



Mitsubishi Electric Corporation **Industrial** Robot

# MELFA Technical News

BFP-A6079-0214E-\*

January 2018

**Subject:** Precautions of replacement from RV-12SD/12SDL to RV-13FR-D/RV-13FRL-D

**Applicable to:** RV-12SD, RV-12SDL  
RV-13FR-D, RV-13FRL-D

Thank you for your continued support of Mitsubishi industrial MELFA series robots.

This Technical News explains in detail the precautions for the replacement of **RV-12SD/12SDL** vertical multiple-joint type robots with **RV-13FR-D/RV-13FRL-D** robots.

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## Precautions for the replacement of RV-12SD/12SDL with RV-13FR-D/RV-13FRL-D.

### 1. Configurations of the models

The following shows the compatible models of robot arms and controllers for the replacement of RV-12SD/12SDL to RV-13FR-D/RV-13FL-D.

Model	Controller	Model	Controller
RV-12SD	CR2DA-701, CR3D-701M	RV-13FR-D	CR800-13VD
RV-12SDL	CR2DA-701, CR3D-701M	RV-13FRL-D	CR800-13VD

### 2. Specifications

#### 2.1 Specifications of the robot arm

The following table compares the robot arm specifications between old and new models.

Type	Unit	Specifications			
		Old model		New model	
Model	-	RV-12SD/12SDC	RV-12SDL/12SDLC	RV-13FR/13FRM/13FRC-D	RV-13FRL/13FRLM/13FRLC-D
Machine class	-	None: Standard (oil mist) *1/ C: Clean *2		None: Standard/ M: Oil mist *1/ C: Clean *2	
Protection degree	-	Standard: IP65 (J4 to J6), IP54 (J1 to J3)/ C: Class 10 (0.3 μm)		Standard: IP40 / M: IP67 / C: ISO class 3	
Degree of freedom	-	6		6	
Installation style	-	Floor type, ceiling type, (wall type*3)		Floor type, ceiling type, (wall type*3)	
Structure	-	Vertical multiple-joint type		Vertical multiple-joint type	
Drive system	-	AC servo motor		AC servo motor	
Position detection method	-	Absolute encoder		Absolute encoder	
Maximum load capacity *4 (rating load capacity)	kg	12 (10)		13 (12)	
Maximum reach radius	mm	1,086	1,385	1,094	1,388
Operating range	J1	340 (±170)		380 (±190)	
	J2	230 (-100 to +130)		240 (-90 to +150)	
	J3	290 (-130 to +160)		167.5 (-10 to +157.5)	
	J4	320 (±160)		400 (±200)	
	J5	240 (±120)		240 (±120)	
	J6	720 (±360)		720 (±360)	
Maximum speed	J1	276	230	290	234
	J2	230	172	234	164
	J3	267	200	312	219
	J4	352		375	
	J5	375		375	
	J6	660		720	
Maximum composite speed *5	mm/sec	9,600	9,500	10,450	9,700
Cycle time *6	sec	0.66	0.74	0.53	0.68
Positioning repeatability	mm	±0.05		±0.05	
Ambient temperature	°C	0 to 40		0 to 40	
Mass	kg	93	98	120	130
Tolerable moment	J4	19.3		19.3	
	J5	19.3		19.3	
	J6	11		11	
Tolerable inertia	J4	0.4		0.47	
	J5	0.4		0.47	
	J6	0.14		0.14	
Tool wiring	-	Hand: 8 input points/8 output points (forearm), 8 spare wires: AWG#27 (0.1mm <sup>2</sup> )		Hand: 8 input points/8 output points Serial signal cable for multi-function hand and force sensor (24-pin) LAN × 1<100BASE-TX> (8-pin)	
Tool pneumatic piping	-	Primary: φ6 × 2 Secondary: φ6 × 8		Primary: φ6 × 2 Secondary: φ6 × 8, φ4 × 4	
Machine cable	-	7m (connector on both ends)		5m (connector on both ends) *7	
Paint	-	Color: Light gray (Reference Munsell color: 0.08GY7.64/0.81)		Color: Light gray (Reference Munsell color: 0.6B7.6/0.2)	

\*1 Please contact a Mitsubishi Electric dealer beforehand since the environmental resistance may not be secured depending on the characteristics of oil you use.

In addition, an air purge is required.

\*2 Cleanliness levels depends on conditions of a downstream flow of 0.3m/s around the robot and internal robot suctioning.

A φ8-mm coupler for suctioning is provided at the back of the base.

\*3 The wall type specification is special because operating range of the J1 axis is restricted.

\*4 Use the robot in the condition where the hand faces downward and it moves within the range of ±10°.

\*5 The speed is determined on the mechanical interface side when composing all axes.

\*6 The cycle time is based on back-and-forth movement over a vertical distance of 25mm and horizontal distance of 300mm with a load of 5kg.

\*7 For the new model, the machine cable is shortened to 5m.

## Precautions of replacement from RV-12SD/12SDL to RV-13FR-D/RV-13FRL-D

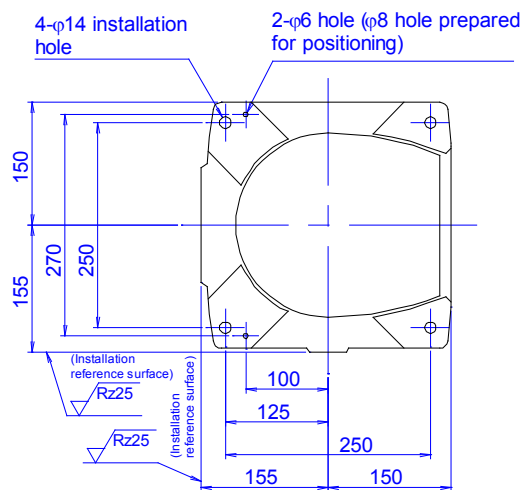
### 2.2 Dimensions of the robot arm and diagram of the operating range

#### 2.2.1 Robot arm installation dimensions and mechanical interface

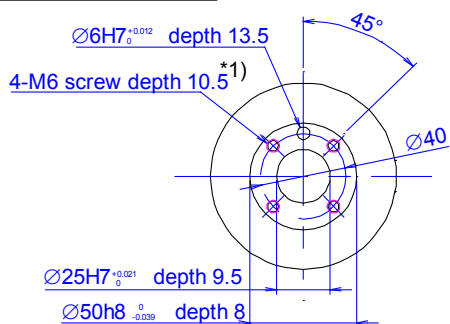
The installation dimensions and mechanical interface have changed. Refer to the following diagrams.

#### Old models: RV-12SD/12SDL

##### Installation dimensions of the robot arm



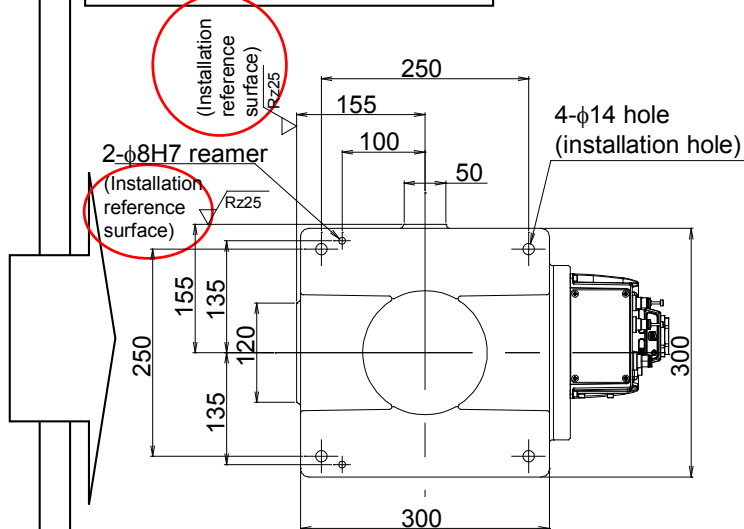
##### Mechanical interface



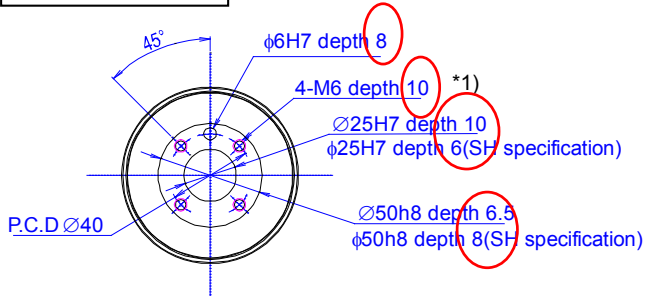
\*1) Thread engagement should be within 9 to 10mm.

#### New models: RV-13FR-D, RV-13FRL-D

##### Installation dimensions of the robot arm



##### Mechanical interface



\*1) Thread engagement should be within 9 to 10mm.

2.2.2 Dimensions of the robot arm and diagram of the operating range

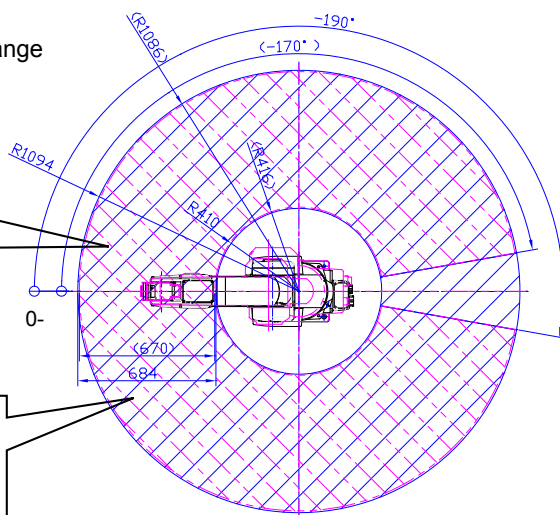
1) Comparison between RV-13FR-D and RV-12SD

The major differences in dimensions of the robot and operating range are described below.

- RV-12SD can be replaced with RV-13FR-D because its operating range is within the one of RV-13FR-D.
- For the reverse area of RV-12SD, refer to caution 1 below.

RV-13FR-D  
Shaded area with lines upward to the right  
(Area in  $-190^\circ$  to  $+190^\circ$ )

RV-12SD  
Shaded area with lines upward to the left  
(2-dot chain line)  
(Area in  $-170^\circ$  to  $+170^\circ$ )



RV-13FR-D

RV-12SD

Robot installation surface

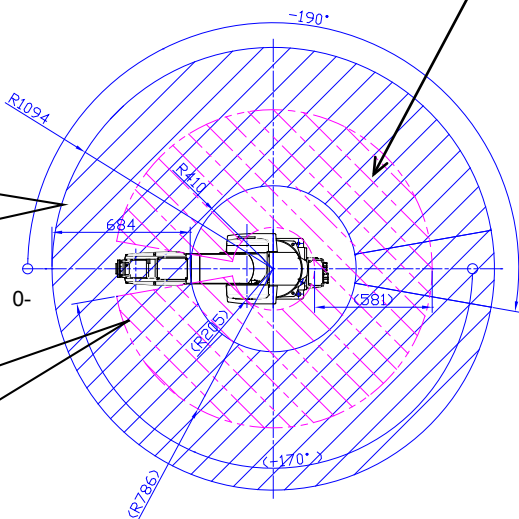
Arm downward facing singular point boundary line

Arm downward facing limit line

Caution 1: The reverse area of RV-12SD is supported by the combination of the J1-axis operating area ( $\pm 190^\circ$ ) and forward operating area of RV-13FR-D.

RV-13FR-D  
Shaded area with lines upward to the right  
(Area in  $-190^\circ$  to  $+190^\circ$ )

RV-12SD reverse area  
Shaded area with lines upward to the left  
(2-dot chain line)  
(Area in  $-170^\circ$  to  $+170^\circ$ )

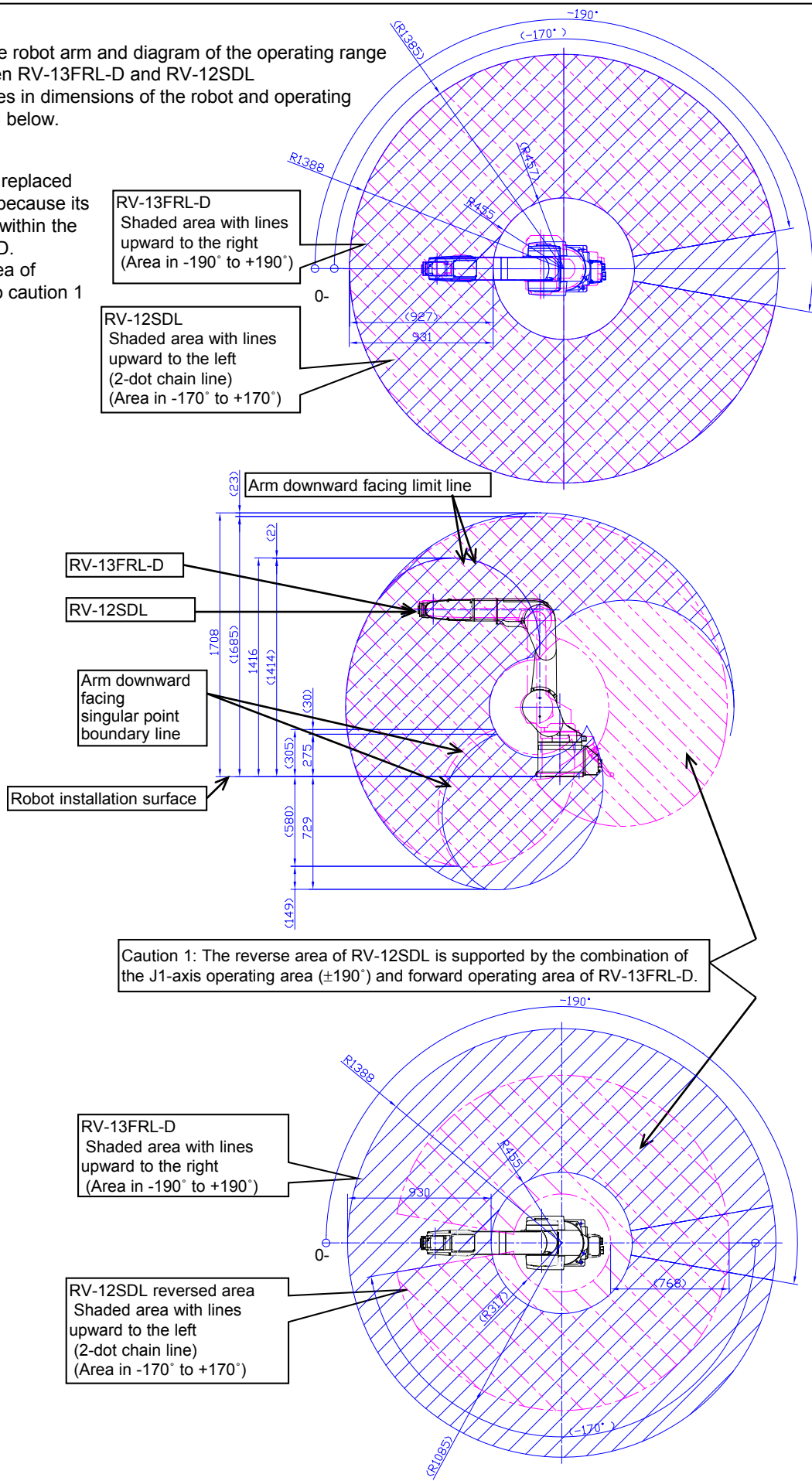


2.2.2 Dimensions of the robot arm and diagram of the operating range

1) Comparison between RV-13FRL-D and RV-12SDL

The major differences in dimensions of the robot and operating range are described below.

- RV-12SDL can be replaced with RV-13FRL-D because its operating range is within the one of RV-13FRL-D.
- For the reverse area of RV-12SDL, refer to caution 1 below.



### 2.3 Specifications of the controller

Please note that the controller model is new, and the dimensions and others have changed. For the details, refer to the following.

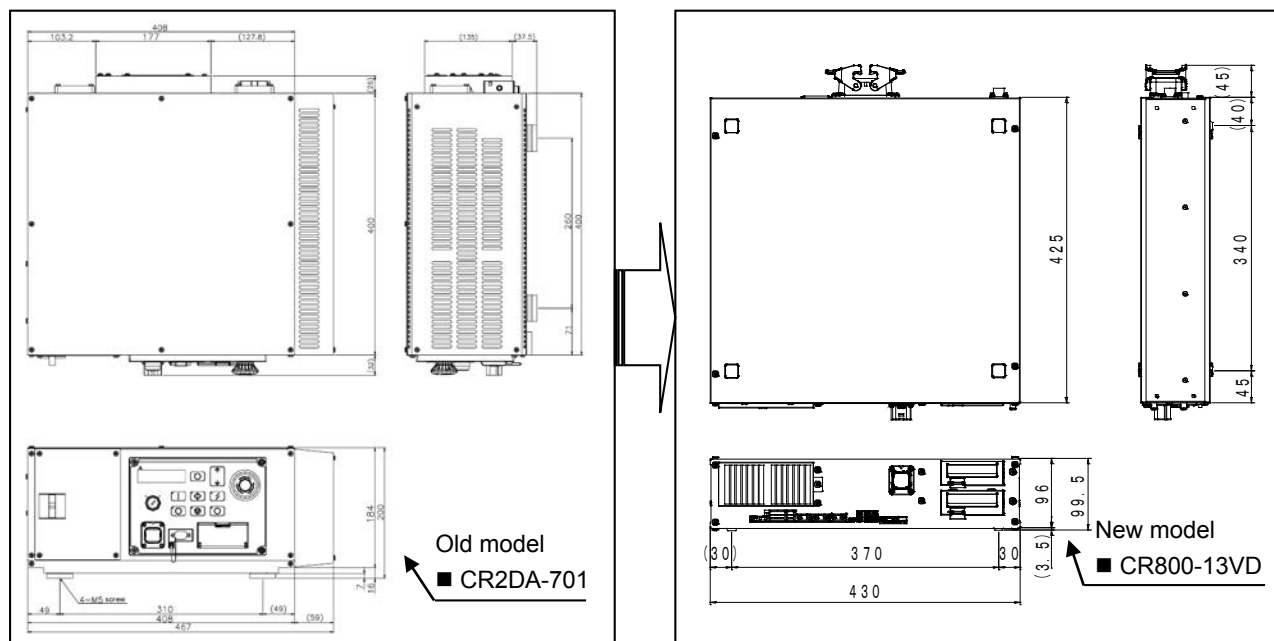
Item	Unit	Specifications			
		Old models		New model	
		RV-12SD/12SDL	RV-12SD/12SDL-SM6	RV-13FR/13FRL-D	
Controller model		CR2DA-701	CR3D-701M	CR800-13VD	
Routing control method		PTP control, CP control		PTP control, CP control	
Number of control axis		Simultaneously 6		Simultaneously 6	
Programming language		MELFA-BASIC IV, V		MELFA-BASIC V, VI	
Memory capacity	Programmed positions	point	13,000	39,000	
	Number of steps	step	26,000	78,000	
	Number of programs		256	512	
External input/output (standard)	General-purpose input/output	point	Input 0/output 0(Max. 256/256: option)		
	Dedicated input/output		Assigned to general-purpose input/output		
	Dedicated stop input		1	1	
	Hand open/close		Input 8/output 0 (when using pneumatic hand interface: 8/8)		
	Emergency stop input		1 (duplication)	1 (duplication)	
	Door switch input		1 (duplication)	1 (duplication)	
	Enabling device input		1 (duplication)	0	
	Emergency stop output		1 (duplication)	1 (duplication)	
	Mode output		1 (duplication)	1 (duplication)	
	Robot error output		1 (duplication)	1 (duplication)	
	Mode output selector input		0	1 (duplication)	
	Additional axis synchronization		1 (duplication)	1 (duplication)	
	Interface	RS-232	port	1	-
		RS-422	port	1 (for T/B)	1 (for T/B)
Ethernet		port	1 (for T/B)/ 1(for customer)	10BASE-T/100BASE-TX	
USB		port	1	1	
Memory expansion slot		SLOT	1	-	
Expansion slot		SLOT	3	2	
Robot input/output link		ch	1	1	
Additional axis function		ch	1 (SSCNETIII)	1 (SSCNETIII/H)	
Input power supply	Voltage range	V	Single phase, 180 to 253 VAC (*1)	Three-phase, 180 to 253 VAC (*1)	
	Power capacity	kVA	3	3	
Outside dimensions	mm	470(W)×400(D)×200(H)	450(W)×440(D)×625(H)	430(W)×425(D)×99.5(H)	
Mass	kg	Approx. 21	Approx. 60	Approx. 12.5	
Construction [Protection specification]		Self-contained floor type, open type [IP20]	Self-contained floor type, closed type [IP54]	Self-contained floor type, open type, available vertically or horizontally [IP20]	
Grounding	W	100 or less (D class grounding)		100 or less (D class grounding)	

\*1: The rate of power-supply voltage fluctuation is within 10%.

### 2.4 Outside dimensions of the controller

The controller's outside dimensions have changed.

(Left drawing: RV-12SD/12SDL controller, right drawing RV-13FR-D, RV-13FRL-D controller)



Note: Dimensions of the oil mist compatible controller

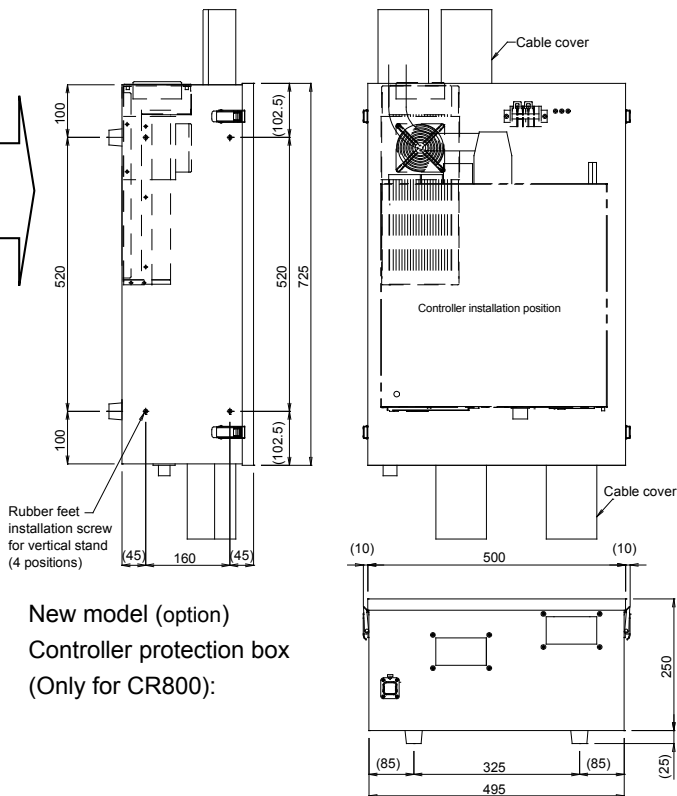
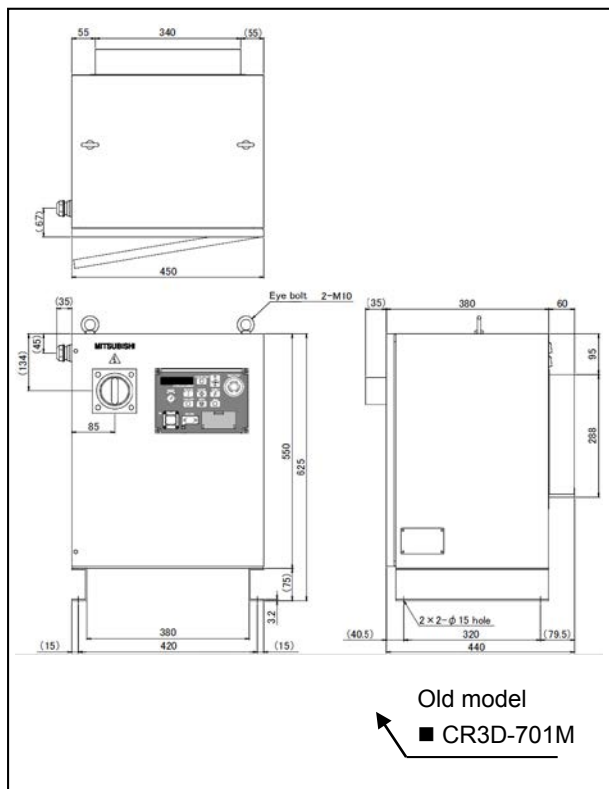
Left drawing: RV-12SD/12SDL-SM6 controller, right drawing RV-13FR-D, RV-13FRL-D controller and controller protection box

• Dimensions of the oil mist compatible controller

(4) CR800-D controller protection box

Put the CR800-D controller into the controller protection box to conform with IP54 protective construction.

■ CR800-MB



## 2.5 Options

## (1) Robot arm options comparison

Item	Specifications			Compatibility
	Old models	New models	Specifications and supplementary explanation	
	RV-12SD/12SDL	RV-13FR-D, RV-13FRL-D		
Solenoid valve set	1S-VD0□-01 (Sink type) 1S-VD0□E-01 (Source type) □: 1 to 4	1F-VD0□-03 (Sink type) 1F-VD0□E-03 (Source type) □: 1 to 4	Solenoid valve set for the pneumatic hand (1 to 4 sets, sink type) Solenoid valve set for the pneumatic hand (1 to 4 sets, source type)	×
Hand output cable	1S-GR35S-01	1F-GR35S-02	The robot side has a connector, and the other side has output cables for unprocessed solenoid valve connection. (Total length: 300mm)	×
Hand input cable	1S-HC25C-01	1F-HC35S-02	The robot side has a connector, and the other side has input cables for unprocessed hand sensor connection. (Total length: 300mm)	×
Hand curl tube	1N-ST06□C	1N-ST06□C	φ6 x □ pics, curl pneumatic tube for solenoid valve connection, □ indicates the number of tubes (02, 04, 06, 08)	○
External wiring set 1 for the forearm	-	1F-HB01S-01	For forearm: An external wiring box to which the hand input cable, Ethernet cable, and electrical hand/force sensor cable are connected	-
External wiring set 2 for the forearm	-	1F-HB02S-01	For forearm: An external wiring box to which the force sensor, electrical hand, and Ethernet cable are connected	-
External wiring set 1 for the base	-	1F-HA01S-01	For base: An external wiring box to which the electrical hand communication signal output, electrical hand/force sensor cable, and Ethernet cable are connected Hand input provided.	-
External wiring set 2 for the base	-	1F-HA02S-01	For base: An external wiring box to which the electrical hand communication signal output, electrical hand, force sensor, and Ethernet cable are connected Hand input not provided.	-
2m machine cable (replacement type)	-	1S-02UCBL-01	Fixed type (Set of 2 cables for power supply and signals), 2m (Provided as substitute for standard 5m cables.)	-
Machine cable (replacement type)	-	1F-□□ UCBL-41 □□: 02, 10, 15, 20	Fixed type: 2m, 10m, 15m, 20m	-
Machine cable (replacement type)	-	1F-□□UCBL-41 □□: 10, 15, 20	Flexed type: 10m, 15m, 20m	-
Machine cable extension (Fixed type)	1S-□□CBL-01 □□: 05, 10, 15	-	Fixed type (Set of 2 cables for power supply and signals), 5m, 10m, 15m (Used for adding to standard 5m cables.)	-
Machine cable extension (Flexed type)	1S-□□LCBL-01 □□: 05, 10, 15	-	Flexed type (Set of 2 cables for power supply and signals), 5m, 10m, 15m (Used for adding to standard 5m cables.)	-

Meaning of symbols in table: ○: Same product, ×: Incompatible, -: Not supported

## (2) Robot controller options comparison

Item	Specifications		CR*DA-7***/CR800-D compatibility	Remarks
	Old models CR2DA-701 CR3D-701M	New model CR800-13VD		
Pneumatic hand interface	2A-RZ365 (Sink) 2A-RZ375 (Source)	☆	○	
Expansion I/O unit	2A-RZ361 (Sink) 2A-RZ371 (Source)	2A-RZ361 (Sink) 2A-RZ371 (Source)	○	
External I/O cable	2A-CBL□□	2A-CBL□□	○	For expansion I/O unit
Build-in I/O interface	2D-TZ368 (Sink) 2D-TZ378 (Source)	2D-TZ368 (Sink) 2D-TZ378 (Source)	○	
CC-Link interface	2D-TZ576	2D-TZ576	○	Ver. 2 compatible
Additional axis interface	☆	☆	☆	
Tracking function	☆	☆	☆	
Expansion serial interface	-	☆	☆	
Expansion memory	2D-TZ454	-	-	
Controller protection box	-	CR800-MB	×	
Teaching box		R32TB	○	
High-functionality teaching box		R56TB	○	
RS-232 cable (for PC support)	2D-232CBL03M	-	-	
Force sensor set	-	4F-FS002H-W200/4F-FS002H-W1000	-	
PC support software	3D-1□C-WINJ	3F-14C-WINJ	-	RT ToolBox3 Standard
		3F-15C-WINJ	-	RT ToolBox3min
		3F-16D-WINJ	-	RT ToolBox3Pro
Simulator (MELFA-Works)	3D-21C-WINJ		-	

Meaning of symbols in table ○: Compatible, ☆: Standard equipment, ×: Incompatible, -: Not supported



### 3. Compatibility

The following table provides compatibility between old and new models.

#### 3.1 Compatibility of the robot arm

Category	Item	Specifications		Compatibility	Remarks
		Old models	New models		
		RV-12SD/12SDL	RV-13FR-D, 13FRL-D		
Outside dimensions	Installation dimensions	Changed		△	Although the base dimensions are compatible, the effect on the BOX must be considered.
	Mechanical interface	Changed		○	Compatible if however, note that the screw depth and hole depth are changed.
	Operating range	Changed		△	Compatible if the operating range of the old model is within that of the new model under a standard use condition. However, when the old model is used in the reverse operating range, check if this range can be replaced with the operating range of the new model.
Tooling	Hand wiring	Changed		×	
	Hand piping	No change		○	
	Backup wiring	Changed		×	
Maintenance	Backup battery	A6BAT	MR-BAT6V1	×	

Meaning of symbols in the table: ○: Fully compatible, ×: Incompatible, △: Partially compatible

#### 3.2 Compatibility of the controller

Category	Item	Specifications		Compatibility	Remarks
		Old models	New model		
		CR2DA-701 CR3D-701M	CR800-13VD		
Operation	TB	R32TB		○	
	High-functionality TB	R56TB		○	
	I/O map	0 to 9999	0 to 9999	○	
	Programming language	MELFA-BASIC V	MELFA-BASIC VI	×	
	PC support software	RT ToolBox2	RT ToolBox3	×	
Maintenance	Backup battery	Q6BAT	-	×	

Meaning of symbols in the table: ○: Fully compatible ×: Incompatible

#### Precautions of controller specifications

Item	Specifications	
	Old models	FR series
	CR2DA-701/CR3D-701M	CR800-13VD
Robot language	MELFA-BASIC IV MELFA-BASIC V	MELFA-BASIC IV cannot be used directly. (RT3 converts MELFA-BASIC IV into MELFA-BASIC V or VI.) MELFA-BASIC V MELFA-BASIC VI (upper-compatible of MELFA-BASIC V) * In MELFA-BASIC VI, the description method of program is the same as MELFA-BASIC V unless the Function or Include commands are used.
Serial number of robot	Necessary to input (by using the T/B or RT2)	Not necessary to input (The data has been stored in the robot's internal ROM.)
Origin setting	Necessary to input (by using the T/B or RT2)	Not necessary to input (The data has been stored in the robot's internal ROM.)
Hand type	Sink type (initial value) It is necessary to set a parameter for selecting the source type.	Not set (initial value) It is necessary to select either sink or source type by setting a parameter. (If not set, an error will occur.)
Mode selector input	Provided	Provided (Customer needs to prepare a mode selector switch) Recommended key switch: HA1K-2C2A-2 (manufactured by IDEC)
Enabling device switch input	Provided	Not provided
Battery	Using (Q6BAT, 1 pc.)	Not using (Not necessary to replace the battery)
TB dummy connector	Necessary	Not necessary After deadman turns on, the T/B can be removed without stopping the robot even during operation.

#### 3.3 Precautions of the extension function for GOT direct connection

The start addresses of the GOT shared memory (CPU buffer memory) I/O are different between old and new models.

Item	Specifications		Remarks
	Old models	FR series	
	CR2DA-701 /CR3D-701M	CR800-13VD	
GOT output start address (to robot)	U3E0\G10000	U3E0\G0	
Robot input signal start address	10000	10000	
Robot output signal start address	10000	10000	
GOT input start address (from robot)	U3E1\G10000	U3E1\HG0	
Memory configuration	Shared memory among GOTs	CPU buffer memory	