
- I/O processing program — Base program
- Communications processing program
- Constantly executed program (Executed by tuning the power supply on) — (Common variables)

| Shortened takt time |
| Reduce system costs |

Tracking function

- Transport, alignment, and installation work, etc. can be performed while robots are tracked with the workpiece on the conveyor without stopping the conveyor.
- Different variations can be selected, including vision tracking in combination with a vision sensor, tracking in combination with an opto-electric sensor, etc.
- Tracking can be performed simultaneously for more than one conveyor.
  (SQ series: up to 8 lines, SD series: up to 2 lines)
- Programs can be created easily in robot language (MELFA BASIC IV, V).
- Standard interface function. (For the SD series only. For the SQ series, prepare a separate Q173DPX motion unit for input of encoder signals).
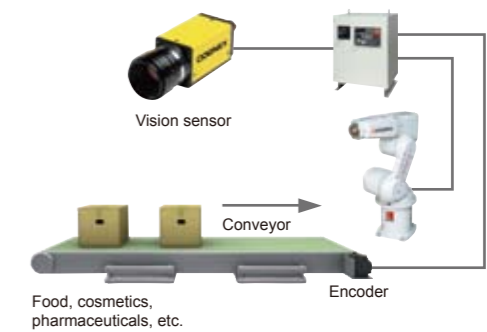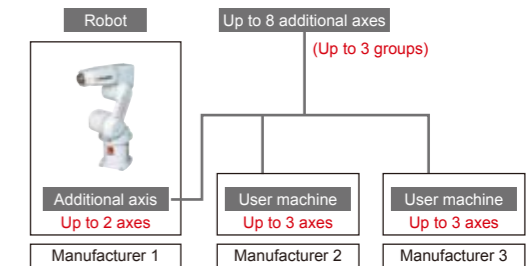
| No need for a positioning device |
| Improved operating tact |
| Reduce system costs |

Vision sensor

Conveyor

Encoder

Food, cosmetics, pharmaceuticals, etc.

Additional axis function

- Robot controller has plug-and-play connection to the MELSERVO-J3 servos.
- Up to 8 additional axes can be controlled by the controller.
- Additional axes and user machines can be operated from the robot program and teach pendant without any additional motion control hardware.
- Additional axis control is performed directly from the robot program.

| No need for separate motion control hardware |

Robot

Up to 8 additional axes
(Up to 3 groups)

Additional axis
Up to 2 axes
Manufacturer 1

User machine
Up to 3 axes
Manufacturer 2

User machine
Up to 3 axes
Manufacturer 3

Maintenance forecast function

- This function notifies users of when to complete maintenance tasks such as greasing, replacing belts, etc. Signals and warnings are output as notification at scheduled times set in advance.
- Data for load conditions during times when the robot is in an actual operating state is collected and analyzed so that the rate of usage of consumables such as grease and belts can be estimated and used in calculating replacement periods.
- System status can also be checked using the personal computer support software.

| Shortened line stop time |
| Reduce maintenance cost |

Consumable usage rate display screen (RT ToolBox2)

Safety features

● **Complies with the latest ISO-10218 (2006) standards for Robots and robotic devices--Safety requirements.**
● **Safety circuits (emergency stop circuits) can easily be installed for the customer's entire system, not just for the robot itself.**

| Reduce maintenance cost |

Enabling device input function
- Enabling devices can be connected in three different positions to protect the robot system and robot operators from accidents.
- The level of safety is increased due to collaborative robot control by multiple operators.
- All safety signals are redundant inputs.

Complies with safety standards

CE standards : European safety standards
- Compliant with the EMC Directive, 2004/108/EC
- Compliant with the EMC Directive, 2006/42/EC
- Compatible with devices with special specifications

UL standards : North American safety standards
- Compliant with UL/CSA standards
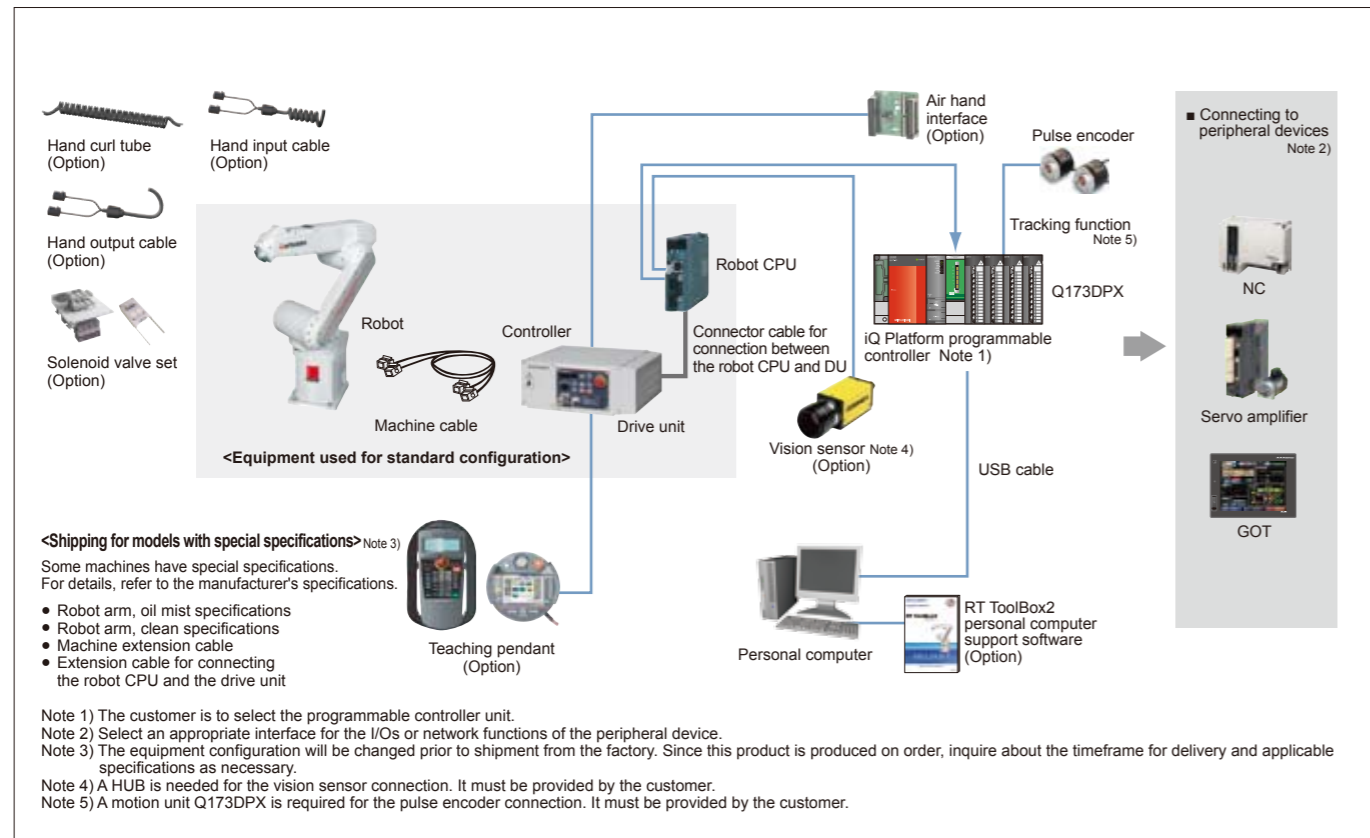- Compatible with devices with special specifications

| Improved safety |

Product Lineup · Robot Specifications · Controller Specifications · Features (SQ series) · Functions · System Configuration · Configurations Options · Support Software

SQseries

System Configuration iQ Platform

(Example with RV-6SQL)

Hand curl tube (Option)
Hand input cable (Option)
Hand output cable (Option)
Solenoid valve set (Option)

Air hand interface (Option)
Pulse encoder

Robot CPU
Robot
Controller
Connector cable for connection between the robot CPU and DU
Machine cable
Drive unit
iQ Platform programmable controller Note 1)
Q173DPX
Vision sensor Note 4) (Option)
USB cable

Tracking function Note 5)

■ Connecting to peripheral devices Note 2)

NC
Servo amplifier
GOT

<Equipment used for standard configuration>

Teaching pendant (Option)
Personal computer
RT ToolBox2 personal computer support software (Option)

<Shipping for models with special specifications> Note 3)
Some machines have special specifications.
For details, refer to the manufacturer's specifications.
- Robot arm, oil mist specifications
- Robot arm, clean specifications
- Machine extension cable
- Extension cable for connecting the robot CPU and the drive unit

Note 1) The customer is to select the programmable controller unit.
Note 2) Select an appropriate interface for the I/Os or network functions of the peripheral device.
Note 3) The equipment configuration will be changed prior to shipment from the factory. Since this product is produced on order, inquire about the timeframe for delivery and applicable specifications as necessary.
Note 4) A HUB is needed for the vision sensor connection. It must be provided by the customer.
Note 5) A motion unit Q173DPX is required for the pulse encoder connection. It must be provided by the customer.

SDseries

System Configuration

(Example of RV-3SDJ-SM)

Hand curl tube (Option)
Hand input cable (Option)
Hand output cable (Option)
Solenoid valve set (Option)

Tracking function
Ethernet
Air hand interface
Vision sensor
Parallel I/O unit
External I/O cable
Parallel I/O interface
External I/O cable
CC-Link interface

Robot
Controller
Machine cable
Expansion memory

■ Connecting to peripheral devices Note 1)

NC
Servo amplifier
Programmable controller
GOT

<Equipment used for standard configuration>

Controller protection box (Option)
Personal computer cable (Option)
Teaching pendant (Option)
Personal computer
RT ToolBox2 personal computer support software (Option)

<Shipping for models with special specifications> Note 2)
Some machines have special specifications.
For details, refer to the manufacturer's specifications.
- Robot arm, oil mist specifications
- Robot arm, clean specifications
- Machine extension cable

Note 1) Select an appropriate interface for the I/Os or network functions of the peripheral device.
Note 2) The equipment configuration will be changed prior to shipment from the factory. Since this product is produced on order, inquire about the timeframe for delivery and applicable specifications as necessary.

Configurations options   For details, refer to the specifications sheets.

Classification	Name	Type	RV 2SQ 2SD	RV 3SQ 3SQJ 3SD 3SDJ	RV 6SQ 6SQL 6SD 6SDL	RV 12SQ 12SQL 12SD 12SDL	RH 3SQHR 3SDHR	RH 6SQH 6SDH	12SQH 20SQH 12SDH 20SDH	Functional specifications
Robot arm	Solenoid valve set	1S-VD0□-01 (Sink) 1S-VD0□E-01 (Source)	–	–	–	O	–	–	–	1 to 4 valves, with solenoid valve output cable. □ indicates the number of solenoid valves (1, 2, 3, or 4 valves) Only 1- or 2-valve models available for RV-2SQ/2SD
		1S-VD0□-02 (Sink) 1S-VD0□E-02 (Source)	–	O	O	–	–	–	–	
		1S-VD0□M-03 (Sink) 1S-VD0□ME-03 (Source)	–	–	–	–	–	–	O	
		1S-VD0□M-04 (Sink) 1S-VD0□ME-04 (Source)	–	–	–	–	–	O	–	
		1S-VD0□-05 (Sink) 1S-VD0□E-05 (Source)	–	–	–	–	O	–	–	
		1E-VD0□ (Sink) 1E-VD0□E (Source)	O	–	–	–	–	–	–	
	Hand output cable	1S-GR35S-01	–	O	O	O	–	–	–	4-valve type, not terminated at one end 2-valve type, not terminated at one end, for RV-2SQ/2SD
		1S-GR35S-02	–	–	–	–	O	O	O	
		1E-GR35S	O	–	–	–	–	–	–	
	Hand input cable	1S-HC25C-01	–	O	O	O	–	–	–	8-point type with splash-proof grommet 4-valve type, not terminated at one end, for RV-2SQ/2SD * RH-20SQH/SDH 1000mm Arm: 1S-HC35C-03
		1S-HC35C-02	–	–	–	–	–	O	O*	
		1S-HC30C-11	O	–	–	–	–	–	–	
		1S-HC00S-01	–	–	–	–	O	–	–	
	Hand (curl) tube	1N-ST060□C	–	–	–	O	–	–	–	φ3 tube for RH-3SQHR/SDHR φ4 tube for RV-3SQ/SD, RV-6SQ/SD, and RH-6SQH/SD φ6 tube for RV-12SQ/SD and RH-12SQH/SDH, RH-20SQH/SDH □ indicates the number of sets (2, 4, 6, or 8 sets) φ4 tube for RV-2SQ/2SD, with 2 or 4 sets.
		1E-ST040□C	O	O	O	–	–	–	–	
		1E-ST0408C-300	–	–	–	–	–	O	–	
		1N-ST0608C	–	–	–	–	–	–	O	
		1S-ST0304S	–	–	–	–	O	–	–	
	Stopper for changing the J1-axis operating range	1S-DH-01	–	–	–	O	–	–	–	For changing the angle for 3SQ/SD (±30°, ±60°, ±90°, ±120°) For changing the angle for 6, 12SQ/SD (±45°, ±90°, ±135°) For changing the angle for 2SQ/SD (±90°, ±150°, ±210°) Installation is the responsibility of the customer.
		1S-DH-02	–	–	O	–	–	–	–	
		1S-DH-03	–	O	–	–	–	–	–	
		1S-DH-11J1	O	–	–	–	–	–	–	
		1S-DH-05J1	–	–	–	–	O	–	–	
	Stopper for changing the J2-axis operating range	1S-DH-11J2	O	–	–	–	–	–	–	For changing the angle for 2SQ/SD (±30°) Installation is the responsibility of the customer.
		1S-DH-05J2	–	–	–	–	O	–	–	
	Stopper for changing the J3-axis operating range	1S-DH-11J3	O	–	–	–	–	–	–	For changing the angle for 2SQ/SD (+70°) Installation is the responsibility of the customer.
	Machine cable (replacement for shorter 2-m type) Note 1)	1S-02UCBL-03	–	O	–	–	–	O	–	2 m (A 2-m cable is supplied instead of the standard 5-m one)
		1S-02CBL-1	–	–	O	–	–	–	–	
		1S-02UCBL-01	–	–	–	–	O	–	O	Special specifications
	Machine cable, for extension/fixed	1S-□□CBL-01	–	–	O	O	O	–	O	Extension type, extended length: 5 m, 10 m, 15 m □ indicates the length of the cable (5 m, 10 m, or 15 m) Replacement type for 2SQ/2SD: 10 m, 15 m
		1S-□□CBL-03	–	O	–	–	–	O	–	
		1S-□□CBL-11	O	–	–	–	–	–	–	
	Machine cable, for extension/flexible	1S-□□LCBL-01	–	–	O	O	O	–	O	
		1S-□□LCBL-03	–	O	–	–	–	O	–	
		1S-□□LCBL-11	O	–	–	–	–	–	–	

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

Classification	Name	Type	SQ	SD	Functional specifications
Controller	Standard teaching pendant (7m, 15m)	R32TB(-**)	O	O	7 m: Standard, 15 m: Custom ("-15" is included in the model name)
	High-function teaching pendant (7 m, 15 m)	R56TB(-**)	O	O	7 m: Standard, 15 m: Custom ("-15" is included in the model name)
	Air hand interface (Sink type) (Source type)	2A-RZ365 2A-RZ375	O	O	8 output points, used exclusively for hand 24 VDC, 0.1 A/point
	On-board Parallel I/O interface (Sink type) (Source type)	2D-TZ368 2D-TZ378	–	O	32 output points (12/24 VDC: 0.1 A/point) 32 input points (12 VDC: 3 mA, 24VDC: 7 mA)
	On-board Parallel I/O cable (5m, 15m)	2D-CBL**	–	O	CBL05: 5 m, CBL15: 15 m, not terminated at one end. For 2D-TZ368/378.
	Remote Parallel I/O (Sink type) (Source type)	2A-RZ361 2A-RZ371	O	O	32 output points (12/24 VDC: 0.1 A/point) 32 input points (12 VDC: 3 mA, 24VDC: 7 mA)
	Remote Parallel I/O cable (5m, 15m)	2A-CBL**	–	O	CBL05: 5 m, CBL15: 15 m, not terminated at one end. For 2A-RZ361/371.
	CC-Link interface	2D-TZ576	–	O	CC-Link Intelligent device station, Ver. 2.0, 1 to 4 stations
	Key switch extension cable	2D-KEY-CBL**M	O	–	Key switch that can be connected to the key switch interface. (For CR1QA-772) ** indicates the cable length, where 05 = 5 m, 10 = 10 m, and 15 = 15 m.
	TB extension cable	2D-EXTB-CBL**M	O	O	Extension cable for connecting to the teaching pendant. ** indicates the cable length, where 05 = 5 m, 10 = 10 m, and 15 = 15 m.
	Expansion memory	2D-TZ454	–	O	User program area with expansion memory: 2 MB (For SD series only)
	Controller protection box *1	CR1D-MB	O	O	With a built-in CR1QA-7XX/CR1DA-7XX for improved dust-proofing.
	Personal computer support software	RT ToolBox2	O	O	With simulation function (CD-ROM)
	Personal computer support software -mini	RT ToolBox2 mini	O	O	Simple version (CD-ROM)
	Personal computer cable	2D-232CBL03M	–	O	RS-232 cable for PC-AT compatible machine, 3 m
	Simulator	MELFA-Works	O	O	Layout study/Takt time study/Program debug. Add-in software for Solidworks® *2
Service part	Backup battery	A6BAT	O	O	Installed in the robot arm (Quantity: Differs by model type)
		Q6BAT	O	O	Installed in the controller (Quantity: 1 pc.)

*1: This only applies to CR1QA-7xx/CR1DA-7xx. Please ask a sales representative for details at the time of purchase.   *2: SolidWorks® is a registered trademark of SolidWorks Corporation (USA).

Product Lineup
Robot Specifications
Controller Specifications
Features (SQ series)
Functions
System Configuration
Configurations Options
Support Software

Support Software

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, and Windows®Vista.

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.

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.

Advanced maintenance functions
- The software has a maintenance function that notifies the operaters 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.
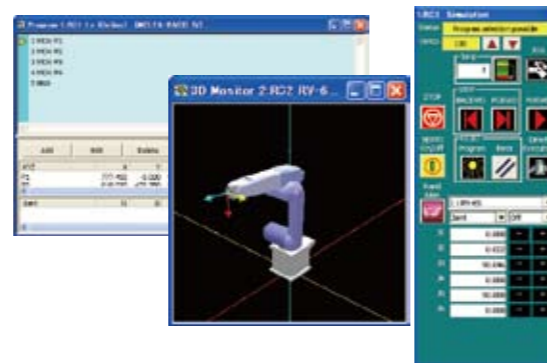
■ Program editing and debugging functions

Creation of programs in MELFA-BASIC IV and 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.
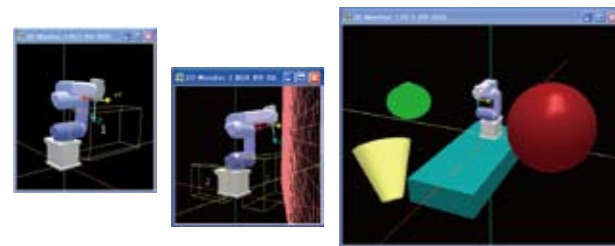
#### ■ Simulation functions

Check the robot movements and measurement the tact time for designated parts of a program can be realized with running the program.

■ Monitor functions

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

■ Maintenance functions

This function is for maintenance and includes maintenance forecast and position recovery support functions, a parameter management function, etc.
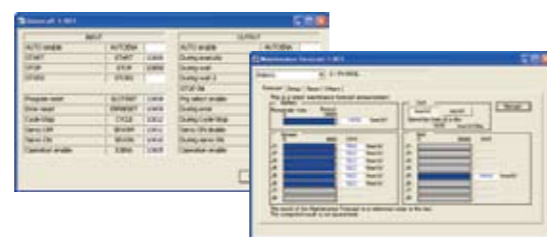
*1: MELFA-BASIC is a programming language that further expands upon and develops the commands needed for robot control. In MELFA-BASIC IV/V, the expansion of the command as well as parallel processing or structuring that were difficult to realize in BASIC language can make it possible to operate MELFA 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 up
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 M_In (12) =1 'Wait for a signal
Mov Pput,-80   'Move the workpiece position up
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.

MELFA-Works is an add-in tool that runs under solid-works,
used for simulating production systems using robots on personal computers,
converting processing paths defined for workpieces to data and outputting this data.

What is MELFA-Works?

MELFA-Works is an add-in tool (*1) for 3D CAD SolidWorks® (*2) software (hereinafter, SolidWorks®). Adding MELFA-Works into the SolidWorks® platform adds to and expands 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/ENGINEERR
- CGR (CATIARgraphics)
- Unigraphics
- PAR (Solid Edge TM)
- IPT (Autodesk Inventor)
- DWG
- DXFTM
- STL
- VRML
- VDA-FS
- Machanical 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

MELFA-Works   SolidWorks®   RT-ToolBox2 (mini)

Calibration tool
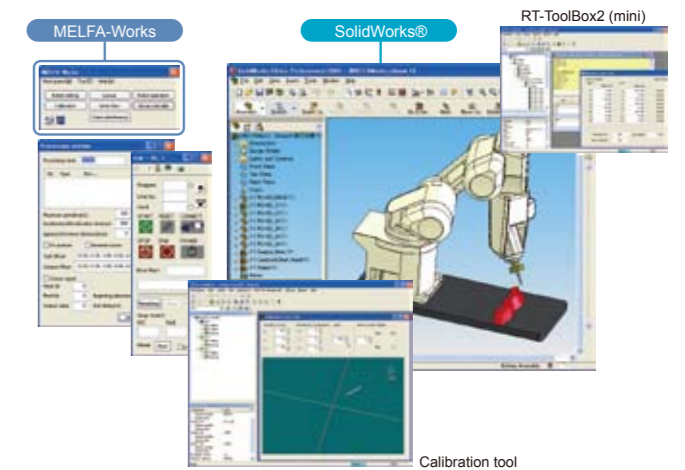
— List of functions —

Loading of part data from peripheral devices and rearrangement

Part data created in Solidworks® can be loaded.
The ositions of loaded parts can be rearranged relative to the CAD origin and otherparts.
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

Programs used with actual robots can be used as is.
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 space as trace lines.

Interference checks

Interference between the robot and peripheral devices can be checked. A target of interference check can be specified simply by clicking 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 occured, and corresponding robot position) can be saved to a log.

Saving of video data

Simulated momements 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 measurement the cycle time of a specified part in a program.

Robot program debugging functions

The following functions are provided to help you debug 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 you normally jog a robot using a teaching pendant.

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