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Mitsubishi Electric Corporation **Industrial** Robot

MELFA Technical News

BFP-A6079-0320E-*

December 2022

Subject: Precautions of replacement from RV-2SD(B) to RV-2FR(B)-D/2FRL(B)-D

Applicable to: RV-2SD, RV-2SDB
RV-2FR-D, RV-2FRB-D, RV-2FRL -D, RV-2FRLB -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-2SD(B)** vertical multiple-joint type robots with **RV-2FR-D** or **RV-2FRL-D** robots.

Contents

Precautions for the replacement of RV-2SD(B) with RV-2FR(B)-D or RV-2FRL(B)-D.

1. Configurations of the models (Compatible model for replacement)

The following shows the compatible models of robot arms and controllers for the replacement of RV-2SD(B) to RV-2FR(B)-D or RV-2FRL(B)-D.

Model	Controller
RV-2SD	CR1DA-771
RV-2SDB	

Model	Controller
RV-2FR-D	CR800-02VD
RV-2FRL-D	
RV-2FRB-D	
RV-2FRLB-D	

2. Specifications comparison

2.1 Specifications of the robot arm

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

Type		Unit	Specifications			
			Old models		FR series	
Model			RV-2SD	RV-2SDB	RV-2FR(B)-D	RV-2FRL(B)-D
Protection degree			Standard: IP30		Standard: IP30	
Degree of freedom			6		6	
Installation style			Floor type, ceiling type, (wall type Note 3)		Floor type, ceiling type, (wall type Note 3)	
Structure			Vertical multiple-joint type		Vertical multiple-joint type	
Drive system			AC servo motor (withJ2、J3、J5 axis brake)	AC servo motor (with all axes brake)	AC servo motor (RV-2FR/2FRL：withJ2、J3、J5 axis brake) (RV-2FRB/2FRLB：(with all axes brake))	
Position detection method			Absolute encoder		Absolute encoder	
Load capacity		kg	Rating2.0、Maximum3.0		Rating2.0、Maximum3.0	
Arm length		mm	230+270		230+270	310+335
Maximum reach radius		mm	504		504	649
Maximum reach radius	J1	degree	480（±240）		480（±240）	
	J2		240(±120)		240(±120)	237(-117～+120)
	J3		160(0～+160)		160(0～+160)	
	J4		400(±200)		400（±200）	
	J5		240（±120）		240（±120）	
	J6		720（±360）		720（±360）	
Maximum reach radius	J1	degree /sec	225		300	225
	J2		150		150	105
	J3		275		300	165
	J4		412		450	412
	J5		450		450	
	J6		720		720	
Maximum composite speed Note 1)		mm/sec	4400		4950	4200
Cycle time Note 2)		sec	0.6～0.7		0.6second range	0.7second range
Positioning repeatability		mm	±0.02		±0.02	
Ambient temperature		℃	0～40		0～40	
Mass		kg	19		19	21
Tolerable moment	J4	N･m	4.17		4.17	
	J5		4.17		4.17	
	J6		2.45		2.45	
Tolerable inertia	J4	kg･m2	0.18		0.18	
	J5		0.18		0.18	
	J6		0.04		0.04	
Tool wiring			Hand: 4 input points/4 output points Note 4)		Hand: 4 input points/4 output points	
Tool pneumatic piping			Primary:φ4×4		Primary: φ4×4	
Machine cable			5m (connector on both ends)		5m (connector on both ends)	
Paint			Color: Light gray (Reference Munsell color: 0.08GY7.64/0.81)		Color: Light gray (Reference Munsell color: 0.6B7.6/0.2)	

Note 1) Value of mechanical interface side when synthesizing all axes

Note 2) Value of 1kg of load and back-and-forth movement for a vertical distance of 25mm and horizontal distance of 300mm

Note 3) In the wall type specification, operation range of the J1-axis is restricted.

Note4) The pneumatic hand interface (option) is required when the tool (hand) output is used. Also, if the

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 of the robot body and the shape and dimensions of the mechanical interface are the same.

RV-2FRL-D has a different motion range from RV-2SD due to the difference in arm 1 and arm 2 lengths and J2 axis motion range.

2.2.2 Operating Range

RV-2SD and RV-2FR-D have the same outer shape and the same operating range for each axis.

RV-2FRL-D has a different motion range from RV-2SD due to the difference in arm 1 and arm 2 lengths and J2 axis motion range.

For details, please refer to the RV-2FRL specifications.

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		単位	仕 様 値	
			従来機種	FRシリーズ
			RV-2SD	RV-2FR-D,RV-2FRL-D
Controller model			CR1DA-771	CR800-02VD
Routing control method			PTP control, CP control	PTP control, CP control
Number of control axis			Simultaneously 6	Simultaneously 6
Programming language			MELFA-BASICⅣ、Ⅴ	MELFA-BASICⅤ、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 I/F(standard)	General-purpose input/output	point	Input 0/output 0□(Max. 256/256: option)	Input 0/output 0□(Max. 256/256: option)
	Dedicated input/output		Assigned to general-purpose input/output	Assigned to general-purpose input/output
	Dedicated stop input		1	1
	Hand open/close		Input 4/Output0 (when using pneumatic hand interface：4/4)	Input4/Output4
	Emergency stop input		1 (duplication)	1 (duplication) Note 1)
	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 selector switch 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	1 (For T/B)/ 1(For customer) 10BASE-T/100BASE-TX/1000BASE-T
	USB	port	1	1
	Hand dedicated slot	SLOT	1	—
	Expansion slot	SLOT	1	2
	Remote I/O	ch	1	1
	Additional axis function	ch	1 (SSCNETⅢ)	—
	Additional axis function /Force sense Function	ch	—	1 (SSCNETⅢ/H) Note 2)
	Encoder input	ch	1	2
	SD Memory Card	SLOT	—	1
Input powe	Voltage range	V	Single phaseAC180～253 Note 3)	Single phaseAC200～230 Note 3)
	Power capacity	kVA	0.5	0.5
Outside dimensions		mm	240(W)×290(D)×200(H)	430(W)×425(D)×99.5(H)
Mass		kg	Approx.9	Approx.12.5
Construction [Protection specification]			Self-contained floor type, open type [IP20]	Self-contained floor type, open type [IP20]
Grounding		Ω	100 or less (D class grounding)	100 or less (D class grounding)
Painting color			Light gray	Dark gray

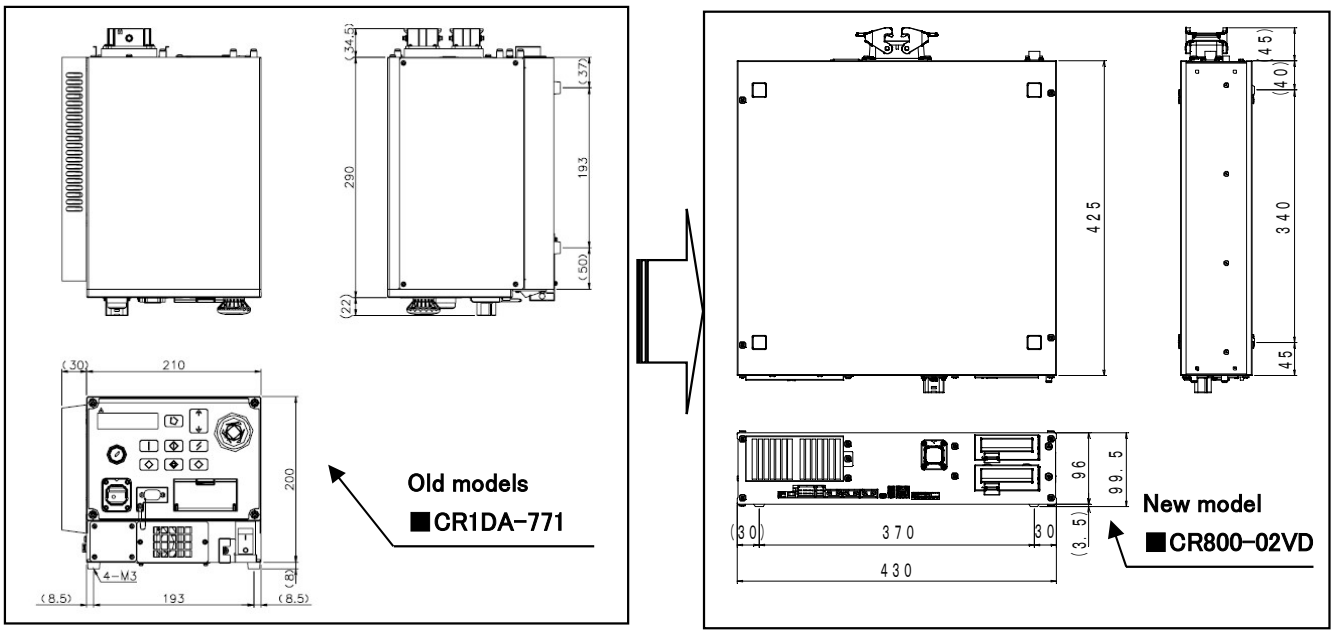
Note1：At factory settings, the STO function meets the requirements of SIL2,Category 3, PL d. To make the STO function meet the requirements of SIL3 Category 4, PL e, change the parameter setting.

Note2：SSCNET III/H (Conect to MR-J4-B series)

Note3:：Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

2.4 Outside dimensions of the controller

The controller's outside dimensions have changed. (Left drawing: RV-2SD controller, right drawing: RV-2FR-D, RV-2FRL-D controller)



2.5 Options

(1) Robot arm options comparison

Item	Specifications			Compatibility
	Old models	New models	ifications and supplementary explar	
	RV-2SD	RV-2FR-D, RV-2FR□-D		
Solenoid valve set	1E-VD0□(Sink type) 1E-VD0□E (Source type) □: 1 to 2	1E-VD0□(Sink type) 1E-VD0□E (Source type) □: 1 to 2	Solenoid valve set for the pneumatic hand (1 to 2 sets, sink type) Solenoid valve set for the pneumatic hand (1 to 2 sets, source type)	○
Hand output cable	1E-GR35S	1E-GR35S	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-HC30C-11	1S-HC30C-11	The robot side has a connector, and the other side has input cables for unprocessed hand sensor connection. (Total length: 300mm)	○
Hand curl tube	1E-ST040□C	1E-ST040□C	φ4 x □ pics, curl pneumatic tube for up to 2-set solenoid valve connection	○
J1-axis operating range change	1S-DH-11J1	1S-DH-11J1	Stopper part for J1-axis operating range change	○
J2-axis operating range change	1S-DH-11J2	1S-DH-11J2	Stopper part for J2-axis operating range change	○
J3-axis operating range change	1S-DH-11J3	1S-DH-11J3	Stopper part for J3-axis operating range change	○
Machine cable (replacement type)	-	1F- □□ UCBL-41 □□ 02,10,15,20	Fixed type: 2m, 10m, 15m. 20m	—
Machine cable (replacement type)	-	1F-□□LUCBL-41 □□ 10,15,20	Flexed type: 10m, 15m, 20m	—
Machine cable extension (replacement type)	1S-□□CBL-11 □□ 10,15	-	Fixed type (Set of 2 cables for power supply and signals), 10m, 15m	—
Machine cable extension (replacement type)	1S-□□LCBL-11 □□ 05,10,15	-	Flexed type (Set of 2 cables for power supply and signals), 5m, 10m, 15m	—

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

(2) Robot controller options comparison

Item	Specifications		CR1DA-7** /CR800-D compatibility	Remarks
	Old models	New model		
	CR1DA-771	CR800-02VD		
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)	○	
External I/O cable	2D-CBL□□	2D-CBL□□	○	For built-in I/O interface
CC-Link interface	2D-TZ576	2D-TZ576	○	Ver. 2 compatible
Expansion memory	2D-TZ454	—	—	
Controller protection box	CR1D-MB	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	—	SSCNETIII/H compatible
PC support software	3D-1□C-WINJ □=1:Standard、2:min、	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	FR series		
		RV-2SD	RV-2FR-D, RV-2FRL-D		
Maintenance	Backup battery	ER6(V)	MR-BAT6V1	×	

○: Fully compatible ×: Incompatible

3.2 Compatibility of the controller

Category	Item	Specifications		Compatibility	Remarks
		Old models	FR series		
		CR1DA-771	CR800-02VD		
Operation	TB	R32TB		○	
	High-functionality TB	R56TB		○	
	Programming language	MELFA-BASIC V	MELFA-BASIC VI	×	
	PC support software	RT ToolBox2	RT ToolBox3	×	
Maintenance	Backup battery	Q6BAT	-	×	

○: Fully compatible ×: Incompatible

Precautions of controller specifications

Item	Specifications	
	Old models	FR series
	CR1DA-771	CR800-02VD
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
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 when using robot programs

•RV-2FR Series have new controller"CR800-D", with more improved control/drive performances than RV-2SD Series. Therefore, Following checking are necessary by the actual robot operation.Clearance around arm while robot motion, Cycle time, waiting time Amplification:

•The above-mentioned performance improvement is due to the speed-up of the processing performance that originates in the processor abilities of the motion processing, the operation processing, and the condition branching processing, etc. The method of processing each instruction is the same as the past and doesn't have the change. There is a possibility of not operating correctly in the part where interlock is not taken though the problem is not in the part where interlock is taken with an external equipment and I/O, etc. when the program is misappropriated by this performance gain. Therefore, please confirm notes, and execute the adjustment as follows.

【Note】

• 1.The robot-operation completion time is reduced as the acceleration/deceleration time in the robot operation is reduced die to the improved drive function. Check the timing of the area in operation without interlock (the area where the operation of peripheral device <positioning etc.> is completed while the robot is in motion).

• 2. Due to the changes in the acceleration/deceleration time of robot, the motion excursion may differ from the current excursion. Check Clearance around arm while robot motion.

• 3.Check if the timer value is appropriate where the operation timing is up to the Dly command as the robot operation time and processing speed of program is high.

3.4 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	
	CR1DA-771	CR800-02VD	
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	